

S3503 Series Signal/Spectrum Analyzer

User Manual



The manual applies to the signal/spectrum analyzers of the following models:

- S3503A signal/spectrum analyzer (3Hz-4GHz).
- S3503B signal/spectrum analyzer (3Hz-9GHz).
- S3503C signal/spectrum analyzer (3Hz-13.2GHz).
- S3503D signal/spectrum analyzer (3Hz-18GHz).
- S3503E signal/spectrum analyzer (3Hz-26.5GHz).
- S3503F signal/spectrum analyzer (3Hz-40GHz).
- S3503G signal/spectrum analyzer (3Hz-45GHz).
- S3503H signal/spectrum analyzer (3Hz-50GHz).
- S3503L signal/spectrum analyzer (3Hz-67GHz).
- S3503A-S signal/spectrum analyzer (3Hz-4GHz).
- S3503B-S signal/spectrum analyzer (3Hz-9GHz).
- S3503C-S signal/spectrum analyzer (3Hz-13.2GHz).
- S3503D-S signal/spectrum analyzer (3Hz-18GHz).
- S3503E-S signal/spectrum analyzer (3Hz-26.5GHz).

Options of the S3503 series signal/spectrum analyzer in addition to standard accessories:

- S3503-H01, Rear panel RF input: postposition the RF signal input interface.
- S3503-H02, High IF output: output the second IF signal with output frequency range of 275MHz-475MHz. Provide 30dB gain, 1dB step.
- S3503-H03, IF output: output the third IF signal with output frequency range of 10MHz-160MHz and step resolution of 1Hz.
- S3503-H04A, Reconstructed IF/video signal output: realize any IF, AM/FM or I/Q signal output through digital reconstruction with bandwidth limit of 40MHz.
- S3503-H04B, Wide band reconstruct IF/video signal output: realize any IF, AM/FM or I/Q signal output through digital reconstruction with bandwidth limit of 50MHz-100MHz.
- S3503-H08, Wide log detect output: output the logarithmic detector signal reflecting the input signal level characteristics.
- S3503-H12A, 40MHz bandwidth digital interface: output real-time signal data through optical fiber and support the signal data output up to 40MHz bandwidth.
- S3503-H12B, 200MHz bandwidth digital interface: output real-time bandwidth data through optical fiber and support the signal data output up to 200MHz bandwidth.
- S3503-H12C, 550MHz bandwidth digital interface: output real-time bandwidth data through optical fiber and support the signal data output up to 550MHz bandwidth.
- S3503-H15, +24V DC power supply: +24V DC power supply.
- S3503-H22A, SAV4711 data recorder: configure a SSD data recorder with same interface characteristics for a real-time and

huge-capacity logging of signal data.

- S3503-H22B, SAV4712 data recorder: configure a HDD data recorder with same interface characteristics for a real-time and huge-capacity logging of signal data.
- S3503-H33, Electronic attenuator: frequency range: 3Hz-4GHz, attenuation range: 0-30dB, step: 1dB.
- S3503-H34-04/S3503-H34-09/S3503-H34-13/S3503-H34-18/S3503-H34-26/S3503-H34-40/S3503-H34-45/S3503-H34-50, Low-noise preamplifier: optional low-bnd preamplifier or all-band amplifier. The maximum frequency of all-band amplifier is up to 50GHz (S3503L exception). If an all-band preamplifier is adopted, a noise optimization path of at least 4GHz frequency band should be provided.
- S3503-H36, Pre-selector bypass: bypass the tracking pre-selector in the reception channel. (Necessary option for H38A,H38B and H38C)
- S3503-H38A, 40MHz analysis bandwidth: support 10Hz-40MHz analysis bandwidth.
- S3503-H38B, 200MHz analysis bandwidth: support 10Hz-200MHz analysis bandwidth.
- S3503-H38C, 550MHz analysis bandwidth: support 10Hz-550MHz analysis bandwidth.
- S3503-H39, Audio analysis: realize audio signal parameter test, distortion measurement and waveform analysis.
- S3503-H40, External mixer: be capable of extending frequency test range through external mixing. In this option, LO output, IF input and signal identification are provided.
- S3503-H41, Realtime analysis: provide digital phosphor spectrum and seamless waterfall, including frequency template trigger, which can support real-time spectrum analysis of 200MHz bandwidth.
- S3503-H48, Noise figure measurement: noise source drive and noise figure measurement function (S3503L exception).
- S3503-S01, Absolute power measurement: provide high-precision measurement of RF signal power by connecting an external USB power probe.
- S3503-S04, Phase noise measurement: provide SSB phase noise curve and single point phase noise measurement.
- S3503-S09, Analog demodulation analyzer: provide modulation characteristic and distortion characteristic analysis of AM, FM and PM signals.
- S3503-S10, Transient analyzer: test and analyze transient parameter spectrums, frequency spectrums and time-variant characteristics of signals and support logging data playback.
- S3503-S12, Vector signal analyzer: provides flexible demodulation functions of multiple single-carrier digital modulation signals. It can provide vector charts, constellation diagrams, eye diagrams, spectrum diagrams, etc., to analyze the characteristics of the modulation signal. The modulation error of the signal can be obtained by demodulation, which helps to judge the cause of the signal error.
- S3503-S13, Pulse signal analyzer: realize automatic measurement for time, level and modulation parameters of pulse waveform and statistic analysis of pulse sequences.
- S3503-S40, WLAN 802.11a/b/g measurement: provide broadband wireless LAN protocol physical layer test (802.11a/b/g), covering radio frequency, modulation analysis, and modulation quality testing.
- S3503-S40N, WLAN 802.11n measurement: provide broadband wireless LAN protocol physical layer test (802.11n), covering radio frequency, modulation analysis, and modulation quality testing.
- S3503-S40AC, WLAN 802.11ac measurement: provide broadband wireless LAN protocol physical layer test (802.11ac), covering

radio frequency, modulation analysis, and modulation quality testing.

- S3503-S40AX, WLAN 802.11ax measurement: provide broadband wireless LAN protocol physical layer test (802.11ax), covering radio frequency, modulation analysis, and modulation quality testing.
- S3503-S51, DTMB signal test: provide one-button power and modulation analysis functions that comply with the DTMB standard.
- S3503-H97, Mounting suit: handles and accessories for S3503 mounting on standard racks.
- S3503-H99, Aluminum alloy aviation case: high-strength and portable aluminum alloy case with a handle and rolling wheels, which are convenient for transportation.

Options of the S3503-S series signal/spectrum analyzer in addition to standard accessories:

- S3503-H03, IF output: output the third IF signal with output frequency range of 10MHz-160MHz and step resolution of 1Hz.
- S3503-H08, Wide log detect output: output the logarithmic detector signal reflecting the input signal level characteristics.
- S3503-H34-04/S3503-H34-09/S3503-H34-13/S3503-H34-18/S3503-H34-26, Low-noise preamplifier: optional low-bnd preamplifier or all-band amplifier. When you select full-waveband preamplifier, we provide above 4 GHz frequency band noise optimization path. (Notes: the No. of low-waveband preamplifier is H34-04. The full-waveband preamplifier should be selected according to the frequency upper limit of the main unit.)
- S3503-S04, Phase noise measurement: provide SSB phase noise curve and single point phase noise measurement.
- S3503-H97, Mounting suit: handles and accessories for S3503-S mounting on standard racks.
- S3503-H99, Aluminum alloy aviation case: high-strength and portable aluminum alloy case with a handle and rolling wheels, which are convenient for transportation.

Preface

Thanks for choosing S3503 Signal/Spectrum Analyzer produced by Saluki Technology Inc. Please read this user manual carefully for your convenience.

We devote ourselves to meeting your demands, providing you high-quality measuring instrument and the best after-sales service. We persist with “superior quality and considerate service”, and are committed to offering satisfactory products and service for our clients.

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Saluki Technology

Manual Authorization

The information contained in this User Manual is subject to change without notice. The power to interpret the contents of and terms used in this Manual rests with Saluki.

Saluki Tech owns the copyright of this User Manual which should not be modified or tampered by any organization or individual, or reproduced or transmitted for the purpose of making profit without its prior permission, otherwise Saluki will reserve the right to investigate and affix legal liability of infringement.

Product Quality Assurance

The warranty period of the product is 18 months from the date of delivery. The instrument manufacturer will repair or replace damaged parts according to the actual situation within the warranty period. The user should return the product to the manufacturer and prepay mailing costs. The manufacturer will return the product and such costs to the user after maintenance.

Product Quality Certificate

The product meets the indicator requirements of the manual at the time of delivery. Calibration and measurement are completed by the measuring organization with qualifications specified by the state, and relevant data are provided for reference.

Quality/Environment Management

Research, development, manufacturing and testing of the product comply with the requirements of the quality and environmental management system.

Precautions



"Warning" indicates danger. It reminds the user to pay attention to a certain operation process, operation method or similar situations. Noncompliance with the rules or improper operation may result in personal injuries. You must fully understand the warning and all the

conditions in it shall be met before the next step



"Attention" indicates important prompts and no danger. It reminds the user to pay attention to a certain operation process, operation method or similar situations. Noncompliance with the rules or improper operation may result in damage to the instrument or loss of important data. You must fully understand the caution and all the conditions in it shall be met before the next step.

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1. Manual Guide

This chapter describes the functions, chapter composition and main contents of the User Manual of S3503 Series Signal/Spectrum Analyzer, and the instrument-related documents for the user.

- [About manual](#)
- [Related documents](#)

1. 1. About the Manual

In the Manual, basic functions and operating methods of the S3503 Series Signal/Spectrum Analyzer are introduced. Including instrument characteristics, basic operating methods, measurement configuration operating manual, menus, remote control, maintenance, specifications and test methods to help you rapidly get familiar with and understand key points of the instrument operation method and use. For the convenience of operation, please carefully read the manual before operating the instrument, and properly operating it according to the guidance in the manual.

The user manual includes the following chapters.

- Overview

It provides an overview of main performance features and typical application of the S3503 signal/spectrum analyzer and safety guidelines for instrument operations. It helps users get to know main performance features of the instrument and guide them to operate it.

- Introduction to Use

In this chapter, inspections before use, instrument navigation, basis measurement methods and data management of the S3503 Series Signal/Spectrum Analyzer are explained to help users get to understand the instrument itself and measurement procedure and lay foundation for subsequent detailed introduction of the instrument measurement operating manual. Contents in this chapter are consistent with chapters in the Quick Start Guide.

- Operation Manual

It introduces in details operations of measurement functions of the instrument, including instrument configuration, measurement process initiation and obtaining measurement results. It mainly includes two parts: function operation manual and advanced operation manual. The functions operation manual introduce and exemplify each setting in a systematic and detail manner for users not familiar with operating methods of the analyzer to help them understand and grasp basic usages of the signal/spectrum analyzer, including setting of frequency, span and marker. The advanced operation guidance introduces complicated test procedures, advanced using techniques and guidelines of measurement implementation with users having the basic knowledge of Signal/Spectrum Analyzer but unfamiliar with some special operations as target readers. Including multi-signal measurement, distortion measurement, noise measurement, modulation signal measurement and power kit measurement.

- Menu

This chapter describes the menu structure and items according to functional categories to facilitate query and reference.

- Remote control

This section outlines the remote control of the instrument, so that the user can rapidly get to know how to remotely control the instrument. It is divided into four sections: the program control basics describe the concepts related to program control, software configuration, program-controlled port, SCPI commands, etc.; instrument port configuration describes the connection and software configuration of the program-controlled port of S3503 signal/spectrum analyzer; basic programming of VISA interface provides an example of basic programming with text illustration and example codes, so that the user can rapidly get to know the programming method; and I/O function library describes the basic concepts of the instrument drive and the basic installation and configuration requirements of the IVI-COM/IVI-C drive.

- Fault diagnosis and repair

This section describes the overall operating theory, fault diagnosis and troubleshooting, and errors and repair.

- Technical indicators and test methods

This section describes characteristics and main specifications of the S3503 signal/spectrum analyzer and recommended test instructions for users.

- Appendix

This section provides necessary reference information for S3503 Series Signal/Spectrum Analyzer, including terminology, remote control commands index, menu index and error messages index.

1. 2. Related Documents

The documents related to S3503 Series Signal/Spectrum Analyzer include:

- Quick Start
- User Manual
- Program Control Document

Quick Start

This manual introduces the basic operations of configuration, start-up and measurement of the instrument, aiming to help users rapidly know the characteristics of the instrument and understand basic local and remote control operations. It mainly includes the following chapters:

- Manual Navigation
- Preparation for use
- Typical application
- Help

User Manual

This manual introduces the functions and operation methods of the instrument in details, including configuration, measurement, program control, maintenance, etc. It aims to guide the user to comprehensively understand the functional characteristics and common test methods of the instrument. It mainly includes the following chapters:

- Manual Navigation
- Overview
- Introduction to Use
- Operation Manual
- Menu
- Remote control
- Fault diagnosis and repair
- Technical indicators and test methods
- Appendix

Program Control Document

This manual introduces the remote programming basis, SCPI basis, SCPI commands, programming examples, I/O drive function library, etc. It aims to guide the user to rapidly and comprehensively know the program control commands and methods of the instrument. It mainly includes the following chapters:

- Remote control
- **Program control commands:**
- Programming examples
- Error illustration
- Appendix

2. General

In addition to main performance features and main applications of the S3503 Series Signal/Spectrum Analyzer, it also describe precautions for proper operation, electrical safety, etc.

- Product overview
- Safe operating manual

2. 1. Product Overview

The S3503 Series Signal/Spectrum Analyzer can cover a frequency range of 3Hz - 67 GHz at most and feature excellent test dynamic range, phase noise, amplitude accuracy and test speed as well as high-sensitivity spectrum analysis, standard power measurement unit, IQ analysis, transient analysis, pulse parameter analysis, audio analysis, analog modulation measurement, phase noise test, providing reliable and high-performance test services for users. Moreover, the signal/spectrum analyzer has good expansion capability for further improvement of test performance with flexible optional configuration and is capable of test system construction or secondary development with various digital and analog signal output interfaces. Such instrument can find wide application signals and equipment test in industries such as aviation, aerospace, radar detection, communications, electronic countermeasure and navigation.

2. 2. Safe operating manual

Please carefully read and strictly follow the notes for attention below!

We will spare no effort to ensure that all production stages conform to the latest safety standards to guarantee the highest safety for users. The design and test of our product and ancillary equipment thereof have been up to relevant standards of security; quality assurance system has been established to monitor the product quality to ensure the consistency with such standards. Precautions proposed in this User Manual should be followed to keep equipment intact and operations safe. Please do not hesitate to consult us if you have any questions.

However, it is your responsibility to operate the product in a correct way. Please read and follow the safety instructions carefully before operating the instrument. The instrument is applicable to the industrial and laboratory environment or field measurement. Pay attention to the limitations for proper operation to avoid personal injury or property damage. We will not take any responsibility for any misuse or inconsistency as required, and you are liable for any risks incurred by. Therefore, please follow the safety instructions to prevent you from personal injury or property damage. Please keep product documentation safe and deliver them to end users.












- Safety signs
- Operation status and location
- Power safety
- Operation precautions
- Maintenance
- Battery and power supply module
- Transportation
- Waste disposal/environment protection

2. 2. 1. Safety Signs

2. 2. 1. 1. Product-related Signs

The safety signs of the instrument are as follows (Table 2.1).

Table 2.1 Instrument Safety Signs

Symbol	Meaning	Symbol	Meaning
	Caution: the user should pay attention to the information. The user should pay attention to the operation information or instructions.	○	Power on/off
	Caution: handle heavy equipment.	⏻	Standby indication
	Danger! Be careful of electric shock!	⎓	Direct-current (DC) power
	Warning! Be careful of surface heat.	~	Alternating-current (AC) power
	Protect the conductive terminal.	⎓	Direct- current/alternating current power (DC/AC)
	Grounding	□	Instrument reinforcement and insulation protection.
	Earthing Terminal		EU mark of battery and accumulator. For details, refer to 1 of "2.2.8 Waste disposal/environment protection".
	Caution: electrostatic sensitive device. Be careful.		EU mark for electronic parts to be collected separately For details, refer to 2 of "2.2.8 Waste disposal/environment protection".
	Warning! Radiation. For details, refer to 7 of 2.2.4 "Operation Precautions" of this section.		

2. 2. 1. 2. Manual-related Signs

The following safety warning signs are used in the product manual to remind the user to operate the instrument safely and pay attention to relevant information.



Danger sign: personal injury and equipment damage may be caused if no attention is paid.



Warning sign: personal injury and equipment damage may be caused if no attention is paid.



Caution sign: minor or moderate personal injury and equipment damage may be caused if no attention is paid.



Attention sign: it indicates important prompts but no danger.



Prompt

Prompt sign: information of the instruction and operation.

2. 2. 2. Operation Status and Location

Pay attention to the following items before operation:

- 1) Unless otherwise stated, the S3503 Series Signal/Spectrum Analyzer should be placed steadily and operated indoor. The instrument should be operated and transported at places with an altitude no higher than 4,600 m. The actual power supply voltage may be the indicated voltage $\pm 10\%$, and the power supply frequency may be the indicated frequency $\pm 5\%$.
- 2) Unless otherwise stated, the instrument is not allowed to be placed on a wet surface, vehicle, cabinet, table and other objects which are not fixed and do not conform to the load conditions since it has not gone through waterproof treatment. Place the instrument steadily and fix it on the solid object surface (such as the anti-static workbench).
- 3) The instrument must not be placed in misty environment. For example, if the instrument is handled in an environment with temperature fluctuation, hazards such as electric shock may be caused by water drops produced on the instrument.
- 4) Do not place the instrument on a heat dissipating surface (such as a radiator). The operating temperature must not exceed the specified range of relevant indicators of the instrument. Overheating may result in electric shock, fire, etc.
- 5) It is prohibited to tuck any article from the opening on the housing into the instrument or cover openings or notches on the instrument for they are used for ventilation of the instrument and preventing overheating.

2. 2. 3. Power Safety

Precautions for the power supply of the instrument:

- 1) Ensure that the actual power supply voltage is the same as that marked on the instrument before powering- on.
- 2) Refer to the power supply requirements on the rear panel of the instrument. Use three-core power cords. Ensure that the power cord is grounded reliably. Floating or improper grounding may result in damage to the instrument and even operator injuries.
- 3) Do not damage the power cord; otherwise, electrical leakage may be caused, resulting in instrument damage and even operator injuries. If any, check the external power cord or terminal block before operation to ensure the power safety.
- 4) If the power socket is not equipped with any ON/OFF switch, the power plug can be directly pulled off to power off the instrument. In this case, ensure it is easy to plug and unplug the power line.
- 5) Do not use any damaged power cord. Before connecting the power cord to the instrument, check the power cord for integrity and safety. Reasonably place the power cord to avoid the impact from human activities. For example, the operator may fall over if the power cord extends over long distance.
- 6) Keep the socket clean and the plug and the socket in good and firm contact.
- 7) The socket and power cord must not be overloaded; otherwise, fire or electric shock may be caused.
- 8) Unless specially permitted, the instrument shell must not be opened; otherwise, internal circuits and parts may be exposed, resulting in unnecessary damage.
- 9) If the instrument needs to be fixed in a test place, the protective ground wire should be installed between the test place and instrument by the electrician with qualifications.
- 10) Take appropriate overload protection measures to avoid instrument damages or personal injuries caused by overload voltage (arising from lightning, etc.).
- 11) It is notable that when the instrument is in fire, toxic gas or liquid harmful to human being may be released

2. 2. 4. Operation Precautions

- 1) The instrument operator must have certain professional and technological knowledge, good psychological quality and emergency response capability.
- 2) Refer to relevant requirements in "2.2.7 Transportation" before handling or transporting the instrument.
- 3) Allergic substances (such as nickel) are produced inevitably during instrument production. If the operator shows any allergic symptom (such as rash, frequent sneezing, red eye, breathing difficulty, etc.), immediately seek medical help to eliminate the symptoms.
- 4) Refer to relevant requirements in "2.2.8 Waste disposal/environmental protection" of this section before removing and disposal of the instrument.
- 5) RF instruments may result in high-intensity electromagnetic radiation. The pregnant women and operators with heart pacemaker must be protected particularly. If the degree of radiation is high, take appropriate measures to remove the radiation source so as to prevent personal injury.
- 6) To avoid the damage to the instrument caused by static electricity, anti-static treatment such as the use of anti-static table pad, foot pad and wrist pad should be provide, and the anti-static voltage should not be over 500V.
- 7) You should choose connectors and cables meeting testing conditions and check connectors and cables before operation.
- 8) During measurement, DC or AC coupling can be selected for the RF input interface. When DC coupling is selected, input of DC signals is prohibited since it will result in damage of internal parts; when AC coupling is selected, the maximum DC signals to be input is 50 V.
- 9) It should be ensured that the input signal power at radio frequency input interface is lower than the maximum safety input level to avoid the burning of the instrument.
- 10) Hotplug should not be used for GPIB and monitor interface which do not support hot plug.
- 11) It is prohibited to remove all connector protectors and matching units accompanying the instrument to avoid damage to connectors and measuring error.
- 12) Turn off the power at front panel in a normal way instead of forcing a power off, or it will result in abnormalities to the operating system;
- 13) The instrument should be preheated for 30 min before testing in order to ensure measurement accuracy.
- 14) To ensure the best measurement effect, the instrument should be working at associated state as much as possible.
- 15) When the tested signal is overloaded, the attenuator or the reference level should be adjusted to display the signal peak under the top division of the screen.
- 16) Users are prohibited to delete ex-factory data of the instrument.
- 17) Open Windows environment is adopted in the analyzer; and the user is prohibited to modify BIOS setup, or it will result in abnormal startup and work of the analyzer;
- 18) Users can only delete the files they store rather than the system file.
- 19) Before transmitting files with USB interface and Internet port, you should ensure the security and reliability of the carrier to avoid virus infection of the instrument.
- 20) Addresses of GPIB and Internet access should be correctly set when GPIB or Internet access is used to form the testing system.
- 21) In case of instrument failure, it is prohibited to disassemble the instrument, and instead, you should send it to the manufacturer for repair.

2.2.5. Maintenance

- 1) The instrument chassis must be opened by a qualified operator who has received special technical training. The power cord should be disconnected before operation, so as to avoid instrument damages and even personal injuries.

- 2) The instrument should be repaired, replaced and maintained by special electronic engineers of the manufacturer, and the replaced or maintained parts must be subject to safety tests to ensure the safety of subsequent operation.

2. 2. 6. Battery and Power Supply Module

Carefully read relevant information before using the battery and power supply module, so as to avoid explosion, fire and even personal injuries. Precautions for battery use:

- 1) Do not damage the battery.
- 2) The battery and power supply module must not be exposed to flame and other heat sources. They must be prevented from direct sunlight and should be kept clean and dry in storage. Clean the connection port of the battery or power supply module with clean and dry soft cloth.
- 3) Do not make the battery or power supply module short-circuited. As the short circuit may be easily caused by mutual contact or contact with other conductors, several batteries or power supply modules must not be stored in the same carton or drawer. Do not remove the original package until the battery and power supply module are required.
- 4) The battery and power supply module must be prevented from mechanical impact.
- 5) The leaky battery must not contact with the skin or eyes. In case of contact, rinse with plenty of clean water and immediately seek medical help.
- 6) Use the standard battery and power supply module provided by the manufacturer. Any improper replacement or charging of alkaline batteries (such as lithium batteries) may easily result in explosion.
- 7) The waste battery and power supply module should be recovered and disposed separately with other wastes.
- 8) The battery contains toxic substances. It must be discarded or recycled according to the local provisions.

2. 2. 7. Transportation

- 1) The heavy instrument must be handled carefully. If necessary, use tools (such as the crane) to move the instrument to prevent damage to the body.
- 2) The instrument handle is applicable to handling by individuals. The instrument must not be fixed on the transport equipment during transportation. In order to prevent damage to the property and body, observe the manufacturer's safety provisions on instrument transportation.
- 3) If the instrument is operated on the transport vehicle, the driver should drive carefully to ensure the transportation safety. The manufacturer will not be responsible for emergencies in transportation. Do not operate the machine during transportation. Take reinforcement and protection measures to ensure the safety of transportation.

2. 2. 8. Waste Disposal/Environmental Protection

- 1) Do not dispose the equipment with the battery or accumulator mark along with other unclassified wastes. Instead, such equipment should be collected separately and discarded or disposed in the appropriate collection place or by the customer service center of the manufacturer.
- 2) Do not dispose the discarded electronic equipment with other unclassified wastes. Such electronic equipment should be collected separately. The manufacturer have the right and responsibility to help end users to dispose waste products. If necessary, contact the customer service center of the manufacturer for corresponding disposal to avoid damage to the environment.
- 3) Toxic substances (heavy dust such as lead, beryllium, nickel, etc.) may be released in machining or thermal reprocessing of the instrument or internal parts. In this case, the instrument or internal parts must be removed by technical personnel who have received special training and relevant experience, so as to avoid personal injuries.
- 4) Toxic substances or fuel released by the instrument in reprocessing should be disposed in the specified method, with reference

to the safety operation rules put forward by the manufacturer, so as to avoid personal injuries.

3. Introduction to Use

This chapter introduces the operation precautions, description of front and rear panel, basic measurement methods, data file management, etc. of the S3503 series signal/spectrum analyzer to help users get a preliminary understanding of the instrument and measurement process. To help users get to understand the instrument itself and measurement procedure. Contents in this chapter are consistent with chapters in the Quick Start Guide.

- Preparation before use
- Front and rear panel
- Basic measurement methods
- Data management

3. 1. Preparations before Operation

- Pre-operation preparation
- Operating system configuration
- Routine maintenance

3. 1. 1. Pre-operation Preparation

This chapter introduces the precautions for initial setting and operation of the S3503 Series Signal/Spectrum Analyzer.



Warning

Prevent damages to persons and the instrument

In order to avoid electric shock, fire and personal injury:

- Do not open the casing without permission.
- Do not disassemble or modify any part which is not described in this manual. Disassembly may result in declining of the electromagnetic shielding performance, damage to parts in the instrument, etc., thus affecting the product reliability. In this case, we will not provide free maintenance services even within the warranty period.
- Please carefully read "2.2 Safe Operating Manual" of this Manual, and the safety precautions listed below and pay attention to the specific operating environment requirements in specifications.



Attention

Electrostatic protection

Pay attention to anti-static measures in the workplace to prevent damage to the instrument. For more details, refer to "2.2 Safe Operating Manual" of this Manual.



Attention

Pay attention to the following requirements before operation:

The improper operation location or measurement setting may result in damage to the instrument or the connected instrument. Pay

attention to the following requirements before powering on the instrument:

- The instrument should be kept at least 15 cm from the wall to ensure the fan blades and the louvers are not blocked. All ventilation holes should be smooth and unobstructed.
- Keep the instrument dry.
- Horizontally and reasonably arrange the instrument.
- The ambient temperature should meet the requirement in the technical specifications;
- The input signal power of the port is within the specified range.
- The signal input interface should be properly connected to avoid overload.



Prompt

Influence of electromagnetic interference (EMI):

Electromagnetic interference will affect measurement results, therefore:

- Select the appropriate shielded cable. Example: use the dual-shielded radio-frequency/network connection cable.
- Always open and close the cable connection port which is not used temporarily.
- Please refer to the EMC grade indicated in the technical specifications.

- [Unpacking](#)
- [Environmental requirement](#)
- [Power-in/off](#)
- [Proper use of connector](#)
- [User inspection](#)

3. 1. 1. 1. Unpacking

1) Appearance inspection

Step 1: check whether the outer packing box and shockproof package are damaged. In case of any damage, keep the outer package for future use. Continue inspection according to the following steps.

Step 2: unpack the box and check whether the host and accompanying articles are damaged.

Step 3: carefully check the above articles according to Table 3.1.

Step 4: Do not turn on the power supply of the instrument if the outer package, instrument and accompanying article is damaged or any error exists. Contact our service consultation center at the service consultation hotline in the Manual. We will rapidly repair or replace the instrument, depending on the actual situation.



Attention

Handling: the heavy instrument and packing box must be handled by two persons and placed carefully.

2) Model confirmation

Accompanying items of the S3503 analyzer are as shown in Table 3.1.

Table 3.1 List of Accompanying Articles of S3503

Name	Quantity	Function
Host		
S3503	1	—
Standard		
Three-core power cord	1	—
USB mouse	1	—
User Manual	1	—
Programming Manual	1	—
Container loading list	1	—
Options		
Depend on users' options	—	—

3. 1. 1. 2. Environmental Requirements

The S3503 series signal/spectrum analyzer should be operated at places conforming to the following environmental requirements:

1) Operating environment

The operating environment should meet the requirements in Table 3.2:

Table 3.2 Operating Environment Requirements of S3503

Operating temperature:	0°C~50°C
Relative humidity:	When the temperature is > + 10 °C, the humidity is (95% ± 5%) RH When the temperature is > +30°C, the humidity is (75% ± 5%) RH When the temperature is > +40°C, the humidity is (45% ± 5%) RH
Altitude	0 - 4,600 m



The above requirements are for the operating environment of the instrument and not the range of technical indicators.

2) Heat dissipation requirements

In order to keep the operating temperature of the instrument within the specified temperature range, the heat dissipation space of the instrument should conform to the following requirements in Table 3.3.

Table 3.3 Heat Dissipation Requirements of S3503

Instrument Part	Heat Dissipation Distance
Rear side	≥150 mm
Left and right side	≥60 mm

3) Electrostatic protection

Static electricity is destructive to electronic components and devices. Generally, two anti-static measures can be taken: combination of conductive table mat and wrist strap; and combination of conductive floor mat and ankle strap. Anti-static effect will be better when two measures are used at the same time. If used independently, only the former can make sure the safety. In order to ensure the user safety, the ground isolation resistance of anti-static components must be 1MΩ at least.

The follow anti-static measures should be taken to reduce static damage:

- All instruments must be properly grounded to prevent static electricity.
- The internal and external conductor of the cable should respectively contact with the ground temporarily before the coaxial cable and instrument are connected.
- Workers must wear the anti-static wrist strap or take other anti-static measures before contact with the connector or wire or any assembly.



Voltage range

The above anti-static measures are not suitable for the places with the voltage higher than 500V.

3. 1. 1. 3. Power on/off

4) Precautions before powering-on

Check the following items before powering on the instrument.

a) Confirm the power supply parameters.

The S3503 Series Signal/Spectrum Analyzer is internally equipped with 220V AC power module (using 200V AC power supply) or 110V/220V self-adaptive AC power module (option, using 110V or 220V AC power supply working in self adaptive way, which means to automatically switch operating mode based on external AC power supply voltage). Therefore, please carefully read power requirements on the rear panel before using the instrument. Table 3.4 lists the requirements of the external power supply for normal operation of the signal/spectrum analyzer.

Table 3.4 Parameters of Working Power Supply of S3503

Power supply parameter	Applicable range	
Voltage, frequency	220V±10%, 50-60Hz	110V±10%, 50-60Hz/400Hz
Power consumption (startup)	<400W	<400W
Power consumption (standby)	<20W	<20W



Prevent mutual interference of various power supplies.

In order to prevent mutual interference of power supplies of various devices, especially the instrument hardware damage caused by peak pulse interference of high-power equipment, it is recommended to use the 220V or 110V AC voltage-regulated power supply to power on the signal/spectrum analyzer.

b) Confirm and connect the power line.

The S3503 Series Signal/Spectrum Analyzer adopts three-core power line interface and conforms to national safety standards. Before

the signal/spectrum analyzer is energized, it should be ensured that the ground wire in its power line is reliably grounded. Floating or improper grounding may result in damage to the instrument and even operator injuries. Do not use the power line with no protective ground wire. When the appropriate power socket is connected, the instrument shell will be grounded through the power line. The rated voltage of the power line should be no less than 250V, and the rated current should be no less than 6A.

Connection of the power line to the instrument:

Step 1: confirm that the power line is not damaged.

Step 2: connect the power socket on the rear panel of the instrument to the well grounded three-core power socket through the power line.



Grounding

Improper/wrong ground might lead to instrument destroy or even personal injury. It should be ensured that the protective ground wire of the instrument and that of the power supply are in good contact before energizing to start the signal/spectrum analyzer.

Use the power socket with protective ground wire. Do not use the external cable, power line or autotransformer subject to no grounding protection instead of the protective ground wire. If autotransformer is used, its common terminal must be connected with the ground protection of the power connection.

5) Initial power-on

The method and precautions of initial power-on are as follows.

a) Connection of power supply

Check the power supply parameters and the power cord before initial energizing. For details, refer to "Precautions before energizing" in 3.1.1.3 of the Manual.

Step 1: Connect power line: Connect one end of the supporting power line of the signal/spectrum analyzer or the three-core power line conforming to the requirements in the packing box to the power socket (as shown in Fig. 3.1) on the rear panel of the signal/spectrum analyzer. The voltage indicator of the signal/spectrum analyzer is marked beside the power socket to remind the user that the applied voltage should conform to the requirements. Connect the other end of the power cord to the required AC power supply.

Step 2: turn on the power switch on the rear panel. As shown in Fig. 3.2, check whether the standby indicator above the power switch on the front panel (as shown in Fig. 3.3) is ON and yellow.

Step 3: Turn on the power switch on the front panel: as shown in Fig. 3.3, do not connect any device to the signal/spectrum analyzer before start-up. Start the instrument under normal conditions. After start-up, the indicator above the power switch on the front panel will turn green.



110 V/220 V self-adaptive AC power module



220 V AC power module

Fig. 3.1 Power outlet on the rear panel of the S3503

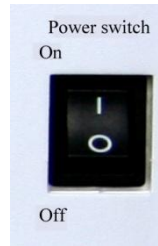


Fig. 3.2 Power Switch of Rear Panel of S3503



Fig. 3.3 Power Switch on Front Panel of S3503

b) Start-up/shutdown

i. Start-up

Step 1: Turn the power switch on the rear panel to "I". At such time, the power indicator above the power switch on the front panel turns yellow and the instrument is in standby mode;

Step 2: Turn on the power switch in the lower left corner of the front panel. The power indicator above the power switch turns from yellow to green;

Step 3: The user interface on the front panel of the instrument will gradually display the information of instrument startup: first with the manufacturer information and logo, followed by operating system options. There are two options available for selection, but users do not need to choose during normal operation. Windows 7 automatically starts after the timer hits 0;

Step 4: After Window 7 is successfully started, the system will automatically initiate the signal/spectrum analyzer and display its main operation interface.

Then the instrument can be operated.



10MHz time base and warm-up

In case of cold start of the S3503 Series Signal/Spectrum Analyzer (the instrument starts from complete shutdown), the instrument should be preheated for a while to reach the operating temperature at 10 MHz. If the instrument is started from standby, no preheating is required. When testing specifications, the instrument should be preheated for 0.5 h (refer to instructions in the technical specifications for more details).



Attenuator initializing

When entering the host program, there will be noise from attenuator gear setting due to attenuator initialization. Do not mistake it for a fault in the signal/spectrum analyzer.



Attention

System startup

Windows + x86 computer control platform is used in this analyzer, therefore no interference by the user is needed during BIOS self inspection and Windows loading. Do not cut the power or modify the setup options in BIOS.

ii. . Shutdown

Step 1: Turn off the power switch at the lower left corner of the front panel. In this case, the shutdown process is started (the power supply must not be turned off until certain processing of software and hardware is completed). The instrument will be shut down after seconds. In this case, the color of the power indicator above the power switch will change from green to yellow.

Step 2: Turn the power switch on the rear panel to "O", or connect the power supply of the instrument.

Thus the instrument is shut down.



Attention

Shutdown of Instrument

The instrument in normal operation must be shut down by operating the power switch of the front panel. Do not directly operate the power switch of the rear panel or directly cut off the power supply of the instrument; otherwise, the instrument cannot be shut down normally and may be damaged, or the current status/measurement data may be lost. Shut down the instrument properly.

c) Cutoff of power supply

In order to prevent personal injury under abnormal conditions, the power supply of the signal/spectrum analyzer requires emergency cutoff. In this case, pull off the power cord (from the AC power socket or the power socket of the rear panel of the instrument). Therefore, sufficient operating space should be reserved for direct cutoff of the power supply if necessary.

3. 1. 1. 4. Proper Use of Connector

Connectors are commonly used in various tests of the signal/spectrum analyzer and the following items should be checked when using connectors:

1) Inspection of connector

Wear the anti-static wristband in connector inspection. It is recommended to use the magnifying lens to check the following items.

- Check whether the plating surface is worn or deeply scratched.
- Check whether threads are deformed;
- Check whether there are metal particles on the connector threads and joint surfaces.
- Check whether the internal conductor is bent or cracking;
- Check whether the connector screw can rotate properly.



Caution

Prevent damage to the instrument port in connector inspection.

Any damaged connector may result in damage to the connector in good conditions even in the first measurement connection. In order to protect each interface of the signal/spectrum analyzer, the connector must be checked before connection.

2) Connection method

Check and clean the connector before measurement connection. Ensure that the connector is clean and intact. Wear the anti-static wristband in connection. The correct connection method and steps are as follows.

Step 1: as shown in Fig. 3.4, align the axes of two connectors to be interconnected, and ensure that the pin of the male connector can concentrically slide into the jack of the female connector.



Fig. 3.4 Diagram of connector connection

Step 2: as shown in Fig. 3.5, horizontally move two connectors to make them connected smoothly. Tighten the connector nut by means of rotation (do not rotate the connector). Avoid relative rotation of connectors during connection.

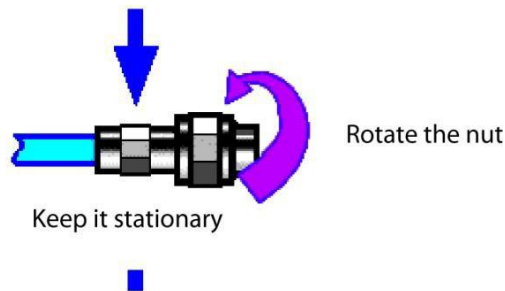


Fig. 3.5 Diagram of connector rotation

Step 3: as shown in Fig. 3.6, complete the final connection by tightening with the torque wrench. Note that the torque wrench must not be beyond the initial break point. Use the auxiliary wrench to prevent the connectors from rotation.

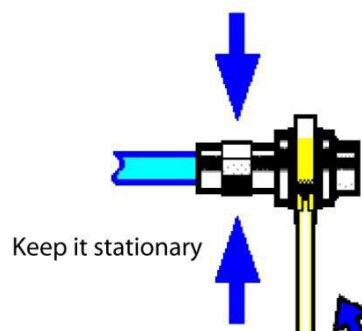


Fig. 3.6 Diagram of wrench operation

3) Disconnection method

Step 1: support the connectors to prevent any kind of force which may result in distortion, shaking or bending.

Step 2: use the open-end wrench to prevent the connector body from rotation.

Step 3: use another wrench to loosen the connector nut.

Step 4: rotate the connector nut by hand to complete final disconnection.

Step 5: horizontally separate two connectors.

4) Use of torque wrench

The use of the torque wrench is shown in Fig. 3.7. Pay attention to the following items.

- Check whether the torque of the torque wrench is set properly before use.
- Ensure that the angle between the torque wrench and the other wrench (used to support the connector or cable) is less than 90° before applying force.
- Carefully grip the handle end of the torque wrench, and apply force in the direction vertical to the handle to reach the break point of the wrench.

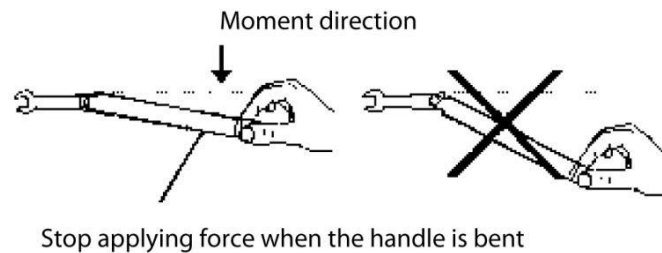


Fig. 3.7 Use of Torque Wrench

3. 1. 1. 5. User inspection

After the S3503 Series Signal/Spectrum Analyzer is energized for the first time, the instrument should be checked for normal operation to prepare for subsequent measurement operations.



Description of hard/soft keys on the front panel

Hard/soft keys on the front panel are described in the following forms:

- Description form of hard key: [XXX], in which XXX is the name of the hard key;
- Description form of soft key: [XXX], in which XXX is the name of the soft key.

If soft keys correspond to more than one state and their selected values have blue background color, it means relevant keys are enabled. For example, [Sweep Time Manual Auto] indicates the sweep time auto on option is available.

1) Self-calibration

When the instrument is used for the first time, or there is obvious change in its temperature, self-calibration is required and the instrument should be calibrated according to the calibration signal. Power the instrument up and check that the power indicator above the power switch at the lower left corner of the front panel turns yellow, which means the standby power is working properly. Press the power switch on the front panel, check that the power indicator on the front panel turns green and the display backlight is on. It takes about 40 s to start the display and show the starting status interface.

The signal/spectrum analyzer should be set as follows:

Step 1: Press the [System] key on the front panel to enter the system menu; press [Calibrate] and [Calibrate All] for the instrument to begin whole-machine calibration. At such time, a yellow dialog box will appear on the screen, saying "Calibration is underway";

Step 2: Wait for the calibration to complete:

The calibration completes when the dialog box disappears. If no error message is prompted at the lower right corner of the screen, it means the instrument is working properly; if there is error message, it means the instrument is not working properly. In this case, please contact our service consultation center at the service consultation hotline in the Manual. We will rapidly repair or replace the instrument, depending on the actual situation.

2) Self-test

Self-test is not necessarily required for every startup of the instrument. It is only required when the instrument is suspected to develop faults.

Step 1: Press [System] key on the front panel to enter the system menu;

Step 2: Press [Self-test] key in the soft menu of the front panel to enter self-test interface;

Step 3: Select the item to be tested and press [Start Self-test] soft menu to start the test. Relevant test result will be displayed. Check the test result. If all items are passed, it means the instrument is working properly; if certain item fails the test, it means the instrument is not working properly in some way. In this case, please contact Saluki.

After the above two steps are done, the instrument will be ready for operation.

3) Functional verification

After self-calibration, the instrument should be set as follows:

Step 1: Press [Input/Output] key on the front panel to pop up the input/output setting soft menu, press [Calibration Interface▶] and [500MHz] to select 500MHz calibration signal and press [Input Interface RF Calibration] soft key to select the input interface for calibration. At such time, the internal calibration signal of the instrument is connected to the RF input interface;

Step 2: Observe the test result on the screen. If 500 MHz calibration signal can be observed, it means the instrument is working properly; if not, it means the instrument is not working properly in some way. In this case, please contact our service consultation center at the service consultation hotline in the Manual. We will rapidly repair or replace the instrument, depending on the actual situation;

Step 3: Press [Calibration Interface, [4800MHz] to select 4800MHz calibration signal;

Step 4: Observe the test result on the screen. If 4800MHz calibration signal can be observed, it means the instrument is working properly; if not, it means the instrument is not working properly in some way. In this case, please contact our service consultation center at the service consultation hotline in the Manual. We will rapidly repair or replace the instrument, depending on the actual situation;

3. 1. 2. Configuration of operating system

In this chapter, operating system and its configuration and maintenance methods of the S3503 Series Signal/Spectrum Analyzer are explained. Please refer to the following precautions for the operating system of the signal/spectrum analyzer to ensure normal operation of software functions of the instrument.

- Description of instrument software
- Windows 7 usage
- Windows 7 configuration
- Windows 7 system security and maintenance
- System backup and recovery

3. 1. 2. 1. Description of instrument software

The S3503 Series Signal/Spectrum Analyzer uses Windows 7 operating system as its host software and such operating system has been installed and configured according to performance requirements of the signal/spectrum analyzer.

3. 1. 2. 2. Windows 7 usage

The following operations will be available with the administrator account:

- Installation of third-part software;

- Configuration of network and printer;
- Reading and writing of any files on the hard disk;
- Adding and deleting user accounts and passwords;
- Reconfiguration of Windows settings;
- Running of other application program.



Attention

The third-part software may affect the instrument performance.

The S3503 Series Signal/Spectrum Analyzer is equipped with the open Windows system, and the third-party software may affect the performance of the signal/spectrum analyzer. The applied software must be tested by the manufacturer and compatible with the host software.

3. 1. 2. 3. Windows 7 configuration

Before the instrument is delivered from the factory, the operating system of the instrument has been set to the best configuration and any change in such setting will result in reduction in measurement performance of the instrument. Generally, no change in Window operating system settings is required.



Attention

Problems caused by changes in system configuration

In case of problems in instrument usage or system crash due to changes in system configuration, the system recovery tool can be used to restore the operating system and application software, or users may contact our service consultation center at the service consultation hotline in the Manual. We will resolve the problems as soon as possible.

However, users may be free to modify the following items to facilitate measurement reporting and system integration.

- Configure USB device
- Configure GPIB
- Configure network
- Configure BIOS
- Connect monitor
- Configure initial state

1) Configure USB device

The S3503 Series Signal/Spectrum Analyzer has USB interfaces on the front and rear panel for direct connection with USD devices. If USB interfaces are not enough, a USB hub can be connected to the USB interface to meet relevant requirement. The USB devices that can be connected to the signal/spectrum analyzer include:

- USB memory that can be directly plugged in or out of the computer to facilitate data updating;
- CD-ROM drive, to help install firmware programs;
- Keyboard and mouse, to facilitate data editing and instrument operation;
- Printer, to help output measurement results.

The Windows 7 operating system supports plug-and-play devices and therefore is easy for USB devices installation. When devices are connected to USB interfaces, Windows 7 will automatically search for device drivers for matching. If no relevant drivers are found, the system will automatically search for driver program directories to complete installation.

If USB devices are removed from the USB interfaces, Windows 7 will automatically detect such changes in hardware configuration and uninstall relevant driver programs. Plugging of the USB devices does not affect operation of the signal/spectrum analyzer.

USB devices should be connected as follows:

a) Connect USB memory or CD-ROM drive

If the USB memory or CD-ROM is successfully installed, Windows 7 will prompt "device successfully installed and available for use" and automatically display relevant path name and prompt (e.g.: "D:").

b) Connect keyboard

Windows 7 system will automatically detect the USB keyboard connected to the instrument with default language as "Chinese (China)-Simplified Chinese - US Keyboard" and set keyboard properties via "Start > Control Panel > Clock, Language and Region > Keyboard and Language".

c) Connect mouse

Windows 7 system will automatically detect the mouse connected to the instrument and set mouse properties via "Start > Control Panel > Hardware and Sound > Equipment and Printer > Mouse".

d) Connect printer

Windows control panel can be used to configure the printer. Externally connected USB mouse and keyboard can be used to make printer configuration more easy. If a new printer is required, only the drive program for such printer is needed. The manufacturer of the printer will provide such drive installer. The installer can be installed via externally connected USB CD-ROM.

e) Configure GPIB

The user may need to modify the GPIB address in system building. The default GPIB address of the signal/spectrum analyzer is 18. Change the GPIB address as follows:

Press [System] [Interface Configuration ►] [GPIB address] to enter the interface shown in Fig. 3.9. Modify the GPIB address in the [Local GPIB address] input box through the number keys on the front panel.

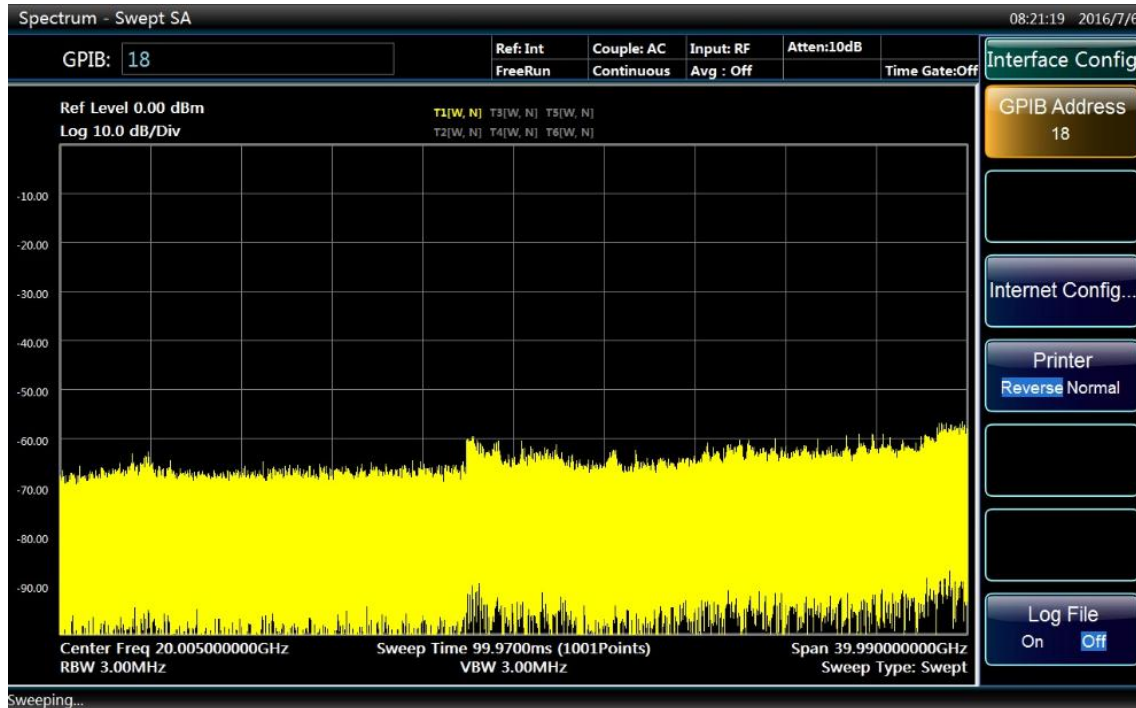


Fig. 3.9 Change GPIB Address

1) **Configure network**

a) **Change host name**

The host name (computer name) of the S3503 Series Signal/Spectrum Analyzer has been preset as "3503-PC" before delivery from the factory. To avoid repetition of network name, if one network is connected to more than one analyzer, users may be free to change the host name. The host name should be changed as follows: (refer to Microsoft Windows 7 help documents.)

Step 1: Press Start menu, select Computer and right click Properties, click Change Settings at the right of Computer Name, Domain and Working Group and again click the Computer Name column to change. As shown in Fig. 3.10.

Step 2: Edit to enter a new host name and click Confirm to restart.

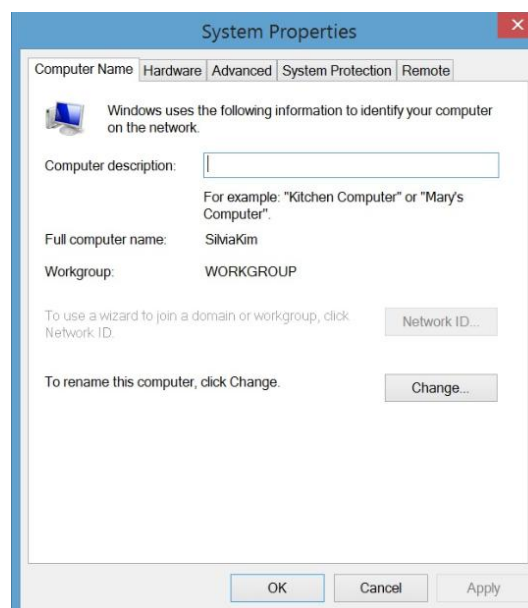


Fig. 3.10 Change host name

a) **Configure IP address, subnet mask and default gateway**

Press [System], [Interface Configuration▶] and [Network Configuration] to pop up the network connection setting interface, click Local Connection and right click Properties, double click "Internet Protocol Version 2 (TCP/IP)" as shown in Fig. 3.11 to change IP address, subnet mask and default gateway.

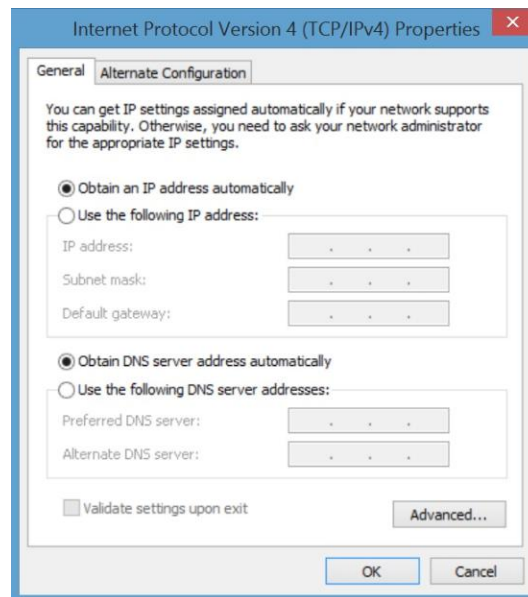


Fig. 3.11 Configure IP address, subnet mask and default gateway

b) Change system firewall settings

The firewall is used to prevent unauthorized users to remotely operate the instrument. Therefore, it is the manufacturer's recommendation to turn on the firewall for protection. Firewall protection has been enabled for the system and all interfaces for remote operations when the signal/spectrum analyzer is delivered from the factory. The administrator is the only person authorized to change firewall settings.

2) Configure BIOS

Targeted setup has been made for the signal/spectrum analyzer in BIOS.



Such BIOS setting cannot be changed.

Targeted setup has been made for the signal/spectrum analyzer in BIOS. Users should not change such setting, otherwise the instrument may not start or operate properly.

3) Connect monitor

External monitor (or projector) can be connected to "Display Interface" connector at the rear panel of the instrument according to the following steps:

- a) Connect the external monitor to the connector at the rear panel of the instrument.
- b) Usually double screen will be displayed automatically. If other options are required, the video card at the lower right corner of the system can be used for setting.
- c) Select the instrument to be displayed:
 - "Display 1": only internal monitor;
 - "Display 2": only external monitor;

- "Double display": internal and external monitors.
- d) When necessary, the screen resolution to be used can be changed.
- e) Before the setting is to take effect permanently, press "Apply" to test it to help to restore the previous setting when necessary.
- f) If such setting is suitable, press "OK".

4) Configure initial state

This section explains how to initially set the S3503 Series Signal/Spectrum Analyzer.

a) Set date & time

Date & time is displayed in the status bar at the top right corner of the operation interface of the instrument. When a file is saved, relevant time information will be saved synchronously. Users can set date/time in the Windows 7 system.

3. 1. 2. 4. Windows 7 system security and maintenance

1) Anti-virus software

Installation of anti-virus software may have some negative effect on performance of the instrument. It is highly recommended that users do not use the instrument as common computer for browsing the Internet or transmitting files to avoid infection of viruses.

Before using any USB mobile memory devices, they should go through anti-virus treatment with a computer installed with latest anti-virus software to ensure that such devices will not carry any virus.

Infection of the signal/spectrum analyzer system by viruses will bring adverse effect on system operation and usage by users. In such case, it is recommended that users restore the system. Refer to "2) System maintenance" for more details.

3. 1. 2. 5. System maintenance

a) Windows 7 backup

It is recommended that users regularly back up the system with the "system recovery tool" of the instrument to completely back up instrument data and the system. See "System backup and recovery" for more details.

It is recommended that before the instrument is used for purposes other than common purposes, such as long-term access to Internet and installation of third-party software, system backup of the instrument should be made to avoid accidental infection of viruses and other damages to operations of the instrument system.

The Windows 7 operating system has similar data backup function and is capable of copying all data in the instrument and creating a system disk to recover Windows system in case of serious failure. Refer to helps and references of Windows 7 system for more information. At the same time, third-party backup software that is compatible with the system software of the instrument can be used. It is recommended to use external devices for backup of the system data, such as network hard disk or USB hard disk.

b) Windows 7 system recovery

The Windows 7 system is capable of system recovery to restore the system to its previous state at certain point. However, Windows built-in system backup and recovery function does not always succeed. Therefore, such backup method is not recommended.

1) Hard disk partition and usage

The hard disk has been divided into three parts: "C:", "D:" and "E".

Disk C contains Windows 7 operating system and instrument application programs. Third-part software can also be installed to Disk C. Disk C is the only disk for program backup and recovery.

Disk D mainly contain the response program for keys: KeyMap.

Disk E is mainly used for data storage. It contains software data saved by users and Disk C system backup data. Users can copy the backup data on Disk E to external memory devices. In this case, all that is needed is to restore backup data to the new disk if the hard

disk is to be replaced.

3. 1. 2. 6. System backup and recovery

1) Disk operating system or data recovery

The disk recovery system of the signal/spectrum analyzer is used to restore in case of software error of Disk C (caused by loss of system files or data) or restore original manufacturer defaults.

Restoring of manufacturer defaults will affect the following:

- User-defined Windows 7 settings. Such as adding new user accounts. After the system is restored, new settings are required.
- After the system is restored, other third-party software installed by users should be reinstalled.

Using data recovery to repair disk error may result in loss of data or files. Therefore, data generated during measurement should be saved in Disk E. Furthermore, it is recommended that users regularly transmit such data via LAN to other computers or other storage media for storage.

2) How to use instrument recovery program

Step 1: Confirm that the instrument is turned off.

Step 2: Connect standard keyboard from PS/2 interface on the rear panel of the instrument;

Step 3: Turn on the instrument. After display of the system information, a operating system menu with a timer will appear:

Windows 7 System Recovery Tool

Before the timer hits 0, use the up/down arrow on the standard keyboard to select "System Recovery Tool" and click Enter.

Step 4: After entering the system recovery program interface, proceed as follows:

c) Select the first item "HOST, DISKGEN, PQMAGIC, MHDD, DOS" and wait to enter the next operation prompt interface;

- Select the third item to start "GHOST11.2", wait to enter GHOST11.2 operating interface and click Enter when a dialog with OK button appears;
- Select Local Partition From Image; use Tab key to enable "File name" input box in the opened file dialogue and enter E:\SystemGhost.GHO;
- Use Tab key to switch to OK in the Select Source Partition dialog popped up and click Enter; then again use Tab key to switch to OK in Select Target Device" dialog popped up and click Enter; select Partition 1 in Select Target Partition dialog popped up, use Tab key to switch to OK and click Enter;
- Select Yes in Alert and Confirmation dialog and click Enter;
- Wait until the system is completely recovered and select Reboot by following the prompts.

Step 5: After the instrument is restarted, the system will restore to the previous state when backup was made.

Step 6: After the system is restored, it is recommended that users execute all IF calibrations when the instrument is working stably after startup.

3. 1. 3. Routine Maintenance

This section describes the routine maintenance of the S3503 Series Signal/Spectrum Analyzer.

- Cleaning method
- Test interface maintenance

3. 1. 3. 1. Cleaning

1) Clean the instrument surface according to the following steps:

Step 1: turn off the instrument by disconnecting the power line connected to the instrument.

Step 2: carefully wipe the surface with dry or slightly wet soft cloth. Do not wipe the inside of the instrument.

Step 3: do not use any chemical cleaner, such as alcohol, acetone or any cleaner which may be diluted.

2) Clean LCD display

The LCD display should be cleaned after using for a while. Follow the steps below:

Step 1: turn off the instrument by disconnecting the power line connected to the instrument.

Step 2: soak clean soft cloth with cleaner, and carefully wipe the display panel.

Step 3: Dry the display panel with clean and soft cotton cloth;

Step 4: Connect the power line after the cleaner is thoroughly dry.



Clean the display.

There is anti-static coating on display surface, do not use fluoride-bearing detergent or acidic/alkaline detergent. Do not spray detergent on display panel directly, otherwise it may penetrate into and damage the instrument.

3. 1. 3. 2. Test interface maintenance

The S3503 Series Signal/Spectrum Analyzer has a RF input interface. If such interface is damaged or there is dust inside it, RF band test result may be affected. Therefore, such interface should be maintained as follows:

- Keep the interface far away from dust and keep it clean.
- Do not expose the interface surface to prevent ESD.
- Do not use damaged interfaces.
- Please use the air blower to clean the interface and new allow tools such as sandpaper to get in contact with the interface surface.



Interface impedance matching

The S3503 series signal/spectrum analyzer has a RF input interface of 50 Ω . If the impedance connector is not matched, the test result will be affected.

3. 2. Front Panel & Rear Panel

This chapter introduces the elements and functions of the front panel, the rear panel and the operation interface of the S3503 Series Signal/Spectrum Analyzer.

- Front panel
- Rear panel

3. 2. 1. Front Panel

This section describes the structure and functions of the front panel of S3503 Series Signal/Spectrum Analyzer. The front panel is as

shown in Fig. 3.12.

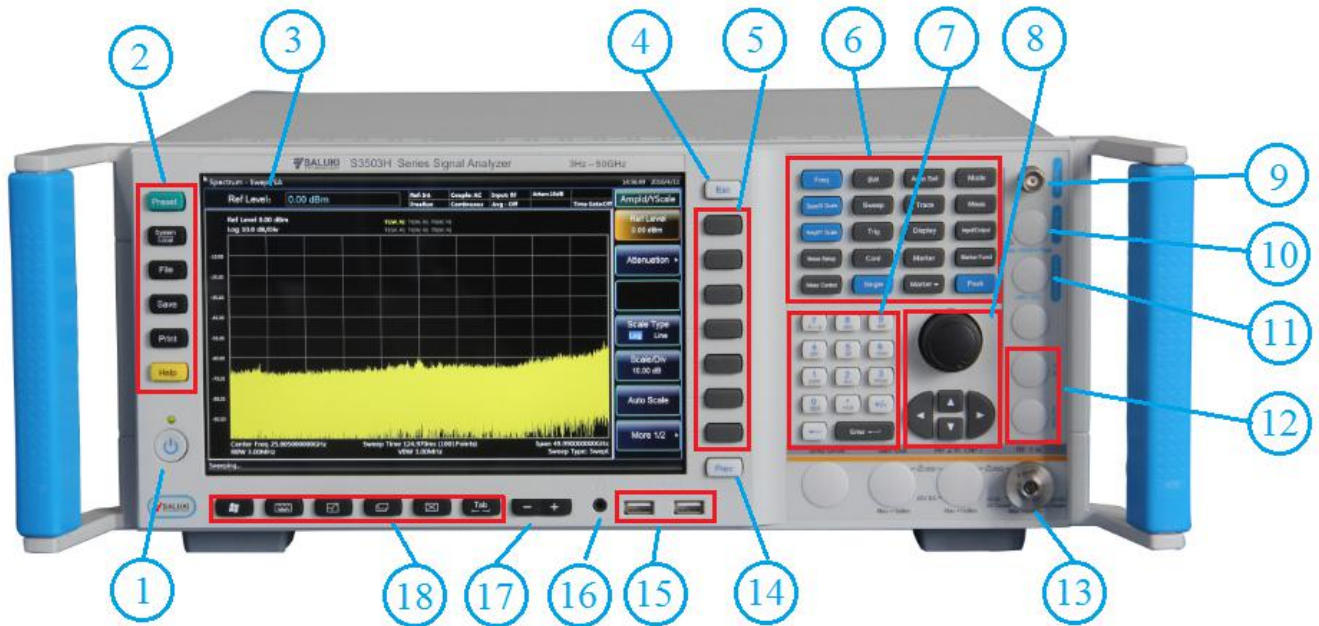


Fig. 3.12 Front Panel of S3503

- | | | |
|---------------------------------|-------------------------------|-------------------|
| 1. Power button | 7. Numeric keypad | 13. RF input |
| 2. System function area | 8. Knob and arrow keys | 14. Back |
| 3. Display zone | 9. Trigger input | 15. USB interface |
| 4. Cancel key | 10. Audio input | 16. Headset jack |
| 5. Soft key | 11. Noise source drive | 17. Volume key |
| 6. Measurement setting key area | 12. External mixing interface | 18. Window keys |

3. 2. 1. 1. Power button

The power button, located lower left corner of the front panel, is used for turning on and off the instrument.

3. 2. 1. 2. System control key area

The function key area is used to set system-level functions as shown in Table 3.5.

Table 3.5 Description of system control key area

Button name	Function description
Reset	To restore the instrument to default settings.
System	To provide functions related to system setting: error list, start-up reset, calibration, time & date, input/output and configuration.
File	To manage, save and call files.
Save	To store instrument settings.
Print	To define printer output, select and configure printer.
Help	To display online help.

3. 2. 1. 3. Display Zone

To display all measurement results on the screen on the front panel. Besides, the screen display also provides status and setting

information and allows users to switch among different measurement tasks. Refer to "3.3.1.1 Display area information" of the Manual for more details.

3. 2. 1. 4. Cancel key

It is used to exit any functional operation without changing current parameters, including cancel trigger, exit numeric keypad and exit file dialog.

3. 2. 1. 5. Soft keys

The display screen on the front panel of the analyzer has 7 unidentified black buttons, known as "soft keys". Such keys have different instructions depending on currently selected mode and measurement and are closely related to keys recently used. Corresponding functions of such keys will be highlighted when they are pressed. Fig. 3.13 shows the soft key menu of [Frequency].



Fig. 3.13 Soft key menu

1) Select soft keys

- Directly press the corresponding soft key at the right of the menu;
- Use the mouse pointer or other pointer device to press the key on the screen.

2) Navigation in the soft key menu

- "Menu 1/2" indicates that such menu has more soft keys than can be showed at a time. Press the menu to display a set of soft keys;
- If the soft key tab has "▶" symbol, it means a submenu of more soft keys is contained. Press such soft key to display the submenu;
- Return key is used to return to the previous menu.

3) Soft keys operation

Press the soft key to execute one of the following actions:

- Open a dialog box to enter data;

- Enable or disable a function;
- Open a submenu (only for soft keys with "►" symbol).

4) Identify status of soft keys by colors

The selected soft key will be displayed in highlight. If it is a switch soft key, it is currently highlighted as black. If some instrument function cannot be used due to specific setting, relevant soft key will be disabled and grayed out. Some soft key belongs to specific (fixed) option and will not be displayed if such option is not installed.

3. 2. 1. 6. Measurement setting key area

The measurement setting key area provides most commonly used measurement settings and functions as shown in Table 3.6. Refer to "5.2 Menu desperation" of the Manual for detailed description of functions.

Table 3.6 Description of measurement setting key area

Button name	Function description
Frequency	To set center frequency, start and stop frequency and frequency step of frequency range of current measurement. This key is also used to set frequency offset, auto tuning and signal tracking.
Span/X Axis	To set the frequency span to be analyzed or return to previous frequency span.
Amplitude/Y Axis	To set reference level, attenuator, scale type, scale size, unit, reference level offset and amplitude correction.
Measurement setting	To set measurement average count, average type, limit line, phase noise optimization, preselector, RF gain and ADC dither status.
Measurement control	To set measurement stop or restart.
Bandwidth	To set resolution bandwidth, video bandwidth, VBW/RBW, frequency span/RBW, filter type and filter bandwidth.
Scanning	To set sweep time, sweep count and to select continuous measurement OFF or ON.
Trigger	To select trigger mode, trigger threshold, trigger delay and trigger hold off time.
Continuous	To select continuous measurement.
Singular	To select continuous measurement off.
Automatic setting	To enable auto setting of mechanical attenuator, resolution bandwidth, video bandwidth, VBW/RBW, frequency span/RBW, sweep time and frequency step.
Track	To obtain and analyze trace configuration of measurement data.
Display	To set display line, language, graticule, status area and frequency information status.
Mark	To set absolute and relative positioning measurement marker (marker and delta marker).
Mark->	To give marker frequency to center frequency, marker to frequency step, marker to start frequency, marker to stop frequency and marker level to reference level.
Mode	To set measurement mode of the signal/spectrum analyzer.
Measurement	To set measurement functions in current mode.
Input Output	To set frequency reference, coupling mode, input interface, calibration interface, HF/IF output switch, logarithm detector output switch and input impedance.

Table 3.6 Description of measurement setting key area (continue)

Button name	Function description
-------------	----------------------

Marker function	To provide additional analysis function for measurement marker: <ul style="list-style-type: none"> ● Marker Count ● Audio Demodulation ● Noise Marker ● n dB measurement ● Bandwidth Power ● Bandwidth Density
Peak search	To execute peak search, delta marker, give marker frequency to center frequency and give marker level to reference level functions for active markers. If no marker is active, enable normal marker 1 and execute peak search.

3. 2. 1. 7. Keyboard



To enter alphanumeric parameters. Including the following keys:

1) Alphanumeric keys

To enter numbers and (special) characters in the edit dialog. See "3.3.1.1 Enter data" in the Manual for more details.

2) Decimal point

To inset one "." at cursor position.

3) Symbolic keys

To change symbols of numeric parameters. When inserting an alphanumeric parameter, a "-" will show at the cursor position.

4) Backspace key

- When alphanumeric character has been entered, this key will delete the character at the left of the cursor;
- If no input field is active, this key will cancel recently entered value and restore the previous value. Therefore, users can switch between two values (such as frequency span).

5) Enter key

- To terminate the input of a dimensionless number and set it as a new value;
- For other inputs, this key may be used as unit key including "Hz/dB";
- Press Default or Focus button in the dialog.

3. 2. 1. 8. Knob and arrow keys

1) Knob function:



- When entering numbers, step up (clockwise) or down (anticlockwise) the instrument parameters as specified;
- To move the selection bar in the Focus area (such as list);
- To move markers or limit lines on the screen;
- If a scroll bar is selected, to vertically move such scroll bar;
- When pressed, it has the same function with Enter key.

2) Up/down key function



- To increase or decrease instrument parameters in the number edit dialog;
- To roll up and down the items in the list;
- To vertically move the selection bar in the table;
- To move the scroll bar in windows or dialogs with the vertical scroll bar.

3) Left/right key function

- To move the cursor in the alphanumeric character edit dialog;
- To roll up and down the items in the list;
- To horizontally move the selection bar in the table;
- To move the scroll bar in windows or dialogs with the horizontal scroll bar.

3. 2. 1. 9. Trigger input

BNC female, for external trigger signal input on the front panel with input voltage range of [-5V, +5V].

3. 2. 1. 10. Audio input

BNC female, for test and analysis of audio signal input with input frequency range of [-5V, +5V].

3. 2. 1. 11. Noise source drive

Reserved for function extension.

3. 2. 1. 12. External mixing interface

Available when relevant option is selected. LO output interface: 2.4 mm connector; IF input interface: 3.5 mm SMA female connector.

3. 2. 1. 13. RF input

For subsequent analysis by connecting the tested device via the cable to RF input interface.



The input interface should not be overloaded. Refer to the specification manual for maximum permissible value. DC input voltage of

no more than 50 V is allowed for AC coupling. No DC voltage is allowed at the input interface for DC coupling. The internal mixer of the instrument will be damaged if the above conditions are not met.

3. 2. 1. 14. **ESC key**

Press Esc to return the soft menu to the previous level.

3. 2. 1. 15. **USB Interface**

Standard USB2.0 interface, A type. For connecting peripherals of the same interface, such as keyboard, mouse, drive and hard disk.

3. 2. 1. 16. **Headset jack**

To connect the headset. If it is connected, the internal loudspeaker will be turned off automatically.



Caution

Be careful! Too high volume may damage hearing.

Headset volume should be checked to be moderate before putting on the headset in order to protect users' hearing.

3. 2. 1. 17. Volume key



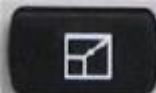

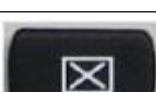
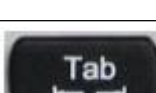


To set headset or loudspeaker volume.

3. 2. 1. 18. Window key

See Table 3.7 for icons and function description of the window key area.

Table 3.7 Description of measurement setting key area

Icon of window key	Name of window key	Function description of window key
	Windows system Start menu key	To display Windows "Start" menu
	Virtual keyboard key	To switch between screen keyboard display interface
	Windows zoom in/out key	Zoom in/out current window
	Window switching key	To switch between several windows
	Window close key	To close currently selected window
	Tab	To move in different areas of Windows dialogs

3. 2. 2. Rear Panel

This section describes the structure and functions of the rear panel of S3503 Series Signal/Spectrum Analyzer. The rear panel is as shown in Fig. 3.14.

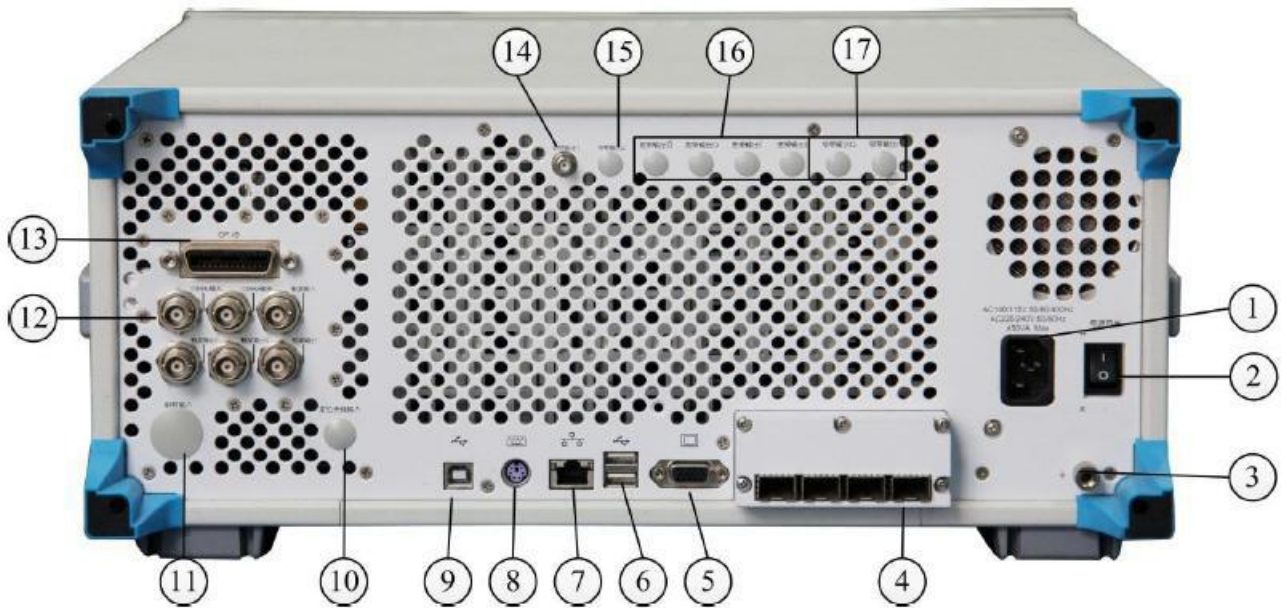


Fig. 3.14 Rear Panel of the S3503 Analyzer

- | | | |
|------------------------------------|-------------------------------|--|
| 1. Input interface of power supply | 6. USB interface | 11. RF input on the rear panel |
| 2. Power switch | 7. LAN interface | 12. BNC input/output on the rear panel |
| 3. Earthing Terminal | 8. Keyboard/mouse interface | 13. GPIB interface |
| 4. PV module interface | 9. USB slave interface | 14. IF output 1 |
| 5. Monitor | 10. Positioning antenna input | 15. IF output 2 |
| 16. Wideband output | 17. Narrowband output | |

3. 2. 2. 1. Input interface of power supply

AC power input of the instrument.

3. 2. 2. 2. Power switch

Main power control switch of the instrument.

3. 2. 2. 3. Grounding terminal

To reliably ground the instrument.

3. 2. 2. 4. PV module interface

To realize IQ data input and output via PV conversion module.

3. 2. 2. 5. Monitor

VGA interface, for external connection with VGA display device.

3. 2. 2. 6. USB Interface

Standard USB2.0 interface, A type. For connecting peripherals of the same interface, such as keyboard, mouse, drive and hard disk.

3. 2. 2. 7. LAN Interface

RJ45 interface, TCP/IP interface, 10/100/1000M self-adaptive, for remote operation of the analyzer.

3. 2. 2. 8. Keyboard and mouse interface

PS/2 keyboard/mouse interface to integrate keyboard and mouse functions. It is default as keyboard interface and if used as mouse interface, a one-to-two cable is required.

3. 2. 2. 9. USB interface (reserved for extension)

USB2.0 interface, B type USB TMC linked to external computer device controller to control the instrument and high-speed data transmission.

3. 2. 2. 10. Positioning antenna input

SMA female, GPS / Beidou positioning module antenna input interface (reserved for extension)

3. 2. 2. 11. RF input on the rear panel

Option with interface type subject to the frequency range of the instrument for signal connection during test system building.

3. 2. 2. 12. BNC input/output on the rear panel

See Table 3.8 and Figure 3.15 for BNC interface on the rear panel and relevant description.

Table 3.8 Description of measurement setting key area

Interface name	Interface description
10MHz input	BNC female for 10 MHz reference signal input with required amplitude over 0 dBm.
10MHz output	BNC female for 10 MHz reference signal output of the analyzer. To lock the frequency of other test devices to the frequency reference of the analyzer.
Trigger input	BNC female for external trigger signal input on the rear panel with input voltage range of [-5V,+5V].
Trigger Output 1	BNC female, TTL level, trigger signal output for synchronizing with other test devices. Output signal type configured by the output/input menu.
Trigger Output 2	BNC female, TTL level, trigger signal output for synchronizing with other test devices. Output signal type configured by the output/input menu.
Detector output	BNC female for video detector signal output.

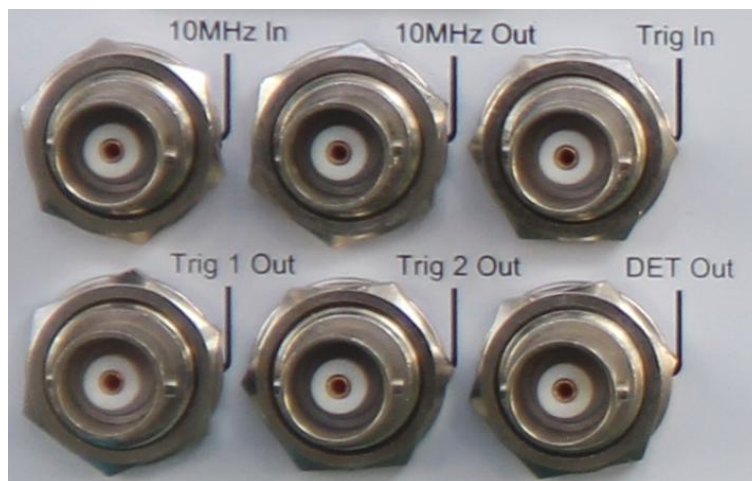


Fig. 3.15 BNC interface input/output on the rear panel

3. 2. 2. 13. GPIB Interface

Standard IEEE488 interface, SCPI language supported. For remote control.

3. 2. 2. 14. IF output 1

To output the second IF signal with output frequency range of 275MHz-475MHz and step resolution of 1Hz.

3. 2. 2. 15. IF output 2

To output the third IF signal with output frequency range of 10MHz-160MHz and step resolution of 1Hz.

3. 2. 2. 16. Wideband output

To realize any IF, AM/FM or I/Q signal output through digital reconstruction with bandwidth limit of 50 MHz-100 MHz.

3. 2. 2. 17. Narrowband output

To realize any IF, AM/FM or I/Q signal output through digital reconstruction with bandwidth upper limit of 40 MHz.

3. 3. Basic measurement methods

This section describes basic settings and measurement methods of the S3503 Series Signal/Spectrum Analyzer, including:

- [Basic operation instructions](#)
- [Basic operation examples](#)

3. 3. 1. Basic operation instructions

This section gives an overall introduction of how to use the S3503 Series Signal/Spectrum Analyzer (including graphic area display information type), how to use the S3503 Series Signal/Spectrum Analyzer via keys on the front panel and other interactive operations and how to use online help.

3. 3. 1. 1. Display area information

Fig. 3.16 shows a measurement interface of the instrument in spectrum analysis mode. Each information zone is marked with description of the operating interface as shown in Table 3.9. A detailed description will be given below. Display interfaces of other application modes or functions may vary slightly.

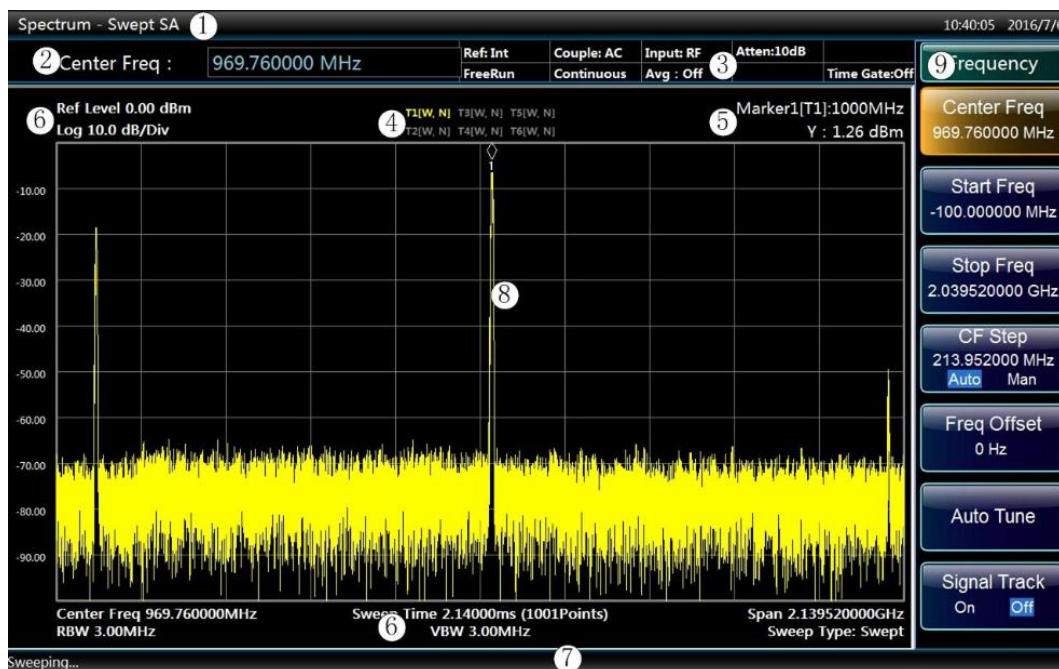


Fig. 3.16 Display interface of the S3503 analyzer

Table 3.9 Description of operating interface

Graphic No.	Function description
1	Title bar to display currently active measurement mode/function.
2	Parameter input area as the input field of the measurement setting.
3	Instrument setting information panel for displaying current setting information of the instrument, such as reference clock internal/external, input source, trigger mode; sweep mode, attenuator decrement; trace average type and average count, time gate on/off, etc.
4	To display trace information.
5	To display active marker information.
6	To display measurement setting of graticule area data. This legend includes reference level, scale type, scale/division, center frequency, sweep time (sweep count), frequency span, resolution bandwidth, video bandwidth and sweep type.
7	Instrument and status information for displaying measurement progress and prompting error messages.
8	To display test table.
9	To display the soft key menu of the last key pressed.

1) Title bar

To display currently active measurement mode/function.

2) Parameter input zone

Number input area of currently active function.

3) Instrument setting information panel

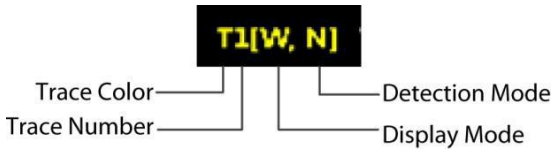
To display information related to the instrument and its settings for view by users as shown in Table. 3.10.

Table 3.10 Description of setting information panel

Message content	Symbol
frequency reference	Reference: internal
	Reference: external
Coupling method selection	Input coupling: AC
	Input coupling: DC
Input interface selection	Input: RF
	Input: calibration
Attenuator	Attenuation: 10 dB
Marker count selection	Marker count: off
	Marker count: on
Trigger Slope	Free Trigger
	Video trigger
	Power Trigger

	External Trigger 1
	External Trigger 2
	Burst Signal Trigger
	Timer Trigger
Sweep status	Continuous scanning
	Continuous sweep off
Average type	Video Average
	Power Average
	Average Voltage
Average count/total count	25/25
Time gate status	On
	Off

4) Trace information



Details of trace information are listed in Table 3.11.

Table 3.11 Description of trace information

Message content	Symbol	Meaning			
Trace color	Highlighted/ Grey	Trace display color and its opening status in the table			
Trace No.	T1—T6	Trace No. indicated			
Display mode	W	Refresh			
	A	Average			
	M	Max. Hold			
	m	Min. Hold			
Detection mode	N	Normal detection			
	P	Positive peak detection			
	S	Sample detection			
	p	Negative peak detection			
	A	Average detection	<table border="1"> <tr> <td>Video Average</td> </tr> <tr> <td>Power Average</td> </tr> <tr> <td>Average Voltage</td> </tr> </table>	Video Average	Power Average
Video Average					
Power Average					
Average Voltage					

1) Marker information

Marker information is shown at the top right corner of the table. See "5.2.2.15 Marker" of the Manual for more details.



5) To display measurement setting of graticule area data.

Center 1.000000000GHz	frequency: Sweep time: 5.50000 ms (1001 points)	Frequency 2.200000000GHz	bandwidth:
Resolution 3.00MHz	bandwidth: Video bandwidth: 3.00MHz	Sweep type: sweep	

Description of settings of general purpose hardware is as shown in Table 3.12.

Table 3.12 Description of settings of general purpose hardware

Message content	Symbol	Meaning
Reference level	Reference level 0.00 dBm	Reference level value currently set for the instrument
Scale Type	Logarithm/linear	Scale type set
Scale/Division	10.0dB/grid	Scale value of each graticule on Y axis
Center frequency:	Center frequency: 1.000000GHz	To display the center frequency of the screen
Bandwidth	Bandwidth=2.200000GHz	To display the frequency range of the screen
Scanning time	Sweep time: 4.400 ms (1001 points)	Sweep time/display count set
Resolution bandwidth	Resolution bandwidth: 3.00MHz	Resolution bandwidth set
Video bandwidth	Video bandwidth: 3.00MHz	Video bandwidth set
Sweep mode	Sweep mode: "Auto" "Sweep"	To display the spectrum sweep mode currently selected.

1) Instrument and status information

The instrument status and error messages (if any) are shown in the status bar at the bottom right of the table.

a) Measurement progress



To display current operation progress in the status bar at the bottom left of the table.

b) Error messages



If any error or abnormality is detected, corresponding error code and error message will be displayed at the right of the status bar.

c) Date/time



To display date and time information at the top right of the screen.

2) Test table

To display the test table in current measurement mode.

3) Soft key menu

To display the soft key menu of the last key pressed.

3. 3. 1. 2. User interaction

The following interactions can be used for the instrument with no need for user operating interface of the external keyboard.

- Screen keyboard;
- Knob;
- Arrow keys;
- Soft keys.

All tasks to be completed during operation of the instrument can be done via this user interface. All keys correspond to external keyboard operations (such as arrow keys and Enter key) and comply with Microsoft standards except for special keys for the instrument.

1) Keyboard

See 3.2.1.7 for details.

2) Knob

See 3.2.1.8 for details.

3) Arrow keys

See 3.2.1.8 for details.

4) Soft keys

See 3.2.1.5 for details.

3. 3. 1. 3. Current window switch key



When users need to switch between several display windows, press the current window switch key at the bottom of the front panel.

3. 3. 1. 4. Input data

The following methods can be used to enter the data into relevant dialog:

- Use keys on the front panel, such as the keyboard, the knob or the navigation key;
- Use keys on the virtual keyboard on the front panel;
- Use external keyboard connected.

Characteristics of Windows dialogs: In some cases, for example, when you want to install a printer, you need to use Windows built-in dialogs. The knob and the function keys do not work in such dialogs.

When entering numeric parameters into certain field, the keyboard can only be used to input numbers:

- Use the keyboard to enter parameters, or use the knob (small step) or up/down keys (large step) to change parameter values currently used;
- After inputting numeric values with the keyboard, press the unit key corresponding to the soft key menu to add relevant unit to the entered values;
- If no unit is required, press "Enter" or any one of the unit keys to confirm values entered. Highlight the edited row to confirm the value entered.

3. 3. 1. 5. Get help

The S3503 series signal/spectrum analyzer features online help: press the yellow [Help] key to call the online help file.

3. 3. 2. Basic operation examples

This section introduces detailed steps of common and important basic settings and functions of the S3503 Series Signal/Spectrum Analyzer with examples to help the user rapidly know the characteristics of the instrument and understand basic measurement methods.

Firstly, complete preparations before operation according to the following steps:

Step 1: energize and start the instrument;

Step 2: enter the system and initialize settings;

Step 3: proceed to the next operation if there is no prompt error message in the main operating interface of the front panel.

3. 3. 2. 1. Measure sine signal

The most common measurement task of the signal/spectrum analyzer is to determine level and frequency of signals. When measuring an unknown signal, users can use [Reset] key to switch the instrument to preset status and start measurement. In this section, the internal calibration signal of the instrument is used as an input to introduce how to measure a simple sine signal.



Attention

If the signal level may be higher than +30 dBm (= 1 W), a power attenuator should be provided at the RF input interface of the signal/spectrum analyzer, otherwise the signal level over 30 dBm will damage the RF attenuator or the input mixer. At the same time, the total power of all current signals should be taken into consideration.

1) Display the internal 500 MHz calibration signal

Step 1: reset the instrument:

- Press [Reset] key to restore the instrument to a predefined configuration status.

Step 2: turn on the internal 500 MHz calibration signal:

- Press [Input/Output] key to pop up input/output setting soft menu.
- Press [Calibration Interface▶] and [500MHz] to select the internal 500 MHz calibration signal.
- Press [Input Interface RF Calibration] soft key to select the input interface for calibration and terminate the input process.

At such time, the internal calibration signal of the instrument is connected to the RF input interface and the 500 MHz calibration signal can be observed on the instrument screen as shown in Fig. 3.17.

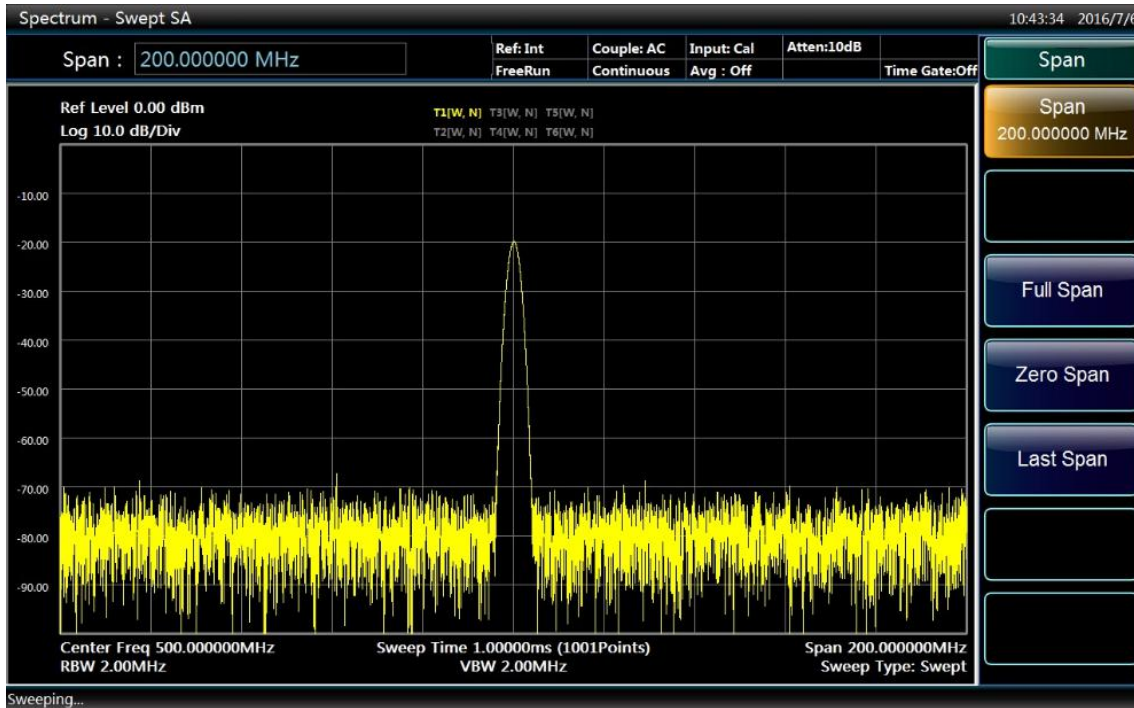


Fig. 3.17 500 MHz calibration signal as RF input

2) Optimize signal display

Adjust the main measurement settings to observe the calibration signal in a better way.

Step 1: set the center frequency as the calibration signal frequency (500 MHz):

- Press [Frequency] key.
- Press [Center Frequency] soft key and input 500 MHz via the numeric keys on the instrument panel.

Step 2: reduce the frequency span to 20 MHz:

- Press [Span/X Axis] key.
- Input 20 MHz via the numeric keys on the instrument panel.

Step 3: set the reference level as -10 dBm:

- Press [Amplitude/Y Axis] key.
- Input -10 dBm via the numeric keys on the instrument panel.

At such time, the calibration signal spectrum is displayed in the middle of the trace and the calibration signal can be observed more directly and clearly as shown in Fig. 3.18.



Fig. 3.18 Calibration signal spectrum after optimizing settings

3. 3. 2. 2. Set and move markers

The marker is used to determine the position of specific function in the trace. Its most common purpose is to determine certain peak. When a marker is enabled, the default settings will be applied. Here we are going to set a peak marker on the spectrum trace.

Step 1: reset the instrument:

- Press [Reset] key to restore the instrument to a predefined configuration status.

Step 2: execute Continuous Sweep Off:

- Press [Continuous Off] key on the front panel.
- Execute Continuous Sweep Off for once to generate a trace to help set a marker on it.

Step 3: enable Marker:

- Press [Marker] key on the front panel to display Marker soft menu.

At such time, Marker 1 is activated default as on Trace 1 and automatically set as the center frequency of Trace 1 as shown in Fig. 3.19. Such marker is indicated at the top right corner of the table as "Marker 1 [T1]". See "3.3.1.1 Display area information" of the Manual for more details the marker.



Fig. 3.19 Marker 1 activation interface

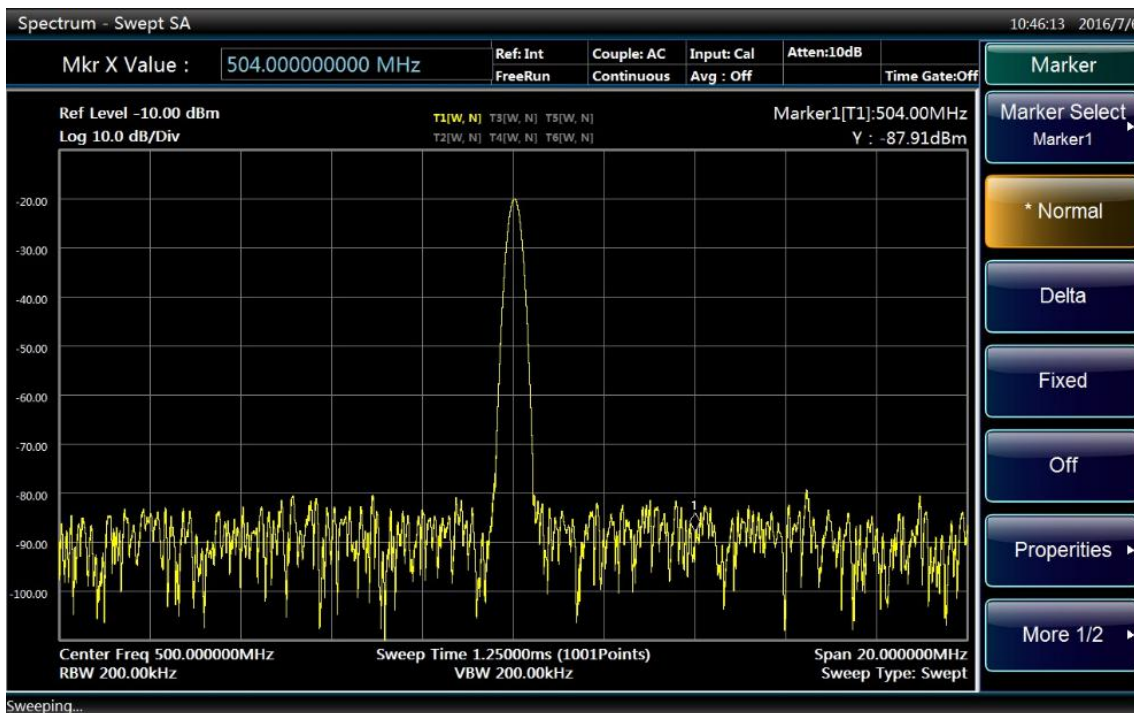


Fig. 3.20 Marker moving interface

Step 4: move the marker:

- Click and drag the marker with the mouse or use the knob or the arrow keys to move the marker to other places. Current position of the marker is indicated with a white diamond box as shown in Fig. 3.20.

3. 3. 2. 3. Peak list

The marker peak list can automatically determine frequency and level in the spectrum.

Step 1: execute Continuous Sweep Off:

- Press [Continuous Off] on the front panel for the instrument to sweep once.

Step 2: open Peak List window:

- Press [Peak Search] to open the peak search soft menu.
- Press [Menu 1/2], [Peak Table ►] and [Peak Table On/Off] to open a new window of marker peak list as shown in Fig. 3.21.

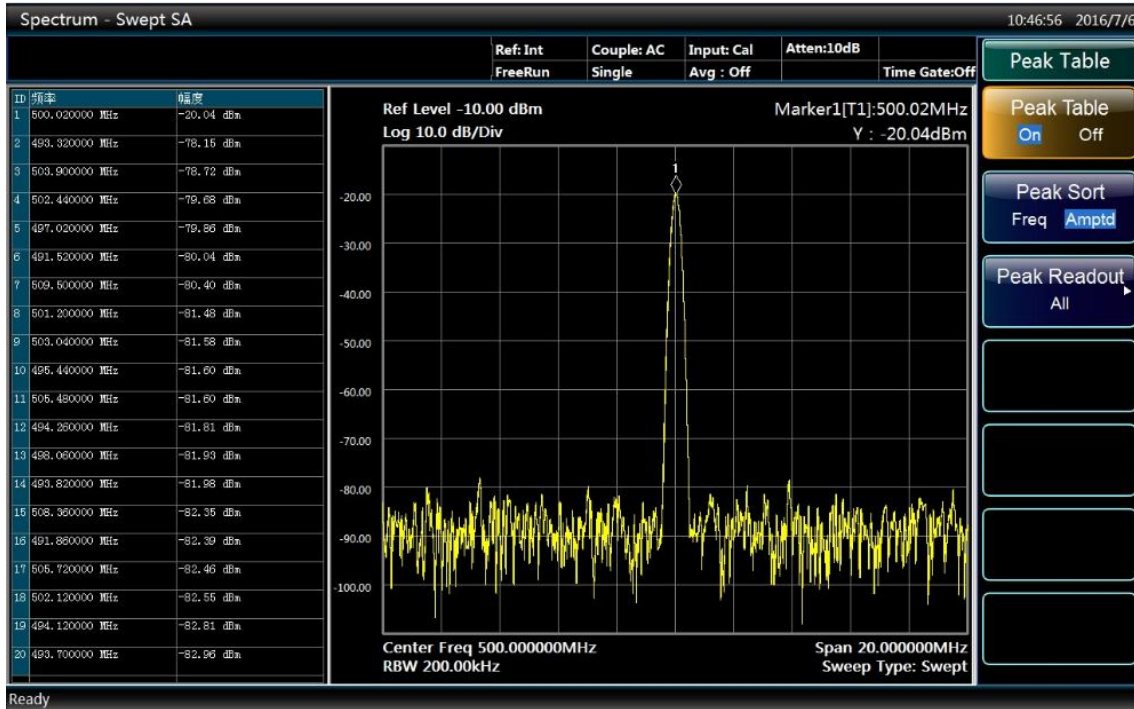


Fig. 3.21 The interface of opening peak table

Step 3: enable Peak Search:

- Press [Peak Search] to open the peak search soft menu; press [Menu 1/2], [Peak Criteria ►] and [Peak Threshold On/Off] to set the peak threshold as -68 dBm as shown in Fig. 3.22.

In order to obtain the noise-free peak and meet users' peak requirement, parameter such as the peak offset and the peak threshold in the peak criteria menu can be set to screen the peak list. For example, to set a threshold higher than the noise floor.

In the peak list, only a peak over -68 dBm is included. The marker peak list displays determined peaks higher than the set threshold.



Fig. 3.22 The interface of opening peak threshold

3. 4. Data management

This section describes working state saving/calling, measurement result data input/output methods and screenshot printing/saving method of the S3503 Series Signal/Spectrum Analyzer.

- Working state saving/calling
- Data saving/calling
- Screenshot printing/saving

3. 4. 1. Working state saving/calling

- Instrument reset state
- User state saving/calling

3. 4. 1. 1. Instrument reset state

The S3503 Series Signal/Spectrum Analyzer uses the startup state previously saved by users as the initial state of startup measurement. If there is no such startup state, the factory default startup state will be called. Usually when the measurement state of the instrument goes wrong, the initial state when the instrument works properly can be restored by resetting the instrument state.

The reset state of the signal/spectrum analyzer is saved and called as follows:

Step 1: save reset state:

- Press [System] key on the front panel.
- Press [Startup Reset] soft menu.
- Press [Save User Reset State] soft menu.

Step 2: call reset state:

- Firstly, press [System] key on the front panel.

- Press [Startup Reset] soft menu.
- Press [Reset Factory/User] to select reset switch.

If the factory state is required, set the reset switch as Factory; if the measurement state previously saved by users is required, set the reset switch as User.

- Press [Reset] key on the front panel to call the reset state.

3. 4. 1. 2. User state saving/calling

The S3503 Series Signal/Spectrum Analyzer provides instrument measurement state (data) saving and calling functions to help users restore required measurement state for repeated observation and analysis as well as saving of required measurement data for further analysis.

1) Save instrument state

Step 1: set file save type:

- Press [File] Key On The Front Panel.
- Press [Save Type] Soft Menu.
- Press [State] Soft Menu To Change Current Save Type As "State".

Step 2: save file:

- Press [Save...] soft menu.

Pop up Save As dialog to select the path and the file name to be saved and then click "Save".

2) Call instrument state

Step 1: set file call type:

- Press [File] key on the front panel.
- Press [Call Type] soft menu.
- Press [State] soft menu to change current call type as "State".

Step 2: call file:

- Press [Call...] soft menu.
- Pop up Open File dialog to select the file to be called and click Open.

3. 4. 2. Data saving/calling

The S3503 series signal/spectrum analyzer features file management and provides functions including file saving/calling, file browsing and copying, cutting, pasting and deleting of directory (file). Data files can be accessed via keys on the front panel, the mouse or remote operation (refer to the remote control manual of the S3503 series signal/spectrum analyzer for more details).

3. 4. 2. 1. Measurement data file type

Data file types of file management are as shown in Table 3.13.

Table 3.13 Table of data file types

File type	Description of saved data
Startup state file	To save current measurement state of the instrument for calling during startup
Reset state file	To save current measurement state of the instrument for calling during reset by users

File type	Description of saved data
User saved state file	To save current measurement state of the instrument (such as center frequency and span)
User saved trace + state file	To save current trace data and current measurement state
User saved image file	To save the bitmap of current operation screen as bmp format
User saved IQ data file	To save IQ modulation data
Limit line file	To save the information of the limit lined edited by users
Amplitude correction file	To save the information of amplitude correction edited by users

3. 4. 2. 2. File saving/calling method

The S3503 Series Signal/Spectrum Analyzer features data file saving/calling function, in which file saving means saving the measurement data into relevant file according to agreed format (such as: ASCII, *.dat) and file calling means opening selected data file, refreshing such display information as measurement parameters and list parameters to facilitate observation and assessment by users.

The signal/spectrum analyzer provides four types of saving functions and two types of calling functions based on information types and its management methods. Four types of files that can be saved include state file, trace (+ state) file, image file and IQ data file. Two types of files that can be called include state file and trace (+ state) file. Users only need to enter corresponding menu to pop up relevant dialog and designate the file name to be saved or select relevant file to complete file saving and calling. Details are as follows:

- File saving method
- File calling method

1) File saving method

Operating procedures:

Step 1: set file save type:

- Press [File] key on the front panel.
- Press [Save Type] soft menu to select file type.

If it is required to save current measurement state, press [State] soft menu to change current save type as "State"; if it is required to save trace data, change the save type to "Trace (+ state)"; if it is required to save current screen image, change the save type to "Image"; if it is required to save IQ data in IQ analysis mode, change current save type as "IQ Data". The state of saving IQ data can be set in "IQ Data" menu, including auto on/off. In auto mode, saved IQ data is consistent with that used for analysis with no need to set IQ data time and length; in auto off mode, IQ data time and length can be set manually and re-collection of IQ data is required when saving.

Step 2: save file:

- Press [Save...] soft menu.

Pop up File Save As dialog to select the path and file name to be saved and click "Save".

2) File calling method Operating procedures: Step 1: set file call type:

- Press [File] key on the front panel.
- Press [Call Type] soft menu to select file type.

If it is required to call measurement state file, press [State] soft menu to change current call type as "State". If it is required to call trace data, change the call type to "Trace (+ state)"; at such time, call the trace data in the file to current trace and change current

trace display mode to "Static Status Display".

Step 2: call file:

- Press [Call...] key to pop up Open File dialog, select the file named to be called and click Call.

3. 4. 2. 3. File directory management

The S3503 series signal/spectrum analyzer does not provide separate file directory management function. Such operations as file browsing, assigning, copying, pasting and deleting should be done in Windows system after exiting the signal/spectrum analyzer.

3. 4. 2. 4. Description file format

All files of the signal/spectrum analyzer are saved directly. All files except IQ data files adopt the binary format and their suffixes are determined by specific file types.

3. 4. 3. Screenshot printing/saving

The S3503 Series Signal/Spectrum Analyzer is capable of saving screenshots to graphic files (bmp format) and printing screenshots.

- [Save screen \(to files\)](#)
- [Print screen](#)

3. 4. 3. 1. Save screen (to files)

Operating procedures:

Step 1: set file save type:

- Press [File] key on the front panel.
- Press [Save Type] soft menu.
- Press [Image] soft menu to use image as the type of the currently saved file.

Step 2: save screen:

- Press [Save...] soft menu to pop up File Save As dialog to select the path and file name to be saved and click Save.

3. 4. 3. 2. Print screen



Install printer drive program

Before printing, a matching printer drive program should be installed firstly for the S3503 series signal/spectrum analyzer.

Step 1: open Print Setting dialog:

- Press [Print] on the front panel to pop up Print Setting dialog.

Step 2: configure the printer:

- Select the printer and click Properties to configure the printer if special configurations are required.

Step 3: click OK to print current screen image.

4. Operating Instruction

In this chapter, operating methods of different measurement functions of the S3503 Series Signal/Spectrum Analyzer are introduced and measurement procedures are explained in detail.

- [Function operation guide](#)
- [Advanced operation guide](#)

4. 1. Function operation guide

This section mainly introduces operating methods related to measurement modes, setting of common measurement parameters and analysis display of the S3503 series signal/spectrum analyzer.

4. 1. 1. Introduction of measurement modes and functions

This section mainly introduces major measurement modes and their main purposes of the S3503 Series Signal/Spectrum Analyzer. The signal/spectrum analyzer has two measurement modes with standard configuration: spectrum analysis mode and IQ analysis mode (IQ analysis mode is not available for S3503-S series). Users may select the measurement mode via [Mode] key on the front panel. Please refer to relevant software option user manual for more information of measurement mode options. Each measurement mode of the S3503 Series Signal/Spectrum Analyzer may contain several measurement functions and in the selected mode, specific measurement functions can be selected via [Measurement] key on the front panel.

4. 1. 1. 1. Spectrum analysis mode

The spectrum analysis mode is one regular general spectrum analysis and measurement environment and has very flexible spectrum analysis ability, which includes the traditional swept spectrum analysis and FFT spectrum analysis; in addition, the spectrum analysis has the signal spectrum peak search, marker function and various trace detectors and trace processing abilities, which enables the user to search and measure different types of signals conveniently.

The spectrum analysis mode can be accessed by activating the [Spectrum Analysis] menu through the [Mode] key on the front panel.

Moreover, the spectrum analysis mode also provides the one-key measurement function for the some special types of signals and common measurement applications. For these measurement functions, the S3503 Series Signal/Spectrum Analyzer pre-configure the measurement parameters of analyzer, which significantly reduces the complicated and trivial measurement setting operations for the user, thus enabling the user to carry out measurement conveniently. For the features of analyzer, the one-key measurement function integrates many measuring algorithms to optimize the measurement results.

Under the spectrum analysis mode, the measurement function can be selected by pressing the [Measurement] key on the front panel. The one-key measurement functions of S3503 Series Signal/Spectrum Analyzer include:

- Swept Analysis
- Channel Power
- Occupied Bandwidth
- Adjacent Channel Power
- Power Statistic
- Burst Power
- Harmonic Distortion
- Three-order Intermodulation
- Spurious Emission

- Spectral Emission Mask

4. 1. 1. 2. IQ analysis mode (S3503-S series is not provided with the IO analysis mode)

The IQ analysis mode can help the user capture the complex number time domain data from the RF input port signal, which retains the vector relation of time, frequency, phase and amplitude of signal. By setting center frequency and analysis bandwidth, the broadband VDC and digital IF processing in the signal/spectrum analyzer can resolve the signal to IQ data. Those IQ data can be analyzed through the IQ analysis function under this mode or inputted to other analysis tools through GPIB, LAN and USB interface for analysis and processing. The IQ analysis tool inside the S3503 Series Signal/Spectrum Analyzer can execute such basis analysis and measurement as FFT spectrum, time domain and IQ waveform.

Under standard configuration, the S3503 Series Signal/Spectrum Analyzer can execute IQ analysis of 10 MHz bandwidth signal and extend the bandwidth signal to 40 MHz or 200 MHz through configuration of options. The IQ analysis mode can be accessed by activating the [IQ Analysis] menu through the [Mode] key on the front panel.

4. 1. 2. Operation guidance for parameter setting of common measurement

This section mainly describes the concept of basic measurement setting commonly used in the spectrum analysis mode and its effect on the measurement results, as well as its setting methods. Regardless of measurement mode or measurement task, those concept and setting methods are of great help to familiarize you with the S3503 Series Signal/Spectrum Analyzer and its use. Some setting methods of measurement may vary slightly should other measurement modes be used, please refer to the corresponding user manual relating to the measurement mode.

- Settings of reset state and PowOn
- Parameter settings of frequency and span/X Axis
- Settings of bandwidth, filter and sweep
- Parameter settings of amplitude/Y Axis
- Settings of trigger parameter
- Measurement setting and parameter settings of measurement
- Parameters settings of coupling and auto input and output settings

4. 1. 2. 1. Settings of reset state and PowOn

Reset state means the signal/spectrum analyzer is restored to one known and definite measurement state. The reset state is classified into two types: factory reset state and user reset state. Whether the analyzer is restored to factory reset state or user reset state can be set by pressing [Reset] key through the [Start-up Reset] soft menu in the [system] key on the front panel.

PowOn refers to one known and definite working state that the analyzer enters automatically when the signal/spectrum analyzer is powered on and started or the software program of signal/spectrum analyzer is started through the Windows operating system.

1) Save user reset state

Step 1. first set the analyzer to the reset working state desired by you;

Step 2. press [System] key on the front panel, then [Start-up Reset] soft menu and [Reset Factory User], set the reset state to user state;

Step 3. finish the saving of user reset state by pressing the soft menu of [Save User PowOn].

2) Execute user reset

Step 1. press [System] key on the front panel and then [Start-up Reset] soft menu, the settings menu displays the state of [Reset Factory User];

Step 2. the user reset is completed by pressing [Reset] key on the front panel.



Attention

Reset Condition

If the user has never saved the user PowOn, the signal/spectrum analyzer will automatically return to the factory reset state during execution of user reset operation.

3) Execute factory reset

Step 1. press [System] key on the front panel and then [Start-up Reset] soft menu, the settings menu displays the state of [Reset Factory User];

Step 2. the factory reset is completed by pressing [Reset] key on the front panel.



Attention

If the signal analysis is under program control mode, the [Reset] key on the front panel is inactive.

4) Save User PowOn

Step 1. first set the analyzer to the working state of PowOn desired by you.

Step 2. press [System] key on the front panel and then press [Start-up Reset] soft menu many times to guarantee that the settings menu display state of [Reset Factory User];

Step 3. finish the saving of user PowOn by pressing the soft menu of [Save User PowOn].



Attention

Power-on State

If the user has never saved the user PowOn, the signal/spectrum analyzer will automatically enter the factory reset state when the signal/spectrum analyzer is powered on and started or the software program of signal/spectrum analyzer is started through the Windows operating system.



Prompt

Reset state under different measurement modes and functions

The S3503 Series Signal/Spectrum Analyzer has multiple measurement modes (menu corresponding to [Mode] key), while different measurement functions may be provided under one measurement mode (menu corresponding to [Measurement] key). Each measurement mode or function in the S3503 series signal/spectrum analyzer is equipped with separate factory reset and user reset state. Therefore, the reset operation is executed only for the current active measurement mode and function.

Factory reset state under different measurement modes and functions

For factory preset value of each measurement parameter of S3503 Series Signal/Spectrum Analyzer, please refer to the menu description of relevant parameter and for relevant details, please refer to chapter "[5.2 Menu description](#)" herein.

4. 1. 2. 2. Settings of frequency and span/X Axis

The [Frequency] key and [Span/X Axis] key can be used to set the range displayed by X Axis in the current active window of signal/spectrum analyzer. Under non-zero span (greater than zero), the active window of spectrum analysis mode usually displays the signal spectrum trace with X Axis as frequency axis; the frequency measurement range can be set through the [Frequency] key and [Span/X Axis] on the front panel; under zero span (equals to zero), it displays the trace of signal frequency changing over time with X Axis as time axis. Only the span can be changed should corresponding soft menu of [Span/X Axis] be operated.

5) Parameter description of [Frequency] key

Frequency range (frequency measurement range) refers to the display range of frequency axis of signal/spectrum analyzer. The frequency range is displayed in the information display area under screen with two ways including center frequency value and span value or start frequency value and stop frequency value. The parameters corresponding to [Frequency] key include [Center Frequency], [Start Frequency],[Stop Frequency],[Frequency Step],[Frequency Offset], [Auto Tune] and [Signal Track].

- [Center Frequency] is used to set and indicate the frequency value in the center of measurement display window of signal/spectrum analyzer;
- [Start Frequency] is used to set and indicate the frequency value in the leftmost position of measurement display window of signal/spectrum analyzer;
- [Stop Frequency] is used to set and indicate the frequency value in the rightmost position of measurement display window of signal/spectrum analyzer;
- [Frequency Step] is used to set and indicate the frequency step size when the center frequency, start frequency and stop frequency are changed through Up/Down key on the front panel;
- [Frequency Offset] is used to set and indicate the correction value of frequency range of information display area;
- After the [Auto Tune] is pressed, the signal/spectrum analyzer will automatically optimize and set the frequency measurement range and display range of Y Axis based on the signal characteristics. For the specific setting methods and operation guidance of auto optimization, please refer to chapter "4.1.2.7 Parameter setting of coupling and auto" herein;
- [Signal Track] is used to track and measure the drift signal, by which the center frequency of signal/spectrum analyzer can be automatically tuned for the maximum peak frequency of input port signal. For measurement methods of drift signal, please refer to chapter "4.2.8 Drift signal measurement" herein.

6) Parameter description of [Span/X Axis] key

Span refers to difference between start frequency and stop frequency measured by signal/spectrum analyzer. Under spectrum analysis mode, the parameters corresponding to [Span/X Axis] key on the front panel include [Span], [Full Span], [Zero Span] and [Previous Span], which are used to set the frequency range measured by signal/spectrum analyzer, provided that the center frequency remains unchanged. Differences may exist in other modes, please refer to relevant manual for specific operations.

[Full Span] is used to set the frequency measurement range as maximum frequency range. It should be noted that the center frequency will automatically change to 1/2 of nominal maximum upper limit frequency of analyzer. This setting is of great use for observing the signals in the entire frequency measurement range.

[Zero Span] is used to set the span as 0 Hz, then the X Axis will change to time axis and the length of time will automatically become the sweep time of current signal/spectrum analyzer.

[Previous Span] is used to set the span as the value set last time. This function can help the user quickly switch the detail measurement under full span measurement and narrower span.

7) How to set frequency measurement range

The following methods are commonly used to set the frequency measurement range of signal/spectrum analyzer through [Frequency] key, [Span/X Axis] key and corresponding soft menus; for programming methods under program control mode, please refer to program control manual:

Method 1. set frequency measurement range through [Center Frequency] and [Span].

Method 2. set frequency measurement range through [Start Frequency] and [Stop Frequency].

Method 3. frequency measurement range can be set through [Center Frequency] and [Span] should time domain power be measured.

Method 4. frequency measurement range can be set through [Full Span] should the measurement of entire frequency range be executed.



Attention

When the span manually input is 0 Hz, the signal/spectrum analyzer will automatically enter the zero span state and execute the measurement of time domain power.

Method 5. frequency measurement range can be set quickly through [Previous Span] should the frequency range set last time be measured.

Method 6. frequency measurement range can be set quickly through [Auto Tune] should RF input signal be barely understood.

The center frequency, start frequency and stop frequency can be set manually with number keys and adjusted through the Up/Down key and knob on the front panel.

8) How to adjust frequency measurement range

When the measurement is being executed in the current frequency range, the following methods can help the user quickly adjust the frequency measurement range:

Method 1. the center frequency, start frequency and stop frequency can be adjusted through the Up/Down key and knob on the front panel.

Step1. Set frequency step.

The frequency step value desired by you can be inputted manually through the number keys on the front panel by pressing [Frequency] key on the front panel and then [Frequency Step].



Attention

When the frequency step is set to auto, the Up/Down key on the front panel is corresponding to frequency step 1, 2, 5 and 10; during zero span, the frequency step corresponding to the knob is 1/20 of current resolution bandwidth; during non-zero span, the frequency step corresponding to the knob is 1/200 of current resolution bandwidth.

Step 2. press the soft menu of [Center Frequency], [Start Frequency] or [Stop Frequency] to be adjusted.

Step 3. the adjustment can be realized by pressing the Up/Down key or knob on the front panel.

If the center frequency needs to be adjusted, press the Up key on the front panel once, then center frequency will automatically change to current center frequency value plus frequency step size; while press the Down key on the front panel once, then center frequency will automatically change to current center frequency value minus frequency step size. The start frequency and stop frequency are adjusted in the same way provided above.

Method 2. adjust the measurement span through the Up/Down key and knob on the front panel. The span step corresponding to the Up/Down key on the front panel of S3503 Series Signal/Spectrum Analyzer is based on way of 1-2-5-10, while the step size corresponding to the knob is 1/10 of maximum order of current span.

Method 3. if the frequency of display signal is drifting, you can enable the signal track function, then the signal/spectrum analyzer will automatically adjust the center frequency based on the signal peak.



Prompt

The span is likely to change automatically when the center frequency is changed.

For S3503 Series Signal/Spectrum Analyzer, the minimum value of frequency display range is -100 MHz, while the maximum value is related to the maximum nominal value of analyzer:

S3503A	4.1 GHz;
S3503B	9GHz;
S3503C	13.5GHz;
S3503D	18.3GHz;
S3503E	27GHz;
S3503F	40.4GHz;
S3503G	45.5GHz;
S3503H	51GHz.

When the center frequency is adjusted to approach the lowest frequency limit, if current span is $> 2 \times (\text{center frequency} + 100\text{MHz})$, the current span will automatically change to $= 2 \times (\text{center frequency value} + 100\text{MHz})$.

When the center frequency is adjusted to approach the nominal highest frequency limit of signal/spectrum analyzer, if current span is $> 2 \times (\text{maximum value of display range} - \text{center frequency value})$, the current span will automatically change to $= 2 \times (\text{maximum value of display range} - \text{center frequency value})$.



Prompt

Rules of signal track

When the signal track function is enabled, the signal/spectrum analyzer, with the current marker frequency value as center and 1/10 of current measurement span as search span, will set the frequency value corresponding to the signal peak searched to the center frequency of next measurement.

Method 4. adjust the center frequency, start frequency and stop frequency through [Marker →].

For the use and operation of [Marker →] key, please refer to the "4.1.3 Operation guidance on general analysis and display function" herein.

9) How to change frequency offset

If you hope that the frequency measurement range displayed on screen is to be corrected within the frequency measurement range of signal/spectrum analyzer during actual work, the correction value of frequency offset can be set with number keys on the front panel by pressing [Frequency] key on the front panel and activating [Frequency Offset] menu. The step size set for frequency offset corresponding to the Up/Down key and knob on the front panel is same as frequency step size.

4. 1. 2. 3. Settings of bandwidth, filter and sweep

The section mainly describes the meaning of the parameters corresponding to [Bandwidth] key and [Sweep] key and provides the operation guidance. When the signal/spectrum analyzer is executing the spectrum measurement, the [Bandwidth] key and [Sweep]

key can be used to set the parameters including resolution bandwidth, video bandwidth, sweep time, sweep type, etc., which are used to determine the access way of spectrum data of signal/spectrum analyzer and filter type. Differences may exist in other modes, please refer to relevant user manual

1) Parameter description of [Bandwidth] key

The setting menus corresponding to the [Bandwidth] key on the front panel include [Resolution Bandwidth], [Video Bandwidth], [VBW/RBW], [Span/RBW], [Filter Type] and [Filter Bandwidth].

[Resolution Bandwidth] is used to set and indicate the frequency resolution capability when the signal/spectrum analyzer executes the spectrum measurement. The parameters of Resolution Bandwidth (RBW) determines the minimum frequency interval that the spectrum distinguish two signals. The smaller the resolution bandwidth is, the higher the resolution capability is.

For a simple-frequency signal, the trace displayed by swept spectrum analysis is the frequency response shape of checked IF filter. When the filter bandwidth is changed, the trace width displayed by analyzer will change at the same time. For two signals with equal amplitude and very close frequency, the spectrum traces of two signals display as one signal if the broader filter is selected; if filter narrow enough is used, these two input signals can be distinguished and display as two separate spectrum peaks. Therefore, the signal resolution capability is determined by the IF filter of analyzer.

When the settings of resolution bandwidth are changed, the IF filter inside the analyzer will change at the same time. Usually, the resolution bandwidth is defined as 3 dB bandwidth of filter or as 6 dB bandwidth of filter sometimes. To distinguish two signals with equal amplitude, the resolution bandwidth has to be less than or equal to signal frequency interval. If the resolution bandwidth is equal to the signal interval and video bandwidth is less than resolution bandwidth, a 3 dB dip will appear between two signals on the spectrum trace. The smaller the resolution bandwidth is, the deeper the dip goes. Therefore, distinction between two adjacent signals will be more clear.

The desired resolution bandwidth can be realized with IF filter by S3503 Series Signal/Spectrum Analyzer under swept spectrum measurement mode or with FFT filter under FFT spectrum measurement mode. FFT filter can be understood as the window function operation before executing FFT spectrum operation.

The Video Bandwidth Filter is the low-pass filter operation or average operation executed on spectrum trace, which can smoothen the spectrum trace displayed. Under swept spectrum measurement mode, video bandwidth (VBW) refers to the bandwidth of low-pass filter executed on spectrum trace. Under FFT spectrum measurement mode, video bandwidth (VBW) refers to the equivalent low-pass filter bandwidth after the FFT spectrum trace is averaged many times.

[VBW/RBW] is used to set and indicate the specific value of resolution bandwidth and video bandwidth used by current spectrum measurement. This parameter can be set automatically or manually. The signal/spectrum analyzer is set as 1 automatically, namely the resolution bandwidth is same as video bandwidth. This parameter only has influence on the settings of video bandwidth. When the video bandwidth is set to auto, the VBW value of signal/spectrum analyzer will be determined based on the current RBW and [VBW/RBW].

[Span/RBW] is used to set and indicate the specific value of current span and resolution bandwidth. This parameter can be set automatically or manually. The signal/spectrum analyzer is set as 106 automatically, namely the resolution bandwidth is approximately equal to 1/106 of current span. This parameter only has influence on the settings of resolution bandwidth. When the resolution bandwidth is set to auto, the resolution bandwidth of signal/spectrum analyzer will be determined based on the current span and [Span/RBW].

[Filter Type] is used to set whether the resolution bandwidth of signal/spectrum analyzer is realized with Gaussian filter or flat top filter.

[Filter Bandwidth] is used to set whether the resolution bandwidth is selected as 3dB, 6dB, noise bandwidth or pulse bandwidth when the signal/spectrum analyzer uses the Gaussian filter. When this parameter is changed, the resolution bandwidth filter is fixed, and the bandwidth value in the information display zone changes.

2) Parameter description of [Sweep] key

The parameters corresponding to the [Sweep] on the front panel include [Sweep Time], [Sweep Continuous OFF ON], [Sweep Setting]

►] and [Sweep Counts].

[Sweep Time] is used to set and indicate the time that is used by the signal/spectrum analyzer to execute one measurement. The information of this parameter is displayed in the lower middle position of screen trace display area. When the sweep time is set as auto, the signal/spectrum analyzer will automatically execute the sweep based on the sweep type and rules set.

[Sweep Continuous OFF On] is used to control whether the next measurement manually started by the user or auto start of re-measurement is required for the signal/spectrum analyzer after finishing one measurement. The [Continuous OFF] key and [Continuous ON] key on the front panel also can be used to set this parameter.



Continuous measurement and sweep OFF

When the "Average Count" ([Measurement Setting] menu) is set as 1, or trace average and hold are not opened, the continuous sweep and measurement OFF are equivalent. By pressing [Continuous OFF] key, the signal/spectrum analyzer will stop the measurement after executing one sweep and measurement and enter idle state.

When the "Average Count" [Measurement Setting] menu) is set as greater than 1, or average or hold is opened for any trace, the signal/spectrum analyzer will execute multi-measurement or data capture operations and stop the measurement after reaching the specified average count and enter idle state by pressing [Continuous OFF] key.

The operation corresponding to the [Continuous OFF] key on the front panel is to execute the continuous OFF measurement.

[Sweep Setting ►] is used to determine whether Swept or FFT is adopted for the signal/spectrum analyzer. Also set the FFT step bandwidth for FFT sweep.

[Sweep Count] is used to set the number of trace data that is required to be captured by the signal/spectrum analyzer during one measurement.

3) Interactions of bandwidth, filter and sweep time

The bandwidth and filter are closely related to and correlate with the sweep time. The values of resolution bandwidth and video bandwidth depend on the type of filter selected, and, meanwhile, these settings have an influence on other measured parameters to a certain degree. As the analog or digital filter is used, the sweep speed will be limited by the transient response of IF and video filter.

If $VBW > RBW$ during sweep, the transient time of video filter is not affected. In such case, the transient response time required is inversely proportional to the square of RBW, as shown below:

$$T_{\text{sweep}} = k \times \text{Span} / \text{RBW}^2$$

Wherein: T_{sweep} is the minimum sweep time required under the given span and resolution bandwidth with unit of s;

RBW is resolution Bandwidth with unit of Hz;

Span is the display span with unit of Hz;

K refers to the filter constant, depending on the type of filter and permissible error of transient response. Gaussian filter is used for the signal/spectrum analyzer by default.

If $VBW < RBW$, the minimum sweep time required will be affected by the transient time of video filter. Similar to the IF filter, the reducing bandwidth will increase the transient time. If the analog technology is used, the video filter is in general first-order low pass or simple RC circuit; there is one linear relation between VBW and sweep time. Decrease the video bandwidth by factor n and extend the sweep time by n-fold.

During FFT, the sweep also interacts with the resolution bandwidth and video bandwidth. The sweep time is about the sum of data acquisition time and the time of executing FFT spectrum operations. During FFT measurement, the sweep time cannot be set

randomly, while the signal/spectrum analyzer provides one approximate value based on the current resolution bandwidth, video bandwidth and FFT step configuration.

4) How to set parameters of solution bandwidth

Usually, the S3503 Series Signal/Spectrum Analyzer sets the resolution bandwidth automatically based on the specific value of [Bandwidth/RBW] and current span. There are over 160 scales of settings for the resolution bandwidth of S3503 series signal/spectrum analyzer, with 25 per 10 octave within 1 Hz - 1 MHz, changing by 10% step between 1 Hz and 3 MHz and taking 4 MHz, 5 MHz, 6 MHz, 8 MHz, 10 MHz and 20 MHz above 3 MHz. Changing the resolution bandwidth if it is expected to can be realized in the following two methods:

Method 1. When the specific value of span and resolution bandwidth is changed manually by pressing [Span/RBW] after pressing the [Bandwidth] key on the front panel, the resolution bandwidth will automatically select based on the specific value.

Method 2. the expected resolution bandwidth can be entered with the number keys or the resolution bandwidth can be set with Up/Down key or knob on the front panel by pressing [Resolution Bandwidth] after pressing [Bandwidth] key on the front panel. When the number of resolution bandwidth is entered with number keys, the signal/spectrum analyzer will automatically set the resolution bandwidth to the scale closet to the number entered. When the resolution bandwidth is set with Up/Down key, the resolution bandwidth of signal/spectrum analyzer will change in the step way of 1-2-3-5-10. When the resolution bandwidth is set with knob, all scales of resolution bandwidth can be selected.

5) How to set parameters of video bandwidth

Usually, the S3503 Series Signal/Spectrum Analyzer selects the video bandwidth automatically based on the specific value of [VBW/RBW] and according to the current resolution bandwidth. The video bandwidth and resolution bandwidth of S3503 Series Signal/Spectrum Analyzer vary in scale. Changing the video bandwidth if it is expected to can be realized in the following two methods:

Method 1. when the specific value of RBW and VBW is changed manually by pressing [VBW/RBW] after pressing the [Bandwidth] key on the front panel, the video bandwidth will automatically select based on the specific value.

Method 2. the expected video bandwidth can be entered with the number keys or the video bandwidth can be set with Up/Down key or knob on the front panel by pressing [Video Bandwidth] after pressing [Bandwidth] key on the front panel. When the number of video bandwidth is entered with number keys, the signal/spectrum analyzer will automatically set the video bandwidth to the scale closet to the number entered. When the video bandwidth is set with Up/Down key, the video bandwidth of signal/spectrum analyzer will change in the step way of 1-2-3-5-10. When the video bandwidth is set with knob, all scales of resolution bandwidth can be selected.

6) Set sweep parameters manually

Setting the suitable sweep parameters manually is of great help for executing measurement task.

- Set sweep time manually

When the sweep time of S3503 series signal/spectrum analyzer is set as auto, it usually select the fastest sweep time to execute measurement and the maximum error of measurement is less than 0.1 dB in comparison with the sweep measurement with relative longer time.

The sweep time can be set with the number keys, Up/Down key or knob on the front panel in the [Sweep Time Auto Manual] by pressing the [Sweep] key on the front panel.



Limitations on the setting of sweep time

When the sweep type is sweep frequency (and span > 0 Hz), the signal/spectrum analyzer will automatically work out the minimum sweep time based on such parameters as resolution bandwidth, video bandwidth and type of filter. When the sweep time set manually is less than the minimum sweep time, the signal/spectrum analyzer will automatically execute the measurement based on the

minimum sweep time. When the sweep time set manually is greater than 6,000 s, the signal/spectrum analyzer will automatically execute the measurement based on the sweep time of 6,000 s.

When the sweep type is zero span, the sweep time of signal/spectrum analyzer is not related to the parameters including resolution bandwidth, video bandwidth and type of filter. When the sweep time set manually is less than the minimum sweep time (1 us), the signal/spectrum analyzer will automatically execute the measurement based on the minimum sweep time. When the sweep time set manually is greater than 6,000 s, the signal/spectrum analyzer will automatically execute the measurement based on the sweep time of 6,000 s.

When the sweep type is FFT, the sweep time cannot be set manually.

- How to switch continuous sweep ON and OFF

The continuous sweep ON indicates that the signal/spectrum analyzer automatically executes the measurement based on the trigger event set. The continuous sweep ON is the default state of the signal/spectrum analyzer.

The continuous sweep OFF indicates that the signal/spectrum analyzer is manually controlled by the user to execute the measurement based on the trigger event set. When the trace average function is opened, the signal/spectrum analyzer will not stop the measurement until the designated trace average count is reached. For more details, please refer to "4.1.2.6 Parameter settings of [Measurement Setting] and [Measurement Control]" herein.

Many methods in the S3503 series signal/spectrum analyzer are available for switching the continuous sweep ON and OFF directly.

Method 1: switch can be realized with [Sweep Continuous OFF ON] soft menu by pressing [Sweep] key on the front panel.

Method 2: switch can be realized by pressing [Continuous OFF] and [Continuous ON] key on the front panel

Configure sweep type rules manually

For the S3503 series signal/spectrum analyzer, the sweep type includes sweep frequency and FFT, while the sweep type rules include "Best Dynamic Range" and "Best Speed".

- "Best Dynamic Range" rules: when RBW is or larger than 300Hz, the sweep type is Swept; when RBW is less than 300Hz, the sweep type is FFT.
- "Best Speed" rules: when RBW is or larger than 3kHz, the sweep type is Swept; when RBW is less than 3kHz, the sweep type is FFT.

The user can set the sweep type rules manually by pressing [Sweep] key on the front panel and entering sweep setting menu. In the reset state, the S3503 usually select the sweep type automatically based on the "Best Dynamic Range".

- Configure sweep type manually

By setting the [Sweep Type ►] as manual by entering sweep setting menu through [Sweep] and [Sweep Setting ►] key, the user can manually set the sweep type of the current signal/spectrum analyzer as sweep frequency or FFT.



Judge the parasitic or residual response of signal/spectrum analyzer by changing sweep time

The S3503 Series Signal/Spectrum Analyzer can carry out the spectrum measurement by using sweep and FFT. When you find the lesser parasitic or residual response on the measured data, you can try to judge that the response is generated by signal/spectrum analyzer itself or brought into by the input signal by changing the sweep type. If the response signal disappears or gets smaller in different sweep type, it can be considered that the signal distortion to a certain degree is caused by the hardware measurement channel of signal/spectrum analyzer.

- Configure FFT width manually

The FFT width can be set by activating the [Sweep Setting ▶] and [FFT Width ▶] though [Sweep] key on the front panel.

Before the FFT width is set manually, the working principle and process that S3503 Series Signal/Spectrum Analyzer executes the FFT spectrum measurement should be understood first. When the FFT is used to measure the signal spectrum within one frequency range, the signal/spectrum analyzer is tuned to center frequency of measured frequency range, then the FFT spectrum calculation is carried out for the time domain data obtained. As the limitation of resolution bandwidth, the maximum frequency range of this way of measurement is also limited with limit value of FFT width. For the spectrum measurement of frequency range exceeding the FFT width, the signal/spectrum analyzer will measure one section of frequency range at a time by tuning the center frequency of RF reception circuit by step and joint the measured spectrum.

FFT width is only active when the FFT sweep type is selected. When the sweep type is set as auto, the S3503 Series Signal/Spectrum Analyzer will execute FFT spectrum measurement, the maximum resolution bandwidth is 1 MHz. The larger is the FFT width, the faster is FFT spectrum measurement, but the dynamic range performance will be affected.

Under FFT sweep, the FFT width setup limits the maximum value for center frequency step of each tune. For example, if [<100Hz] is selected, the maximum value for center frequency step of each tune is 100Hz. As the FFT width gets larger, the count of instrument center frequencies get smaller when performing measurement of same frequency scope, and the response measurement gets faster. Therefore, to improve measurement speed, you can manually change the FFT width.



Attention

If the FFT width is set as [≤ Maximum Value], the maximum FFT is 10 MHz under standard configuration.

7) Select the filter bandwidth and type reasonably

- Configure filter type manually

The filter type can be selected manually by activating the [Filter Type] through [Bandwidth] key on the front panel.

In general, the S3503 Series Signal/Spectrum Analyzer uses Gaussian filter, i.e., use filter approximate to the Gaussian shape to complete filtering of resolution bandwidth. If the flat top filter is used, the signal/spectrum analyzer adopts filter approximate to the rectangular shape to complete filtering of resolution bandwidth. The response time of flat top filter of S3503 Series Signal/Spectrum Analyzer is about 3 times of that of the Gaussian filter, as the sweep speed of the flat top filter is smaller than that of the Gaussian filter. The flat top filter has better selectivity than the Gaussian filter and therefore is more capable of distinguishing two signals with unequal amplitude.

- Configure filter bandwidth manually

The filter bandwidth can be selected manually by activating the [Filter Bandwidth] through [Bandwidth] key on the front panel.

The S3503 Series Signal/Spectrum Analyzer has four ways to describe the Gaussian filter bandwidth: 3 dB and 6 dB bandwidth of filter, pulse bandwidth and noise bandwidth. Wherein: the noise bandwidth refers to the bandwidth when the rectangular filter is used to pass through the noise signal power with same peak gains. The pulse bandwidth refers to the bandwidth when the rectangular filter passes through the pulse signal power with same peak gains.

When the electromagnetic interference test is executed, the 6 dB bandwidth or pulse bandwidth is applicable to describe the filter bandwidth; when the noise-like signal or channel power is measured, the noise bandwidth is applicable to describe the bandwidth.

When the parameters of [Filter Bandwidth] are changed, the filter bandwidth actually used will not be affected, and the signal/spectrum analyzer only uses another way to describe the filter bandwidth and display it on the screen information area. e.g., the 3 dB (1 kHz) bandwidth and 6 dB (1.41 kHz) bandwidth, equivalent noise bandwidth filter of 1.06 kHz and equivalent pulse width filter of 1.48 kHz.



Attention

When the S3503 Series Signal/Spectrum Analyzer selects the "flat top" for the filter type, the filter bandwidth cannot be selected and the [Filter Bandwidth] turns grey.

4. 1. 2. 4. Set parameters of amplitude/Y Axis

The section mainly describes the meaning of the parameters corresponding to [Amplitude/Y Axis] and provides the operation guidance. The [Amplitude/Y Axis] key and the corresponding setting soft menu are used to set the amplitude reference and display range of active window of signal/spectrum analyzer, which is available in multiple measurement modes and functions. In the spectrum analysis mode, they are mainly used to set the reference level, attenuator, display range of level and unit of amplitude of the signal/spectrum analyzer. The functions may vary in other measurement modes or functions, please refer to the corresponding manual.

8) Parameter description of [Amplitude/Y Axis]

The menus corresponding to the [Amplitude/Y Axis] key on the front panel include [Reference Level], [Attenuator ▶], [Scale Type Logarithm Linear], [Scale/Division], [Auto Scale], [Y Axis Scale Unit ▶], [Reference Level Offset], [Amplitude Correction ▶].

[Reference Level] refers to the maximum signal acceptable by the measurement hardware on the premise that the measured results are guaranteed. The input level exceeding the above the maximum signal may distort. In such case, the information bar of S3503 Series Signal/Spectrum Analyzer will display the prompt information of "IF Overload".

[Attenuator ▶] submenu is mainly used to control the gain distribution of the RF reception hardware of the signal/spectrum analyzer and includes such parameters to be set as mechanical attenuator, electronic attenuator, step of mechanical attenuator and maximum mixer level. Only the options of electronic attenuator are configured properly will the settings of relevant electronic attenuator become effective.

[Scale Type Logarithm Linear] is used to select the trace data in display area to be linear or logarithm. When the "Logarithm" is selected as the type scale, the graticule of Y Axis is segmented in way of logarithm and the top graticule is corresponding to the reference level (when the reference level offset is set as zero), while the numbers corresponding to other Y axes can be set through amplitude scale. When the "Linear" is selected as the type scale, the graticule of Y Axis is segmented in linear and the top graticule is corresponding to the reference level (when the reference level offset is set as zero), the bottom graticule 0 V and middle graticule of Y Axis 1/10 of reference level.

[Scale/Division] is used to set the gain between graticules of Y Axis in the trace display area. This parameter is effective only when the [Scale Type] is logarithm. When the scale type is linear, the menu turns gray automatically and is in the idle state.

[Auto Scale] is used to automatically set the amplitude scale for the current measured data and the reference value corresponding to the top graticule of Y Axis.

[Y Axis Scale Unit ▶] is used to change the scale unit displayed by the Y Axis in the trace display area. By default, when the scale type is set as "Logarithm", the scale unit of Y Axis is dBm; by default, when the scale type is set as "Linear", the scale unit of Y Axis is V. Regardless of logarithm or linear scale type, the scale unit of Y Axis can be set as any one of dBm, dBmV, dBmA, W, V, A, dBuV and dBuA.

[Reference Level Offset] is used to increase the reference level display by one offset. Reference level indicates the absolute amplitude value represented by the top graticule of Y Axis in the trace display area.

[Amplitude Correction ▶] is used to correct the correction value edited by the user on the measured trace data.

9) Set reference level properly

Reference level indicates the absolute amplitude value represented by the top graticule of Y Axis in the trace display area and is closely related to the maximum signal level receivable by the RF input port and internal mixer of the signal/spectrum analyzer. If the reference level is set improperly, the serious signal distortion may occur, directing affecting the measured results.



The total power of all input signals of RF input port should be considered and known and the reference level set should be greater than the total power of all input signals when the reference level is set.

The reference level can be set by activating the [Reference Level] soft menu through the [Amplitude/Y Axis] key, on the front panel. If you are to set the reference level manually, the signal/spectrum analyzer will just correct the data offset on the measured trace instead of stopping the current measurement in most cases. Only when the change of reference level brings about the change of associated attenuator will the signal/spectrum analyzer top the current measurement and restart measurement.

Generally, that measured by the S3503 Series Signal/Spectrum Analyzer is the level value of input signal, while that displayed by the measured result is the effective value of the unadjusted sine signal level calibrated and corrected. By default, assuming that the input impedance is 50 Ω , the reference level is the converted power = 1 mW (0 dBm). For more information about "assuming that the input impedance is 50 Ω ", please refer to "4.1.2.8 Input and output settings" herein.

10) Optimize the measured results by setting attenuator properly

The attenuator of S3503 Series Signal/Spectrum Analyzer is located at the back-end of RF input port and directly connected to the RF input port, which is mainly used to guarantee that the mixer at the back end of attenuator will not be damaged by inputting high power RF signal. Therefore, The S3503 Series Signal/Spectrum Analyzer, by default, will automatically set the attenuator based on the reference level set. The input level of mixer can be calculated in the following formula:

Input level of mixer = input level of signal - attenuator value



Warning

The maximum input level of mixer is -10 dBm. If the signal level inputted into the mixer exceeds -10 dBm, the wrong measured result may occur, even the mixer may be damaged.

The measuring sensitivity of signal/spectrum analyzer is closely related to the attenuator, so the higher the attenuator is, the greater the inherent noise inside the signal/spectrum analyzer is; and the measuring sensitivity of signal/spectrum analyzer will decrease with the increase of noise floor in the trace display area. The attenuator is usually set as 0 dB to obtain higher measuring sensitivity. The measuring sensitivity will decrease by 10 dB and the corresponding average noise level displayed increases by 10 dB as the decrement increases by every 10 dB. Therefore, the decrement of attenuator should be decreased usually to improve the SNR of measuring signal. However, the greater decrement set can prevent the signal/spectrum analyzer from intermodulation or harmonic distortion, and, in such case, the RF amplification circuit at the back of mixer can re-amplify the signal.

Accordingly, the attenuator can be set as distortion measurement or high sensitivity measurement to complete the complicated measurement. If you have not understood the functions of attenuator thoroughly, it is suggested that the attenuator should be set as auto coupling.



Prompt

Benefits of setting attenuator manually

When you are executing the distortion measurement, such as harmonic distortion or intermodulation distortion, the greater decrement set is of great help and helps to determine whether the distortion is caused by signal/spectrum analyzer.

When you are executing the weak signal measurement, the attenuator is set as 0 dB, which is an effective method for increasing the measuring sensitivity of signal/spectrum analyzer.

Two types of attenuators including mechanical attenuator and electronic attenuator are provided for the S3503 Series Signal/Spectrum Analyzer. Wherein the mechanical attenuator includes one mechanical attenuator with step of 2 dB, maximum decrement of 6 dB and

AC/DC switch function and one mechanical attenuator with step of 6 dB and maximum decrement of 66 dB, which jointly form the attenuator component with minimum step of 2 dB and maximum decrement of 72 dB. The connection relation is shown in Fig. 4.1.

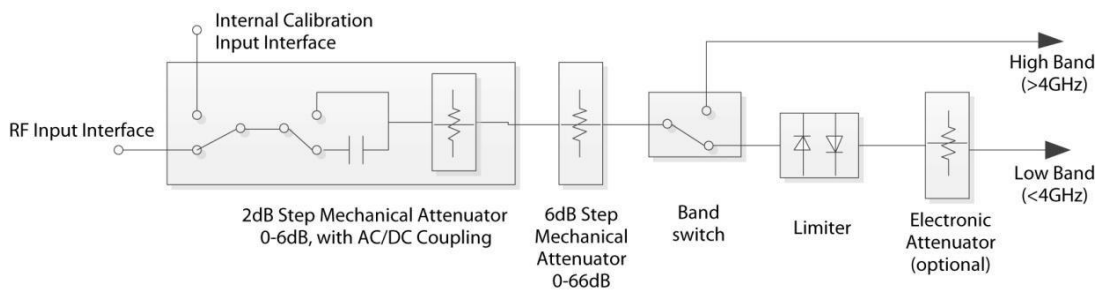


Fig. 4.1 Connection Relation of Attenuators of S3503 Series Signal/Spectrum Analyzer

● **Set mechanical attenuator manually**

Generally, the mechanical attenuator is set automatically based on the reference level set with step of 2 dB. The signal/spectrum analyzer will automatically set the attenuator based on the following formula:

$$\text{Decrement of attenuator} = \text{reference level} + \text{gain of preamplifier} + \text{external gain} - \text{reference level offset} - \text{maximum mixer level} + \text{IF gain}$$

Wherein: if the options of preamplifier are not set, its gain is 0 dB; IF gain is the variable gain amplifier at the back end of the circuit of mixer, invisible for the user, which is set automatically by the signal/spectrum analyzer based on the reference level.

In addition, the attenuator values automatically set are greater than or equal to 6 dB. The decrement of attenuator calculated based on the formula above is rounded up to an integer and parameters are set based on the step of mechanical attenuator, automatically selecting the closest decrement. E.g., if the decrement of attenuator calculated is 40.1 dB, the attenuator will automatically select 50 dB (the step of mechanical attenuator is 10 dB) or 42 dB (the step of mechanical attenuator is 2 dB).

If you hope to set the mechanical attenuator manually, the decrement of mechanical attenuator can be modified with number keys, Up/Down key or knob on the front panel by pressing [Amplitude/Y Axis] key on the front panel, entering [Attenuator ►] menu and modifying the mechanical attenuator to [Mechanical Attenuator Auto Manual].

In addition, you can set the step of mechanical attenuator as 2 dB or 10 dB manually. When the step menu of mechanical attenuator is set as 10 dB, namely [Mechanical Attenuator Step 2dB 10dB], the decrement scope of mechanical attenuator can only be set within 0 dB - 70 dB with a minimum step of 10 dB. Then the minimum step size corresponding to the Up/Down key and knob on the front panel is also set as 10 dB automatically. When the step menu of mechanical attenuator is set as 2 dB, namely [Mechanical Attenuator Step 2dB 10dB], the decrement scope of mechanical attenuator can only be set within 0 dB - 70 dB with a minimum step of 10 dB. Then the minimum step size corresponding to the Up/Down key and knob on the front panel is also set as 2 dB automatically.

● **Set maximum mixer level**

The [Maximum Mixer Level] in the [Attenuator ►] menu only has an influence on the auto setting algorithm of attenuator. The maximum mixer level of S3503 Series Signal/Spectrum Analyzer is -10 dBm by default. Unless you have a thorough understanding of the principle of measurement of signal/spectrum analyzer, do not change the maximum mixer level.

11) How to set display range of Amplitude/Y Axis

● **Set scale type**

The scale type can be selected by activating the [Scale Type Logarithm Linear] menu after pressing [Amplitude/Y Axis] key on the front panel. Usually, the signal/spectrum analyzer is set as logarithm scale type.

When the [Scale Type Logarithm Linear] is selected to be linear, the measured values are always linear distribution in the display check. The linear scale is of great use for exactly displaying the signal level of small range. However, if the maximum and minimum values of signal are displayed on the screen at the same time, it is very difficult to display each value exactly or distinguish two approximate signal levels. The linear scale type is commonly applied to the demodulation waveform display of AM signal.

When the [Scale Type] is selected to be logarithm, the smaller measured value display will occupy most area of screen display area, so it is very effective for distinguishing the signals of low level. If you hope to display the greater measured data of signal level range on one screen, selecting the logarithm scale type is very useful. The unit commonly selected for the logarithm scale type is the data of logarithm (such as dBm or dB).

- **Set display range of Y Axis through amplitude scale and reference level**

When the scale type is selected to be logarithm, the amplitude value represented by each division of Y Axis can be set with number keys, Up/Down key or knob on the front panel by pressing [Amplitude/Y Axis] key on the front panel and activating the [Scale/Division] menu. Usually, the signal/spectrum analyzer is set as 10 dB.

When the reference level is changed with number keys, Up/Down key or knob on the front panel by pressing [Amplitude/Y Axis] key on the front panel and activating the [Scale/Division] menu, the display range of Y Axis will change, then the measured value represented by the top division of screen is: reference level + reference level offset, while measured value represented by the bottom division is: reference level + reference level offset - 10 × amplitude scale value.



The influence of changing display range of Y Axis by changing reference level

As the attenuator and IF gain in the RF reception circuit of corresponding signal/spectrum analyzer may change when the reference level is changed, the corresponding measurement performance, such as dynamic range or sensitivity, will change as well. If you want to avoid this situation, set the display range of Y Axis through the amplitude scale and reference level offset.

- **Set display range of Y Axis through amplitude scale and reference level offset**

Changing the reference level offset through [Menu 1/2] soft menu is of help for you to change the logarithmic amplitude value represented by the top division in the screen display area.

- **Set display range of Y Axis through auto scale**

When the [Amplitude/Y Axis] key on the front panel is pressed and the [Auto Scale] soft menu is then clicked, the signal/spectrum analyzer will set the [Scale/Division] (logarithm scale type) and reference level offset based on the maximum and minimum value of latest measured data, optimize the display range of Y Axis and reflect all the latest measured data on the screen. The auto scale menu corresponding to the active window may vary slightly in other measurement modes or functions, please refer to the corresponding manual or menu description of corresponding function for more details.



Auto Scale

When you click the [Auto Scale] once, the signal/spectrum analyzer will set [Scale/Division] (logarithm scale type) and reference level offset once only based on the current measured data and will not reset even in case of change of the measured data.

12) Open preamplifier (optional)

If the signal/spectrum analyzer purchased by you is equipped with the option of preamplifier, it can be seen that the [Preamplifier ON OFF] menu is in active state by pressing [Amplitude/Y Axis] key on the front panel and [Menu 1/2▶] soft menu, or the menu turns grey, indicating idle state. The built-in preamplifier of signal/spectrum analyzer can be opened by setting the menu.

By opening the preamplifier, the signal/spectrum analyzer can obtain better noise factor, improving the measuring sensitivity, and the dynamic range performance (such as TOI indicator) of signal/spectrum analyzer will be deteriorated.

The S3503 Series Signal/Spectrum Analyzer can be equipped with multiple options of preamplifiers, including the low-band

preamplifier (with frequency range from 10 MHz to 4 GHz) and full-band preamplifier (10MHz to upper limit of maximum measured frequency), but only one type of preamplifier can be equipped.

During sweep, the measured result of signal/spectrum analyzer will automatically take into account the gain of preamplifier. Even though the measured frequency range set by you exceeds the operating frequency range of built-in preamplifier, the signal/spectrum analyzer will reflect the corrected gain in the measured result.

4. 1. 2. 5. Trigger parameter setting

Under the default settings of spectrum measurement mode, the signal/spectrum analyzer executes the measurement immediately when you start measurement through the [Continuous OFF] and [Continuous ON], which is called free trigger normally. However, the measurement will not be executed sometimes until some measurement conditions are met. E.g., the measurement will be executed or executed based on certain time period when the signal level exceeds one certain value. In such case, the trigger measurement will be used.

The trigger measurement refers to the measurement executed or capture of certain piece of data in the signal of interest when certain measurement conditions are met (also called trigger event. Setting different trigger modes and proper trigger parameters is of help for detecting different signal events. Parameter description of [Trigger] key

Choosing different trigger modes (also called trigger source) by pressing [Trigger] key on the front panel can enable the signal/spectrum analyzer to execute different trigger measurement tasks. Under the spectrum analysis mode, the S3503 series signal/spectrum analyzer has many trigger modes, including free trigger, video trigger, power trigger, external trigger 1, external trigger 2, burst signal trigger and timer trigger.

[Video Trigger] refers to the trigger measurement based on the video signal level; [Power Trigger] refers to the trigger measurement based on the power frequency signal of AC power supply; [External Trigger 1] refers to the trigger measurement based on the trigger input port signal of front panel; [External Trigger 2] refers to the trigger measurement based on the trigger input port signal of rear panel; [Burst Signal Trigger] refers to the trigger measurement based on the signal power of RF input port; [Timer Trigger] refers to the predefined time period.

Except the timer trigger and free trigger, other trigger modes have the settings of [Trigger Polarity]. The S3503 series signal/spectrum analyzer can set the trigger polarity for these trigger modes respectively and the [Trigger Polarity Positive Negative] menu is located in the submenu of each trigger mode. Negative polarity indicates that the trigger event occurs when the trigger input signal level increases to the trigger level, while negative polarity indicates that the trigger event occurs when the trigger input signal level decreases to the trigger level.

Except the free trigger, other trigger modes have the settings of trigger delay. The S3503 series signal/spectrum analyzer can set the trigger delay for these trigger modes respectively and the [Trigger Delay ON OFF] menu is located in the submenu of each trigger mode. When the trigger delay is set as "OFF" state, the corresponding menu displays [Trigger Delay ON OFF], the signal/spectrum analyzer will execute the measurement immediately after the trigger event occurs. When the trigger delay is set as "ON" state, the corresponding menu displays [Trigger Delay ON OFF], the signal/spectrum analyzer will not execute the measurement until a period of time after the trigger event occurs. The trigger delay time can be set with number keys, Up/Down key or knob after the [Trigger Delay ON OFF] is activated.

[Trigger Holdoff] can set one time parameter, which limits the minimum time interval of occurrence of effective trigger event. When the trigger hold off is opened, the trigger event that occurs within the trigger hold off time will be neglected after one trigger event.

13) Execute video trigger measurement

The trigger input signal corresponding to the video trigger is the IF signal envelope displayed on the screen. The external trigger level can be set in such steps of pressing the [Trigger] key on the front panel, entering [Video Trigger ►], pressing soft menu of [Trigger Level] and then using the number keys, Up/Down key or knob. After entering [Video Trigger] menu, the signal/spectrum analyzer will automatically execute the video trigger measurement. By default, the video trigger level is -25 dBm, and the display line (red) of trigger level and trigger level value will be displayed on the screen and the "Video Trigger" will be displayed in corresponding state bar, as shown in Fig. 4.2.

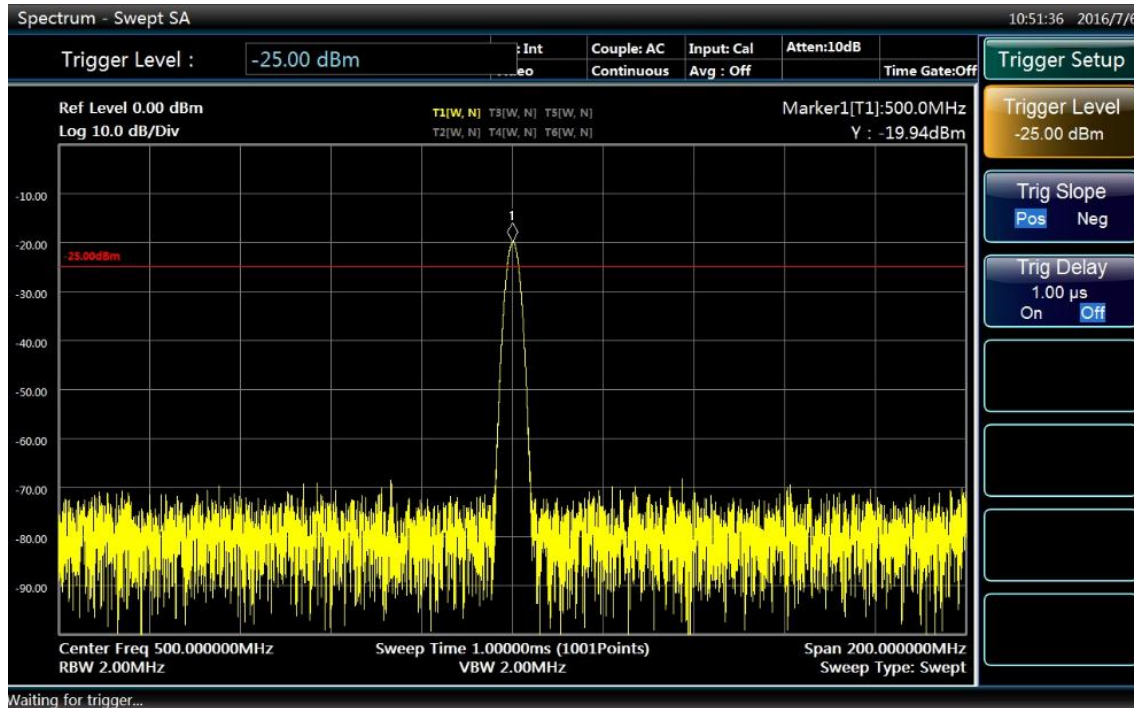


Fig. 4.2 Setting Interface of Video Trigger

Prompt

Applicable conditions of video trigger

Usually, the video trigger is applied to the time domain power measurement under zero span, while, under non-zero span (span > 0 Hz), the correct spectrum measurement may not be executed if the video trigger is set, then the burst signal trigger mode will be used instead of video trigger.

14) Execute external trigger measurement

The trigger input signal corresponding to the external trigger is the trigger input on the front panel (external trigger

1) or the trigger input on the rear panel (trigger input 2). The trigger input port on the front and rear panel is BNC. The input port can receive the signal provided by the external device with level ranging from -5 V - +5 V. The trigger input signal can be sine AC signal or TTL level signal. When the sine AC signal is input, the comparator circuit inside the signal/spectrum analyzer will compare with the trigger level set and then convert it into TTL level signal.

The external trigger level can be set in such steps of pressing the [Trigger] key on the front panel, entering [External Trigger 1 ►] or [External Trigger 2 ►], pressing soft menu of [Trigger Level] and then using the number keys, Up/Down key or knob. If the External Trigger 1 is activated, the signal/spectrum analyzer will automatically select the trigger input signal on the front panel; if the External Trigger 2 is activated, the signal/spectrum analyzer will automatically select the trigger input signal on the rear panel.

Prompt

In the state of external trigger measurement, please carefully inspect whether the analyzer is properly connected with the external device or not and ensure that the correct external trigger input signal is provided if the signal/spectrum analyzer cannot execute the measurement properly.

15) Execute power trigger measurement

The trigger input signal corresponding to the power trigger is the power frequency signal of AC power supply provided for

signal/spectrum analyzer. The circuit inside the signal/spectrum analyzer will automatically extract the signal and convert it into trigger input signal. The trigger polarity and parameters of trigger delay can be set in such steps of pressing the [Trigger] key on the front panel and then entering [Power Trigger] menu. The trigger level is inactive during power trigger and the corresponding Power Trigger Menu is not available.

16) Execute burst signal trigger measurement

The trigger input signal corresponding to the burst signal trigger is the IF (intermediate frequency) signal envelope outputted by the signal/spectrum analyzer at the second IF. Some signal/spectrum analyzers are also known as IF power trigger, then the IF bandwidth is also known as trigger bandwidth. When the burst signal of the S3503 Series Signal/Spectrum Analyzer is triggering, the trigger bandwidth is about 200 MHz. When the non-zero bandwidth is being measured, the second IF signal approximately represents the signal of start frequency relating to the measurement of analyzer; when the zero bandwidth is being measured, the second IF signal approximately represents the signal of center frequency relating to the measurement of analyzer. As the signal/spectrum analyzer has the IF bandwidth of 200 MHz, the noise limits the setting range of the trigger level, please refer to the Data Manual of S3503 Series Signal/Spectrum Analyzer for details.

The external trigger level can be set in such steps of pressing the [Trigger] key on the front panel, entering [Burst Signal Trigger ►], pressing soft menu of [Trigger Level] and then using the number keys, Up/Down key or knob.



The trigger level of the burst signal of the S3503 Series Signal/Spectrum Analyzer is set without considering the amplitude correction and reference level offset, so a larger difference may exist between the trigger level set by you and the signal level displayed by measurement, which can be eliminated by closing amplitude correction and modifying reference level offset.



When the start frequency in the state of nonzero bandwidth measurement or the center frequency in the state of zero bandwidth measurement is close to 0 Hz and less than 120 MHz, the LO feedthrough will cause the decrease of the trigger function or failure of trigger of the burst signal.

17) Execute timer trigger measurement

The trigger input signal corresponding to the timer trigger is the signal outputted periodically and regularly inside the signal/spectrum analyzer.

In most cases, it is very complicated and difficult to measure the burst RF signal. Although the burst signal trigger is helpful for executing some routine measurement work of burst RF signal, measurement cannot be carried out sometimes due to many limiting conditions, e.g., the power of the burst RF signal to be measured is too small to form effective trigger signal or the power is less than 100 MHz. If you have already known the generation period of the signal, the measurement can be carried out by using timer. When the generation period of the burst RF signal is slow and drifting, or there is difference between the internal time base of signal/spectrum analyzer and that of the device being measured, the measurement can also be carried out in such way as the S3503 Series Signal/Spectrum Analyzer adjusts the timer trigger offset and open the sync function of the timer trigger.

For the purpose of better understanding and using the timer trigger function, the sequence diagram relating to the measurement of the timer trigger is shown in Fig. 4.3. The synchronizing signal of timer trigger in the figure is selected as the signal from the port of trigger input 1 on the front panel. The waveform at the top of the figure is the signal waveform of the port of trigger input 1 on the front panel, whose rising edge will cause the timer to execute sync, then the timer will generate the timing pulse based on the time base provided by the signal/spectrum analyzer until the end of sync source hold off of timer, then the sync will proceed based on the rising edge of the trigger input. As the internal time base of the signal/spectrum analyzer is different from that of the signal being measured, the input

of timer will drift during the sync hold off of timer. The timer offset determines the actual time of occurrence of the trigger event, when the timer trigger has occurred, the signal/spectrum analyzer will not carry out the measurement until the trigger delay time if the trigger delay is on-state.

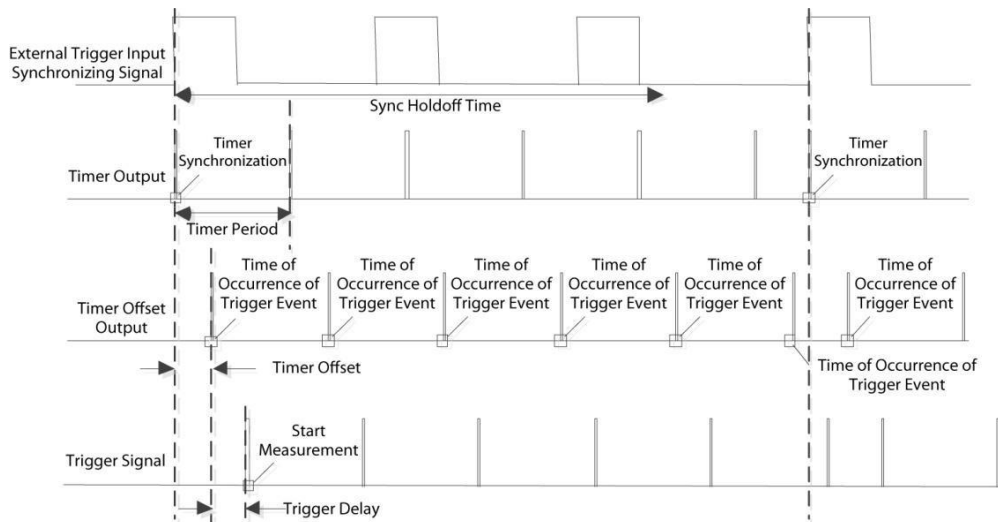


Fig. 4.3 Sequence Relation of Timer Trigger and Timing Sync

The parameters of timer trigger including [Select Sync Source], [Timer Period], [Timer Offset], [Timer Source Holdoff], [Trigger Delay], etc. can be set in such steps of pressing the [Trigger] key on the front panel, entering [Timer Trigger ►] and then using the number keys, Up/Down key or knob.

The sync source can be selected as external trigger 1, external trigger 2 or burst signal trigger. With the menu of [Select Sync Source], the trigger level and sync source polarity can be set through the [External Trigger 1], [External Trigger 2] and [Burst Signal Trigger]. If the sync source is set as "Positive", namely [Sync Source Polarity Positive Negative], it means the sync of the rising edge of the timer output and sync source signal. If the sync source is set as "Negative", namely [Sync Source Polarity Positive Negative], it means the sync of the falling edge of the timer output and sync source signal. When the trigger level of the sync source is set, the trigger level in the corresponding trigger mode menu will change at the same time.

 **Attention**

When the signal/spectrum analyzer sets the parameters of timer trigger, it will first reset the internal timer to configure the timing parameters, default the timer offset as 0 s and then start the timer. When you modify [Timer Offset] with the menu, the signal/spectrum analyzer just modifies the time of occurrence of the trigger event instead of resetting or restarting the timer.

4. 1. 2. 6. Parameter settings of [Measurement Setting] and [Measurement Control]

The section mainly describes the parameters corresponding to the [Measurement Setting] key and [Measurement Control] key on the front panel. The parameters corresponding to the [Measurement Setting] key vary greatly with different measurement modes and measurement functions.

1) Description of parameters of [Measurement Control] key

The measurement state of the signal/spectrum analyzer can be controlled with soft menus of [Restart Measurement] and [Pause] by pressing the [Measurement Control] key. The menus of [Pause] and [Restart Measurement] cannot work at the same time. **Menu description:** when the signal/spectrum analyzer is in operation, this menu is used for pausing current measurement; when in Paused status, this menu is used for continuing measurement. If the average or hold function is enabled, the average count will be frozen, then the measurement will stop accordingly.

When the signal/spectrum analyzer stops measuring, the [Restart Measurement] is enabled; the signal/spectrum analyzer will restart

measuring by pressing [Restart Measurement] menu.

[Restart Measurement] is used to restart the current swiping or measurement; when the average/hold function of trace is enabled, the signal/spectrum analyzer will reset the current average count and clear the previous hold results by pressing [Restart Measurement] menu.

 **Attention**

If the signal/spectrum analyzer is in the process of calibration or LO auto adjustment, it will not execute the corresponding operations until the end of the process of calibration or LO auto adjustment by pressing [Pause] or [Restart Measurement]

2) Parameter description of [Measurement Setting] key

Under the mode of spectrum analysis, the parameters set corresponding to the [Measurement Control] key on the front panel include [Average Count], [Average Type], [Limit Line], [Phase Noise Optimization Rules] and [ADC Dither].

- Set trace average

The count of trace average and average type can be set by pressing [Measurement Setting] key on the front panel. Starting the trace average needs to press the [Trace] key on the front panel, select the trace requiring average and enable the [Average] menu.

[Average Count] is used to control the average count when then the trace average ([Trace] key on the front panel) is enabled.

[Average Type] is used to control the averaging algorithm of trace data, including video average, voltage average or power average.

Video average (also called logarithm power average) refers to the average based on the signal level of the log unit being measured.

Power average (also called root mean square (RMS) average) refers to the process during which average results are again converted into the measured values displaying scale requirements after all measured values are converted into power values and averaged.

Voltage average refers to the process during which average results are again converted into the measured values displaying scale requirements after all measured values are converted into voltage values and averaged.

For more details relating to the trace average, please refer to the corresponding menu description.

If the trace average type is set as auto, the signal/spectrum analyzer will automatically select the average type based on the detector type, marker function, amplitude scale, etc. of the corresponding trace. Rules on auto selection of average type: if trace detector (for detector, please refer to relevant information stated in the section of 4.1.3) is power average, the average type is selected as power average; if the trace detector (for detector, please refer to relevant information stated in the section of 4.1.3) is voltage average, the average type is selected as voltage average; if the noise marker, bandwidth power or bandwidth density of the marker function (for marker function, please refer to relevant information stated in the section of 4.1.3) is opened, the average type is selected as power average; if the amplitude scale (for amplitude scale, please refer to relevant information stated in the section of 4.1.2.4) is selected as linear scale, the average type is selected as voltage average or video average.

 **Prompt**

Average operation in the S3503 Series Signal/Spectrum Analyzer

The trace average is to average the signal levels of multiple traces generated from swiping for many times.

The video average detector, power average detector and voltage average detector are to average the period of time or the frequency interval data reflected by the data of a certain point on one trace.

Noise marker is to average the data of multiple measurement points on the same trace to decrease the amplitude fluctuation.

The video filter is also considered to average the same trace being measured in a similar way.



Attention

The average operation carried out to the logarithm power data and the data conversion carried out to the data averaged will generate totally different measurement results.

- Limit line measurement

The function of limit line measurement can help you execute some specified conformance measurements quickly. The limit line can be edited and the limit line measurement can be started with [Limit Line Measurement] menu by pressing [Measurement Setting] on the front panel.

- Control ADC dither

The ADC dither circuit of the signal/spectrum analyzer can be opened and closed manually with [ADC Dither] menu corresponding to the [Measurement Setting] key. The ADC dither function is helpful for improving the linearity low level signal measurement at the cost of compromising part of measurement SNR (signal to noise ratio) performance.

With ADC dither opened, the signal/spectrum analyzer can provide better measurement linearity, so as to improve the fidelity of scale, which works effectively particularly during small-signal measurement. With ADC dither closed, the lower noise floor can be obtained.

Under default state, the ADC dither is under auto state; the signal/spectrum analyzer sets the auto control of ADC dither to be open or close based on different measurements.

4. 1. 2. 7. Parameter settings of coupling and auto

Many parameters of S3503 Series Signal/Spectrum Analyzer can be set automatically based on the current measurement state, so as to enable you to carry out measurement in a more convenient way.

If you hope to restore the measurement parameters from manual state to auto state quickly, all the measurement parameters will be restored to auto state by pressing [Couple] and enabling the [Couple All] menu. The menus corresponding to the [Couple] key also include the common [Mechanical Attenuation Auto ON OFF], [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF], [VBW/RBW], [Span/RBW], [Sweep Time Auto ON OFF] and [Frequency Step Auto ON OFF].



Attention

The parameters of corresponding menus will be modified accordingly after the auto parameter settings in the [Couple] menu are modified.

4. 1. 2. 8. Input and output settings

The input and output settings are effective under all measurement modes and measurement functions of signal/spectrum analyzer. The [Input/output] key on the front panel is used to control the input and output parameters of signal/spectrum analyzer. The input and output interfaces on the front and rear panel of signal/spectrum analyzer may be involved generally when the input and output parameters are modified, which remain unmodified normally, so most input and output parameter settings are not modified when reset is carried out.



Attention

While input and output parameters are global parameters relative to the measurement mode and measurement function of

signal/spectrum analyzer, all measurement modes and measurement functions can be affected by modifying those parameters, some parameters are invalid under some measurement modes or measurement functions.

1) Set frequency reference

The frequency reference signal used by the signal/spectrum analyzer can be selected from internal or external with [Frequency Reference Internal External] menu by pressing [Input/output] key on the front panel.



When the frequency reference is set as "Internal", the reference output of the rear panel is the 10 MHz signal inside the analyzer; if the frequency reference is set as "External", the reference output of the rear panel is the reference input signal of rear panel.

When the frequency reference of the signal/spectrum analyzer is set as "Internal", it still uses the internal reference signal of 10 MHz even the reference input port of the rear panel is connected with the external device.

When the frequency reference is set as "External", the signal/spectrum analyzer will use the reference signal provided by the external reference input port of rear panel, the screen message display area will display "Reference: External". If incorrect external reference input signal is sensed, e.g., reference input not available, the signal power fails to reach the required power range, the error message prompt area will display "Invalid External Reference". Once the external reference reaches those required by the signal/spectrum analyzer, the error message will be cleared.

2) Set input port

- Settings of input port selection

The signal measured by the signal/spectrum analyzer can be selected as the RG signal inputted from front panel or the internal calibration signal with [RF Input RF Calibration] menu by pressing [Input/output] key on the front panel.

The screen message display area on the front panel will display the RF input state. If the calibration signal is selected, the "Input: Calibration" will display; if the RF input signal of front or rear panel is selected, the "Input: RF" will display.

Settings of calibration port selection

If the RF input is selected as calibration, namely [RF Input RF Calibration], any one of three calibration signals including 500 MHz sine signal, comb wave signal and 4.8 GHz sine signal inside the analyzer can be selected through [Calibration Port].

The internal calibration signals of the signal/spectrum analyzer are mainly used to calibration of analyzer. When the calibration operation is running (the calibration can be carried out to the analyzer with soft menu of [Calibration ►] by pressing [System] key on the front panel), the analyzer will automatically select those calibration signals without concern of users.

Setting the RF input to calibration can help you learn to use the analyzer or judge whether fault exists in the analyzer.

Settings of coupling method

The coupling method can be switched with [Input Coupling AC DC] menu by pressing [Input/output] key on the front panel and then entering [Menu 1/2 ►]. AC represents AC coupling, while DC represents DC coupling. Signal/spectrum analyzer uses DC coupling by default.

When the input coupling is selected as AC coupling, the blocking capacitor will insert into the back end of the RF input to prevent the DC signal from entering the internal circuit of the signal/spectrum analyzer, so as to effectively protect the signal/spectrum analyzer from being damaged due to the DC voltage existing in the RF input port. However, the AC coupling will limit the frequency measurement range of the signal/spectrum analyzer, mainly the measurement of lower frequency signal, e.g., the input signal less than 10 MHz.

For the signal less than 10 MHz, the measurement performance of the S3503 Series Signal/Spectrum Analyzer is guaranteed under

DC coupling.

If the input coupling is selected as DC coupling, it should be noted that the range of the DC voltage existing in the RF input port must be ensured between 0 V - 200 mV.

Regardless of DC coupling or AC coupling, the power of the signal of the RF input port cannot exceed + 30 dBm (1 W).

- Settings of input impedance

The unit correction value can be modified with [Input Impedance 50 Ω 75 Ω] menu by pressing [Input/output] key on the front panel and then entering [Menu 1/2 ►]. The actual impedance of the hardware circuit of the signal/spectrum analyzer is 50Ω. The input impedance is only used for the purpose of calculation, only affecting the measurement results. When the scale of Y Axis uses the voltage or current (dBmV, dBμV, dBμA, V, A) as the unit, the input impedance only affect the measurement results; while it uses the power (dBm, W) as the unit, the measurement results are not affected.

When users measure the device with impedance of 75 Ω by using the 75 Ω-50 Ω adapter, it is very meaningful to set the input impedance as 75 Ω.

- Set reconstructed signal output (optional)

Multiple auxiliary output ports on the rear panel of the signal/spectrum analyzer can be set with [Reconstructed Signal Output ►] menu by pressing [Input/output] key on the front panel. The auxiliary output ports can help you use the signal/spectrum analyzer to construct the measurement system or output to other external devices to test, while the output port is not applicable to all measurement modes and measurement functions.

- Set reconstructed any IF output (option H04A + H04B)

The S3503 Series Signal/Spectrum Analyzer is to realize the any IF output function with two technological approaches: the first one is to reconstruct the internal fixed IF signal to any IF signal with the digital processing technology and output through the ports including narrowband I, narrowband Q and broadband I (differential) on the rear panel with SMA female connector; the second one is to convert the second IF signal into the any IF signal through the analog mixer and output, and the corresponding output interface on the rear panel is IF 2.

The settings and use methods of the reconstructed any IF output will be described below. The function of the reconstructed any IF output is only applicable to the transient analysis in the IQ analysis mode and signal analysis mode. The different signal types can be selected for the output ports of narrowband I, narrowband Q, broadband I (differential output port) and broadband Q (differential output port) on the rear panel by setting reconstructed signal output. The corresponding relation is shown as Table 4.1. From the above table, it can be seen that the reconstructed any IF output, AM/FM demodulation output, IQ demodulation output and detector cannot remain valid at the same time.

Table 4.1 Signal Type of Narrowband and Broadband Output Interface of Rear Panel

Parameter Setting	Narrowband I	Narrowband Q	Broadband I (Differential)	Broadband Q (Differential)
Any IF Output (Bandwidth ≤ 40 MHz)	IF signal	Invalid	Invalid	Invalid
Any IF Output (Bandwidth > 40 MHz)	Invalid	Invalid	IF signal	Invalid
AM/FM Demodulation Output (Bandwidth ≤ 40 MHz)	AM Demodulation Signal	FM Demodulation Signal	Invalid	Invalid
AM/FM Demodulation Output (Bandwidth > 40 MHz)	Invalid	Invalid	AM Demodulation Output	FM Demodulation Output
IQ Demodulation Output (Bandwidth ≤ 40 MHz)	I channel signal	Q channel signal	Invalid	Invalid

IQ Demodulation Output (Bandwidth > 40 MHz)	Invalid	Invalid	I channel signal	Q channel signal
Detector output (Bandwidth ≤ 40 MHz)	Detector output	Invalid	Invalid	Invalid
Detector output (Bandwidth > 40 MHz)	Invalid	Invalid	Detector output	Invalid

The step configuration is carried out for the reconstructed IF output bandwidth within 100 Hz - 200 MHz on the basis of 1-2-5. Only when the 40 MHz broadband digital IF (option H38A) or 200 MHz broadband digital IF (option H38B) is configured is the function of reconstructed IF output enabled, while the any IF output (option H04A) is being configured. The output range of IF and bandwidth varies with different options selected, the specific mapping relation is shown in Table 4.2.

Table 4.2 Function of Reconstructed Any IF Output and Option Configuration Relation Table

Configuration Combination of Options	Output Range and Bandwidth of Any IF (Narrowband I Port)	Output Range and Bandwidth of Any IF (Broadband I Port)
Option H04A	IF Range: 10 MHz - 75 MHz Band width: 10MHz	Invalid
Option H04A + Option H38A	IF Range: 10 MHz - 75 MHz Band width: 40MHz	Invalid
Option H04A + H04B + Option H38A + H38B	IF Range: 10 MHz - 75 MHz Band width: 40MHz	IF Range: 10 MHz - 140MHz Bandwidth: 50 MHz/100 MHz/200 MHz

The IF can be set with number keys, Up/Down stepping keys and knob in the [Reconstructed IF ►] menu in the [Reconstructed Signal Output ►] menu by pressing [Input/output] key on the front panel.

The signal/spectrum analyzer applies different frequency conversion plans for different wavebands, so the IF output signal spectrum may invert in comparison with the RF input signal spectrum, that is, the left and right signal spectrum exchange with each other centering around center frequency, then the inversion can be switched with the [Spectrum Inversion Switch] soft menu.

The IF output frequency can also be adjusted with the menu of [Reconstructed IF ►] and [Digital Gains]. The gain of the S3503 series signal/spectrum analyzer is 0 dB by default, then the IF output power is 8 dB - 12 dB less than the RF output power, e.g., if the RF input power is -10 dBm, the IF output power is -18 dBm to -22 dBm. If you set the digital gain as 6 dB, the IF output power will amplify by 6 dB.

Attention

The adjustment function of digital gain in the [Reconstructed IF ►] menu is realized through the digital processing technology, so the parameters are only used to adjust the IF output power instead of changing the output SNR.

If you hope to change the output SNR, the parameters including reference level, attenuator, preamplifier, etc. can be set with [Amplitude/Axis] key.

- Set AM/FM demodulation output (option H04A + H04B)

The S3503 Series Signal/Spectrum Analyzer demodulates the AM/FM signal with digital technology and outputs through the ports including narrowband I, narrowband Q, broadband I (differential) and broadband Q (differential) on the rear panel with SMA female connector. The step configuration is carried out for the demodulation bandwidth within 100 Hz - 200 MHz on the basis of 1-2-5. Only when the 40 MHz broadband digital IF (option H38A) or 200 MHz broadband digital IF (option H38B) is configured is the function of AM/FM demodulation output enabled, while the AM/FM demodulation output (option H04A) is being configured. The demodulation bandwidth range varies with different options selected, the specific mapping relation is shown in Table 4.3.

Table 4.3 AM/FM Demodulation Output Function and Option Configuration Relation Table

Configuration Combination of Options	Demodulation Bandwidth (Narrowband I and Narrowband Q Port)	Demodulation Bandwidth (Broadband I and Broadband Q Port)
Option H04A	Demodulation bandwidth: ≤ 10 MHz	Invalid
Option H04A + Option H38A	Demodulation bandwidth: ≤ 40 MHz	Invalid
Option H04A + H04B + Option H38A + H38B	Demodulation bandwidth: ≤ 40 MHz	Demodulation bandwidth: 50 MHz/100 MHz/200 MHz

When the reconstructed signal output is selected as the AM/FM demodulation output, the narrowband I or broadband I port outputs AM demodulation signal, while narrowband Q or broadband Q port outputs FM demodulation signal.

The [AM Digital Gain] and the [FM Digital Gain] in the [AM/FM Demodulation ►] menu is available for the adjustment of output voltage. The gain of the S3503 Series Signal/Spectrum Analyzer is 0 dB by default, so the output voltage of the demodulation signal will double if you set the output gain as 6 dB.

- Set detector output

The S3503 Series Signal/Spectrum Analyzer carries out the envelope detector and logarithmic detector for the RF signal with digital processing technology and outputs through the narrowband I port on the rear panel with SMA female connector. The step configuration is carried out for the detector bandwidth within 100 Hz - 10 MHz on the basis of 1-2-5. When the 40 MHz broadband digital IF (option H38A) is being configured, the detector bandwidth can be extended to 40 MHz.

You can set the output as logarithm or linearity with the [Output Options] in the [Detector Output ►] menu, while the default setting of the S3503 Series Signal/Spectrum Analyzer is logarithm. The [FM Digital Gain] in the [Detector Output ►] menu is also available for the adjustment of the voltage of detector output signal. The S3503 Series Signal/Spectrum Analyzer is 0 dB by default.

Attention

The [Bandwidth] menu in the function settings menu of [Reconstructed Signal Output ►] in the S3503 Series Signal/Spectrum Analyzer is only used to indicate the value of the current IF bandwidth (reconstructed IF output), demodulation bandwidth (AM/FM demodulation output or IQ demodulation output) or the detector bandwidth (detector output). If those parameters are required to be changed, the settings can be carried out by selecting relevant menu through the [Measurement Setting] key of measurement functions.

Attention

The functions including reconstructed IF output, AM/FM demodulation output, IQ demodulation output and detector output of the S3503 Series Signal/Spectrum Analyzer are only applicable to the IQ analysis mode and transient analysis mode.

- Set broadband logarithmic detector output (option H08)

The second IF signal inside the S3503 Series Signal/Spectrum Analyzer will go through one fast log amplification and detector module, and it will output the detector signal to the detector output port (BNC) of the rear panel. For every 1 dB change in RF input signal, the open-circuit output level of the detector output port varies about 25 mV. When the power of the RF input signal is 0 dBm, the voltage of the detector output port is 1 V (Different signal/spectrum analyzers may vary slightly on this). In comparison with the digital detector output, the detector output features faster rise time and shorter delayed response time, which can be used for the test of pulse signal.

The function can be opened or closed with [Detector Output] menu in the [Reconstructed Signal Output ►] menu by pressing

[Input/output] key on the front panel.

3) Set HF/IF output

The S3503 Series Signal/Spectrum Analyzer connects the internal HF/IF of analyzer to the IF 1 output port on the rear panel (SMA female) The function can be opened or closed with [HF/IF Output] menu by pressing [Input/output] key on the front panel. The HF/IF of the S3503 Series Signal/Spectrum Analyzer varies with different analysis bandwidth settings. The HF/IF output frequency is 425 MHz under the spectrum analysis mode. Under other analysis modes, if the analysis bandwidth is ≤ 40 MHz, the HF/IF output frequency is 425 MHz; if the analysis bandwidth is > 40 MHz, the HF/IF output frequency is 375 MHz.



S3503 Series Signal/Spectrum Analyzer uses the electronic switch to control whether the second IF signal is used for the internal service or outputted to external ports, so the analysis function cannot execute properly when the second IF output is selected as "On".

4. 1. 3. Operation guidance on general analysis and display function

The section mainly describes the operation guidance on the general analysis and display that are carried out by the S3503 Series Signal/Spectrum Analyzer using trace and marker under the spectrum analysis mode. Regardless of measurement mode or measurement task, those operations are of great help to familiarize you with the S3503 Series Signal/Spectrum Analyzer and its usage. The measurement and analysis method may vary if you are using other measurement modes, please refer to the user manual of corresponding measurement mode.

- Trace detector and trace operation
- Marker

4. 1. 3. 1. Trace detector and trace operation

The trace refers to a set of sampling points of data, each of which (x, y) has one x value generally representing frequency or time and y value generally representing amplitude. Each data point is also called trace point. In any trace, the first data point is called trace 0, while the last one is called trace (sweep point -1). The trace points are also called sweep points. For the spectrum trace, one trace point is generally corresponding to one frequency interval, also called Bucket sometimes, and the measured value Y represents a measured data corresponding to one Bucket. The menu corresponding to the [Trace] key on the front panel can help you configure the measured trace and complete the trace operation.

Each trace can be considered to be one analysis implemented to the measured data. Each trace window of the S3503 Series Signal/Spectrum Analyzer can display 6 traces. The trace configurations determine how the measured data analyzes and displays. The section mainly describes how to configure the trace and execute trace operation.

1) Concept of trace detector

When the sweep type is sweep under the spectrum analysis mode, the signal/spectrum analyzer control the LO by digital mode to carry out step sweep in smallest frequency. During the entire sweep period, the sampling points captured by ADC in the digital IF circuit are much larger than the sweep points that used by the signal/spectrum analyzer for display. When the sweep type is FFT, the signal/spectrum analyzer tunes the LO to fixed frequency point. During the entire measurement period, after the FFT is carried out, the sampling points captured by ADC in the digital IF circuit may be larger than the sweep points that used by the signal/spectrum analyzer for display.

E.g., we assume that the sampling frequency of ADC is 100 MSa/s, sweep points are 1000, sweep time is 100 ms and the span is 1 GHz. For each sweep, the signal/spectrum analyzer captures 100*105 sampling points, which are needed to be turned into 1001 trace data. Equivalently, every 100,000 sampling data is corresponding to the trace

data at one point, while each trace datum represents the signals appeared with frequency range of 1 MHz. If the sweep points are added, the span corresponding to each trace datum is narrower, the measured results are more stable and the frequency readout

accuracy is higher.

From the above analysis, it can be seen that the trace display needs to turn the more sampling data points into the less sweep trace points, which is what the trace detector needs to do.

There are many types for the trace detector modes. The S3503 Series Signal/Spectrum Analyzer has 7 trace detector modes:

- **Normal detection**

Take the maximum value and minimum value from the sampling data assigned to each trace point and display them at the same time.

- **Positive peak detection**

Take and display the maximum value from the sampling data assigned to each trace point.

- **Negative peak detection**

Take and display the minimum value from the sampling data assigned to each trace point.

- **Sampling Value Detector**

Take and display the last value from the sampling data assigned to each trace point.

- **Power Average Detector**

Also called root mean square (RMS) detector. Calculate the root mean square of all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After square these voltage values, take sum and divide the count of sampling data points corresponding to each trace point. Finally, take square root. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those RMS values are trace data.

- **Voltage Average Detector**

Also called average (AVG) detector. Take linear average for all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After summing those voltage values, divide the number of sampling data points corresponding to each trace point. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those average values are trace data.

- **Video Average Detector**

Also called Logarithm Power Average Detector, i.e., take the logarithm power average value for all data assigned to each trace point; earlier signal/spectrum analyzer generally displays the measurement trace of logarithm scale, and all filtering and averaging are based on the logarithm power data; the trace is generally called as video signal. After digital IF processing is adopted, to make measurement results same as the earlier signal/spectrum analyzer, the video average detector function is added.

The trace detector mode of S3503 series signal/spectrum analyzer can be manually set or set as auto selection. When the detector mode is set as auto selection, the signal/spectrum analyzer will automatically select the suitable detector mode based on the current trace processing mode, marker function and trace average type.

2) Concept of trace processing

When the signal/spectrum analyzer is in the continuous sweep mode or has carried out the sweep measurement continuously for many times, the trace processing mode determines how the current measured trace deals with the previous measured traces to obtain new trace.

The S3503 series signal/spectrum analyzer has four trace processing modes:

- **Refresh**

New trace is directly assigned with the current measured trace, irrelevant with the previous measured traces.

- **Average**

Based on the average count N set in the [Measurement Setting], update trace is obtained after averaging the performance index of the measurement trace.

Detailed algorithm:

New trace = ((K-1) previous trace + current measurement trace)/K where, K is accumulated average count.

Under continuous measurement, when K is accumulated to the average count N set in the [Measurement Setting], the K will always equal to N. Under single measurement status, when K is accumulated to the average count N set in the [Measurement Setting], the measurement will stop.

- **Max. Hold**

The new trace data is assigned with maximum value of previous measured trace data.

- **Min. Hold**

The new trace data is assigned with minimum value of previous measured trace data.

For each trace activated, the trace processing mode is defaulted to refresh in the S3503 series signal/spectrum analyzer.

3) Trace display ON/OFF

The trace display ON/OFF indicates whether the trace will execute and be displayed on the display area of the front panel. There are four types of the S3503 series signal/spectrum analyzers:

- **Refresh Display (Trace on)**

New trace will execute refresh in the internal part of application (backstage) and will be displayed on the display area of the front panel.

- **Static Display (View)**

When the trace [Display ON/OFF] is set as "Static Display", the signal/spectrum analyzer will keep the most recent trace and do not go through trace processing. The latest trace will be displayed in the display area of the front panel.

- **Backstage Refresh (Background)**

New trace will execute refresh in the internal part of application (backstage), but not be displayed on the display area of the front panel. This type is commonly applied in remote control.

- **Display OFF (Blank)**

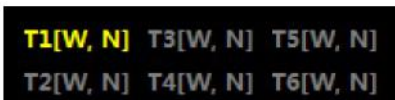
"Display OFF" indicates that the signal/spectrum analyzer neither goes through backstage trace processing nor display. That means, the trace is not activated and is OFF.

For each trace activated, the Display ON/OFF is defaulted to refresh display in the S3503 series signal/spectrum analyzer.

4) How to activate and configure trace

The S3503 series signal/spectrum analyzer can activate up to 6 traces at the same time including Trace 1, Trace 2, Trace 3, Trace 4, Trace 5 and Trace 6. The signal/spectrum analyzer only activates Trace 1, the processing mode of Trace 1 is "Refresh", Display ON/OFF of Trace 1 is set as "Refresh Display", the detector of Trace defaults to auto and other 5 traces are in Display OFF (OFF) state by default.

The prompt area of screen trace message displays:



Multiple traces can be selected, activated and configured with [Trace Select] submenu by pressing [Trace] key on the front panel. For

the purpose of better understanding and reasonably configuring the trace, we assume that the signal/spectrum analyzer is in the default state and the Trace 1 is activated with processing mode of "Refresh", Display ON/OFF set as "Refresh Display" and Detector Mode automatically selected as Normal. Please activate and configure Trace 2 based on the following steps:

Step 1. Select Trace 2:

Select the Trace 2 in the [Trace Select] submenu by pressing [Trace] key on the front panel. After it is selected, the signal/spectrum analyzer returns to the previous menu automatically. Then the [Trace Select] soft key menu displays [Trace Select Trace 2], which indicates that the subsequent trace processing mode settings and trace Display ON/OFF operation are only applicable to the Trace 2.

Step 2. Select the processing mode of Trace 2 and activate Trace 2:

When you press the [Refresh] soft menu, the signal/spectrum analyzer will automatically activate the Trace 2 and set its processing mode as Refresh, [Display ON/OFF] menu as [Refresh Display] and detector mode as Auto.

If you directly enter the [Display ON/OFF] menu instead of pressing [Refresh] soft menu and select [Refresh Display], the signal/spectrum analyzer will also activate the Trace 2 and set its processing mode as Refresh, [Display ON/OFF] as [Refresh Display] and detector mode as Auto. It can be seen that the [Refresh] soft menu appears light blue representing active.

Step 3. Select Max. Hold for the processing mode and sample detector for the detector mode of Trace 2:

By pressing [Max. Hold] menu, the Trace 2 will be set as Max. Hold, the character "*" will pop up in the [* Max. Hold] menu and the detector mode of Trace 2 will be automatically set as Auto same as Trace 1. The detector of Trace 2 will be changed to manual sample detector by selecting [Sample] for the detector in the [Detector] submenu.



As the S3503 series signal/spectrum analyzer can only use one type of detector at the same time, other active traces will change to use the same type of detector when the detector mode of any trace is changed.

5) Rules on auto trace average and auto trace detector

If the trace average type is set as auto, the signal/spectrum analyzer will automatically select the average type based on the detector type, marker function, amplitude scale, etc. of the corresponding trace. Rules on auto selection of average type: if trace detector (for detector, please refer to relevant information stated in the section of 4.1.3) is power average, the average type is selected as power average; if the trace detector (for detector, please refer to relevant information stated in the section of 4.1.3) is voltage average, the average type is selected as voltage average; if the noise marker, bandwidth power or bandwidth density of the marker function (for marker function, please refer to relevant information stated in the section of 4.1.3) is opened, the average type is selected as power average; if the amplitude scale (for amplitude scale, please refer to relevant information stated in the section of 4.1.2.4) is selected as linear scale, the average type is selected as voltage average or video average.

If the trace detector is set as auto, the signal/spectrum analyzer will automatically select the detector type based on the processing mode, average type, marker function, amplitude scale, etc. of the corresponding trace. Rules on auto selection of detector type: if the noise marker, bandwidth power in the marker function of the current trace or any function of bandwidth density function is enabled, the detector mode is automatically selected as power detector; if the trace average type is power average, the detector mode is automatically selected as power detector, if the trace processing mode is Max. Hold, the detector mode is automatically selected as Max. value; if the trace average is voltage average, the trace detector is automatically selected as voltage average; if the amplitude scale is linear scale, the detector mode is selected as voltage average detector; if the trace average type is selected as video average, the detector mode is automatically selected as video average; if the trace processing is Min. Value Hold, the detector mode is automatically selected as Min. value or normal.

If the trace average type and trace detector type are auto, the auto rules are based on the last settings. E.g., if the last operation is trace average type settings, the auto rules of detector type are followed; if the last operation is detector type settings, the auto rules of average type are followed.

6) Clear trace and clear all traces

Clearing trace is to restore the trace data currently selected in the signal/spectrum analyzer to defaults. If the current trace processing mode is not Min. Hold, clearing trace will reset the trace data to the minimum value state; if the current trace processing mode is Min. Hold, clearing trace will reset the trace data to maximum value state.

Clearing all traces is to restore all trace data currently selected in the signal/spectrum analyzer to defaults. If the current trace processing mode is not Min. Hold, clearing trace will reset the trace data to the minimum value state; if the trace with processing of Min. Hold exists, clearing trace will reset the trace data to maximum value state.

Clearing trace and clearing all traces will not change any variable and parameter of analyzer.

7) Open and use trace operation

Trace operation refers to the mathematical operation carried out to the data of two traces. The signal/spectrum analyzer can take mathematical operation for any two traces from the active 6 ones, and save the results to the update data of the second trace. The trace operation in the S3503 series signal/spectrum analyzer includes addition and subtraction.

The math rule is used for specifying the data type of two traces under processing, including logarithmic power, linear voltage (current) or linear power.

The trace operation will be executed with [Trace Operation] submenu in the [Menu 1/2 ►] menu by pressing [Trace] key on the front panel. Specific steps are as follows.

Step 1. Select the trace corresponding to the Operator 1 through [Operator 1 Select ►] menu:

Select any trace among Trace 1 to Trace 6 by pressing [Operator 1 Select ►] menu; if the trace selected is not active, the signal/spectrum analyzer will automatically activate this trace.

Step 2. Select the trace corresponding to the Operator 2 through [Operator 2 Select ►] menu:

Select any trace among Trace 2 to Trace 6 by pressing [Operator 1 Select ►] menu; if the trace selected is not active, the signal/spectrum analyzer will automatically activate this trace.

Step 3. Execute trace addition:

When the [Operator 1 + Operator 2 -> Operator 2] menu is pressed, the signal/spectrum analyzer will automatically activate the trace operation and carry out addition operation to the trace corresponding to Operator 1 and the trace corresponding to Operator 2 and then save the results to the trace corresponding to Operator 2.

Step 4. Execute trace subtraction:

When the [Operator 1 - Operator 2 -> Operator 2] menu is pressed, the signal/spectrum analyzer will automatically activate the trace operation and carry out the subtraction operation to the trace corresponding to Operator 1 and the trace corresponding to Operator 2 and then save the results to the trace corresponding to Operator 2.

Step 5. Change operational rules:

When the [Operational Rules ►] menu is pressed, the data type of two traces in the operation will be changed. Operational rules are logarithmic by default.

Step 6. Close trace operation:

When the [OFF] menu is pressed, the signal/spectrum analyzer will close the trace operation.



The operation results can only be obtained by executing sweep measurement. During process of trace operation, clearing trace, uploading trace and copying trace from file will affect the results of trace operation, so those operations should be avoid.

8) Understand the relation of trace processing and trace operation

The trace operation is the mathematical operation carried out to the current active traces (any two traces from 6 ones) during one sweep, while the trace processing is to average or hold the traces obtained during many sweeps. Whenever the trace operation function is enabled, operational rules are changed or operator selected is changed, the trace data saving operation results will be cleared and the sweep measurement will be re-executed.

After the trace is obtained, execute trace operation, then trace processing and save the processing results to new trace for display or that transferred to the users through programmable interface. The specific relation is shown in Fig. 4.4.

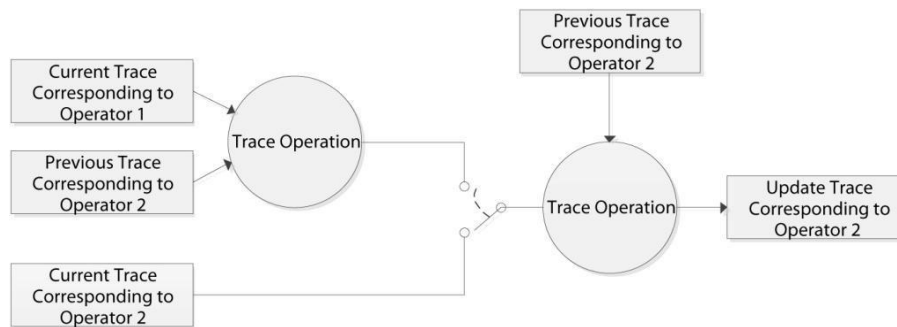


Fig. 4.4 Relation of Trace Processing and Trace Operation

Fig. 4.4 provides the relation figure of trace operation and trace processing corresponding to Operator 2. When the trace operation function is enabled, the current trace data of trace processing comes from the results of trace operation, while the trace operation function is disabled, the current trace data of trace processing comes from the traces obtained currently, then update the trace after trace processing including averaging or holding with previous trace. The trace updated is used for display or transferred to the users through programmable interface.

The signal/spectrum analyzer will always execute trace operation and trace processing to all active traces based on the sequence of Trace 1, Trace 2, Trace 3, Trace 4, Trace 5 and Trace 6, which is very important. E.g., if the Operator 1 set by you is corresponding to the Trace 1, while the Operator 2 is corresponding to the Trace 2, the current trace corresponding to the Operator 1 is the trace data that has already gone through detector and trace average/hold when the Trace 2 is executed.

9) Copy trace

Copying trace is used to help you select the data of one trace (e.g., Trace 1) and copy them to any trace selected (e.g., Trace 2). Note that Copy Trace is only an operation rather than parameter setting; therefore, it is only performed once and not for every sweep and measurement.

The Copy Trace will be executed with [Copy Trace] submenu in the [Menu 1/2 ►] menu by pressing [Trace] key on the front panel. Assuming that we hope to copy the data of Trace 2 to Trace 3, the execution steps are as follows:

Step 1. Select Trace 2 as the one corresponding to the Operator 1 through [Operator 1 Select ►] menu:

Select Trace 2 by pressing [Operator 1 Select ►] menu after entering [Copy Trace] submenu.

Step 2. Select Trace 3 as the one corresponding to the Operator 2 through [Operator 2 Select ►] menu:

Select Trace 3 by pressing [Operator 2 Select ►] menu after entering [Copy Trace] submenu.

Step 3. Execute Copy Trace

The signal/spectrum analyzer will execute single Copy Trace by pressing [Operator 1 -> Operator 2] menu after entering [Copy Trace] submenu.

4. 1. 3. 2. Marker

Marker can help you quickly select and read specific trace data and accurately locate the position of one measured data in the trace, obtain its information and indicate its position. Each active window of the S3503 series signal/spectrum analyzer can activate up to 12

markers.

The marker function is to execute the more complicated measurement process and calculation function on the basis of marker measurement, which can help you execute noise measurement, signal demodulation, high-accuracy frequency measurement, etc.

The section mainly describes the basic concept and operation methods of marker and marker function. The marker function is not available for all measurement modes and measurement functions. The corresponding menu will not display in the measurement function without marker or marker function.

1) Type of marker

The S3503 series signal/spectrum analyzer has three types of markers:

- **[Normal Marker]**

Indicating that the marker is position marker. The normal marker can move on the trace points by assigning X Axis value, and the corresponding trace value is the absolute value of Y Axis.

- **Delta Marker**

Indicating that the marker is numeric marker. The delta marker refers to the relative value between the selected marker and its reference marker. The delta marker can move on the trace data by assigning the relative value of X Axis between itself and its reference marker.

- **Fixed Marker**

Indicating that the marker is position marker. As the name suggests, the fixed marker means that it remains stationary in the designated position. The fixed marker can move by assigning X Axis and Y Axis or peak-peak search. Once the move of fixed marker is finished, it will remain stationary. If the normal marker or delta marker is to be changed to fixed marker, the X Axis position and Y Axis value corresponding to the marker will remain unchanged.

2) Active marker

One marker is corresponding to one trace, so the marker will be activated only when it is displayed on the active window. If the trace display in the current active window is closed, the corresponding trace marker and marker function will automatically close accordingly. The active marker appears white diamond in the corresponding screen position.

By default, when the [Marker] key on the front panel is pressed, the S3503 series signal/spectrum analyzer will automatically activate Marker 1 with type of normal marker, which is corresponding to the trace selected currently, and place the position of marker in the center of display area, namely the center of x Axis.

The signal/spectrum analyzer will automatically activate the markers and set them as normal marker after being selected through soft keys after entering [Marker Select ►].

4. 2. Advanced operation guide

This section introduces the relatively complex measurement procedures of S3503 Series Signal/Spectrum Analyzer.

- [Multi-signal measurement](#)
- [Distortion measurement](#)
- [Small-signal measurement](#)
- [Increase frequency resolution by using frequency count function](#)
- [Noise signal measurement](#)
- [AM signal demodulation](#)
- [Drift signal measurement](#)

- Improvement of amplitude measurement accuracy by applying amplitude correction function
- Time gate measurement
- Channel Power
- Occupied Bandwidth
- Adjacent Channel Power
- Power Statistic
- Burst Power
- Harmonic Distortion
- Three-order Intermodulation
- Spurious Emission
- Spectral emission mask
- Display and limit line

4. 2. 1. Multi-signal measurement

4. 2. 1. 1. Use delta marker to compare signals on the same screen

Users may find it easy to compare frequency difference and amplitude difference between signals with S3503. When two signals are shown on the screen at the same time, the signal/spectrum analyzer can calculate their difference in frequency and amplitude with the delta marker function.

In this section, we take the reference signal output of 10 MHz of the analyzer as input to demonstrate how to measure the difference in frequency and amplitude of two signals on the same screen.

Step 1: connect reference signal output of 10 MHz on the rear panel of the analyzer to the RF input port on the front panel.

Step 2: set the analyzer at spectrum analysis mode and then reset it:

- Press [Mode] and [Spectrum Analysis].
- Press [Reset].

Step 3: set center frequency, frequency span and reference level of the analyzer in order to observe 10 MHz reference signal and its 20 MHz harmonic at the same time:

- Press [Frequency], [Center Frequency] and enter 25 MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 40 MHz.
- Press [Amplitude/Y Axis], [Reference Level] and enter 0 dBm.

Step 5: open a marker and search for the maximum peak on the trace:

- Press [Peak Search] to ensure the marker is on 10 MHz reference signal.

[Next Peak Left] and [Right Next Peak Left] soft keys in the peak menu can enable shift of the marker from one peak to another.

Step 6: retain the first marker and trigger a second delta marker:

- Press [Marker] and [Delta Marker].

The diamond symbol of the first marker changes from hollow to red solid, indicating the first fixed marker (reference point) and the marker No. changes to 2. The second marker has a diamond symbol with a number of 1R2, representing the delta marker. When [Delta Marker] is pressed for the first time, two markers overlap at the same frequency point.

Step 7: use the knob or peak search key on the front panel to move the delta marker to another signal peak:

- Press [Peak Search] and [Next Peak].

Difference in amplitude and frequency of two markers are shown in the marker result area at the top right corner of the screen. As shown in Fig. 4.5.

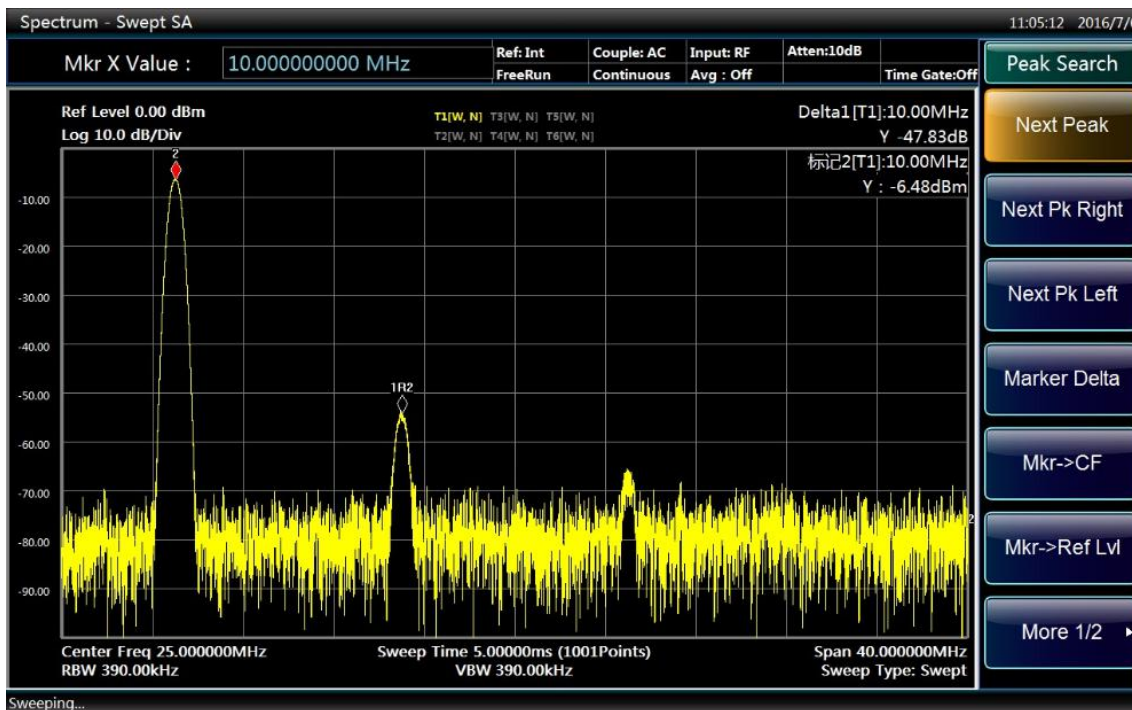


Fig. 4.5 Use of delta marker function

Attention

Frequency readout accuracy can be further improved by enabling frequency count function.

4. 2. 1. 2. Use delta marker function to compare signals not on the same screen

How to measure difference in frequency and amplitude of two signals not on the same screen? (Such technology is very useful for measuring harmonic distortion of low level under bandwidth with small frequency span and low resolution.)

In this section, we take the signal output of 10 MHz of the analyzer as reference to demonstrate how to measure difference in frequency and amplitude of two signals when one is inside the screen while the other is outside.

Step 1: connect reference output of 10 MHz on the rear panel to the RF input on the front panel.

Step 2: set the analyzer in spectrum analysis mode and reset such mode:

- Press [Mode] and [Spectrum Analysis].
- Press [Reset].

Step 3: set center frequency, frequency span and reference level of the analyzer in order to observe 10 MHz reference signal:

- Press [Frequency], [Center Frequency] and enter 10MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 5MHz.
- Press [Amplitude/Y Axis], [Reference Level] and enter 10 dBm.

Step 5: open a marker, set it to the peak of 10 MHz reference signal and then set center frequency as marker frequency (10 MHz):

- Press [Peak Search].
- Press [Marker →] and [Marker → Center Frequency].

Step 6: trigger a second delta marker:

- Press [Marker] and [Delta Marker].

Step 7: increase center frequency to 10 MHz in order to observe 20 MHz harmonic of 10 MHz reference signal:

- Press [Frequency], [Center Frequency] and [↑].

Move the first marker and the delta marker to the left of the screen at the peak of 10 MHz reference signal.

Step 8: move delta marker to peak frequency of 20 MHz harmonic signal:

- Press [Peak Search].

"←2" shown on the left of the screen in Fig. 4.6 indicates that 10 MHz reference signal has a lower frequency than the scope displayed on the screen. Delta marker 1R2 appears on the 20 MHz harmonic frequency point. Delta marker result shows difference in frequency and amplitude between 10 MHz reference signal and 20 MHz harmonic signal.

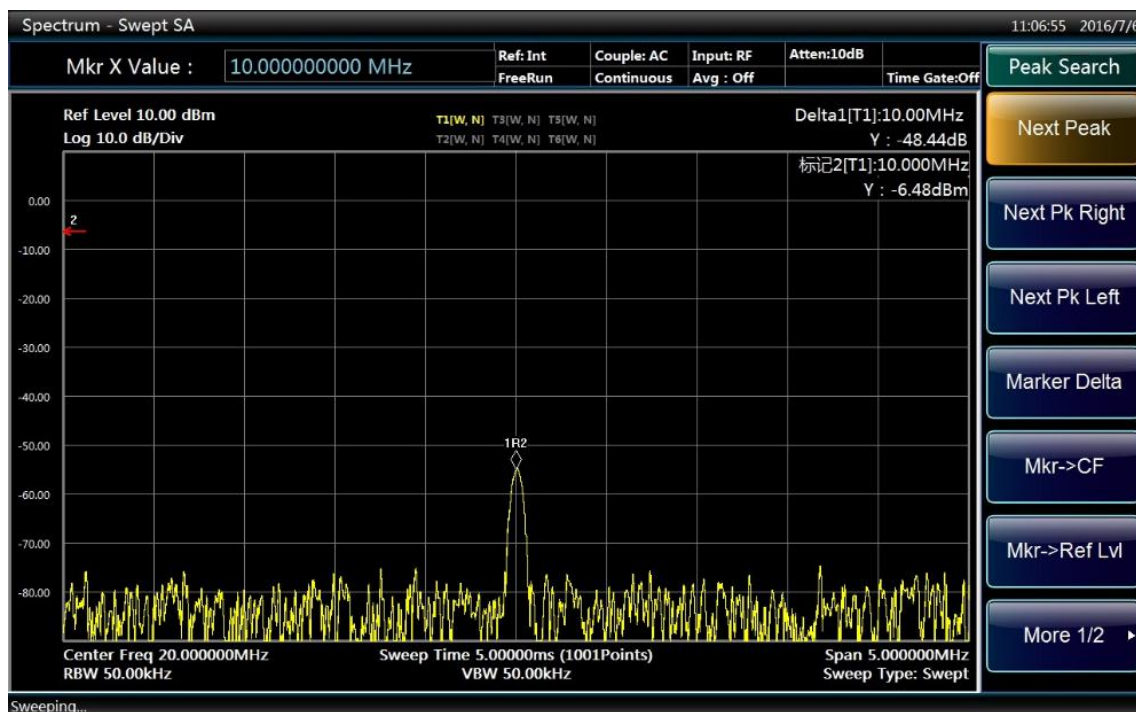


Fig. 4.6 Delta marker of two signals on different screens

Step 9: close all markers:

- Press [Marker] and [Marker OFF].

4. 2. 1. 3. Distinguish measurements of two signals with constant amplitude

1) Basic Concepts

For frequency response of a simple-frequency signal, the signal/spectrum analyzer has a trace of the shape of the selected IF filter (usually referred as resolution bandwidth (RBW) filter). When the filter bandwidth is changed, trace width shown by the analyzer will change accordingly. The resolution bandwidth is usually defined as 3 dB bandwidth of the filter or sometimes, 6 dB bandwidth of the filter.

A basic characteristic of the signal/spectrum analyzer is that it can separate each spectrum component from a composite signal. While

separation of such component depends upon the resolution bandwidth used. If the resolution bandwidth is too large, it may be impossible to distinguish each spectrum component, thus displaying only one signal.

To distinguish two signal of constant amplitude, the resolution bandwidth has to be less than or equal to signal frequency interval. If the resolution bandwidth is equal to the frequency interval, a 3 dB dip will appear in the spectral view between two signals. The smaller the resolution bandwidth is, the deeper the dip goes. Therefore, distinction between signals will be clearer.

For signal/spectrum analyzer in sweep mode, the sweep time is automatically set as $1/RBW^2$ to ensure measurement accuracy. With frequency span remaining unchanged, if the bandwidth is narrow, higher frequency resolution should be obtained at the cost of higher sweep time. If the resolution reduces by 10 times, the sweep time will increase by 100 times. In S3503, RBW can be set to as large as 20 MHz.

To optimize sweep time and maintain standard measurement of the analyzer, the sweep time ([Sweep], [Sweep Time]) and sweep type ([Sweep], [Sweep Setting] and [Sweep Type]) can be set as auto.

2) Measure two signals with frequency interval of 100 kHz

In this section, two signals of constant amplitude with frequency interval of 100 kHz are analyzed by reducing their resolution bandwidth and video bandwidth. Attention should be paid to ensure that the resolution bandwidth

selected should be equal to signal frequency interval and that the video bandwidth should be slightly smaller than the resolution bandwidth.

Step 1: connect two signal sources to the RF input port of the analyzer as shown in Fig. 4.7.

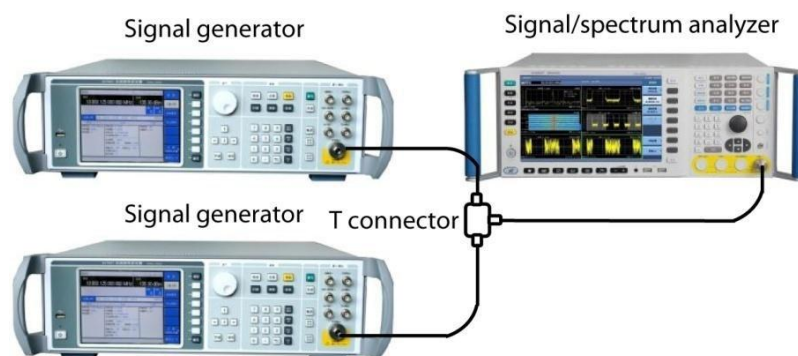


Fig. 4.7 Test instrument connection diagram of two input signals

Step 2: set frequency of one signal generator at 300 MHz and the other at 300.1 MHz and then set output amplitude of both generators at -20 dBm.

Step 3: set the signal/spectrum analyzer in spectrum analysis mode and reset:

- Press [Mode] and [Spectrum Analysis];
- Press [Reset].

Step 4: set parameters of the analyzer:

- Press [Frequency], [Center Frequency] and enter 300 MHz;
- Press [Bandwidth], [Resolution Bandwidth Auto ON/OFF] and enter 300 kHz;
- Press [Frequency Span/X Axis], [Frequency Span] and enter 2MHz.
- Press [Trace], [Menu 1/2 ►], [Detector ►] and [Positive Peak] to switch the detector mode to positive peak. Then you can see there is only one signal peak on the screen of the analyzer as shown in Fig. 4.8.

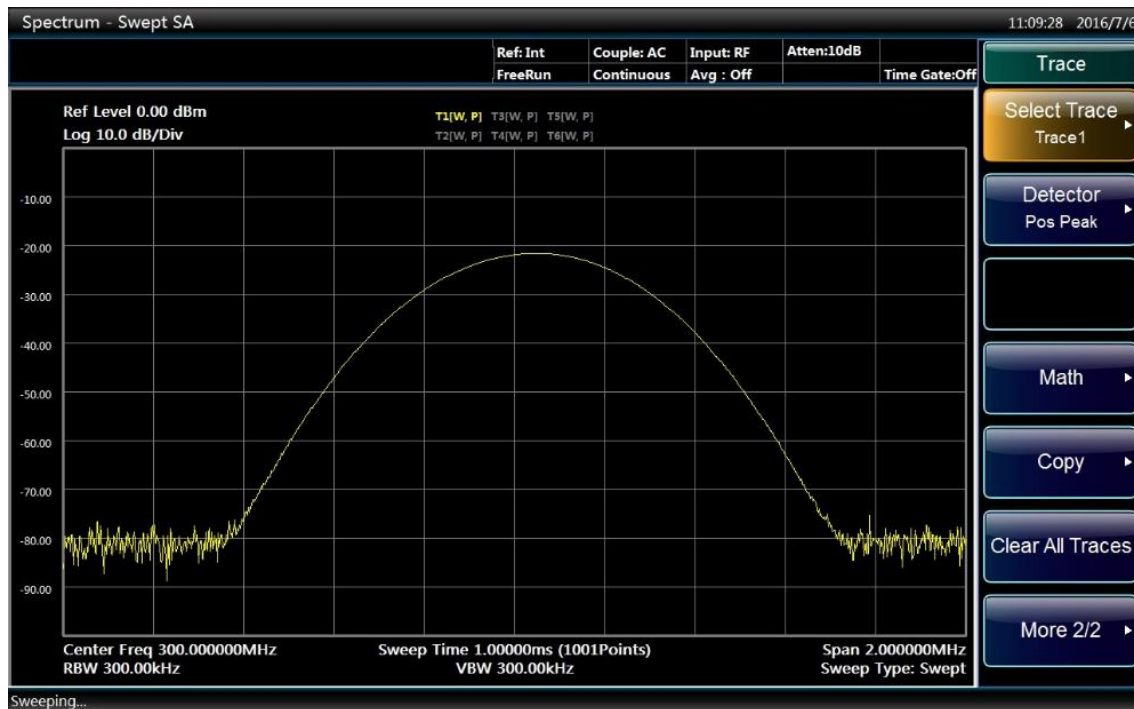


Fig. 4.8 Spectrogram when resolution bandwidth (300 kHz) is larger than signal frequency bandwidth

Step 5: change resolution bandwidth to 100 kHz to make it equal to frequency interval of two signals and reduce video bandwidth to 10 kHz:

- Press [Bandwidth], [Resolution Bandwidth Auto ON/OFF] and enter 100 kHz;
- Press [Bandwidth], [Video Bandwidth Auto ON/OFF] and enter 10 kHz.

You can clearly distinguish two signals with two independent peaks on top of them, as shown in Fig. 4.9.



Video bandwidth setting

The video bandwidth is set as 10 kHz in order to show level reduction between two signals in the center of the screen. For large video bandwidth, video voltage generated by the envelope detector cannot be fully suppressed. Therefore, additional voltage will be generated in the transition area of two and displayed on the trace.

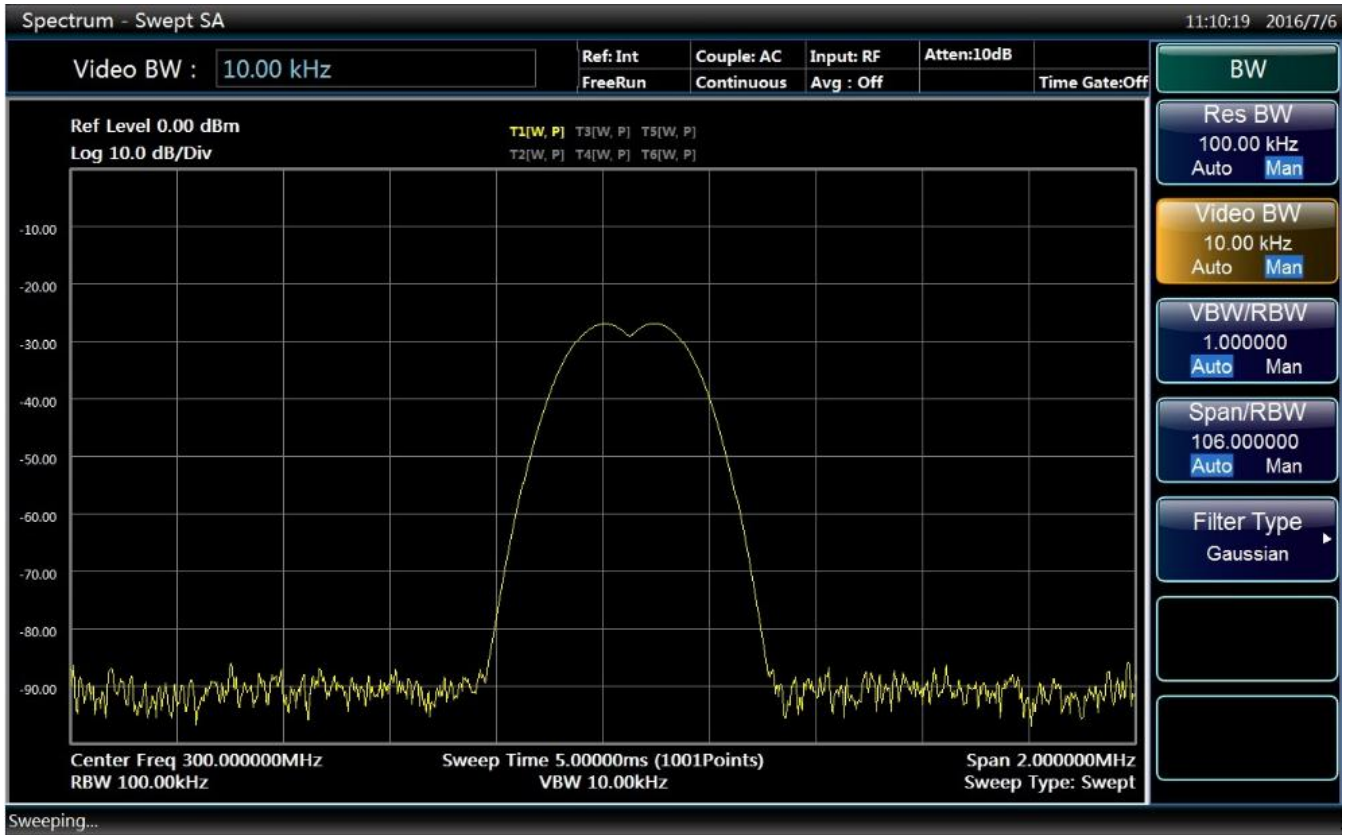


Fig. 4.9 Spectrogram when resolution bandwidth (100 kHz) is equal to signal frequency bandwidth

Step 6: reduce resolution bandwidth to 10 kHz:

- Press [Bandwidth], [Resolution Bandwidth Auto ON/OFF] and enter 10kHz;

Two signals are completely separated as shown in Fig. 4.10. The knob or up and down arrow keys may also be used to further reduce resolution bandwidth to obtain higher frequency resolution and thus better resolution signals. However, the sweep time will get longer. S3503 Series Signal/Spectrum Analyzer can be finely tuned in 10% increment to optimize resolution bandwidth and sweep speed.

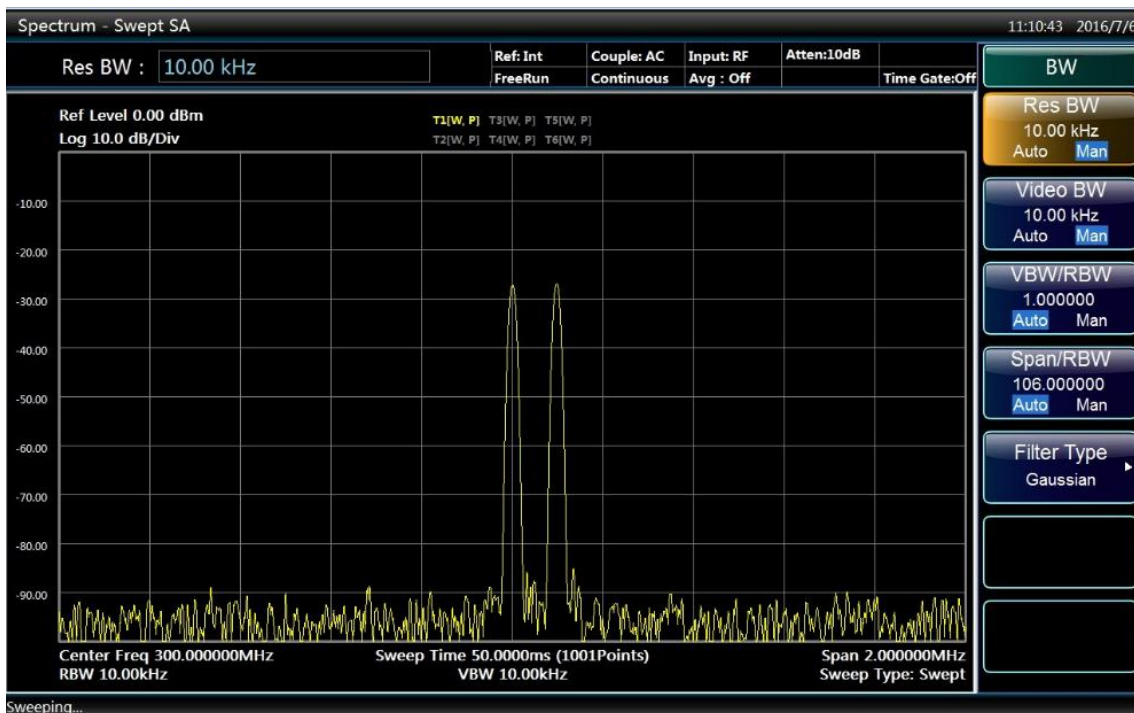


Fig. 4.10 Spectrogram when resolution bandwidth (10 kHz) is smaller than signal frequency bandwidth

4. 2. 1. 4. Distinguish two signals with unequal amplitude

1) Basic concepts of filter selectivity

When distinguishing two signals with unequal amplitude but similar frequency, the filter shape in the signal/spectrum analyzer, i.e. 3 dB bandwidth should be taken in to account. The filter shape is defined by filter selectivity, which the ratio of 60 dB bandwidth against 3 dB bandwidth. Filter bandwidth and selectivity are shown in Fig. 4.11. If one small signal is located very close to a large signal, then such small signal may be overwhelmed by the large signal.

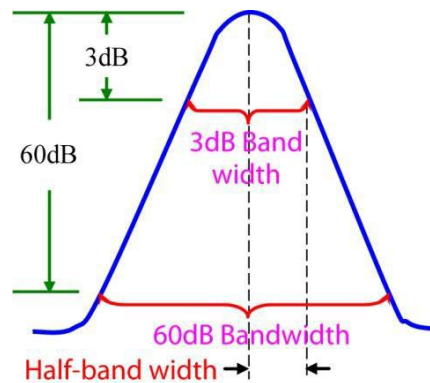


Fig. 4.11 Diagram of filter bandwidth and selectivity

Fig. 4.12 shows the diagram of relationship between two close signals, in which a indicates frequency interval of two signals and k indicates half of the filter bandwidth of the large signal. a should be larger than k in order to measure level of the small signal.

Digital filter bandwidth of the analyzer is about 1/3 of typical analog resolution bandwidth filter, which means when distinguishing a nearby signal, a wider resolution bandwidth can be used to cut sweep time.

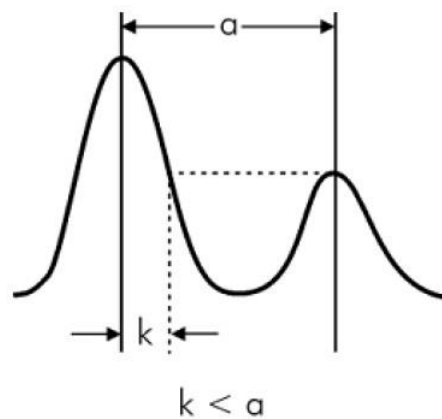


Fig. 4.12 Resolution bandwidth requirement when distinguishing small signals

2) Distinguish two signals with frequency difference of 50 kHz and amplitude difference of 60 dB

In this section, a narrow resolution bandwidth is adopted to distinguish two signals with frequency interval of 50 kHz and amplitude difference of 60 dB. Output ports of two signal generators should be connected to the input port of the analyzer as shown in Fig. 4.7.

Step 1: set frequency of one signal generator at 300 MHz and its amplitude at -10 dBm; set frequency of the other signal generator at 300.05 MHz and its signal output amplitude at -70 dBm. Turn on RF output of two signal generators.

Step 2: set the signal/spectrum analyzer in spectrum analysis mode and reset:

- Press [Mode] and [Spectrum Analysis].
- Press [Reset].

Step 3: set parameters of the analyzer:

- Press [Frequency], [Center Frequency] and enter 300MHz.
- Press [Bandwidth], [Resolution Bandwidth Auto ON/OFF] and enter 30kHz;
- Press [Frequency Span/X Axis], [Frequency Span] and enter 500kHz.

Step 4: Set 300 MHz signal peak to reference level:

- Press [Peak Search], [Marker] and [Marker →Reference Level].



Attention

Rectangle coefficient of the resolution bandwidth filter of the analyzer is about 4.1:1. When resolution bandwidth is 30 kHz, 60 dB bandwidth is 123 kHz and half-band width is 61.5 kHz, larger than the frequency interval of 50 kHz. Therefore, it is impossible to distinguish two input signals as shown in Fig. 4.13.

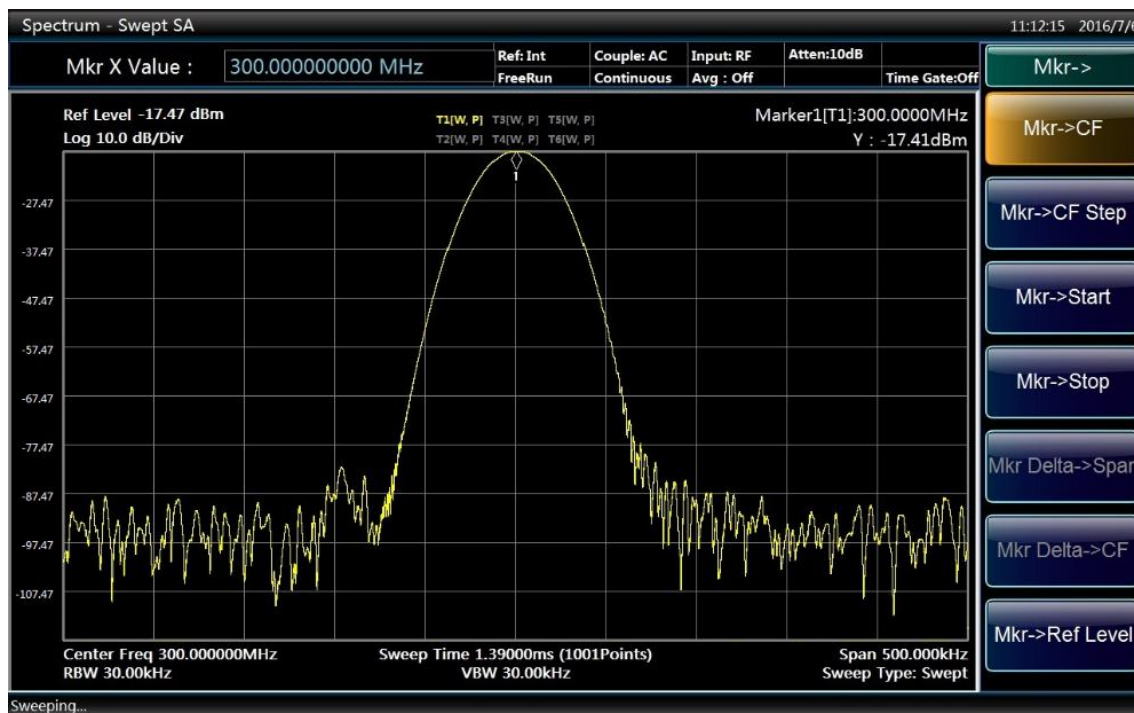


Fig. 4.13 Test interface with resolution bandwidth of 30 kHz

Step 5: reduce resolution bandwidth to observe the hidden small signal:

- Press [Bandwidth], [Resolution Bandwidth Auto ON/OFF] and enter 1kHz;

As shown in Fig. 4.14, half-band width is 2.05 kHz, smaller than the frequency interval of 50 kHz, therefore, two input signals can be distinguished.

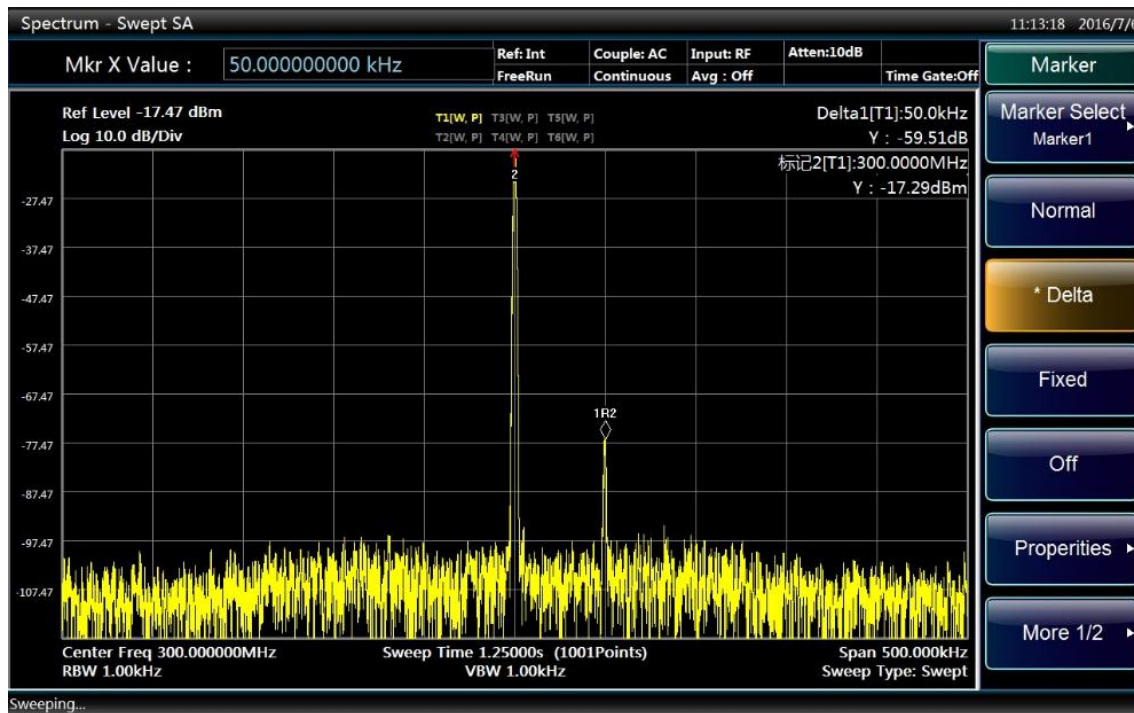


Fig. 4.14 Test interface with resolution bandwidth of 1kHz

Step 6: measure frequency and amplitude difference of two signals with delta marker:

- Press [Peak Search].
- Press [Marker] and [Delta Marker].
- Press [Peak Search] and [Next Peak] and read difference in frequency and amplitude of two signals of unequal amplitude.

Attention

The average function may also be used to distinguish two signals in more clear manner.

Press [Trace] and [Average] to turn on average function; press [Measurement Setting] and [Average Count] and enter 10 to set average count as 10 times.

4. 2. 2. Distortion measurement

Mutual interference between equipment is common in a crowded operating environment of the communications system. For example, second-order and third-order intermodulation distortion is common in narrowband systems. When there are two signals (F_1 and F_2) in one system, they and second harmonic distortion signals generated by them ($2F_1$ and $2F_2$) mix and become third-order intermodulation products $2F_2-F_1$ and $2F_1-F_2$ very close to original signals, thus resulting in high-order intermodulation distortion. Such distortion products are mostly generated by devices such as amplifiers and mixers in the system. Most transmission units and signal generators have harmonics and their components need to be measured.

4. 2. 2. 1. Identify distortion generated by the signal/spectrum analyzer

When a large signal is input, it will cause distortion of the signal/spectrum analyzer and thus affect distortion measurement result of the actual signal. In this case, an attenuator can be used to determine which one is the distortion signal generated in the analyzer. In this section, the input signal generated by the signal generator is used to explain whether the analyzer produces harmonic distortion.

Step 1: connect RF output of the signal generator to the input port of the analyzer.

Step 2: set an output dot frequency signal of the signal generator with frequency of 200 MHz and amplitude of 0 dBm.

Step 3: set the analyzer as spectrum analysis mode:

- Press [Mode] and [Spectrum Analysis].

Step 4: set center frequency and frequency span of the analyzer:

- Press [Reset].
- Press [Frequency], [Center Frequency] and enter 400MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 500MHz.

It can be seen from the trace of the analyzer that the harmonic distortion generated by the signal has 200 MHz frequency offset from the original signal of 200 MHz, as shown in Fig. 4.15.

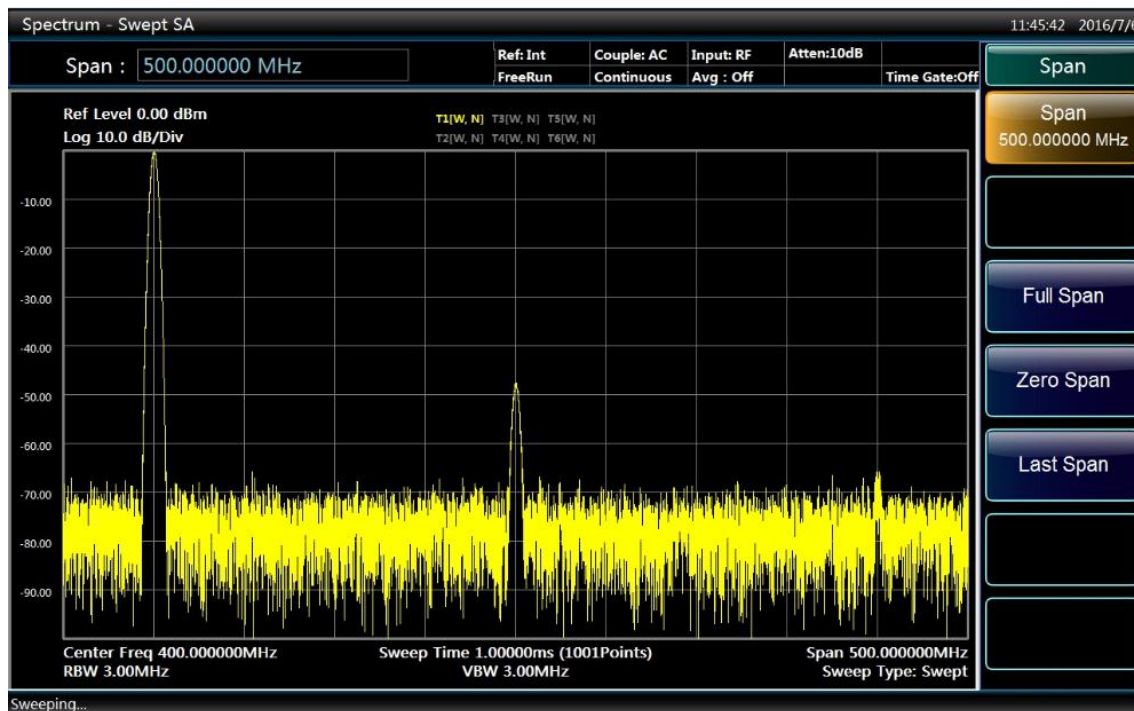


Fig. 4.15 Observe harmonic distortion

Step 5: set center frequency of the analyzer to the position of the first harmonic distortion:

- Press [Peak Search] and [Next Peak].
- Press [Marker →] and [Marker → Center Frequency].

Step 6: set frequency span as 50 MHz and reset center frequency:

- Press [Frequency Span/X Axis], [Frequency Span] and enter 50MHz.
- Press [Marker →] and [Marker → Center Frequency].

Step 7: set attenuator as 0 dB and open interpolation marker:

- Press [Amplitude/Y Axis], [Attenuator ►], [Mechanical Attenuator Auto ON/OFF] and enter 0 dB.
- Press [Peak Search] and [Delta Marker].

Step 8: increase attenuator setting to 10 dB:

- Press [Amplitude/Y Axis], [Attenuator ►], [Mechanical Attenuator Auto ON/OFF] and enter 10 dB.

Attention should be paid to the reading of delta marker as shown in Fig. 4.16, which is the difference in distortion when the attenuator setting is 0 and 10 dB. When the attenuator setting is changed, if delta marker reading is larger than 1 dB, it means certain distortion

has been generated by the analyzer. When delta marker reading is not obvious, the attenuator setting may also be increased.

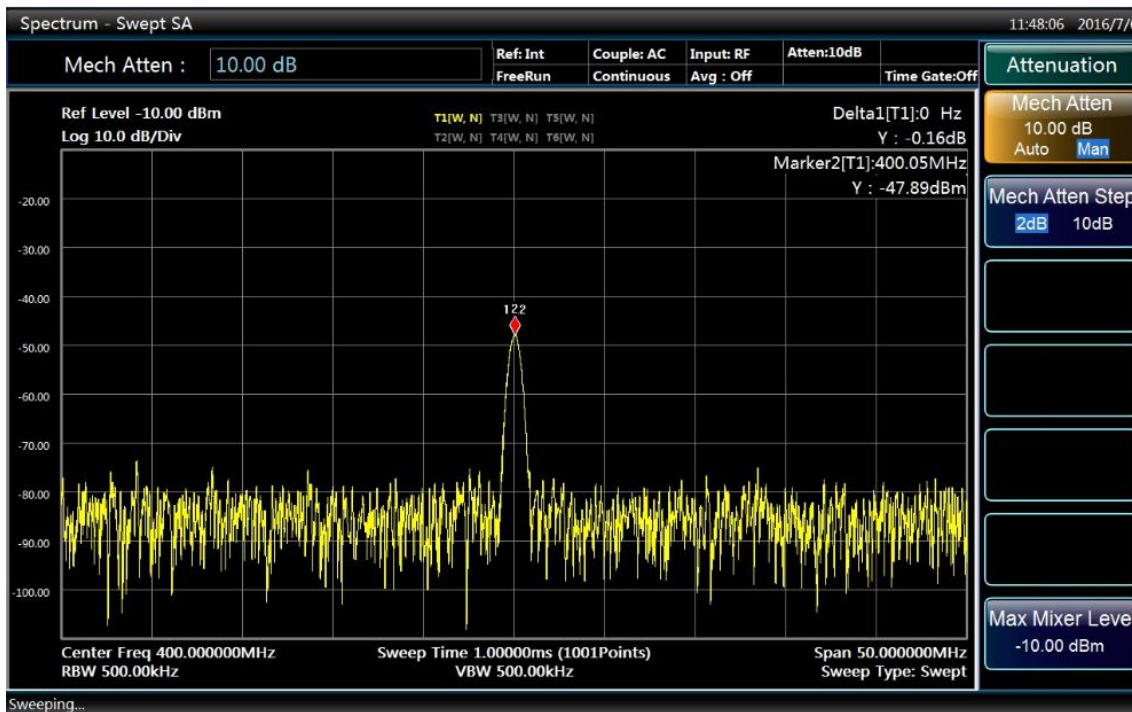


Fig. 4.16 Set attenuator as 10 dB

The amplitude reading of the delta marker comes from two sources: firstly, positive reading will be displayed when signal-to-noise ratio is reduced due to increase in RF attenuation; secondly, negative reading will be shown when the harmonic distortion generated by the analyzer circuit reduces. The larger the reading, the bigger the error of measurement. In such case, the attenuator setting may be changed to reduce absolute amplitude of such delta marker reading.

4. 2. 2. 2. Quick harmonic measurement

In this section, harmonic components are measured of a signal with frequency of 1 GHz and power of -10 dBm generated by the signal generator. The 500 MHz calibration signal of the analyzer may also be used, but the start and stop frequency of the analyzer should be adjusted to match with the signal frequency and its harmonic.

Step 1: connect output of the signal generator to the RF input port of the analyzer.

Step 2: set the analyzer as spectrum analysis mode and reset:

- Press [Mode] and [Spectrum Analysis].
- Press [Reset].

Step 3: set start and stop frequency of the analyzer:

- Press [Frequency], [Start Frequency] and enter 800 MHz.
- Press [Stop Frequency] and enter 2.5 GHz.

As shown in Fig. 4.17, the fundamental wave and the second harmonic are displayed on the screen at the same time.

Step 4: smooth the noise with video frequency to increase resolution:

- Press [Bandwidth], [Video Bandwidth Auto Manual] to enable auto off.

Use [↓] key to reduce video bandwidth.

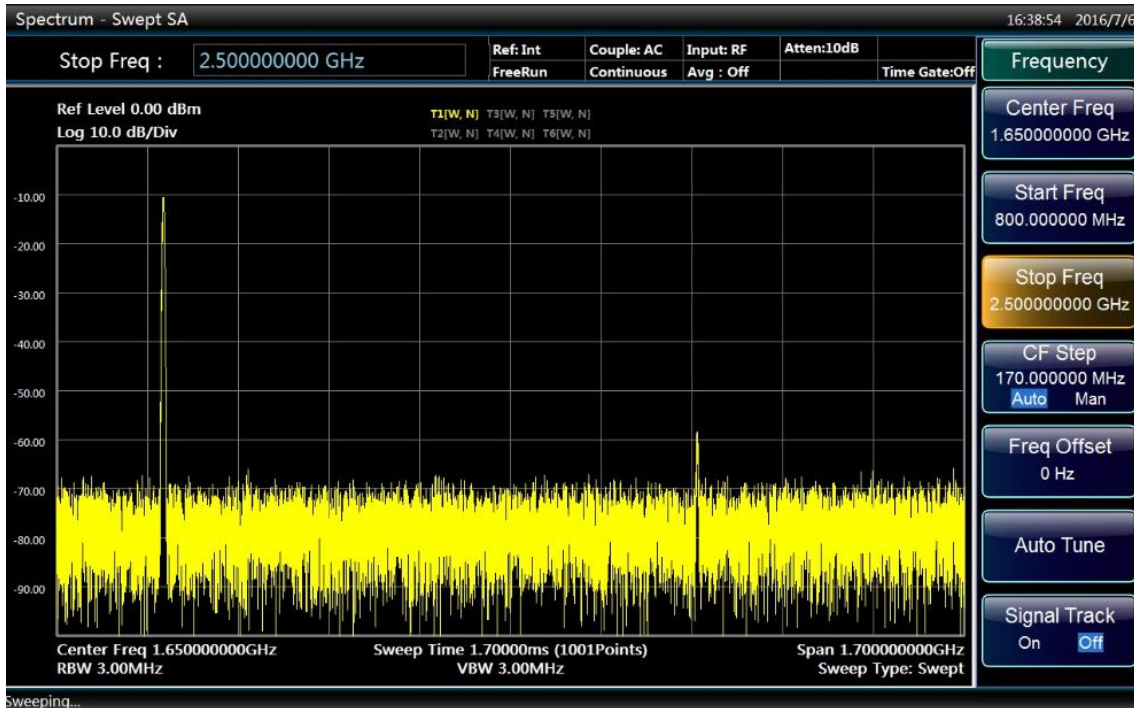


Fig. 4.17 Display interface of input signal and harmonic

Step 5: set fundamental wave peak level as reference level in order to improve measurement accuracy:

- Press [Peak Search] and [Marker →Reference Level] to obtain an interface as shown in Fig. 4.18.

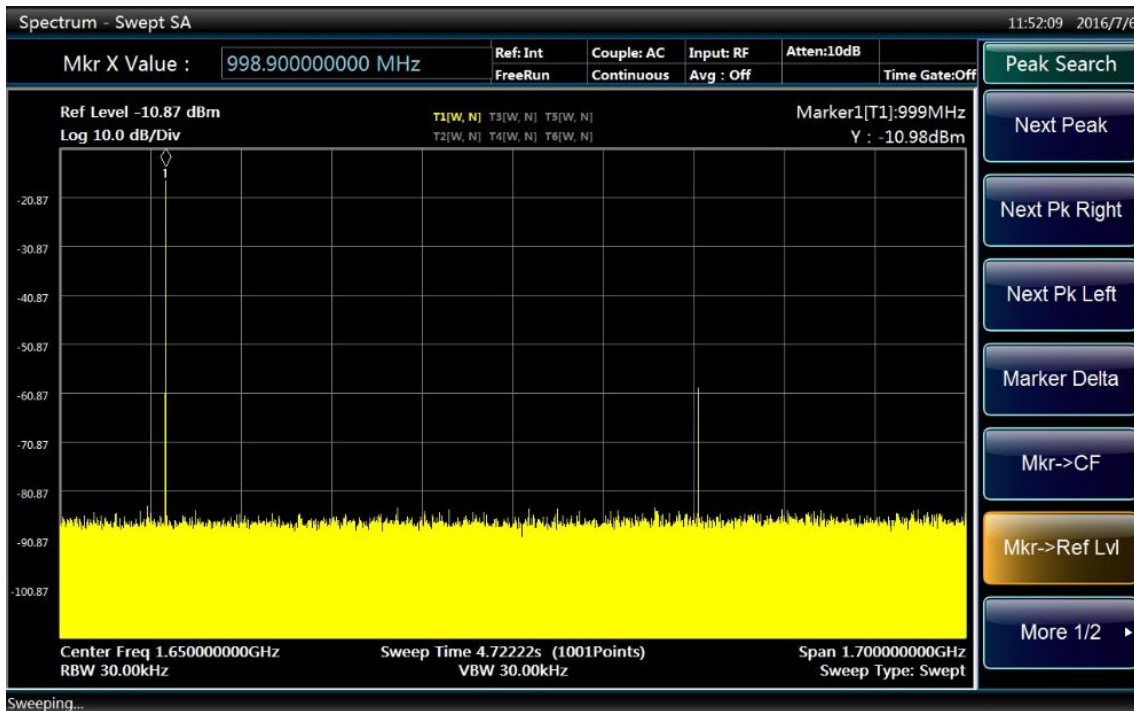


Fig. 4.18 Display interface of signal peak at reference level

Step 6: trigger second marker:

- Press [Peak Search] and [Delta Marker].
- Press [Peak Search] and [Next Peak]. At this time, the fixed marker is indicated on the fundamental wave and the active marker is at the peak of the second harmonic as shown in Fig. 4.19.

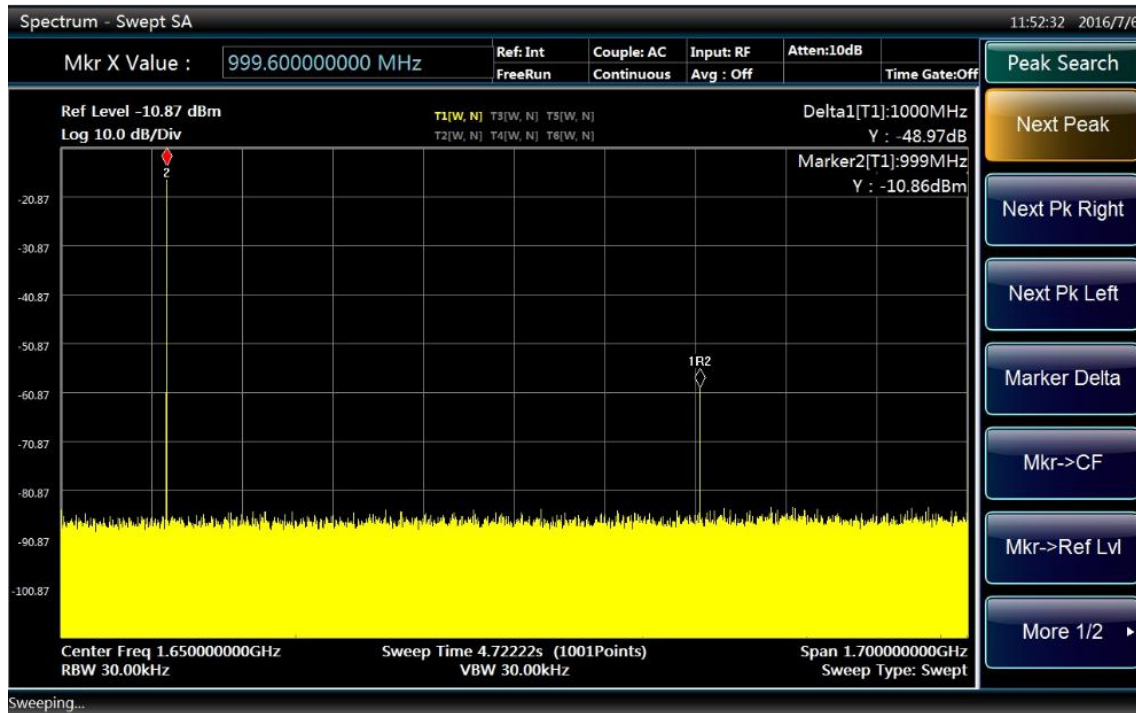


Fig. 4.19 Display interface of second harmonic measurement with delta marker

Step 7: measure harmonic distortion (method 1):

The fundamental wave and the second harmonic as shown in the figure has an amplitude difference of about -60 dB, or a harmonic distortion of 0.1% (see Fig. 4.20).

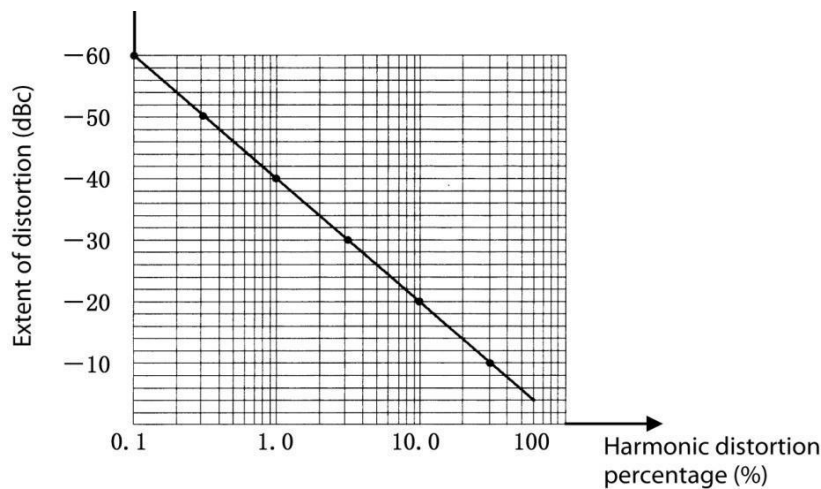


Fig. 4.20 Harmonic distortion amplitude percentage transformation diagram

Before reading amplitude ratio of other harmonics and the fundamental wave, the harmonic should be measured for three times and [Peak Search] and [Next Peak Right] should be pressed.

Step 8: measure harmonic distortion (method 2):

- Press [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] and [V].

By this time, the delta marker changes automatically to volt (V) and move the decimal point of the ratio shown two places to the right to get the distortion percentage. An easy way to determine distortion percentage is to change the unit to volt. The minimum ratio that can be displayed is 0.01 or 1%.

4. 2. 2. 3. Accurate harmonic measurement

It will be explained below how to measure the harmonic of 1 GHz signals. It takes more steps to measure in this method, but since measurement is done with smaller frequency span and resolution bandwidth for each signal, the signal-to-noise ratio is increased and more accurate measurement result will be obtained.

Step 1: connect output of the signal generator to the RF input port of the analyzer.

Step 2: reset the signal/spectrum analyzer:

- Press [Reset] key.

Step 3: set start and stop frequency of the analyzer:

- Press [Frequency], [Start Frequency] and enter 800 MHz.
- Press [Stop Frequency] and enter 2.5 GHz.

As shown in Fig. 4.17, the fundamental wave and the second harmonic are displayed on the screen.

Step 4: set the video frequency to smooth the noise and increase resolution:

- Press [Bandwidth], [Video Bandwidth Auto ON/OFF] to enable auto off. Use [↓] key to reduce video bandwidth.

Step 5: use signal tracking to reduce frequency span:

- Press [Peak Search] to trigger marker and search signal peak.
- Press [Frequency] and [Signal Track On/Off].
- Press [Frequency Span/X Axis], [Frequency Span] and enter 1MHz.

Step 6: turn off signal tracking:

- Press [Frequency] and [Signal Track On/Off].

Step 7: Move signal peak to top grid line to get the best amplitude measurement accuracy:

- Press [Marker →] and [Marker →Reference Level] to obtain an interface as shown in Fig. 4.21.

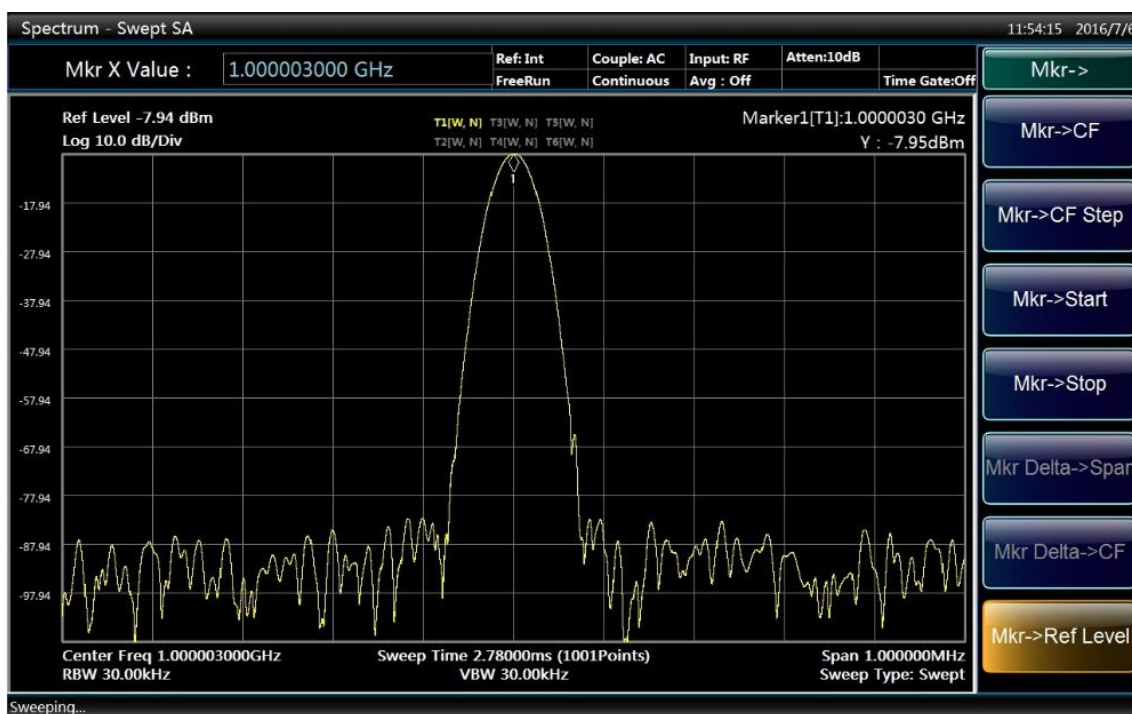


Fig. 4.21 Display interface of input signal with 1 MHz frequency span

Step 8: set center frequency increment as fundamental wave signal frequency:

- Press [Frequency] and [Frequency Step Auto Manual] and enter 1 GHz.
- Press [Frequency], [Center Frequency] and [↑] to increase center frequency.

Step 9: measure second harmonic:

- Press [Peak Search], [Next Peak] and [Marker → Center Frequency]. Move the center frequency of the analyzer to the second harmonic.
- Press [Marker →Reference Level] to adjust harmonic peak to the reference level with second harmonic amplitude as shown in Fig. 4.22.

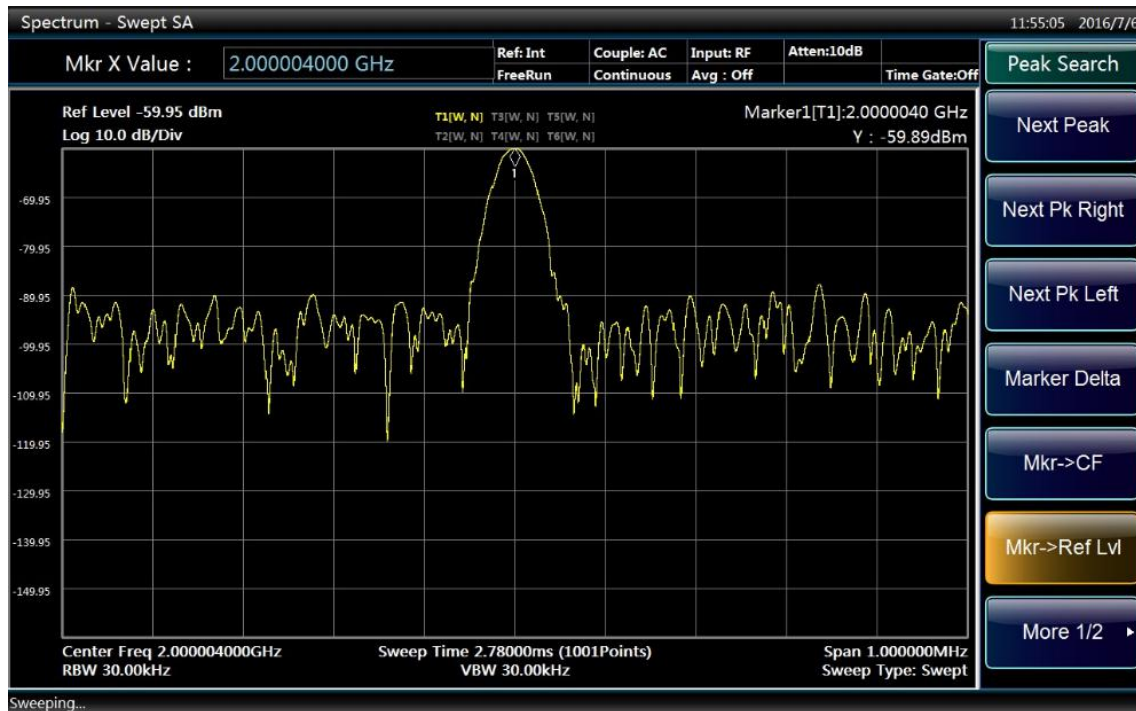


Fig. 4.22 Display interface of second harmonic amplitude

Step 10: calculate harmonic distortion:

- Use the relation shown in Fig. 4.20 to convert distortion percentage between the second harmonic and the fundamental wave. The unit can be changed again to volt in order to read the voltage ratio of two signals.

Repeat step 9 - 10 for other harmonics to be measured to get their distortion percentage. Total signal harmonic distortion percentage is also subject to frequent test. In order to test such parameter, amplitude of each harmonic should be tested with linear unit (such as volt) rather than relative unit dBc.

Step 11: measure total harmonic:

- Press [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] and [V] and set amplitude unit as volt. Measured signal amplitude may be used in the following equation to calculate total harmonic distortion:

$$\text{Total harmonic distortion} = \frac{100 \times \sqrt{(A_2)^2 + (A_3)^2 + \dots + (A_n)^2}}{A_1} \%$$

Where:

A1 refers to fundamental wave amplitude (V)

A2 refers to second harmonic amplitude (V)

A3 refers to third harmonic amplitude (V)

An refers to nth harmonic amplitude (V)

If the signal amplitude is measured carefully as indicated above, measured harmonic distortion percentage will be very accurate.

4. 2. 3. Measure small signals

Noise produced inside the signal/spectrum analyzer determines the ability of the analyzer to measure small signals and the following methods can be used to change measurement settings in order to increase measurement sensitivity of the analyzer.

4. 2. 3. 1. Reduce RF attenuator decrement to measure small signals

The input attenuator affects input signal level. If the input signal is very close to the noise floor, reduction in attenuator decrement may help to extract the signal from the noise.



Total power of all signals of the analyzer should be kept under +30 dBm (1 W)!

Step 1: reset the signal/spectrum analyzer:

- Press [Reset].

Step 2: Set the signal generator and connect the signal/spectrum analyzer:

- Set the signal generator frequency as 300 MHz and amplitude as -80 dBm; connect RF output of the signal generator to the input port of the analyzer.

Step 3: set center frequency, frequency span and reference level of the analyzer:

- Press [Frequency], [Center Frequency] and enter 300MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 5MHz.
- Press [Amplitude/Y Axis], [Reference Level] and enter -40 dBm.

Step 4: move the signal peak to the center frequency (300 MHz in this case):

- Press [Peak Search] and [Marker → Center Frequency].

Step 5: reduce frequency span to 1 MHz and if necessary, repeat step 4 to ensure the signal peak in at the center frequency of the analyzer:

- Press [Frequency Span/X Axis], [Frequency Span] and enter 1MHz.

Display as shown in Fig. 4.23.

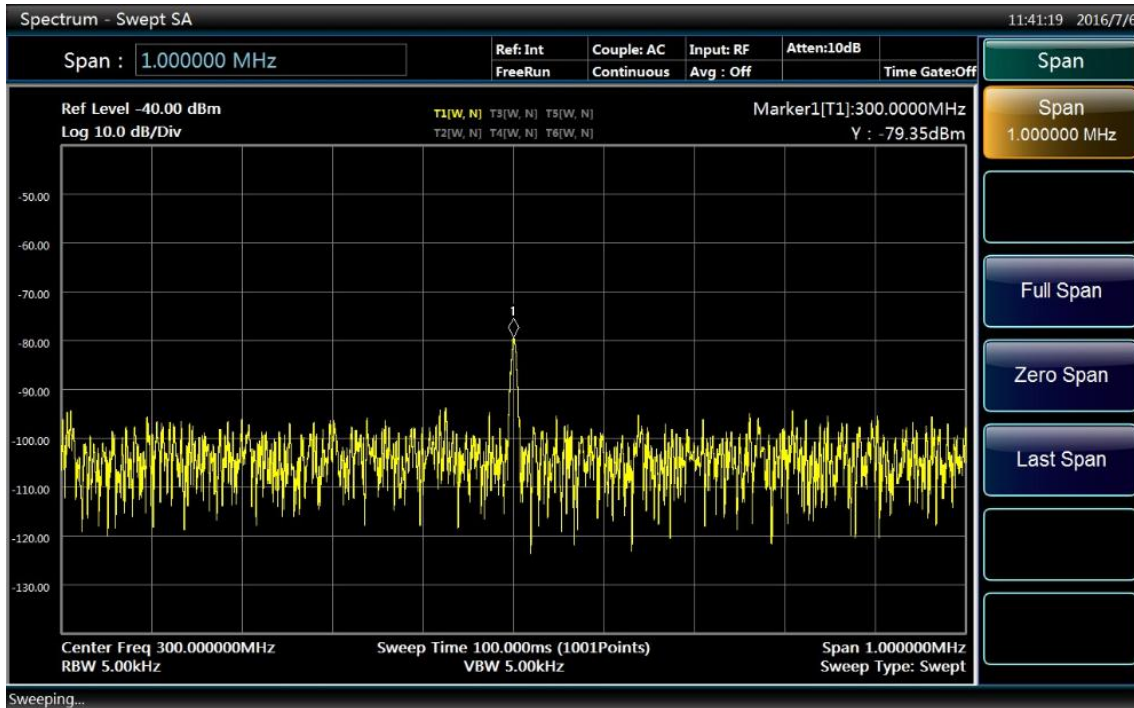


Fig. 4.23 Small signal when the attenuator is default as 10 dB

Step 6: set attenuation decrement as 20 dB:

- Press [Amplitude/Y Axis], [Attenuator ►], [Mechanical Attenuator Auto ON/OFF] and enter 20 dB.

As shown in Fig. 4.24, when attenuator decrement is increased, the noise floor gets more closer to the signal level.

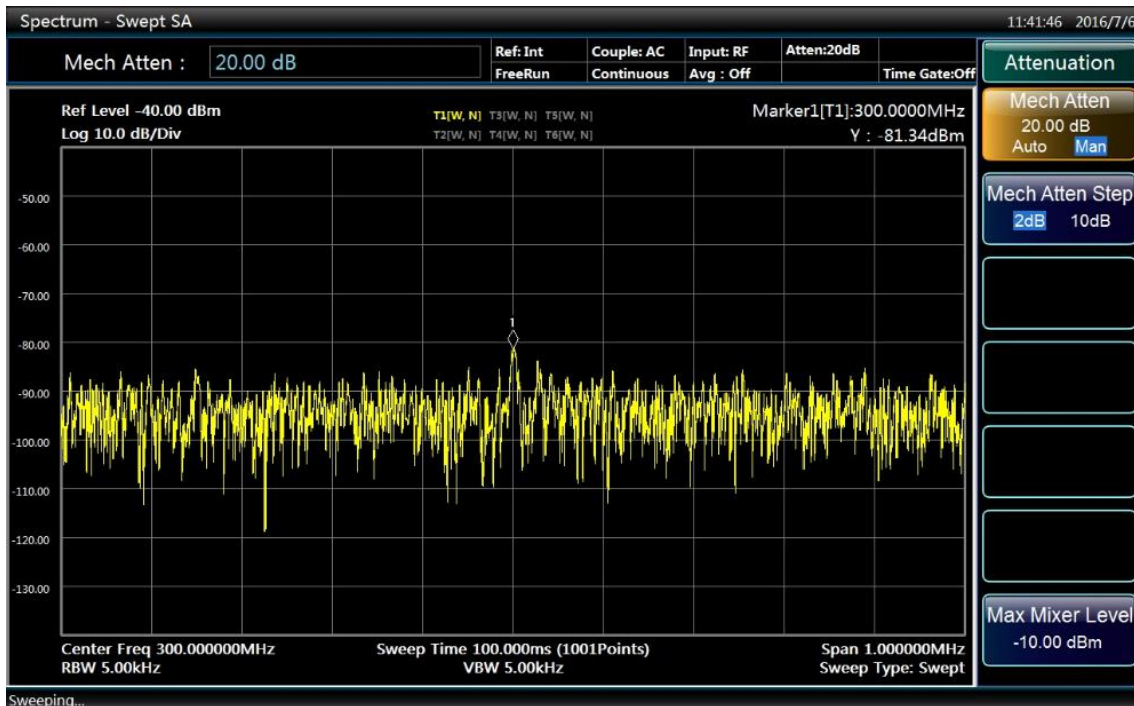


Fig. 4.24 Small signal when attenuator is set as 20 dB

Step 7: set attenuator as 0 dB in order to observe the measured signal more clearly:

- Press [Amplitude/Y Axis], [Attenuator ►], [Mechanical Attenuator Auto ON/OFF] and enter 0 dB.

Fig. 4.25 shows the measured signal displayed by the analyzer when the attenuator decrement is 0 dB.

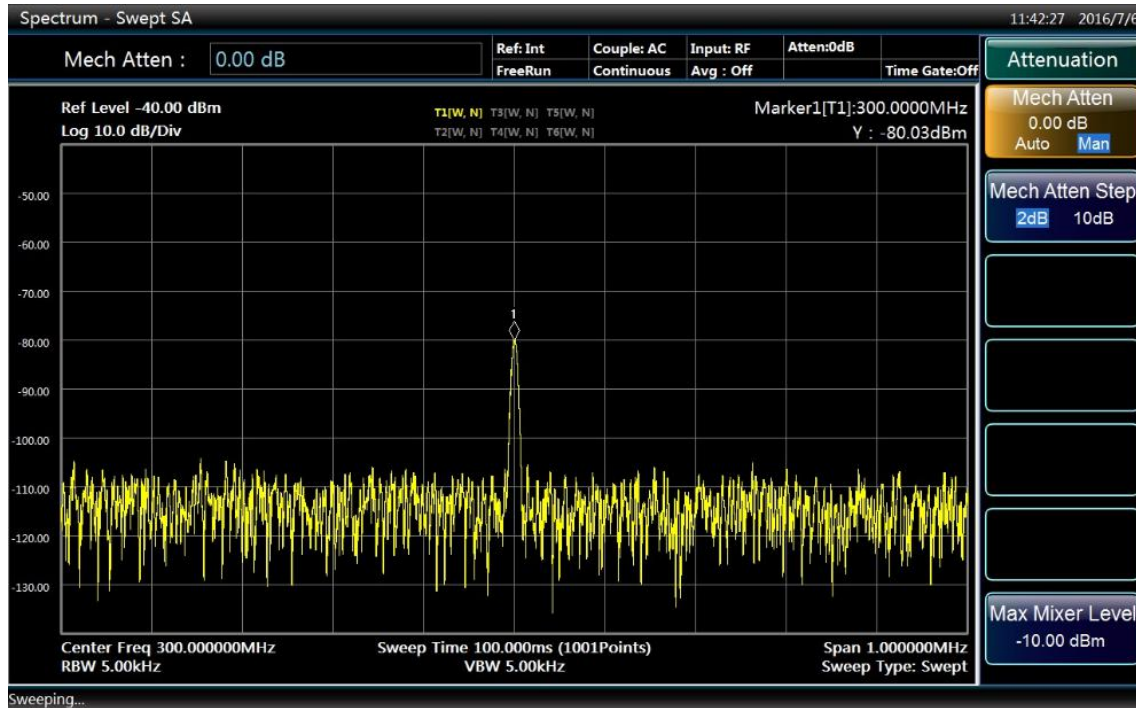


Fig. 4.25 Small signal when attenuator is set as 0 dB

Attention

Please remember to restore attenuation value of the analyzer after test in order to protect the RF input port.

Press [Amplitude/Y Axis], [Attenuator ►], [Mechanical Attenuator Auto Manual] or press [Couple] and [Couple All].

4. 2. 3. 2. Reduce resolution bandwidth to measure small signals

The resolution bandwidth affects the noise floor inside the analyzer but has no effect on measurement of the level of continuous-wave signals. The relation between noise reduction and resolution bandwidth can be expressed with the following formula:

$$\Delta L = 10 \log \frac{BW_1}{BW_2}$$

Where, ΔL refers to change in the noise amplitude (dB). BW_1 and BW_2 refer to different resolution bandwidths (Hz).

Therefore, when the frequency bandwidth is reduced by 10 times, the noise floor will be reduced by 10 dB.

Step 1: reset the signal/spectrum analyzer:

- Press [Reset].

Step 2: Set the signal generator and connect the signal/spectrum analyzer:

- Set the signal generator frequency as 300 MHz and amplitude as -80 dBm; connect RF output of the signal generator to the input port of the analyzer.

Step 3: set center frequency, frequency span and reference level of the analyzer:

- Press [Frequency], [Center Frequency] and enter 300MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 1MHz.
- Press [Amplitude/Y Axis], [Reference Level] and enter -40 dBm.

Step 4: use [↓] to reduce resolution bandwidth:

- Press [Bandwidth], [Resolution Bandwidth] and [↓].

As shown in Fig. 4.26, the noise floor reduces and therefore we can see the signal more clearly. Since reduced resolution bandwidth will result in increase in sweep time, in S3503 series signal/spectrum analyzer, the resolution bandwidth is increased or decreased in 10% within the range of 1 Hz - 3 MHz. By choosing a proper resolution bandwidth, a more delicate balance can be achieved between the sweep time and the resolution bandwidth.

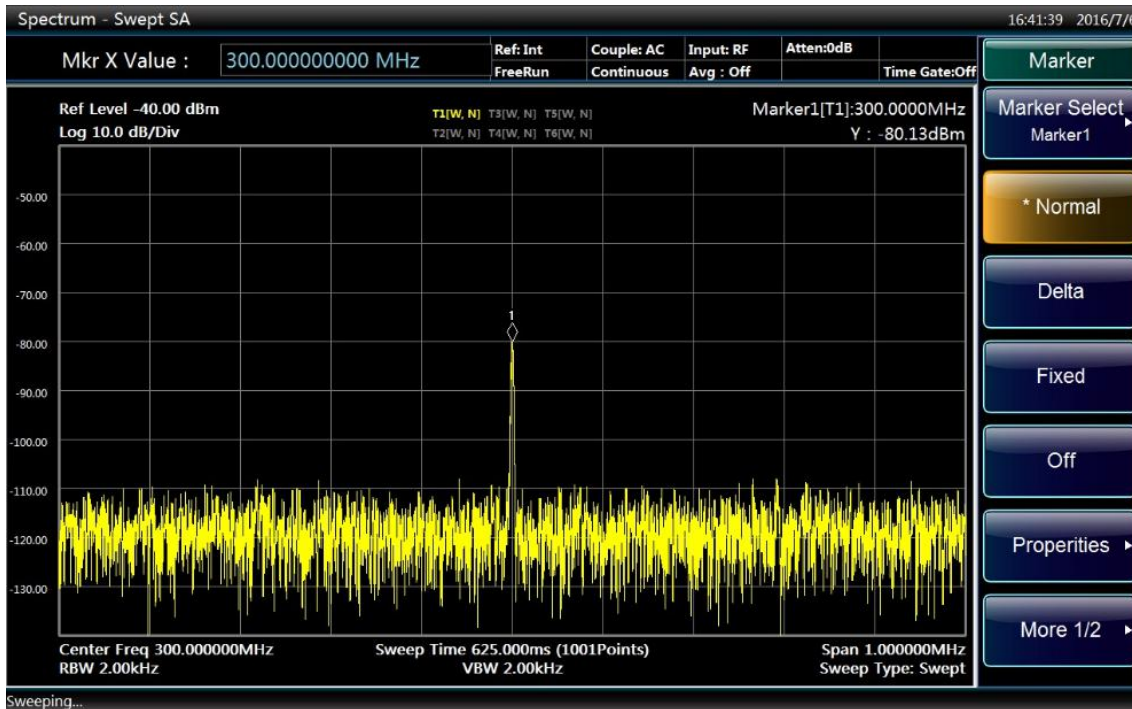


Fig. 4.26 Reduce resolution bandwidth to measure small signals

4. 2. 3. 3. Measure small signals with average detector and increase in sweep time

When the noise floor of the analyzer covers small signals, average detector can be used and the sweep time can be increased to smooth the noise so as to increase signal visibility. Longer sweep time will result in better average noise variance.

Step 1: reset the signal/spectrum analyzer:

- Press [Reset].

Step 2: Set the signal generator and connect the signal/spectrum analyzer:

- Set the signal generator frequency as 300 MHz and amplitude as -80 dBm; connect RF output of the signal generator to the input port of the analyzer.

Step 3: set center frequency, frequency span and reference level of the analyzer:

- Press [Frequency], [Center Frequency] and enter 300MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 5MHz.
- Press [Amplitude/Y Axis], [Reference Level] and enter -40 dBm.

Step 4: Select detector mode of the analyzer as average detector:

- Press [Trace], [Menu 1/2 ▶], [Detector ▶], [Average ▶] and [Video Average].

Step 5: increase sweep time of the analyzer:

- Press [Sweep], [Sweep Time Auto ON/OFF] and [↑] to increase the sweep time.

When the sweep time is increased, more data will be obtained to get average of each trace pixel as shown in Fig. 4.27.

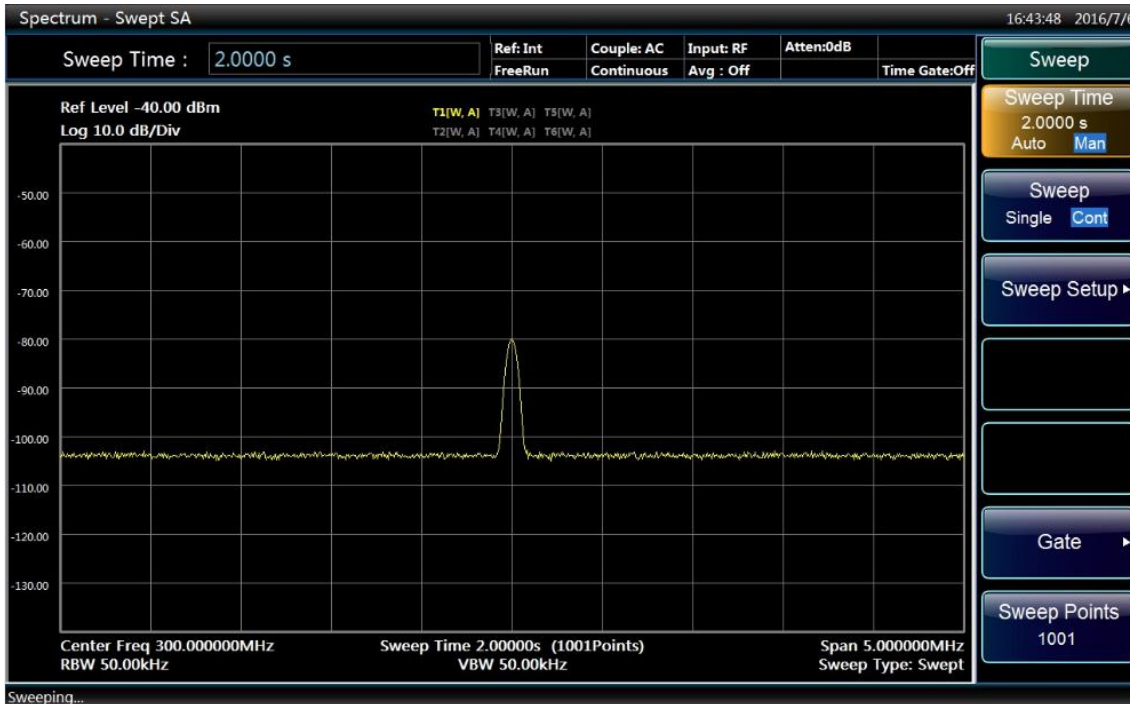


Fig. 4.27 Small signals after increasing sweep time

4. 2. 3. 4. Measure small signals with video average

In video average function, digital method is used to average mean values of current trace point for sweeping and previous same trace position. After the video average is turned on, the analyzer will automatically set the detector mode as sample detector. Measurement of the signal peak by the sample detector is less accurate than that by the normal detector, therefore, it is common that the sample detector is unable to find out the real signal peak. The video average gets different result from the average detector.

Step 1: reset the signal/spectrum analyzer:

- Press [Reset].

Step 2: Set the signal generator and connect the signal/spectrum analyzer:

- Set the signal generator frequency as 300 MHz and amplitude as -80 dBm; connect RF output of the signal generator to the input port of the analyzer.

Step 3: set center frequency, frequency span and reference level of the analyzer:

- Press [Frequency], [Center Frequency] and enter 300MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 5MHz.
- Press [Amplitude/Y Axis], [Reference Level] and enter -40 dBm.

Step 4: turn on video average function:

- Press [Trace] and [Average] to prompt "Average type: video" at top right corner of the screen and display average count.

As averaging of the trace continues, small signals get more and more clear. The default average count is 100.

Step 5: set average count as 25:

Press [Measurement Setting] and [Average Count].

Enter 25 from the number input area on the front panel and press [←] or press [Confirm] in the soft menu as shown in Fig. 4.28.

At the moment, average count displayed in the annotation window on the top of the screen will change to 25. Once the average count is set, the analyzer will continue to average operation on the basis of such count.

If you wish to stop the measurement after the average count is reached, you may use single sweep function. Press [Sweep] and [Sweep Single Continuous].

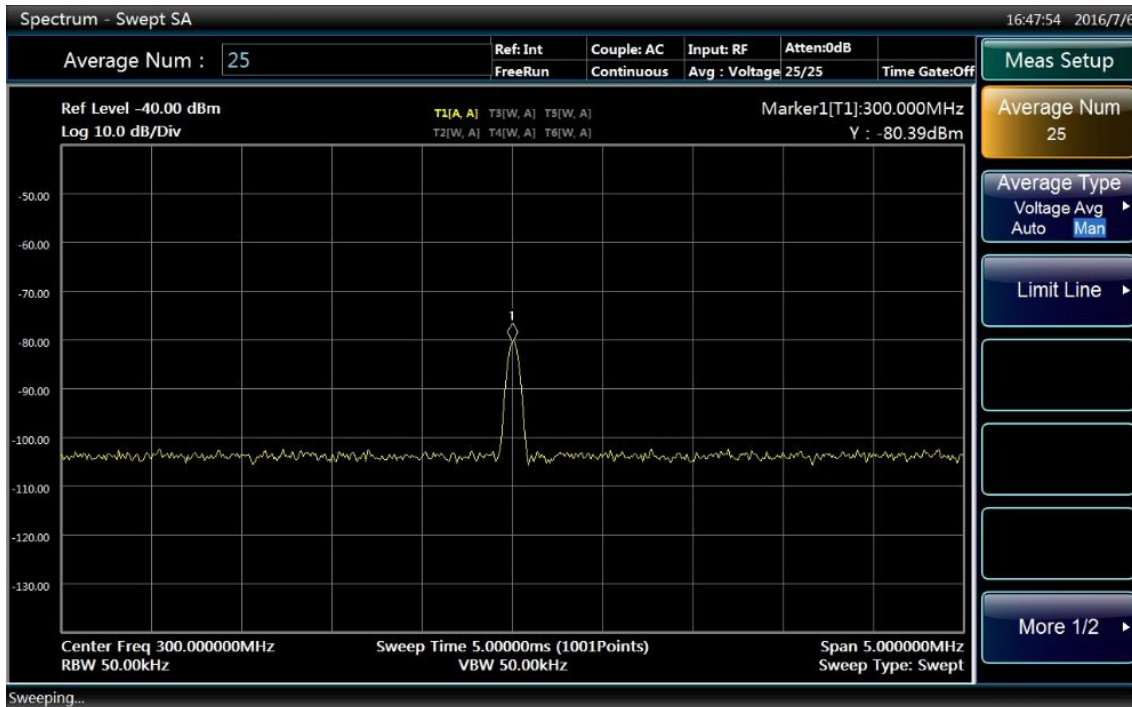


Fig. 4.28 Measure small signals with trace average

4. 2. 4. Increase frequency resolution and accuracy by using frequency count function

In this section, 500 MHz calibration signal of the analyzer will be taken as an example to explain how to use the frequency count to increase measured frequency read-out accuracy.

Step 1: set the analyzer as spectrum analysis mode and reset the analyzer:

- Press [Mode] and [Spectrum Analysis].
- Press [Reset].

Step 2: enable 500 MHz calibration signal of the analyzer:

- Press [Input/Output], [Input Port RF Calibration] to select calibration port.
- Press [Calibration Port▶] and [500MHz] to select 500 MHz calibration signal.

Step 3: set center frequency of the analyzer as 500 MHz and frequency span as 80 MHz:

- Press [Frequency], [Center Frequency] and enter 500MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 80MHz.

Step 4: Turn off marker count function:

- Press [Peak Search] to enable the marker.
- Press [Marker Function], [Marker Count ▶] and [Marker Count On/Off].

Observe the marker reading with frequency resolution capable of reaching 0.001 Hz. As shown in Fig. 4.29.

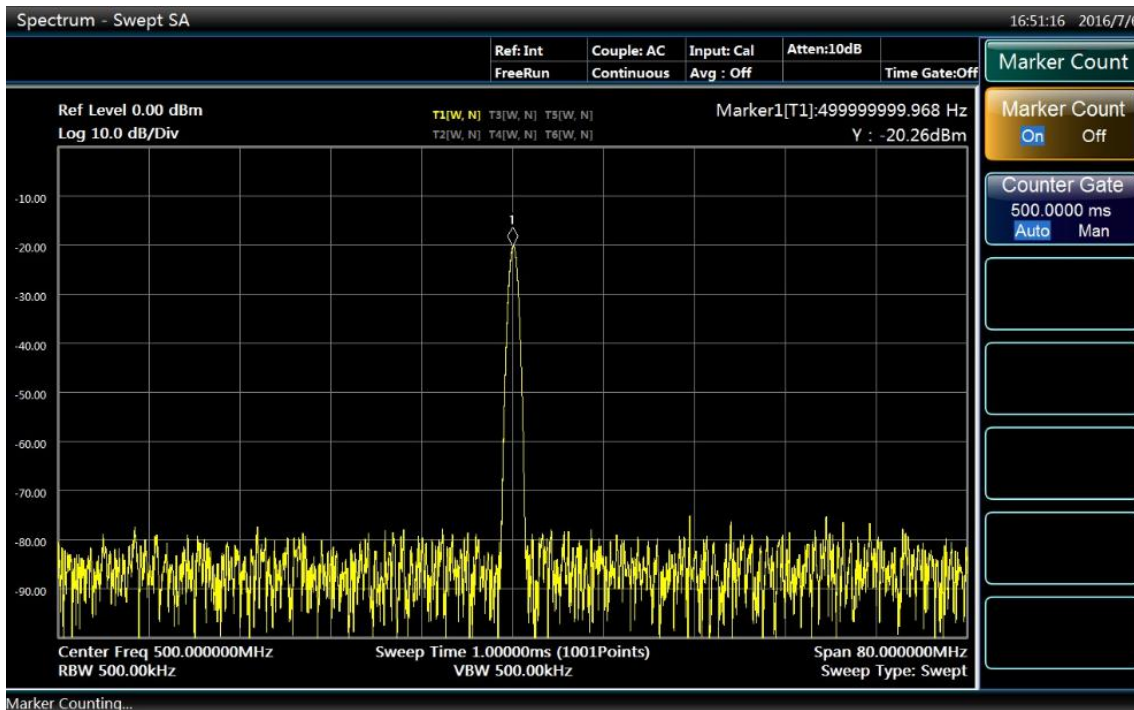


Fig. 4.29 Increase frequency measurement accuracy with marker function

The marker count function can only measure continuous wave signal or discrete spectrum component with signal amplitude over -50 dBm and above the noise level of 30 dB.

Step 5: change marker count gate time:

- Press [Marker Function], [Marker Count ►] and [Gate Time Auto Manual].

When the value of the gate time is changed, the count accuracy can also be changed. The longer the gate time, the higher the count accuracy, as shown in Fig. 4.30. When the gate time is longer than or equal to 2s, a count accuracy of 0.1 Hz can be ensured.

Step 6: Turn off marker count function:

- Press [Marker Function], [Marker Count ►] and [Marker Count On/Off].

Attention

When using the frequency count function, if users find that sweep speed of the analyzer is dropping, it is normal because it takes longer for the analyzer to execute accurate signal locating and IF counting in the background.

Attention

When using the frequency count function, the signal generator to be measured and the analyzer should share the same time base in order to accurately measure the frequency!

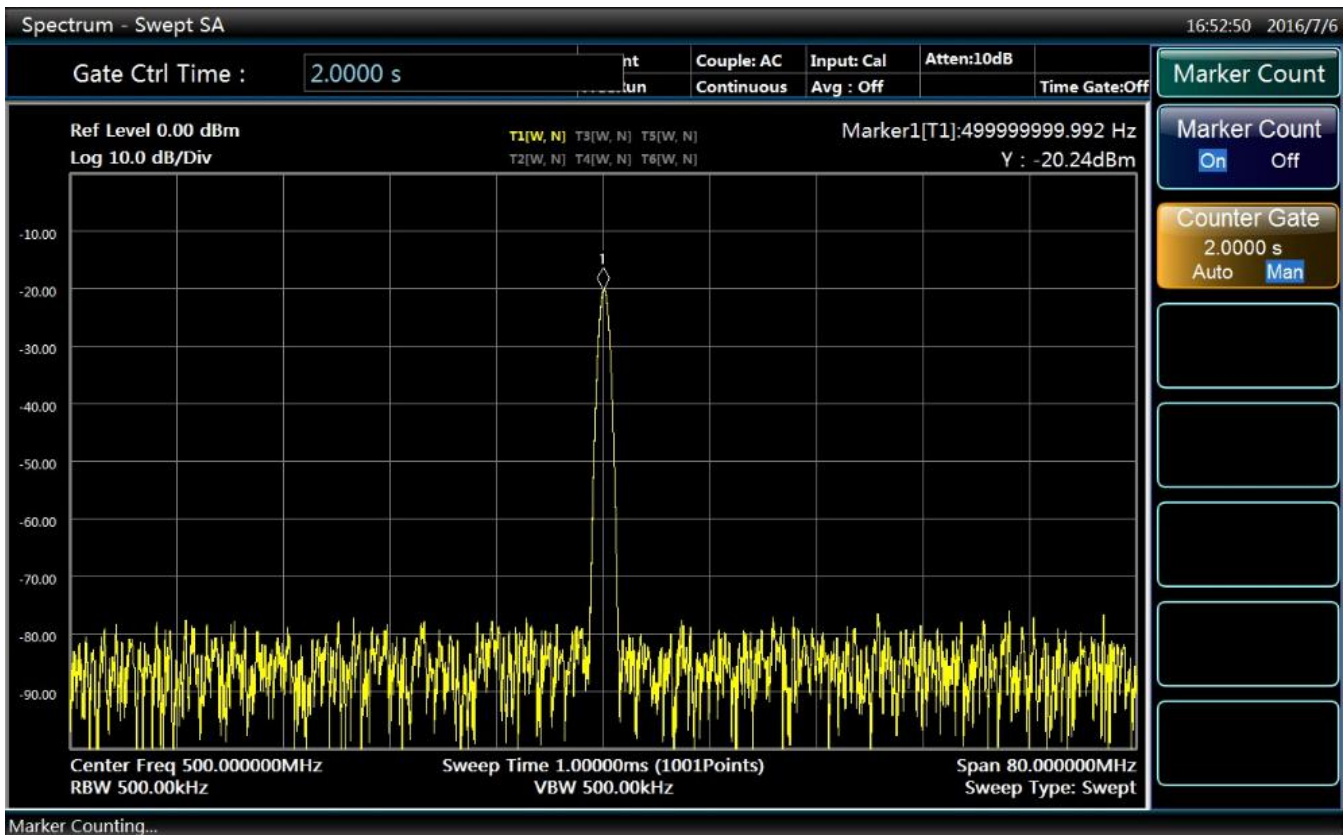


Fig. 4.30 Improve count accuracy by changing the gate time

4. 2. 5. Noise signal measurement

4. 2. 5. 1. Concept of noise measurement

In communications systems, signal-to-noise ratio (SNR) is usually used to express noise amplitude. When the noise level in the system increases, SNR decreases and it will be harder to demodulate modulated signals. SNR measurement is also used to indicate measurement of ratio of carrier against noise in communications systems.

In the following example, the way to measure SNR and noise with marker function of S3503 series signal/spectrum analyzer will be introduced. In the example, SNR is measured with the signal (carrier) having only single frequency point. If the system to be measured has modulated signal, testing procedures have to be modified to correct the level of such modulated signal.

4. 2. 5. 2. Measure SNR

Step 1: set the analyzer as spectrum analysis mode and reset the analyzer:

- Press [Mode] and [Spectrum Analysis].
- Press [Reset].

Step 2: Input 500 MHz internal calibration signal into the analyzer:

- Press [Input/Output], [Input Port RF Calibration] to select calibration port.
- Press [Calibration Port], [500MHz] to select 500 MHz calibration signal.

Step 3: set center frequency, frequency span, reference level and attenuator:

- Press [Frequency], [Center Frequency] and enter 500MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 1MHz.
- Press [Amplitude/Y Axis], [Reference Level] and enter -10 dBm.

- Press [Amplitude/Y Axis], [Attenuator ►], [Mechanical Attenuator Auto ON/OFF] and enter 40 dB.

Step 4: place the marker at the signal peak and then put the delta marker to the noise with 200 kHz frequency offset:

- Press [Peak Search], [Delta Marker] and enter 200 kHz.

Step 5: turn on the delta marker function to check SNR:

Press [Marker Function], [Noise Marker ON/OFF] to open noise marker. As shown in Fig. 4.31.

SNR reading is expressed in the unit of dBc/Hz because such noise level is the value of noise bandwidth under 1 Hz which is reduced at a rate of $10 \times \log(BW)$. If you wish to obtain noise values under different channel bandwidth, the measurement result needs to be corrected based on current bandwidth. For example, if the analyzer reading is -86.07 dBc/Hz and the current channel bandwidth is 30 kHz, SNR will be $S/N = 86.07 \text{ dBc} / \text{Hz} - 10 \times \log(30 \text{ kHz}) = 41.3 \text{ dBc} / (30\text{kHz})$. If the delta maker is smaller than 1/4 of the distance from the signal peak to response edge, there will be potential error in noise measurement.

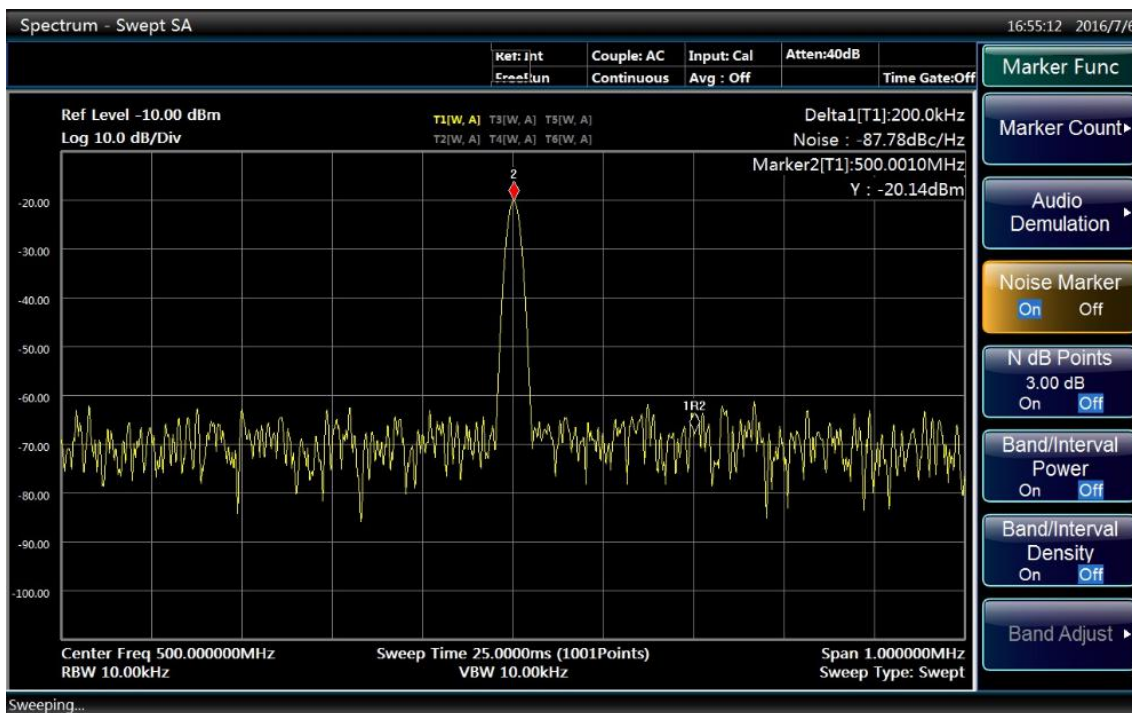


Fig. 4.31 Measure SNR

4. 2. 5. 3. Measure noise with noise marker function

In this example, the noise marker function will be used to measure the noise of 1 Hz bandwidth with 500 MHz internal calibration signal.

Step 1: Input 500 MHz internal calibration signal into the analyzer:

- Press [Input/Output], [Input Port RF Calibration] to select calibration port.
- Press [Calibration Port ►] and [500MHz] to select 500 MHz calibration signal.

Step 2: set center frequency, frequency span, reference level and attenuator:

- Press [Frequency], [Center Frequency] and enter 499.98MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 100kHz.
- Press [Amplitude/Y Axis], [Reference Level] and enter -10 dBm.

- Press [Amplitude/Y Axis], [Attenuator ►], [Mechanical Attenuator Auto Manual] and enter 40 dB.

Step 3: enable the noise marker:

- Press [Marker Function] and [Noise Marker ON/OFF].

At such moment the detector mode will be automatically set as power average. If you wish to obtain noise power under different channel bandwidth, current bandwidth needs to be corrected based on $10 \times \log(BW)$. For example, if the noise power within 1 kHz bandwidth is to be obtained, $10 \times \log(1000)$ or 30 dB has to be added to the reading.

Step 4: Reduce measurement error by increasing sweep time:

- Press [Sweep], [Sweep Time] and enter 3 s.

Step 5: move the marker to 500 MHz:

- Press [Marker] and turn the knob on the front panel to set noise marker reading as 500 MHz.

The noise marker value is derived by multiplying the number of sweep trace points with 5% and the marker position is the center of such trace points. The noise marker will not be at the signal peak since such position has no enough trace points for calculation. Therefore, when the resolution bandwidth is narrow, the noise level will average trace points below the signal peak. As shown in Fig. 4.32.

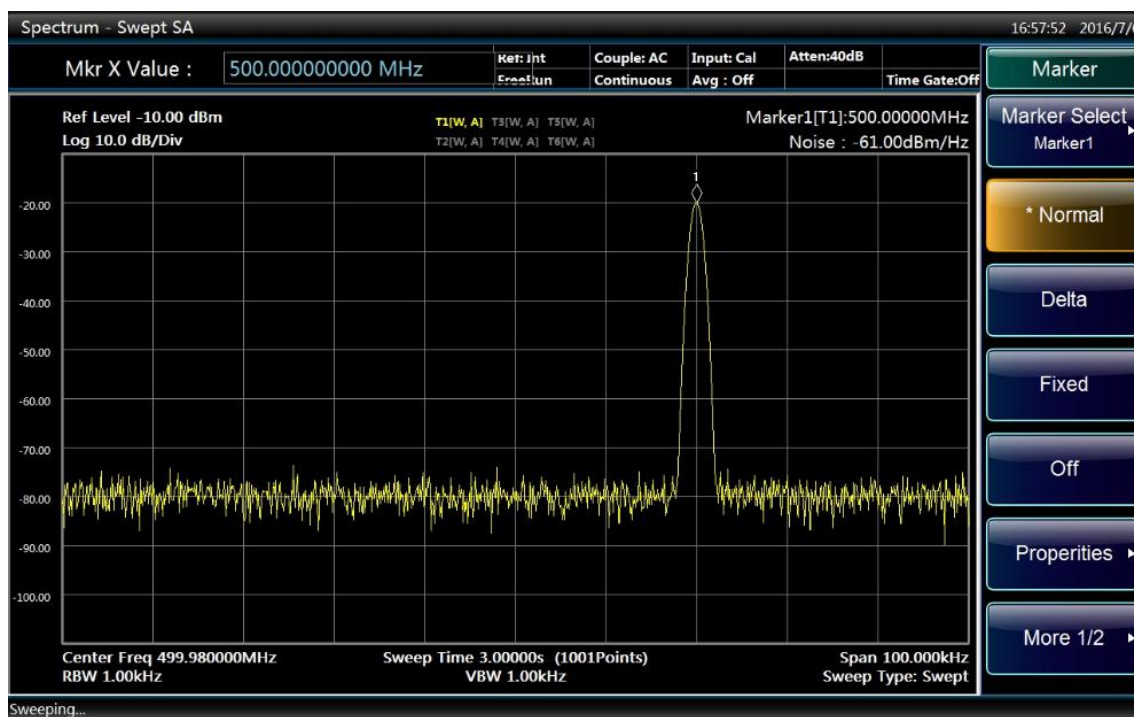


Fig. 4.32 Measure noise with the noise marker function

Step 6: set the analyzer as zero frequency span with the marker as the center:

- Press [Marker →] and [Marker → Center Frequency].
- Press [Frequency Span/X Axis] and [Zero Frequency Span].
- Press [Marker].

The amplitude reading of the noise level is correct at the moment since all points are averaged under the same frequency without being affected by the shape of the resolution bandwidth filter. The noise marker is derived by averaging frequency points of interest. When measuring the power of discrete frequency points, the analyzer should be tuned to the frequency points of interest and then the measurement should be made under zero frequency span.

4. 2. 6. AM signal demodulation

4. 2. 6. 1. Definition of modulation

Modulation refers to the process of transforming low frequency or base band signals (sound, music and data) to high frequency signals. During modulation, some characteristics of carrier signals (usually frequency or amplitude) will change in proportion to transient change of base band signal amplitude. When demodulating AM signals, the analyzer can serve as a fixed-tuned receiver (time domain), which means to use zero frequency span mode to restore amplitude-modulated carrier signals. S3503 Series signal/spectrum analyzer can clearly display AM signal waveform via following operations:

- Obtain stable trace by setting trigger conditions on the modulation envelope and sweep demodulated waveform synchronously with video trigger if signal modulation is stable;
- Apply linear display in AM measurement to avoid distortion of logarithmic display caused during signal demodulation;
- Observe AM signal modulation speed via sweep time;
- Set resolution bandwidth and video bandwidth based on measured signal bandwidth.

In the following section, it will be explained how to measure AM and FM signals, how to display signals on the analyzer and how to monitor AM and FM broadcasting signals.

4. 2. 6. 2. Measure modulation speed and depth of AM signals with RF spectrum

AM signals can be generated by one signal generator and demodulated by connecting one antenna to RF input port of the analyzer. The AM signal in this example is produced with a signal generator.

Step 1: connect output of the signal generator to the RF input port of the analyzer:

- Set the signal generator with an AM signal with output carrier of 100 MHz, amplitude of -10 dBm, modulation depth of 5% and modulation speed of 34 kHz.

Step 2: set center frequency of the analyzer as 100 MHz and frequency span as 500 MHz:

- Press [Mode] and [Spectrum Analysis].
- Press [Reset].
- Press [Frequency], [Center Frequency] and enter 100MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 500kHz.

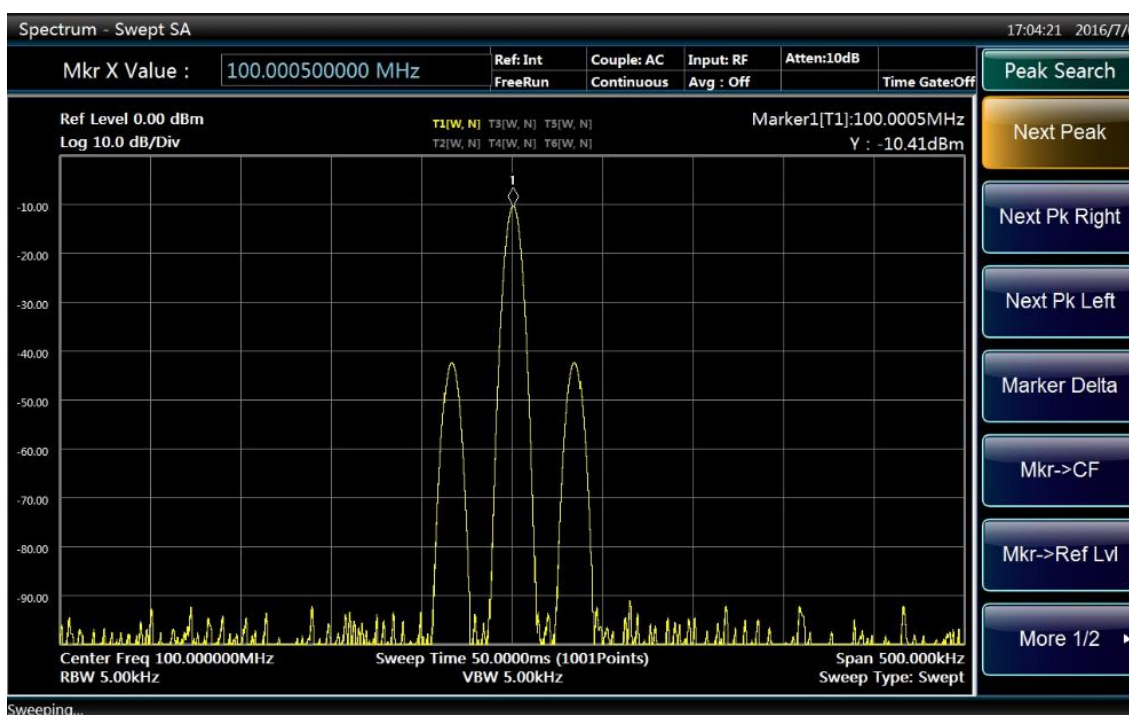


Fig. 4.33 AM signal

Fig. 4.33 shows the AM signal displayed on the screen of the analyzer. Press [Peak Search] to define carrier signal frequency.

 **Attention**

Amplitude different between upper and lower sideband indicates that there is residential frequency modulation on the input signal. Residential frequency modulation will reduce modulation depth and measurement accuracy.

Step 3: define parameters of modulated signals easily with carrier and sideband via following operations:

- Press [Peak Search], [Delta Marker] and [Next Peak] to get the difference between the carrier and the sideband signal. The frequency difference of two signals can be read via the delta marker, which is the modulation speed of the measured AM signal and used to determine modulation depth as shown in Fig. 4.34.

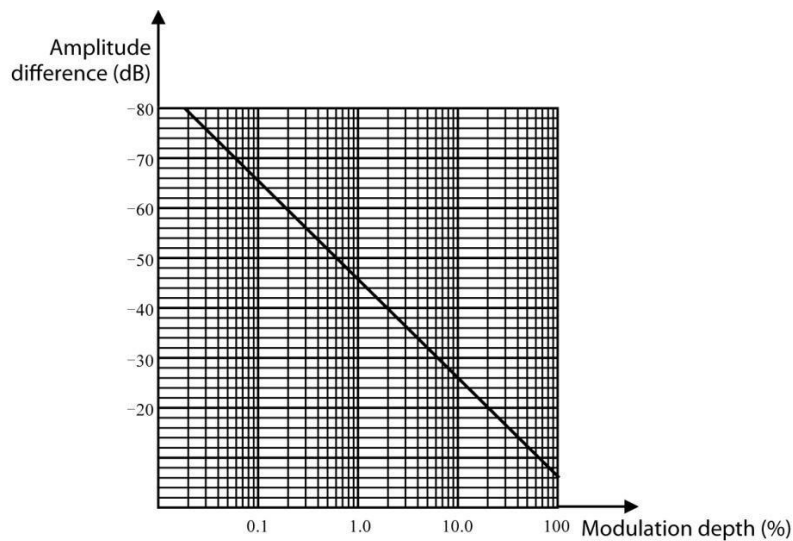


Fig. 4.34 Relation graph of modulation depth and amplitude difference

When the amplitude difference in dB is obtained, the following formula can be used to calculate modulation depth:

$$AM\% = 200 \times 10^{-(\Delta dB / 20)}\%$$

Where:

ΔdB refers to the amplitude difference of the carrier and the sideband.

4. 2. 6. 3. Measure amplitude modulation speed with demodulation waveform

Step 1: connect output of the signal generator to the input port of the analyzer:

- Set the signal generator with an AM signal with output carrier of 300 MHz, amplitude of -10 dBm, modulation signal of 1 kHz and AM depth of 80%.

Step 2: reset the analyzer and set center frequency, frequency span and sweep time:

- Press [Reset].
- Press [Frequency], [Center Frequency] and enter 300MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 500kHz.
- Press [Bandwidth], [Resolution Bandwidth Auto Manual] and enter 30kHz;

- Press [Sweep], [Sweep Time Auto Manual] and enter 20 ms.

Step 3: set Y axis scale unit as volt:

- Press [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] and [V].

Step 4: place the signal peak near the reference level:

Press [Amplitude/Y Axis], [Reference Level] and turn the knob to adjust the reference level.

Step 5: change Y axis display scale to linear scale:

Press [Amplitude/Y Axis] and [Scale Type Logarithm/Linear].

Step 6: set the analyzer as zero frequency span for time domain measurement:

- Press [Frequency Span/X Axis] and [Zero Frequency Span].
- Press [Sweep], [Sweep Time] and enter 5 ms.

Step 7: use video trigger function to stabilize display trace:

- Press [Trigger] and [[Video Trigger ►]].

Since the modulation is stable, sweep operation can be triggered on the waveform via video trigger to stabilize trace, which process is similar to the oscilloscope, as shown in Fig. 4.35. If the video trigger level is set too high or too low in video trigger mode, the sweep will stop. In this case, the knob on the front panel can be used to adjust the video trigger level until the sweep resumes.

Step 8: measure amplitude modulation speed with delta maker:

- Press [Peak Search] and [Delta Marker].
- Press [Peak Search], [Next Peak Left] or [Next Peak right], place the marker at the peak and then use the delta marker to measure the time difference between peaks.

During measurement, it should be ensured that the delta marker is on the nearby peak as shown in Fig. 4.35. The modulation speed of the FM or AM signal can be derived by dividing 1 with the time difference between adjacent peaks.

In this example, AM signal speed is obtained by calculating the time difference between AM signal time domain peaks. In order to measure more accurately, the center frequency can be placed on the steep point at the edge of the AM signal and set the analyzer as zero frequency span and sweep time two times of the modulation speed so as to increase sweep points for the purpose of improving measurement accuracy.

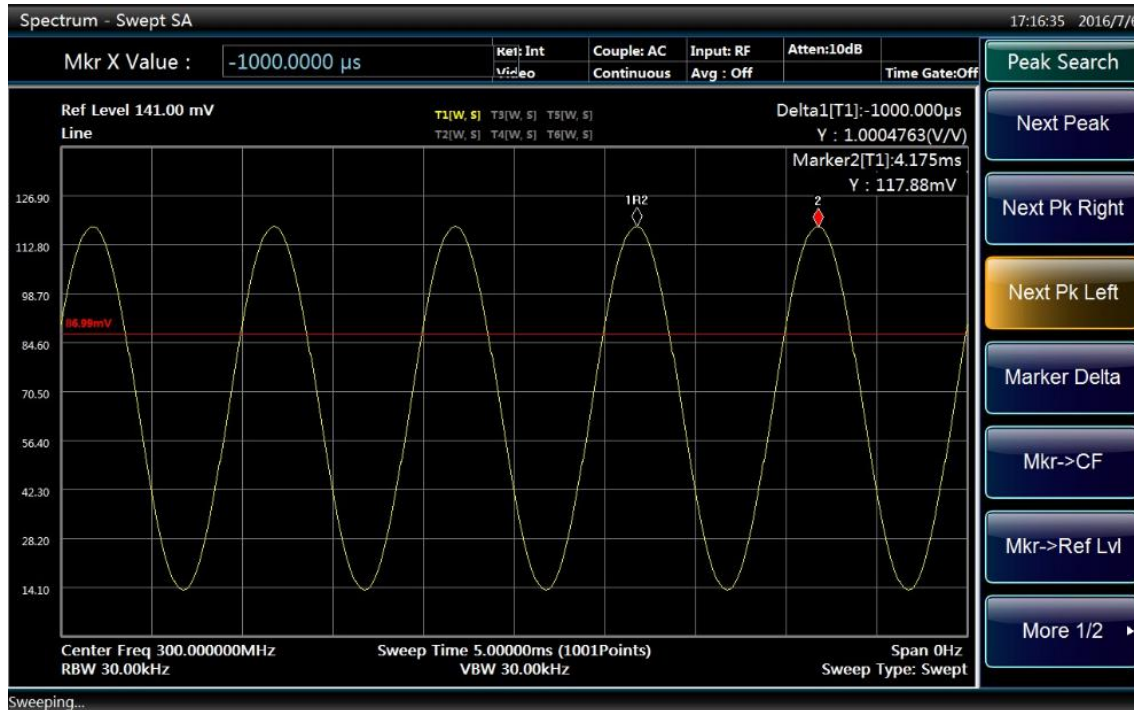


Fig. 4.35 Measure AM signal modulation speed with demodulation waveform

4. 2. 6. 4. Measure AM modulation depth with demodulation waveform

In this section, we explain how to use the analyzer as a fixed-tuned (time domain) receiver to measure AM signal modulation depth with the measurement result expressed in percentage.

Step 1: connect output of the signal generator to the RF input port of the analyzer:

- Set the signal generator with an AM signal with output carrier of 300 MHz, amplitude of -10 dBm, modulation signal of 1 kHz and AM depth of 80%.

Step 2: reset the analyzer and set center frequency, frequency span and sweep time:

- Press [Reset].
- Press [Frequency], [Center Frequency] and enter 300MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 500kHz.
- Press [Bandwidth], [Resolution Bandwidth Auto ON/OFF] and enter 30kHz;
- Press [Sweep], [Sweep Time Auto On/Off] and enter 20 ms.

Step 3: set Y axis scale unit as volt:

- Press [Amplitude/Y Axis], [Menu 1/2 ▶], [Y Axis Scale Unit ▶] and [V].

Step 4: place the signal peak near the reference level:

- Press [Amplitude/Y Axis], [Reference Level] and turn the knob to adjust the reference level.

Step 5: change Y axis display scale to linear scale:

- Press [Amplitude/Y Axis] and [Scale Type Logarithm/Linear].

Step 6: set the analyzer as zero frequency span for time domain measurement:

- Press [Frequency Span/X Axis] and [Zero Frequency Span].
- Press [Sweep], [Sweep Time] and enter 5 ms.

Step 7: use video trigger function to stabilize display trace:

- Press [Trigger] and [[Video Trigger ▶].

Since the modulation is stable, sweep operation can be triggered on the waveform via video trigger to stabilize trace, which process is similar to the oscilloscope, as shown in Fig. 4.35. If the video trigger level is set too high or too low in video trigger mode, the sweep will stop. In this case, the knob on the front panel can be used to adjust the video trigger level until the sweep resumes.

Step 8: close all markers and set the analyzer as free trigger mode:

- Press [Marker] and [Marker OFF].
- Press [Trigger] and [Free Trigger].

Step 9: increase sweep time and reduce video bandwidth to display the waveform as a horizontal signal:

- Press [Sweep], [Sweep Time] and enter 5 s.
- Press [Bandwidth], [Video Bandwidth Auto Manual] and enter 30Hz.

Step 10: place the horizontal signal at the center of Y axis, increase video bandwidth and reduce sweep time to display the waveform in a sine wave:

- Press [Amplitude/Y Axis] and [Reference Level], turn the knob to adjust the reference level and place the horizontal signal at the center of Y axis.
- Press [Bandwidth], [Video Bandwidth Auto Manual] and enter 100kHz.
- Press [Sweep], [Sweep Time Auto Manual] and enter 5 ms.

Step 11: measure AM signal modulation depth:

- To obtain a modulation depth in percentage, the following method can be used to read the trace: 100% AM modulation depth takes up all the grids from top to bottom, while 80% AM (as shown in this example) takes up grids from second from the top to second from the bottom. The number of grids taken up by Y axis can be counted to determine signal modulation depth percentage, as shown in Fig. 4.36.

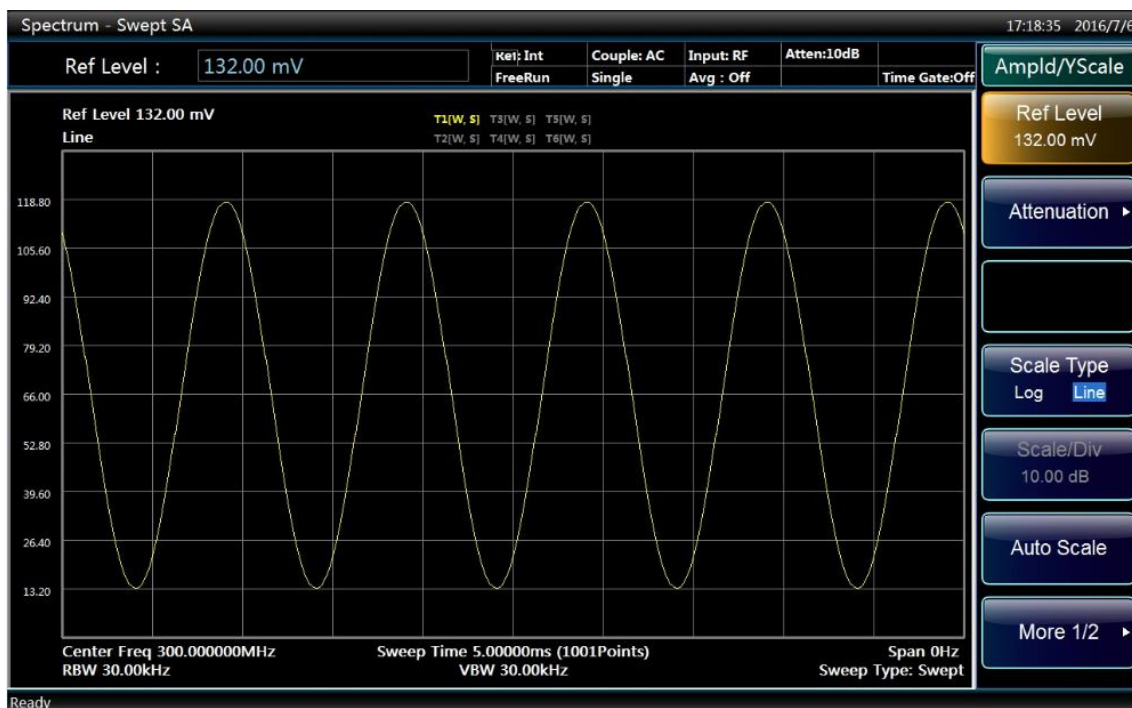


Fig. 4.36 Measure AM signal modulation depth with demodulation waveform

4. 2. 7. Drift signal measurement

4. 2. 7. 1. Definition of drift signal

The signal to be measured is a drift signal, the center frequency should be frequently changed at different time when measuring with the analyzer in order to observe properly. If the signal tracking function of the analyzer is used, the marker peak will always be displayed at the center frequency of the analyzer to facilitate measurement.

4. 2. 7. 2. Available functions of signal/spectrum analyzer

The Section describes how to measure the drift signal, where the amplitude track and occupied bandwidth will be observed by the use of signal/ spectrum analyzer tracking, tracking and max hold functions for the signal drift.

4. 2. 7. 3. Measurement of frequency drift for signal generator

The signal/spectrum analyzer can measure the short-term and long-term stability of the signal generator, and display the max peak amplitude and frequency drift of the input signal via the max hold function signal of track/ spectrum analyzer. The max hold function of track may be used to measure the occupied bandwidth of signal.

This example will maintain the drift signal to display in the center position by the signal tracking of signal/spectrum analyzer, and capture the drift signal via the max hold of the analyzer.

Step 1: connect RF output of the signal generator to the input port of the analyzer.

Step 2: set the signal of the signal generator with output frequency of 300MHz and amplitude of -20dBm, and open its RF output.

Step 3: set the analyzer as spectrum analysis mode:

- Press [Mode] and [Spectrum Analysis].

Step 4: set the center frequency, frequency span and reference level of the analyzer:

- Press [Reset].
- Press [Frequency], [Center Frequency] and enter 300MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 10MHz.
- Press [Amplitude/Y Axis], [Reference Level] and enter -10 dBm.

Step 5: place the marker on the signal peak position and open the signal tracking:

- Press [Peak Search].
- Press [Frequency] and [Signal Track On/Off].

Step 6: reduce the bandwidth to 500kHz:

- Press the [bandwidth] and input 500kHz to remain the signal at the center.

Step 7: Close the signal tracking:

- Press [Frequency] and [Signal Track On/Off].

Step 8: measure the signal drift through the function of max hold:

- Press the [Track] and [Max Hold].

When the signal changes, the max hold will maintain the maximum response to the input signal. Note the track mode indication at the top of the screen, e.g. the yellow T1 [M, P] means Track 1 is in the status of max hold.

Step 9: activate Track 2 and set it for continuous update mode:

- Press the [Trace], [Select Trace ►], [Trace 2] and [Update].

Note that the track mode indication at the top of the screen, e.g. T2 is highlighted to be blue, T2[W, P] indicating the Track 2 in continuous update mode and the detection mode is positive peak.

Step 10: slowly change the output frequency of signal generator, to make it change at 1kHz step and range from ± 50 kHz. What displays on the signal/spectrum analyzer is shown in Fig. 4.37.



Fig. 4.37 Signal drift observation by the max hold

4. 2. 7. 4. Tracking signal

The signal tracking function is very useful for the slow drift signal, which enables the drift signal to be the center of the display screen.

It should be noted that the signal tracking is to track the unstable signals, rather than track the signals until the center frequency of the signal/spectrum analyzer is changed. Make sure the tracked signal is correct when the center frequency of the analyzer is changed.

Step 1: set the output signal of the signal generator with frequency of 300MHz, amplitude of -20dBm, and stepped frequency of 100kHz, and open its RF output.

Step 2: set the analyzer as spectrum analysis mode:

- Press [Mode] and [Spectrum Analysis].

Step 3: set center frequency to be 1 MHz of frequency offset for the signal/spectrum analyzer:

- Press [Reset].
- Press [Frequency], [Center Frequency] and enter 301MHz.
- Press [Frequency Span/X Axis], [Frequency Span] and enter 10MHz.

Step 4: open the signal tracking:

- Press [Frequency] and [Signal Track On/Off].

It should be noted that the marker will be placed in the max peak amplitude, and then the signal is displayed in the center of the analyzer, and the center frequency will be automatically adjusted for each scanning.

Step 5: open the Delta Marker function:

- Press [Marker] and [Delta Marker].

Step 6. Adjust the output frequency of the signal generator by 100kHz step: the observable center frequency of the signal/spectrum analyzer also changes by the stepped frequency of 100kHz, where the step signal is always in the center of the screen display. As shown in Fig. 4.38.

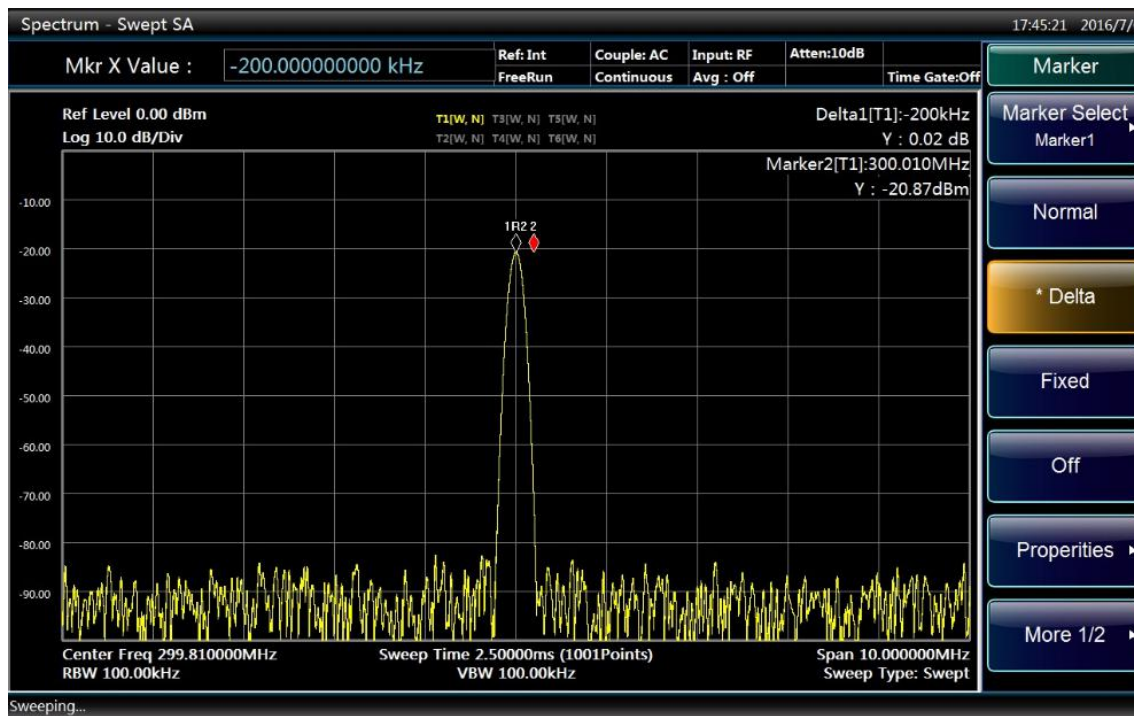


Fig. 4.38 Measurement of drift signal by signal tracking

4. 2. 8. Improvement of amplitude measurement accuracy by amplitude correction function

4. 2. 8. 1. Definition of amplitude correction

The amplitude correction function aims to improve the accuracy of amplitude measurement. Due to many factors including the losses of adapter and cables, the flatness of the system is often impacted. Therefore, the amplitude correction is used for the unified disposal for the system, so as to eliminate the influence on the measurement results. Run the amplitude correction function after the paired frequency/amplitude correction data are input into the signal/spectrum analyzer, and the analyzer will conduct the real-time correction for the measurement results via the revised data. The amplitude correction functions of S3503 series signal/spectrum analyzer include: user correction, antenna gain correction and cable correction, and the user can select the correction menu in need.

4. 2. 8. 2. Available functions of signal/spectrum analyzer

The Section will describe the function of amplitude correction where the application method of input and editing functions regarding the amplitude correction data is given for the convenience of inputting the frequency and amplitude correction data pair. A pair of data can be stored and reused once input.

4. 2. 8. 3. Measuring steps for amplitude correction

The amplitude correction function is used to measure and calibrate the flatness changes of the system. Providing that the signal/spectrum analyzer is applied for the measurement of one device, and the output signal frequency ranges from 1GHz to 3GHz. It is necessary to use cables and connector to connect the device and the analyzer. So the amplitude correction function can correct the measuring errors arising from the losses of cables and adapters, even the potential fluctuation of frequency response of the analyzer within the measured frequency range.

The measuring system is comprised of a signal generator used to simulate the device, plus the cables, connector and signal/spectrum analyzer. After determining the amplitude correction values, input and save them. The correction values should be applied to the same measuring device.

Step 1. connect a signal generator ranging from 1GHz to 3GHz to the signal/spectrum analyzer by the cables and connector as shown in Fig. 4.39.

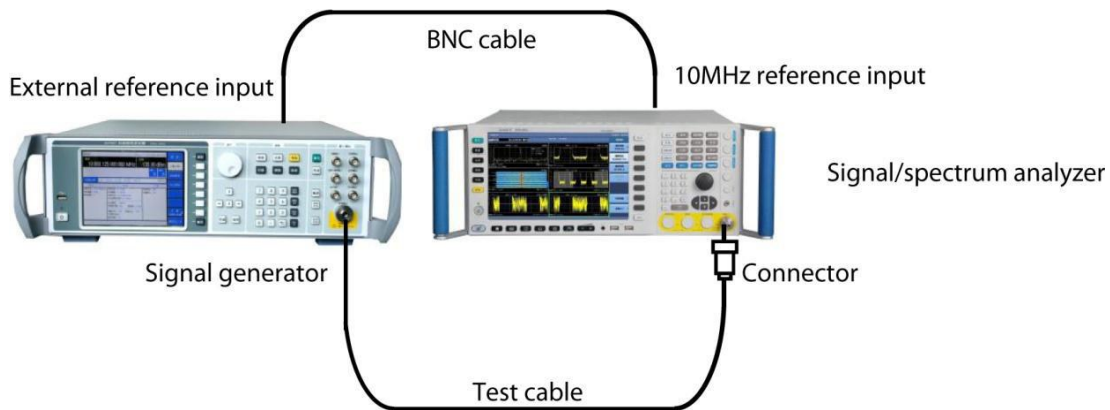


Fig. 4.39 Connection of measurement system for amplitude correction

Step 2: set the signal of the signal generator with output frequency of 1GHz and amplitude of -10 dBm, and open its RF output.

Step 3: set the analyzer as per the following parameters:

- Press [Mode] and [Spectrum Analysis].
- Press [Reset] key.
- Press [Frequency] and input 1GHz.
- Press [Bandwidth], [Resolution Bandwidth Auto Manual] and enter 1MHz;
- Press [Bandwidth], [Video Bandwidth Auto Manual] and enter 1MHz.
- Press [Amplitude/Y Axis], [Reference Level] and enter -6 dBm.
- Press [Amplitude/Y Axis], [Scale/Division] and input 1dB.
- Press [Sweep], [Sweep Time Auto Manual] and enter 50 ms.

Step 4. adjust the signal generator to make the amplitude reading on the analyzer be -10dBm:

- The amplitude value to be corrected is obtained by the value on the signal generator subtracting -10dBm, which should be recorded as the amplitude correction value at the frequency point.

Step 5. set the frequency on the signal generator to the next point which needs to be modified, and the set the frequency of the analyzer to the corrected frequency as well. Repeat the steps 3 4 until all correction values are recorded.

Step 6. to input the corrected value:

- Press [Amplitude/Y Axis], [Menu 1/2 ►], [Amplitude Correction ►] and [Correction Edit ►]. If the system has been loaded with the correction data, remove it (or clear the data prior to save it, and see below for details).

Step 7. input the corrected value:

- Press the soft key [Insert New Points]. Edit the frequency points and amplitude values that need to be corrected. Input the amplitude correction value corresponding to each point recorded in Step 4 and press the soft key of [Insert New Point] to add the next correction point. 100 independent correction points can be input to the series signal/spectrum analyzer. Every serial number corresponds to a frequency point and the amplitude value to be corrected.
- In case of any error of input data, press the [Delete Point] to remove the input data, and press [Insert New Point] to continue the input process of correction points.

- Press [Return] and [Save Correction]. The corrected data can be saved in the hard disk by cor as the file extension.

Step 8. Application of amplitude correction data:

- Press [Amplitude/Y Axis], [Menu 1/2 ►], [Amplitude Correction ►] and [Correction On Off] to close the amplitude correction data. The amplitude correction data is invalid.
- Press [Amplitude/Y Axis], [Menu 1/2 ►], [Amplitude Correction ►] and [Correction Delete] to clear the amplitude correction data.
- After the amplitude correction value is entered, disconnect the signal/spectrum analyzer and signal generator, and connect the measurement signals by the same cables. Press [Amplitude/Y Axis], [Menu 1/2 ►], [Amplitude Correction ►] and [Correction Call], and select the correct amplitude correction file to press OK on file dialog box, and then select [Correction On Off] to call the saved amplitude correction data, for the track amplitude correction in the frequency range defined by the data correction.

Step 9. Application condition of amplitude correction

Errors may be caused in the following circumstances in the process of amplitude correction:

- Track data is above or below the values of grid coordinates.

If there is any point of track data not corrected above or below the grid line of the signal/spectrum analyzer, the amplitude correction function will not be able to correct the values at the point. The amplitude accuracy of the analyzer is uncertain if the track data are above or below the values of grid coordinates. In order to avoid such mistake, make sure the track data are in the grid area of the analyzer prior to the application of amplitude correction data.

- Correction measurement near the bottom of the display grid lines;

If the coordinate scale of 10dB/grid, and the measurement signals are at the bottom of the grid are, the logarithmic distortion of the signal/spectrum analyzer will result in the errors of amplitude correction.

- Flatness correction and temperature drift.

If the temperature plays a decisive role in the flatness changes, the correction is invalid.

4. 2. 9. Time gate measurement

4. 2. 9. 1. Definition of time gate

This section will introduce some basic concepts related to the time gate, to help you to more reasonably set relevant parameters of signal/spectrum analyzer during the measurement of time gate.

Under some circumstances, it is hardly to analyze the pulse RF signal, time-division multiplexing signal, time division multiple access (TDMA) signal or intermittent signal without the signal/spectrum analyzer of time gate function. For example, there are two wireless communication signals #1 and #2 as shown in Fig. 4.40, where the same channel is used for the time division, and it takes 1 ms for each communication channel. How to separately analyze the frequency spectrum for each transmitter?

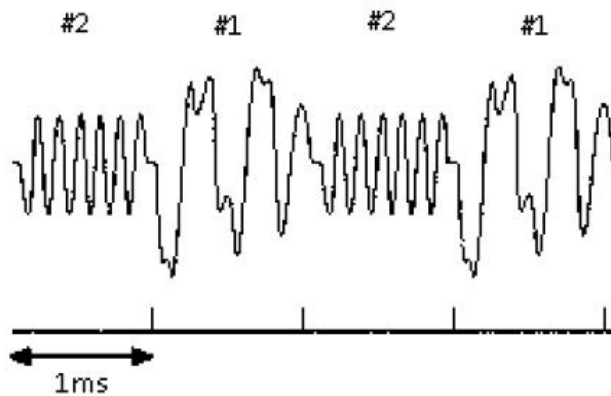


Fig. 4.40 Time domain waveform of simple digital communication signals

Although the scanning speed of analyzer becomes faster, the radio transmitter has switched back and forth for dozens of times when the analyzer has scanned once (the scanning time is tens of milliseconds). Because the two radio signals are transmitted with the same frequency, their spectrum will overlap, as shown in Fig. 4.41. The signal/spectrum analyzer displays the spectrum of composite signal, so you cannot tell the signal corresponding to which spectrum. Therefore, the measurement cannot be achieved without the signal/ spectrum analyzer of time gate function.

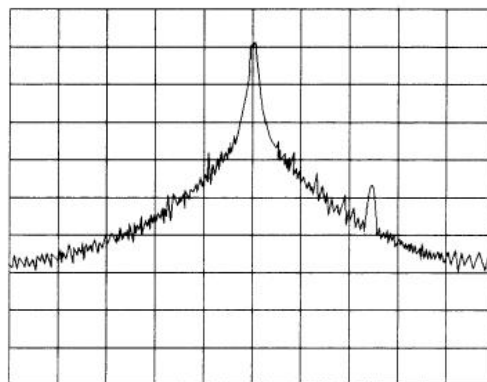


Fig. 4.41 Mixed spectrum of the two communication signals

The time gate refers to the time window for measurement defined by users. It means that users can specify the signal required to be measured, and eliminate or shield the interference signals. With the time gate function and external trigger signal, you can see the separate spectrum of Signal 1 (or Signal 2). The time gate spectrum of Signal 1 is shown in Fig. 4.42 and Fig.4.43 for Signal 2. There is false signal in Signal 1 of Fig. 4.42.

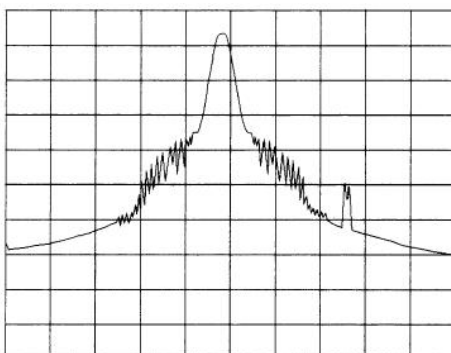


Fig. 4.42 Time gate spectrum of Signal 1

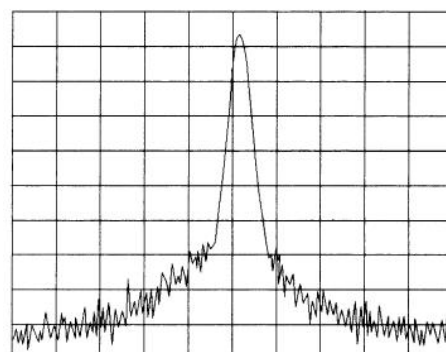


Fig. 4.43 Time gate spectrum of Signal 2

4. 2. 9. 2. Measurement principle of time gate

The measurement of time gate refers to the signal/spectrum analyzer uses the trigger signals to carry out the alternative measurement, see Fig. 4.44. The gate width determines the capture time of measurement data (the signal pass through if gated, and the signal fails

to pass through if closed). In proper conditions, the signal measured by the analyzer merely refers to the input signal during the gating, and other signals will be shielded if the setting is correct.

The gating conditions are determined by the trigger mechanism of the signal/spectrum analyzer, including edge triggering and level triggering, which are described as follows:

Edge triggering: when the selected edge (positive or negative edge) of the trigger signal arrives, whether the Gate is ON is determined by the subsequent gate delay and gate length (both can be set by the menu). The Gate is ON whenever the trigger event arrives and the gate delay time is passed. During the gate length, the signal passes through; when the gate length ends, the signal is blocked, as shown in Fig. 4.44. In general, for edge triggering, the trigger signal is an TTL periodic signal, whose positive and negative edges are synchronous with those of the measured pulse signal. Gate delay time refers to the time during which the signal/spectrum analyzer needs to wait from the trigger event to Gate ON.

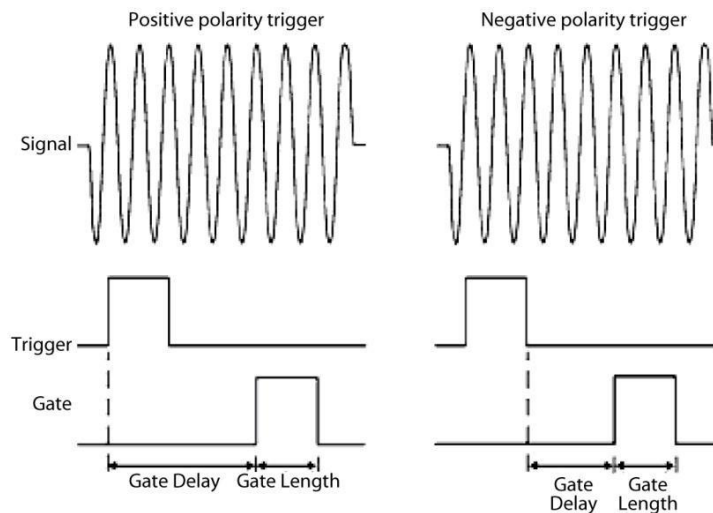


Fig. 4.44 Sequence diagram of edge triggering

Level triggering: when the gate signal has achieved a certain level (high level or low level. In signal/spectrum analyzer, positive polarity indicates high level; and negative polarity indicates low level), the signal passes through; and when the gate signal fails to achieve specified level, the signal is blocked, as shown in Fig. 4.45. In Level triggering, the Gate Delay and Gate Length parameters are void.

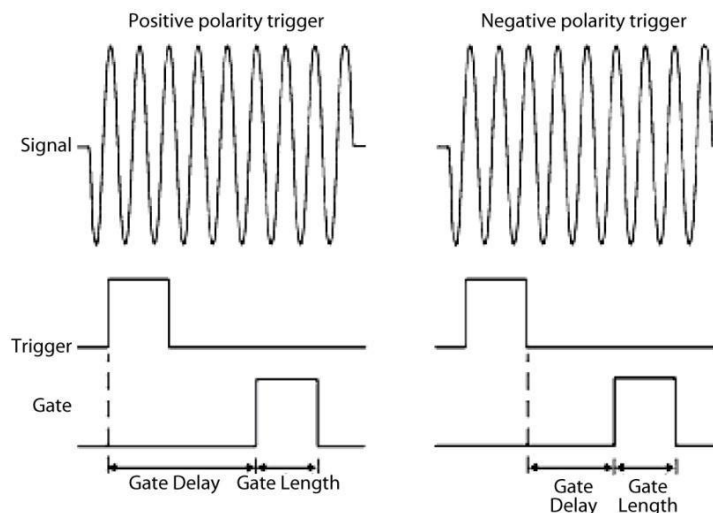


Fig. 4.45 Sequence diagram of level triggering

The following three parameters are required to be considered when the time gate judges the signal passed or shielded:

- Triggering conditions: in general, for edge triggering, the trigger signal is a TTL periodic signal, while the level triggering refer to the high/low electrical level.
- Gate delay: the gate delay time refers to the duration from the time that triggering conditions are satisfied to gating signal (for the edge triggering).
- Gate width: the gate width determines the time duration of gating signal (for the edge triggering).

Research on the spectrum measurement of double pulse RF signal can better help users to understand the time gate, where the time allocation of three key signals is required to be considered during the measurement. The three signals include:

- Measured pulse RF signal
- The time gate trigger signal provided by the signal generator.
- Gate output signal from the BNC connector of the back panel of the signal/spectrum analyzer. The signal is the TTL low electric level when the Gate is "Off" (shielding), and TTL high electric level when "On" (measurement).

Observing the three signals with an oscilloscope, you can be fully aware of the impact of the time allocation among them. The three signals on the oscilloscope is shown in Fig. 4.46.

The main purpose is to measure the spectrum of pulse sequence 1 and determine whether there is low-level modulation or false signal. The carrier frequencies of pulse sequence for Signal 1 and Signal 2 are similar, so both frequency domain spectra are overlapped. But the amplitude of Signal 2 is wider, therefore, its spectrum of the pulse sequence is stronger. If there is no time gate, it is impossible to observe the pulse sequence of Signal 1.

The pulse sequence of spectrum is covered by that of Signal 2.

To measure the pulse sequence 1, the time gate must opened in the pulse sequence 1. The tame gate should be closed in other time periods so that other signals are blocked. The gate delay and width should be set to have the gate opened only in a certain area of the central pulse as shown in Fig. 4.46 Never position the gate at the positive or negative edge of the pulse. For the grid line marked "Gate" in the figure, the output signal indicates the actual position of gate on the time axis if the gate is activated.

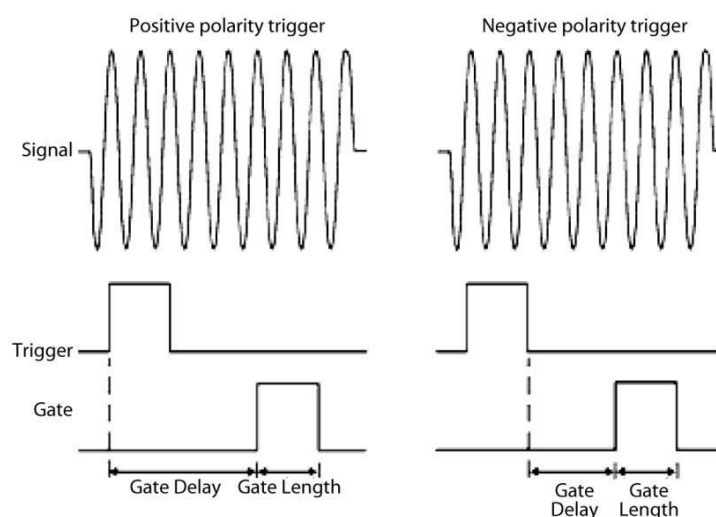


Fig. 4.46 Temporal relation between signal and gate

If you complete the gate measurement of signal/spectrum analyzer, you will merely observe the spectrum of pulse train 1 as shown in Fig. 4.47; that of the pulse train 2 has been shielded. Additionally, you have to eliminate the spectrum generated at the pulse edge during the observation of pulse train 1, that is, the gate should be placed in the middle position of the pulse.

The time gate should be moved in the center of pulse train 2, and the results are shown in Fig. 4.48. By this time, only the spectrum of Signal 2 can be observed; the edge pulse spectrum of Signal 2 and Signal 1 are removed.

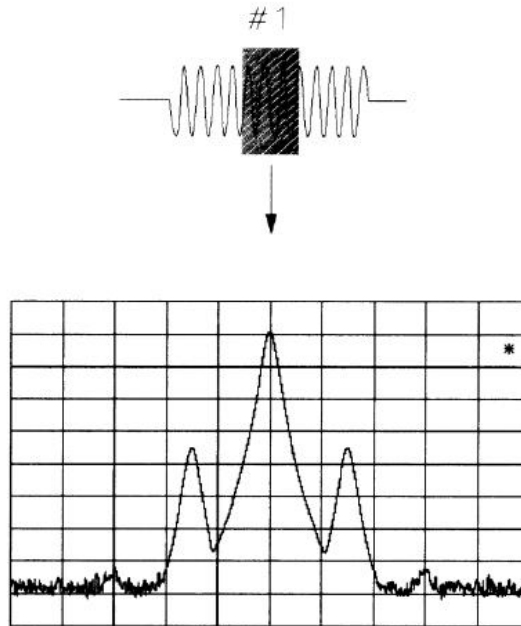


Fig. 4.47 Observation of Signal 1 by time gate

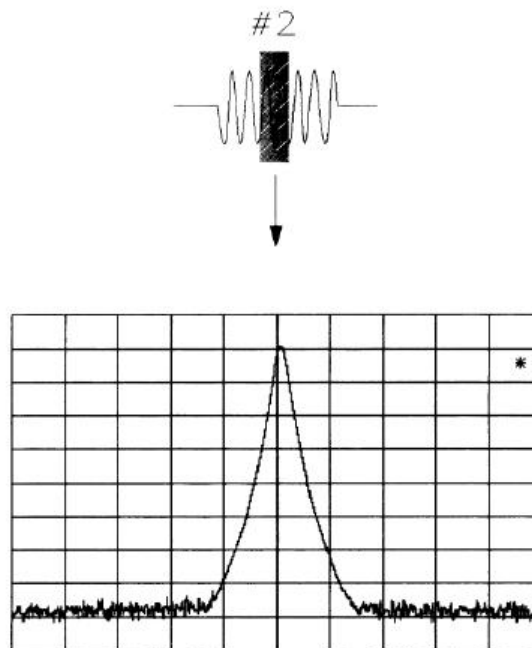


Fig. 4.48 Observation of Signal 2 by time gate

 **Prompt**

Applicable conditions for measurement of time gate

The time gate is a useful tool for the measurement and analysis of various signals. However, the signals repeatedly occur, and contain the trigger signal of TTL synchronous with the time gate.

There are three ways to realize the measurement of the time gate of S3503 series signal/spectrum analyzer: gating LO, video and FFT which are introduced as follows:

Local oscillator: LO is a smart way for gating. It only sweeps LO when Gate is ON and passes through signal. See Fig. 4.49 for the simple diagram of gating LO. It is observed that the Gate signal controls when the sweep generator scans and when it passes through or shields signal. This enables that the signal/spectrum analyzer only sweeps when Gate is ON, that means, the Gate LO only sweeps LO and passes through signal when Gate is ON.

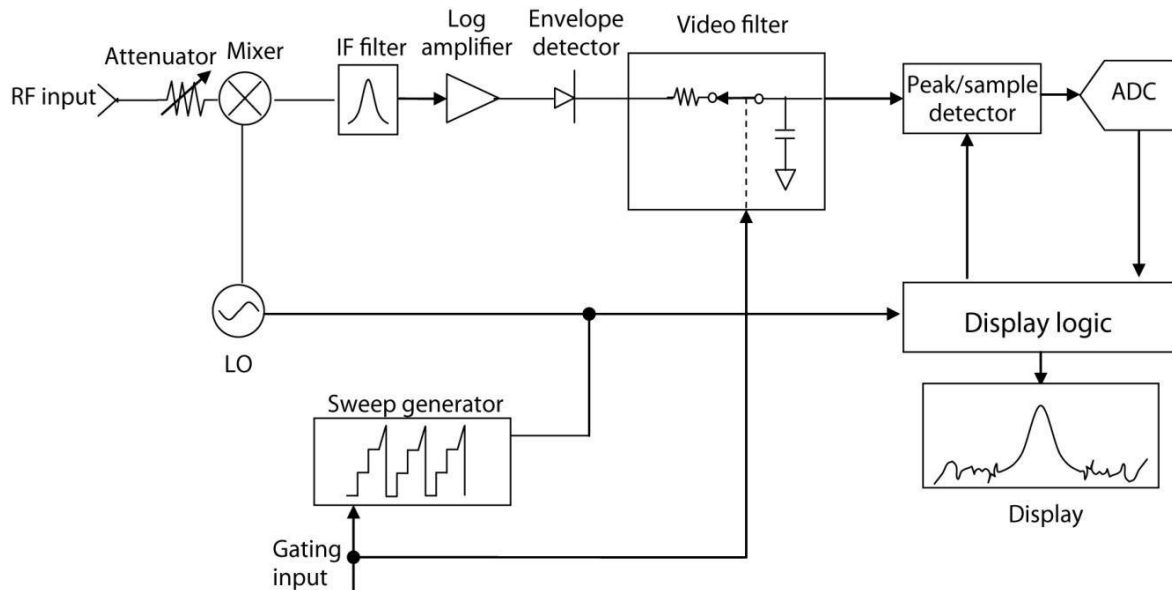


Fig. 4.49 Working principle of gating LO

Gating Video: this form of gating may be thought of as a simple switch, which connects the input signal to the signal/spectrum analyzer. When the switch is ON (Gate ON), the video signal is allowed to pass through; and the switch is off (Gate OFF), the signal is blocked. Under Gated Video, whether the gate is ON or OFF, the signal/spectrum analyzer measures signals and never stops sweeping. The working principle diagram of gating video of S3503 series signal/spectrum analyzer is shown as Fig. 4.50. The Gate Switch is between the signal pathway envelope detector and video filter, therefore is called as Gating Video. Since the Gate Switch is behind the envelope detector, whether the Gate is on or off, the signal/spectrum analyzer measurement path will respond to the input signal; therefore, it is necessary to reduce the sweep speed to the extent that the signal/spectrum analyzer can measure input signal during Gate ON period, which results in certain limits for applying Gated Video measurements. For this reason, in general, Video method results in slower measurement compared with Gated LO and FFT.

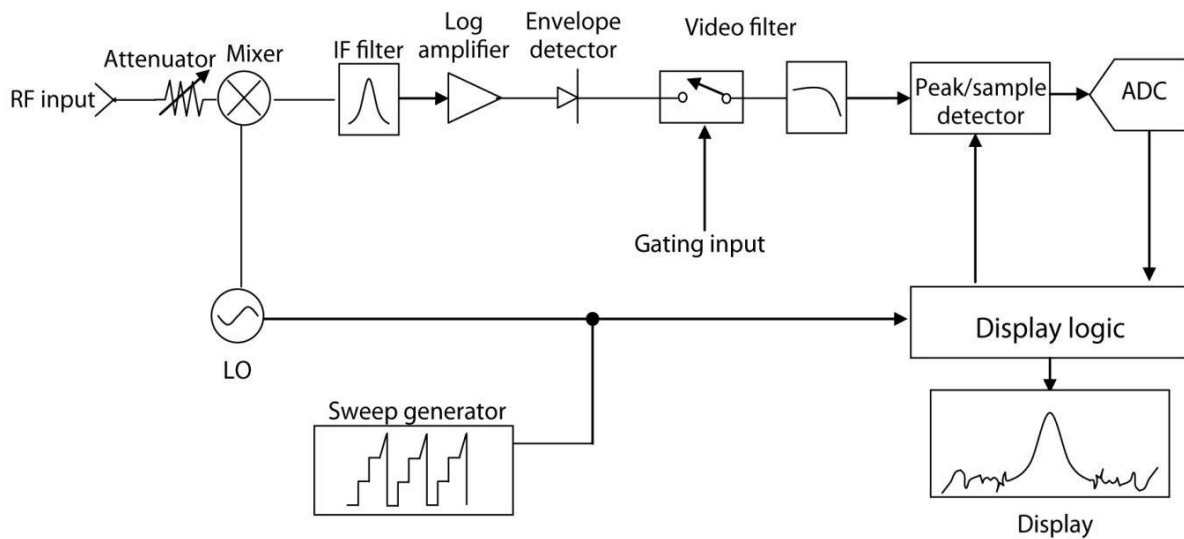


Fig. 4.50 Working principle of gating video

Gated FFT: the way of FFT spectrum measurement if the trigger conditions are satisfied, which is called as the gated FFT. The FFT spectrum is the input signal spectrum through FFT calculation from a time domain waveform during collection. The time for collecting the domain waveform is similar to the gate length. The time for collecting the domain waveform is similar to the gate length. Different from the Sweep Time Gate, under Gated FFT, the gate length is determined by the currently set resolution bandwidth and cannot be set and modified through menu. When the Span is less than 10MHz, in particular for small resolution bandwidth, the FFT measurement is faster than the Sweep measurement; therefore, for a given signal period, compared with Gated LO, the Gated FFT gets higher frequency resolution.

4. 2. 9. 3. More about time gate measurement

The example demonstrates how to measure a specific signal by the use of time gate. Most signals which are required to be measured via the time gate are relatively complex, sometimes even some additional steps are needed for the measurement.

1) Be aware of the signals to be measured in time domain and how to synchronize with the trigger signals

Adjust the gate position by setting the gate delay parameters related to the trigger signals. In order to set the gate delay parameters, you need to know the temporal relation between the trigger signal and the signal to be measured. If not, the following parameters of the signal are required to be determined by the oscilloscope:

- Trigger polarity (positive or negative).
- Pulse repetition interval (PRI) refers to the time interval between two trigger events.
- Pulse width (τ).
- The signal delay (SD) refers to the time interval between the trigger event and stable signal, and the SD will be 0 if the trigger event and signal appear simultaneously.

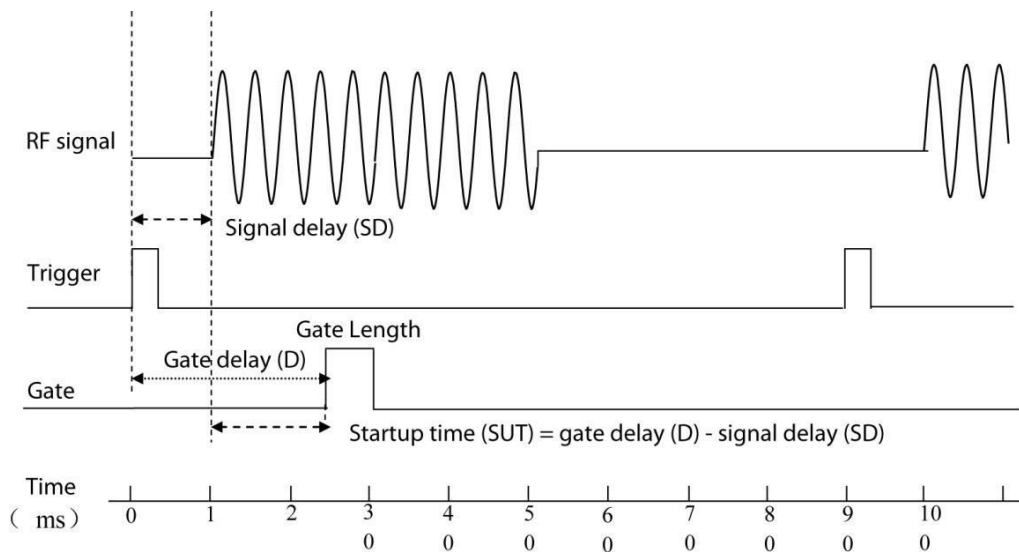


Fig. 4.51 Relation of time-domain parameters

In Fig. 4.51, relevant parameters are listed as follows:

- Pulse repetition interval (PRI) is 9ms.
- Pulse width (τ) is 3ms.
- For the trigger of positive edge, the time of signal delay (SD) is 1ms, while for the trigger of negative edge, the SD is 0.8ms.
- Gate delay time (D) is 2.5ms.
- Startup time (SUT) is 1.5ms.

2) Impact of scanning time

Although the scanning time does not affect the measurement results of gating LO, there may be noncontinuous tracks for two LO intervals on the screen if the scan time is set too short, resulting in increasing the scan time.

The scanning time has significant impact on the measurement results of gating video, so it is required to set the parameters related to the scanning time corresponding to the measurement of time gate. It is recommended that the

scanning time should be set to be $PRI \times (\text{track points} - 1)$ at minimum, and $(PRI - \tau) \times (\text{track points} - 1)$ for the actual scanning time.

3) Optimized bandwidth parameter

For the measurement of time gate, it is important to set proper bandwidth to observe the signal spectrum. To better understand the signal characteristics, the max amplitude of the frequency point can be determined via the max hold before opening the time gate. In order to optimize the measuring speed, the bandwidth can be properly set to short to show the characteristics of the measured signal. For example, it is necessary to set the bandwidth above 200kHz for the observation of the false signal within the frequency range of 200kHz.

4) Set the gate signal by the SUT and SD

Generally, the gate is required to be placed in the area of stable signal, instead of pulse edge or transition zone; otherwise, it will interfere with the spectrum. The gate signal comes from the center of the pulse, and the SUT is calculated after the width of about half a pulse. The setup time (SUT) refers to the duration prior to the arrival of gate and after the signal stability. The SUT is required to set to be long enough for the resolution bandwidth filter of transient burst. The signal delay (SD) refers to the time interval between the trigger event and stable signal. If the trigger event and signal appear simultaneously, the SD will be 0 and the setup time (SUT) is equal to the delay time, otherwise the SUT is equal to the value of gate delay time subtracting the SD, as shown in Fig. 4.52.

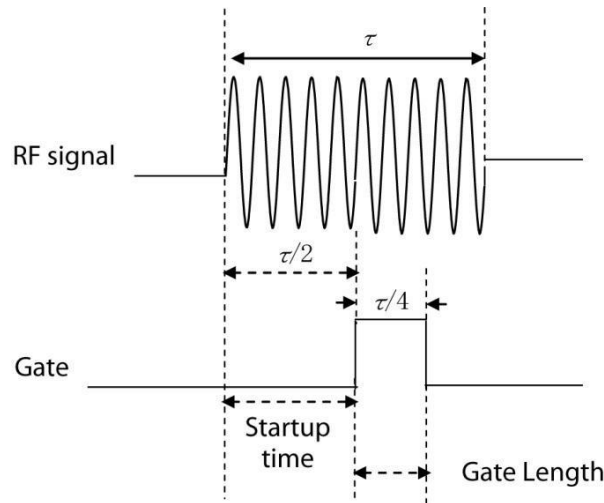


Fig. 4.52 Positioning of time gate

The gate can be set at random, but some positions may provide more selections for the resolution bandwidth, as shown in Fig. 4.53, the time Gate 1 and Gate 2 are extended to the pulse edge or signal transition zone, resulting in some inaccurate measurements. Therefore, it is better to place the gate at 20% - 80% of the pulse. For Gate 3 and Gate 4, the best position is in the middle of the pulse, which makes a good match between the SUT and gate width.

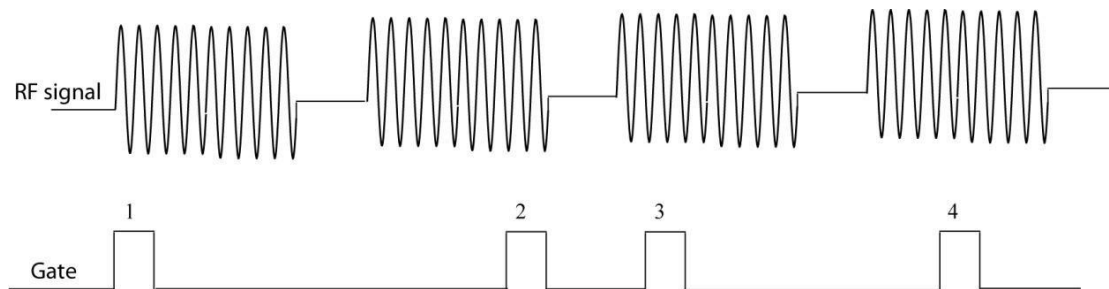


Fig. 4.53 Best position for time gate

The best measurement results are able to be obtained if the gate is generally set in the slight delay position of the signal of interest, namely, within the interior area of signal of interest, but not extending to the pulse edge or signal transition zone. Before the measurement of gate time, the SUT is set to the max value to provide enough time for the resolution bandwidth filter of the analyzer to reach the stable status. In such case, the slight delay position of signal of interest means the allowed $SUT = 4/\text{resolution bandwidth}$. For instance, if the filter of 1kHz is used for the measurement, the minimum SUT will be 4ms.

It should be noted that the signal is not the RF pulse but a specific periodic modulating signal, which continuously effects on the full power or works when the pulse is low. For specific applications, adjusting the gate position ensures enough SUT (not for the alternating process of other signals, e.g. the pulse edge or transition zone). Proper selection of gate delay and gate width may achieve the best signal-to-noise ratio.

For the spectrum measurement between two pulses, there shall be enough SUT after the pulse ends and before the Gate On so that the resolution bandwidth filter can fully discharge for the pulse high level to measure the low level signals between pulses.

5) Effect of resolution bandwidth and video bandwidth

The resolution bandwidth value is determined by the gate position. It takes a long setup time for the small resolution bandwidth, because the resolution bandwidth filter needs enough time to charge prior to the arrival of the gate, where the SUT refers to the period between the gate arrival and the signal stability. As shown in Fig. 4.54.

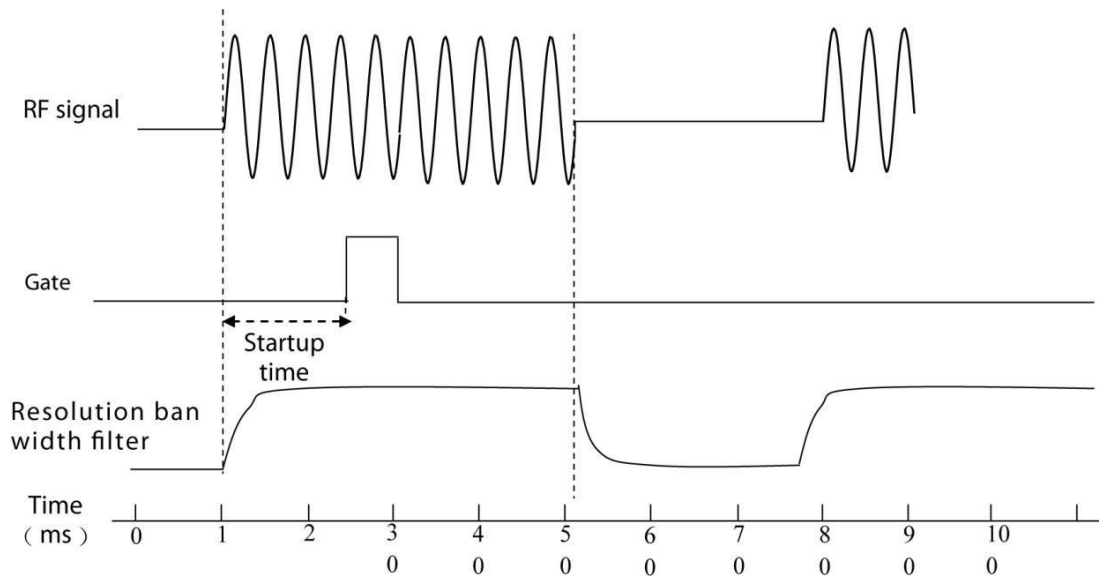


Fig. 4.54 Charging effect of resolution bandwidth filter

The resolution bandwidth filter is a band-limited device, so it will take a certain time for response and condition change. When the signal/spectrum analyzer measure the pulse signal, the filter needs a certain time to fully charge.

- The SUT must be over the charging time of the filter.
- Setup time (SUT) > (4/Resolution Bandwidth).
- Gate length < τ -SUT.

In this example, providing that the SD is 0, the SUT will be equal to the gate delay time; otherwise, the gate delay time is equal to the SUT plus SD. See Fig. 4.55 for the positioning parameters of the time gate.

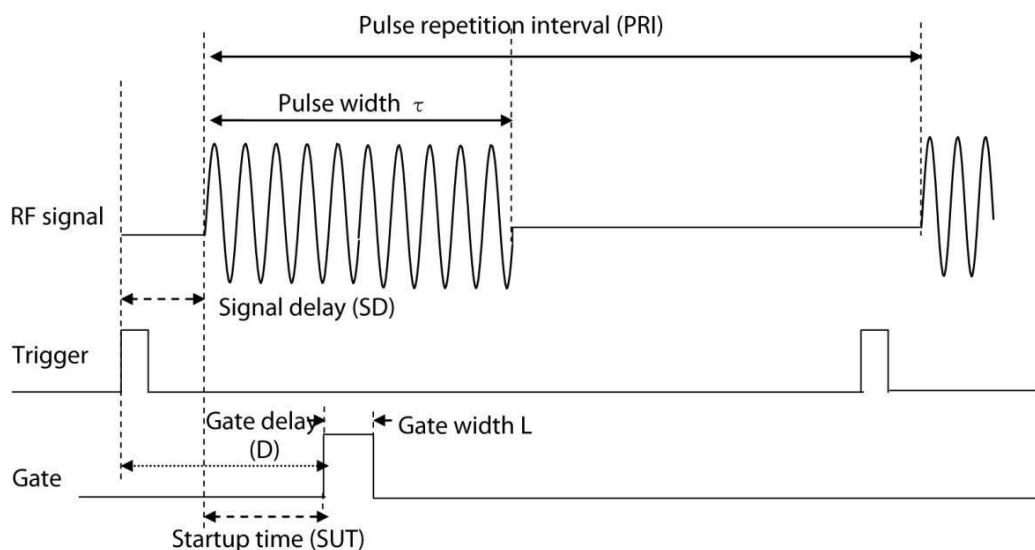


Fig. 4.55 Positioning parameters of the time gate

Similar to the resolution bandwidth filter, the video filter also needs a certain time for charging and discharging. As a post detector, it is used to smooth the track. No matter how long the actual pulse is, seen from the video filter, the pulse length will not exceed the gate width, and it will take some time to charge. If the video bandwidth value is reduced too fast, the amplitude on the screen will decline. For the value selection of video filter, the value can be set to the max, and then decreased until the signal level drops slightly, where the video bandwidth value is set for that before the signal level begins to have a slight decrease. The values of resolution bandwidth and video bandwidth are set to the manual mode so that the values are constant even though the bandwidth changes.

6) General principles for measurement of time gate

For most control setup, the signals are determined by two key parameters, pulse repetition interval (PRI) and pulse width τ . If both parameters are known, the standard setup may be applied. The setting principle of the signal/spectrum analyzer is given in Table 4.4 during the observation of pulse RF signal.

Table 4.4 Setup of signal/spectrum analyzer during the observation of pulse RF

Parameters of signal/spectrum analyzer	Setting principle of signal/spectrum analyzer	Note
Scanning time	Unlimited	Although the scanning time does not affect the measurement results of gating LO, the scanning time is required to be increased if it is set too short.
Gate delay	Gate delay = $SD + 4/\text{resolution bandwidth}$	The setup of gate delay should assure the pulse can be captured upon the Gate On. If the gate delay is too short or long, the pulse will be lost or the response of resolution bandwidth filter in transition zone will be included.
Gate width	Gate length = T-SUT	If the gate is too wide, the response of resolution bandwidth filter in transition zone will be contained. The gate is recommended to set at the position of 25% of the pulse
Resolution bandwidth	Resolution Bandwidth > $(4/SUT)$	The resolution bandwidth value must be large enough to ensure the charging time of the filter is less than the signal pulse width.
Video bandwidth	Video Bandwidth > Resolution Bandwidth	The video bandwidth value should be large enough to make sure the video bandwidth filter does not weaken the signal during the rising time.

The parameters are listed in Table 4.5 for the signal trigger events and the simultaneous arrival of pulses, namely the SD is 0. If the signal is a non-zero delay, it will be added to the recommended value of gate delay.

Table 4.5 Recommended value for measured parameters of the Gate

Pulse width	Gate delay	Minimum Resolution Bandwidth	Gate width
20 μ s	8 μ s	1MHz	8 μ s
50 μ s	40 μ s	100kHz	8 μ s
100 μ s	40 μ s	100kHz	48 μ s
500 μ s	400 μ s	10kHz	80 μ s
1ms	600 μ s	10kHz	200 μ s
5ms	4ms	1kHz	0.8ms
10ms	6ms	1kHz	2.4ms
50ms	30ms	1kHz	12ms
100ms	50ms	1kHz	24ms

4. 2. 9. 4. Measuring example: to measure the RF pulse signal of FM modulation by the use of gating LO

The example of time gate measurement is a simple pulse signal of frequency modulation, aiming to eliminate the pulse spectrum to observe the spectrum of FM carrier, which seems to be a continuous signal instead of a pulse signal. It is possible to reveal the simple modulation behind the pulse spectrum.

Step 1. Generate the FM signal modulated by RF pulse via the signal generator:

There are many ways to generate FM signal modulated by RF pulse. The internal modulation of S1103 series signal generator is applied to this example, with the parameter shown in Table 4.6.

Table 4.6 Parameters of S1103 series signal generator

Frequency	400MHz
Amplitude	-10dBm
Modulation	Pulse modulation On and FM modulation On
pulse period	5ms (or pulse repetition frequency 200Hz)
Pulse width	4ms
Pulse input	Internal auto
FM modulation rate	50kHz
FM frequency offset	1kHz
FMinput	For internal
Waveform	Sine wave

Step 2. Connect the signal generator and signal/spectrum analyzer:

As shown in Fig. 4.56, connect the signal/spectrum analyzer and signal generator, where the RF output of signal generator is connected to the RF input of the analyzer, and the monitoring output port of the signal generator to the input port of external trigger on the front panel of S3503 signal/spectrum analyzer.

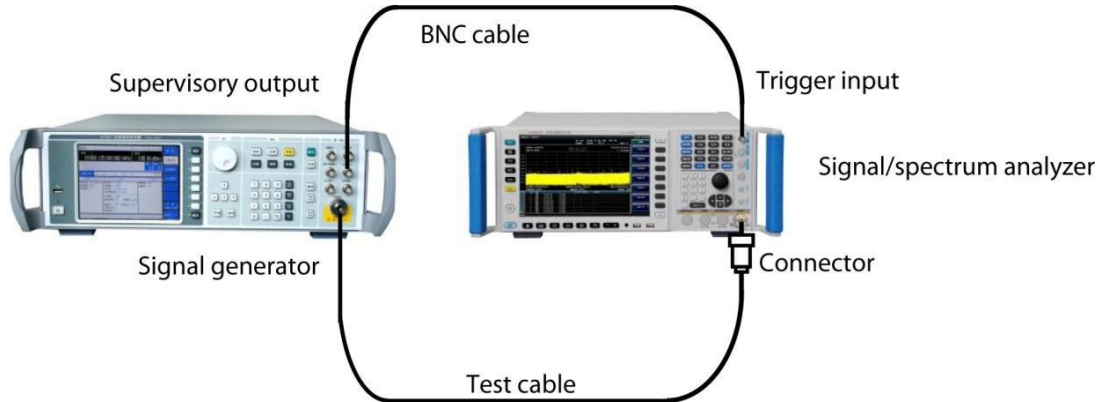


Fig. 4.56 Test connection diagram of signal generator and signal/spectrum analyzer

Step 3: set the center frequency, frequency span and reference level of the analyzer:

- Press [Reset].
- Press [Frequency], [Center Frequency] and enter 400MHz;
- Press [Bandwidth], [Bandwidth] and input 500kHz.
- Press [Amplitude], [Reference Level] and input 0 dBm;
- Press [Scanning], [Scanning Time Auto Manual] and enter 100 ms;
- Mobile signal refers to pulse signal, which can be shielded by the Gate, and the original FM signal will be generated. The spiked period is 5ms (it is the same as the period of the pulse signal) by the judgment of the difference frequency scale, as shown in Fig. 4.57.

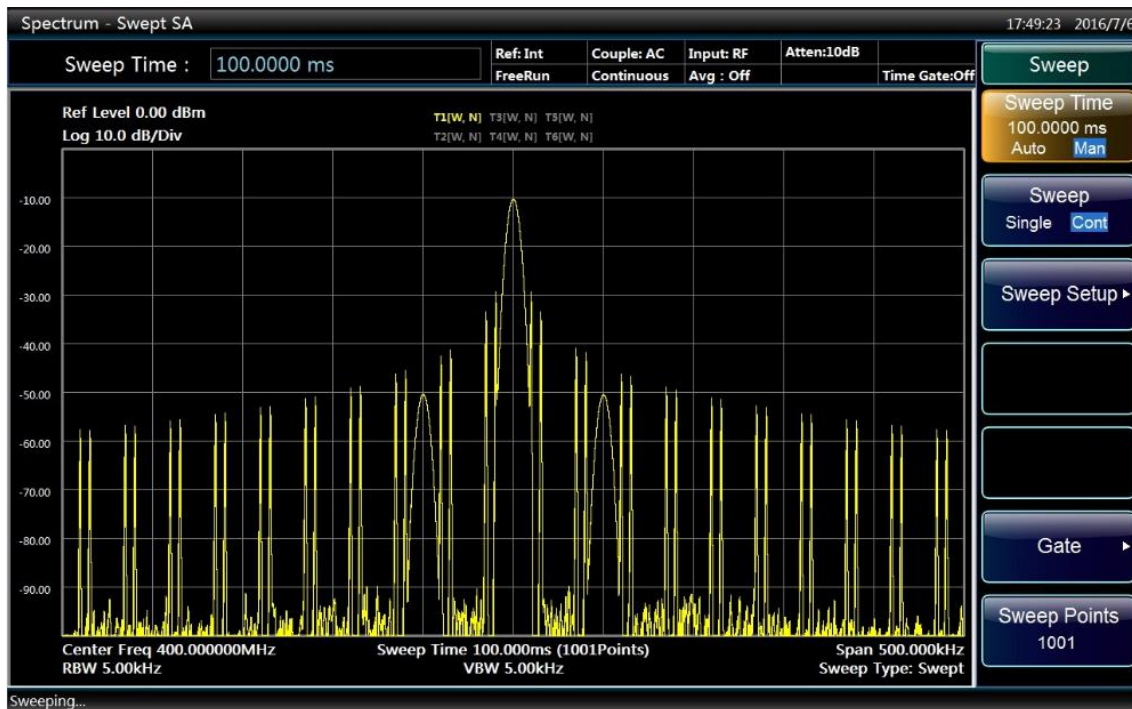


Fig. 4.57 Observed signal spectrum without the Gate

Step 4. Opened the Gate Preview Window, and set the gate delay and gate width, etc.:

- Press [Scanning], [Gate], [Gate Setup], [Gate Mode and [LO];
- Press [Gate Delay] and input 2ms;
- Press [Gate Width] and enter 1ms;
- Press [Gate View Sweep Time] and input 5ms;
- Press [Gate Source] and select [External Trigger Signal 1], [Trigger Level] 1.2V and [Positive] for [Gate Source Polarity].
- Press [Gate View On Off] and select [On].

The interface of Gate Preview Window is shown in Fig. 4.58, stating the temporal relations of the gate trigger, gate delay, width and the measured signal pulse envelope. The time on the left of the figure is the Zero Hour, indicating the time when the gate trigger event occurs, which also refer to the initial time of the Gate On when the gate delay is zero. The green line on the left represents the initial time of Gate On, as well as the gate delay time. The time between the two green lines refers to the gate width, namely the gating time. The yellow path line represents the temporal envelope of the input RF pulse signal.

Adjust the gate delay time to make the gating time between 20% and 80% of the pulse envelope. If there are change in the measuring conditions, such as the resolution bandwidth and bandwidth, etc., the Gate Preview should be reopened to reset the gate trigger polarity, gate delay and gate width, etc.



Fig. 4.58 Gate Preview Interface of LO Status

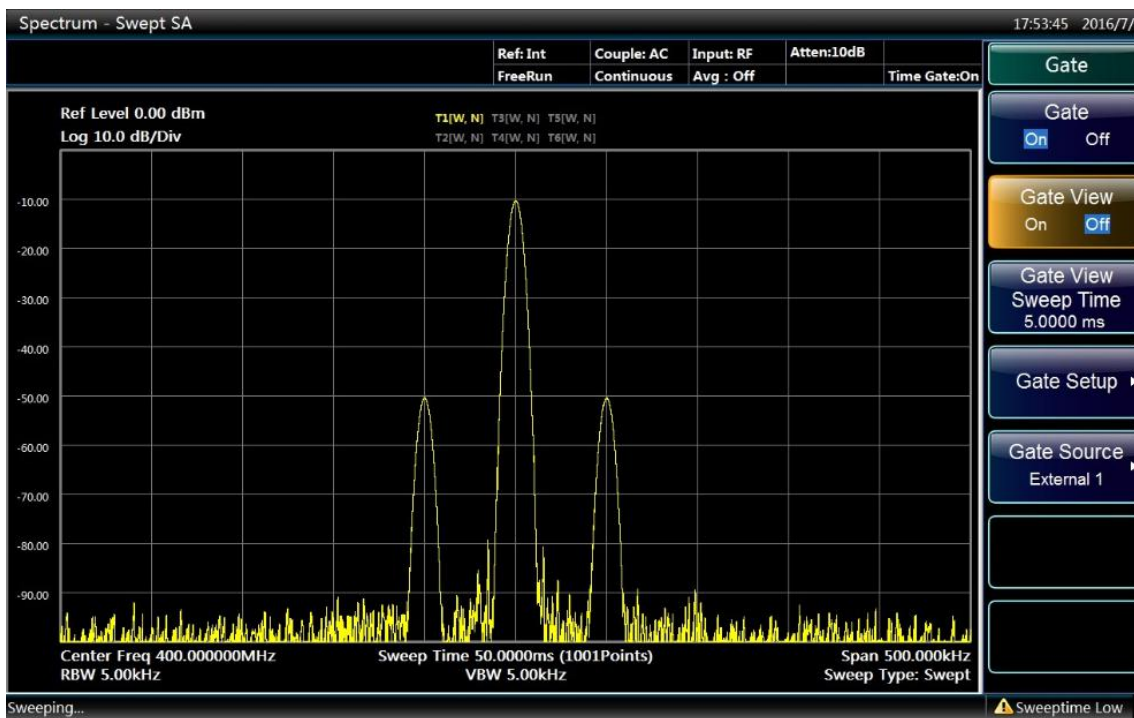


Fig. 4.59 Observed FM signal spectrum with the Gate

Step 5. Close the Gate Preview and open the Time Gate to observe the FM signal spectrum

It is obvious that the spectrum observed with the Time Gate is clearer than that without the Time Gate (see Fig. 4.59).

Select the Pulse Modulation Off on the signal generator and stop the pulse modulation. Press [Sweep], [Time Gate] and [Gate On Off] on the signal/spectrum analyzer to close the time gate. In such case, the spectrum is shown in Fig. 4.60, indicating the spectrum with time gate is consistent with that of FM signal without pulse modulation. There is no change of spectra under two cases.



Fig. 4.60 Observed FM signal spectrum without the Gate

4. 2. 10. Channel power

4. 2. 10. 1. Basic concept

Measure the power and power spectral density under specified channel bandwidth. A pair of markers displayed indicates the edges of the channel. The user can self-define the center frequency, reference level, channel bandwidth and other parameters.

Having press [Measure] and [Channel Power], user can set relevant measurement parameters through [Measurement Setup]. Suspend and restart measurement by pressing [Measurement Control] or switching continuous measurement and singular measurement.

Resolution bandwidth shall be set as 1% - 4% of channel bandwidth during the measurement of channel power. Meanwhile, video bandwidth shall be set as over 10 times of resolution bandwidth for noise-like of signal measured.

4. 2. 10. 2. Measurement Example

This section mainly introduces the channel power measurements of W-CDMA(3GPP)(simulate a W-CDMA signal by signal generator) to measure the total radio-frequency power in the channel. Measurement results show total power (dBm) and power spectral density (dBm/Hz).

Step 1: Set signal source as below:

- Set the mode as W-CDMA.
- Set frequency on signal source to 1.960 GHz.
- Set signal amplitude to -10dBm.

Step 2: Connect the radio frequency output port of the signal source to that of the analyzer. As shown in Fig. 4.61:

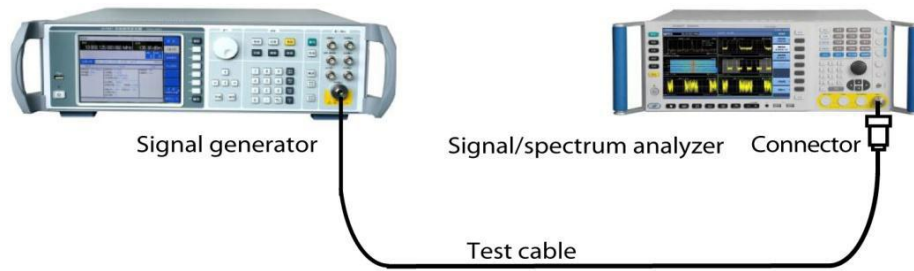


Fig 4.61 Connection Settings of Channel Power Measurement

Step 3: set the analyzer as spectrum analysis mode and activate swept analysis mode:

- Press [Mode] and [Spectrum Analysis].

Step 4: Resetting of analyzer

- Press [Reset] key.

Step 5. Initialize channel power measurement:

- Press [Measurement], [Channel Power].

Set the measurement function as channel power measurement.

Step 5: Set up a wireless standard and switch the wireless devices for base station:

- Press [Measurement], [Menu 1/2 ▶], [Wireless Standard ▶], [W-CDMA 3GPP]. Set the wireless standard as W-CDMA.
- Press [Wireless Devices ▶], [BTS]. Switch the wireless devices as BTS.

Step 6. Set the frequency of the analyzer as 1.960 GHz:

- Press [Frequency], [Center Frequency].

Set the center frequency of the analyzer and input 1.960 GHz.

- Results of channel power measurements are shown in Fig. 4.62. Graphics window and text window display the absolute power value and average power spectral density in channel bandwidth.

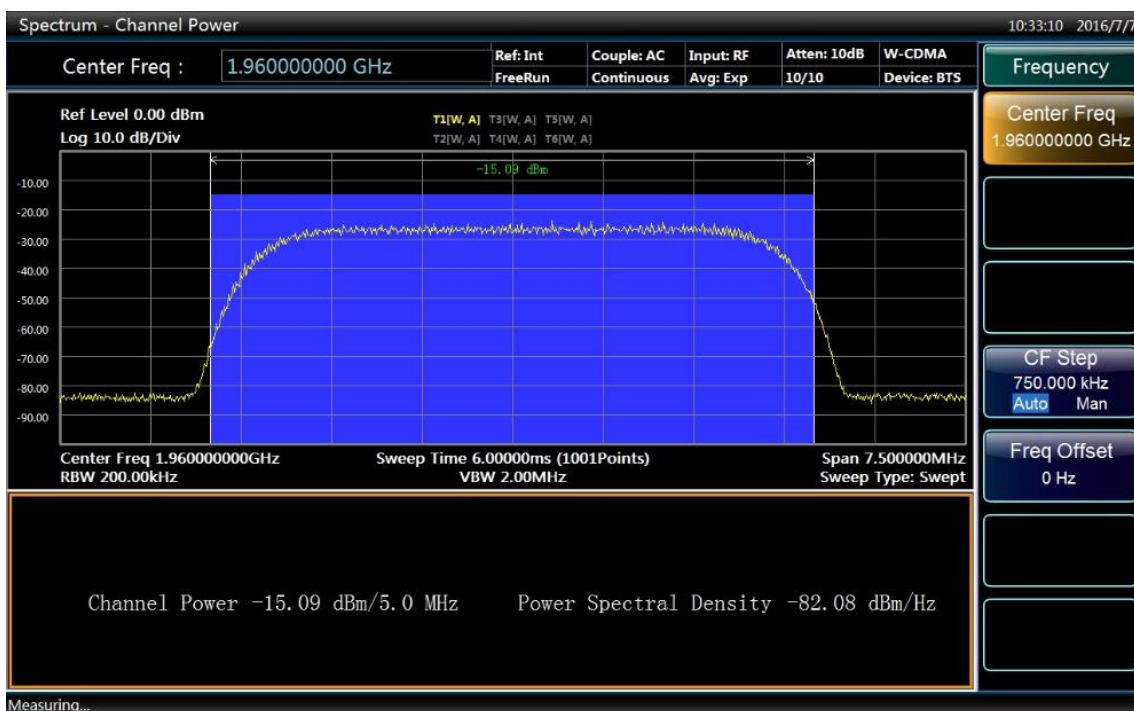


Fig 4.62 Results of channel power measurement

Step 7. Change the measurement parameters:

- Press [Measurement Setting].

Users can modify measurement parameters like integration bandwidth and other as needed.

4. 2. 11. Occupied Bandwidth

4. 2. 11. 1. Basic concept

Occupied Bandwidth Integration display of spectrum power, including marker setting at frequency containing certain power part. The measurement accounts for 99% of the total measurement by default. Firstly calculate the joint power responded by all signals in track. As for power occupying the bandwidth, 99% of power distributed between two vertical line marker, and the rest 1% distributed out of the markers. The difference value between the two markers is the bandwidth occupying 99% power.

Meanwhile, occupied bandwidth measurement can display the center frequency of analyzer and difference value of center frequency in channel, which is called carrier frequency offset.

User can set measurement parameters by himself by pressing [Measurement] key and selecting [Occupied bandwidth] menu, pressing [Measurement Setting] key and enter measurement parameters setup menu, and then selecting single or continuous measurement by pressing [Measurement Control] keys.

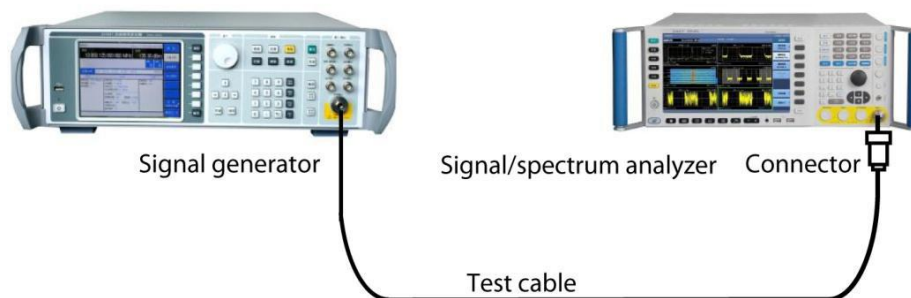
4. 2. 11. 2. Measurement Example

This section mainly introduces the occupied bandwidth measurements of W-CDMA(3GPP) (simulate a W-CDMA signal by signal generator) to measure the total power in the bandwidth and calculate the bandwidth occupied by 99% of total power.

Step 1: Set signal source as below:

- Set the mode as W-CDMA.
- Set frequency on signal source to 1.960 GHz.
- Set signal amplitude to -10dBm.

Step 2: Connect the radio frequency output port of the signal source to that of the analyzer. As shown in Fig. 4.63:


Fig. 4.63 Connection settings of occupied bandwidth measurements

Step 3: set the analyzer as spectrum analysis mode and activate swept analysis mode:

- Press [Mode] and [Spectrum Analysis].

Step 4: Resetting of analyzer

- Press [Reset] key.

Step 5. Initialize occupied bandwidth measurements:

- Press [Measurement], [Occupied Bandwidth].

Set the measurement function as occupied bandwidth measurement.

Step 6: Set up a wireless standard and switch the wireless devices for base station:

- Press [Measurement], [Menu 1/2 ▶], [Wireless Standard ▶], [W-CDMA 3GPP]. Set the wireless standard as W-CDMA.
- Press [Wireless Devices ▶], [BTS].

Switch the wireless devices as BTS.

Step 7. Set the frequency of the analyzer as 1.960 GHz:

- Press [Frequency], [Center Frequency].

Set the center frequency of the analyzer and input 1.960 GHz.

- Results of occupied bandwidth measurements are shown in Fig. 4.64.



Fig. 4.64 Results of occupied bandwidth measurements

Step 8. Change the measurement parameters:

- Press [Measurement Setting].

Users can modify measurement parameters like Occupied Power %, xdB and other as needed.

4. 2. 12. Adjacent Channel Power

4. 2. 12. 1. Basic concept

Adjacent Channel Power (ACP) indicates the power leaked to the adjacent channels. Adjacent channel power can be used to measure different types of signals by selecting different wireless communication standards.

Calculate the power in bandwidth relative to each offset by selecting integration bandwidth method to execute track scanning. Measurement results show the corresponding total power or power spectral density according to reference type selected. User can observe the measurement results by selecting spectrum display or cylindrical diagram display.

Having pressed [Measurement] key and selected [Adjacent Channel Power], press [Measurement Setting] key to enter detailed setup menu of measurement parameters. Press [Measurement Control] key to switch continuous measurement and singular measurement.

4. 2. 12. 2. Measurement Example

Designate the total power and 6 groups of power offsetting channel to measure adjacent channel power. The measurement results show ratio of power offsetting channel and the power of main channel. This section mainly introduces the adjacent channel power measurements of W-CDMA(3GPP) (simulate a W-CDMA signal by signal generator).

Step 1: Set signal source as below:

- Set the mode as W-CDMA.
- Set frequency on signal source to 1.960 GHz.
- Set signal amplitude to -10dBm.

Step 2: Connect the radio frequency output port of the signal source to that of the analyzer. As shown in Fig. 4.65:

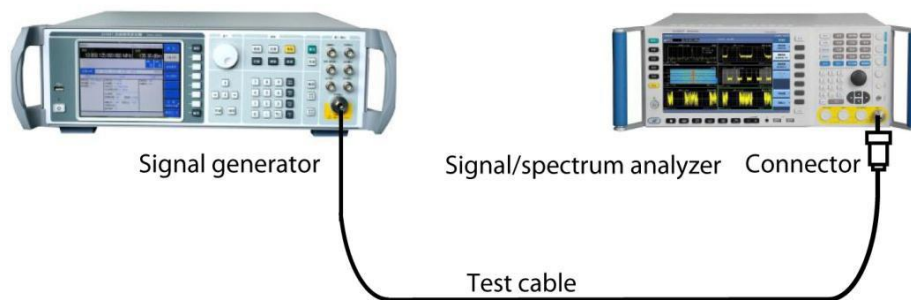


Fig 4.65 Connection settings of adjacent channel power measurement

Step 3: set the analyzer as spectrum analysis mode and activate swept analysis mode:

- Press [Mode] and [Spectrum Analysis].

Step 4: Resetting of analyzer

- Press [Reset] key.

Step 5. Initialize Adjacent Channel Power Measurement:

- Press [Measurement], [Adjacent Channel Power].

Set the measurement function as adjacent channel power measurement.

Step 6: Set up a wireless standard and switch the wireless devices for base station:

- Press [Measurement], [Menu 1/2 ▶], [Wireless Standard ▶], [W-CDMA 3GPP]. Set the wireless standard as W-CDMA.
- Press [Wireless Devices ▶], [BTS]. Switch the wireless devices as BTS.

Step 7. Set the frequency of the analyzer as 1.960 GHz:

- Press [Frequency], [Center Frequency].

Set the center frequency of the analyzer and input 1.960 GHz.

- Results of adjacent channel power measurements are shown in Fig. 4.66. Measurement parameters, including offset frequency, integration bandwidth, bandwidth setting and others are all adopted with default setting referred to wireless standard.

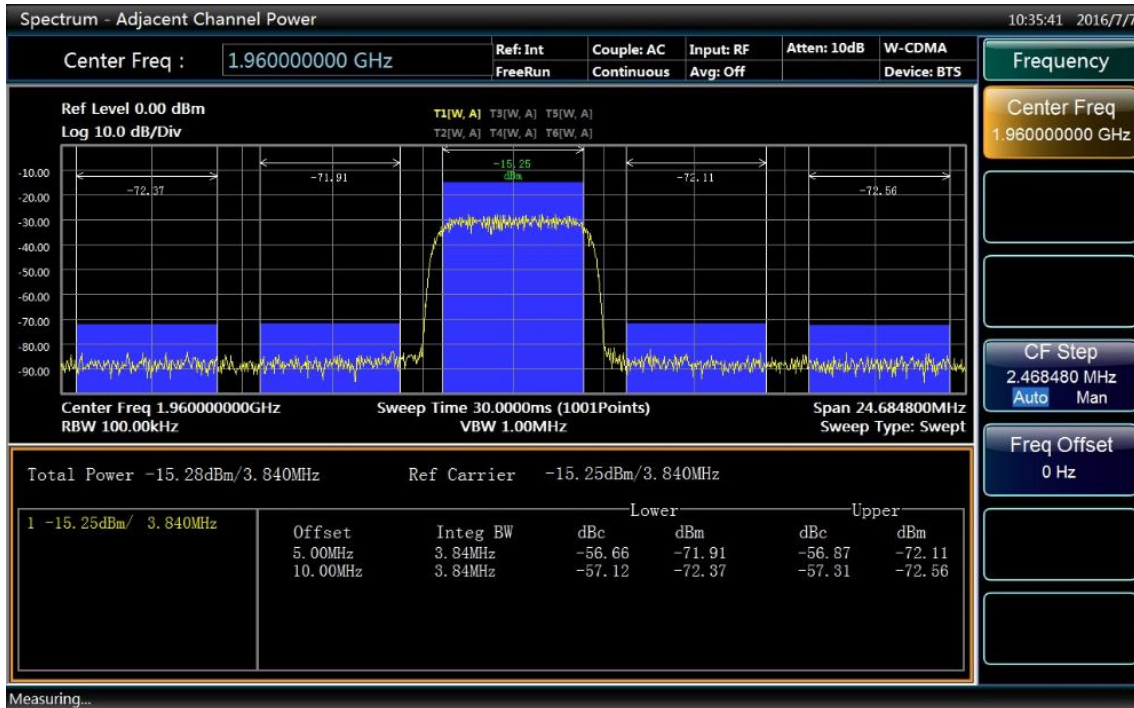


Fig 4.66 Results of Adjacent Channel Power Measurement

Step 8. Define a new third offset:

- Press [Measurement Setting], [Offset/Limit ▶], [Offset ▶], [C]. Select a new offset channel C.
- Press [Offset Frequency ON OFF].

Set offset frequency as ON state and input 15MHz.

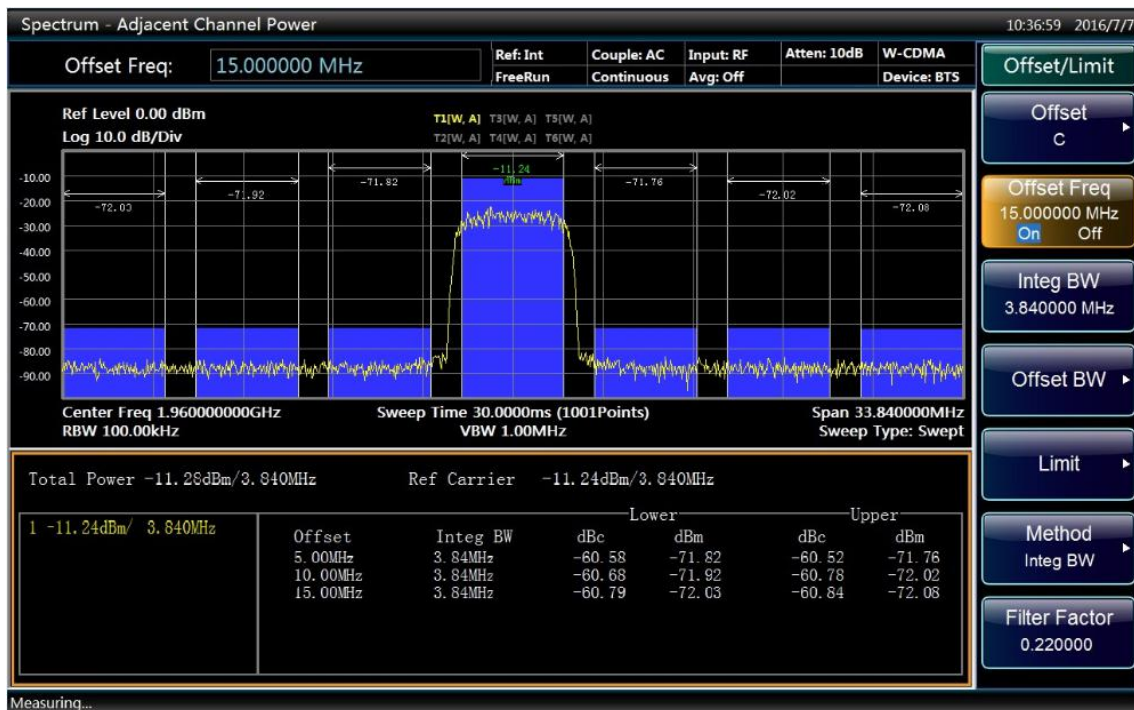


Fig.4.67 Measuring third adjacent channel

Step 9. Set every offset limit of pass/fail:

- Press [Measurement Setting], [Offset/Limit ▶], [Offset ▶], [A], [Limit ▶], [Relative Limit (Car)]. Set the limit value of

offset A and input -55dB.

- Press [Measurement Setting], [Offset/Limit ▶], [Offset ▶], [B], [Limit ▶], [Relative Limit (Car)].
- Set the limit value of offset B and input -75dB.
- Press [Measurement Setting], [Offset/Limit ▶], [Offset ▶], [C], [Limit ▶], [Relative Limit (Car)]. Set the limit value of offset C and input -55dB.

Step 10. Start limit test:

- Press [Measurement Setting], [Menu 1/3 ▶], [Limit Test ON OFF]. Set limit test as ON state.
- In Fig. 4.68, offset A and C passed, and offset B failed. Offset B failed because of its power level exceeding standard of -75dB designated by us. Bar graph and power marker of channel failed will be shown in red.



Fig. 4.68 Limit test

4. 2. 13. Power Statistic

4. 2. 13. 1. Basic concept

CCDF measurement is a statistic measurement for high level signal power or peak power. It reflects, with figures and tables, percentage of time and value which the signal exceeds its average power.

Curve of complementary cumulative distribution function (CCDF) of power indicates high level of power on signal. It shows the scatter diagram to peak-to-average power ratio and corresponding probability. The CCDF curve stands for the time quantum spent on power level whose waveform is equal to or greater than that of given power level. The percentage of time spent by signal on power level which is equal to or greater than given power level is defined as the probability of given power level.

4. 2. 13. 2. Measurement Example

This section mainly introduces power statistics CCDF measurement of W-CDMA(3GPP) (simulate a W-CDMA signal by signal generator).

Step 1: Set signal source as below:

- Set the mode as W-CDMA.

- Set frequency on signal source to 1.960 GHz.
- Set signal amplitude to -10dBm.

Step 2: Connect the radio frequency output port of the signal source to that of the analyzer. As shown in Fig. 4.69:

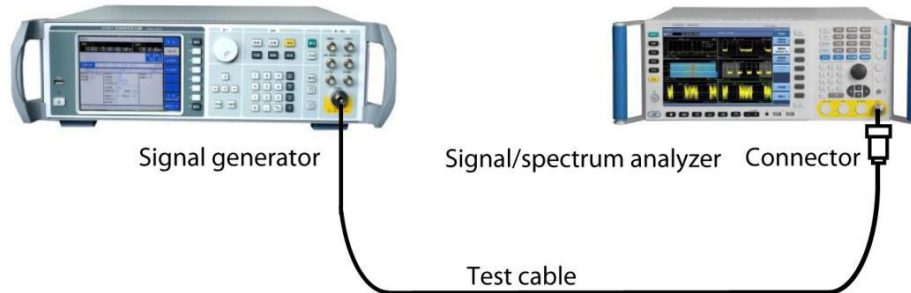


Fig. 4.69 Connection Settings of Power Statistical Measurement

Step 3: set the analyzer as spectrum analysis mode and activate swept analysis mode:

- Press [Mode] and [Spectrum Analysis].

Step 4: Resetting of analyzer

- Press [Reset] key.

Step 5. Initialize power statistical measurement:

- Press [Measurement], [Power Statistic].

Set the measurement function to power statistical measurement.

Step 6: Set up a wireless standard and switch the wireless devices for base station:

- Press [Measurement], [Menu 1/2 ▶], [Wireless Standard ▶], [W-CDMA 3GPP]. Set the wireless standard as W-CDMA.
- Press [Wireless Devices ▶], [BTS]. Switch the wireless devices as BTS.

Step 7. Set the frequency of the analyzer as 1.960 GHz:

- Press [Frequency], [Center Frequency].

Set the center frequency of the analyzer and input 1.960 GHz.

- Power statistical measurement results as shown in Fig. 4.70.



Fig. 4.70. Power Statistical Measurement

Step 8. Save the current measured trace for reference:

- Press [Trace], [Save Reference Trace].

Save the current measured trace as the Reference Trace. During the first CCDF measurement of power statistic, graphic shown is a typical pure noise signal, marked as Gaussian curve and color in blue. CCDF curve currently measured appears as yellow, while the Reference Trace saved for comparison appears as pink.

Step 9. Show the reference trace saved.

- Press [Trace], [Reference Trace On / Off].

Set the Reference Trace to be open, and turn on the reference trace saved.

Step 10. Change the measurement bandwidth to 1 MHz:

- Press [Bandwidth].

Set the frequency of instrument measurement to 1.0 MHz, as shown in Fig. 4.71.

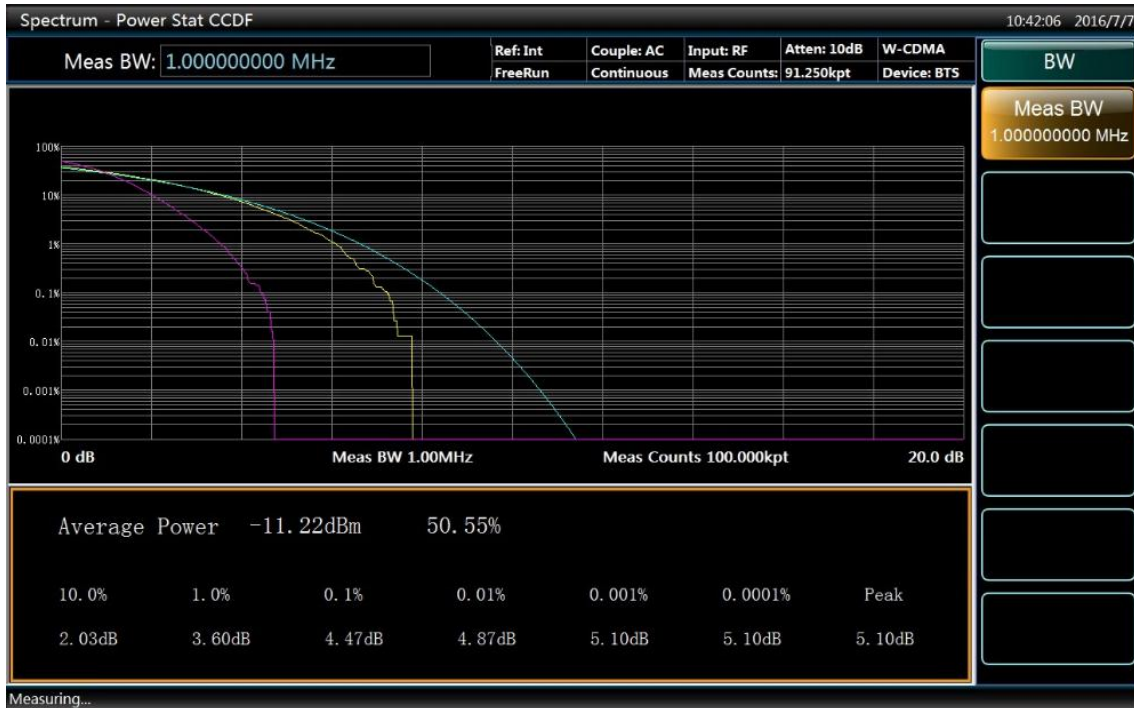


Fig. 4.71 Save and Display CCDF Measurement

Step 11. Amend measurement points to 1 kpt:

- Press [Measurement Setting], [Measurement points]. Set accumulated points to 1 kpt, as shown in Fig. 4.72.

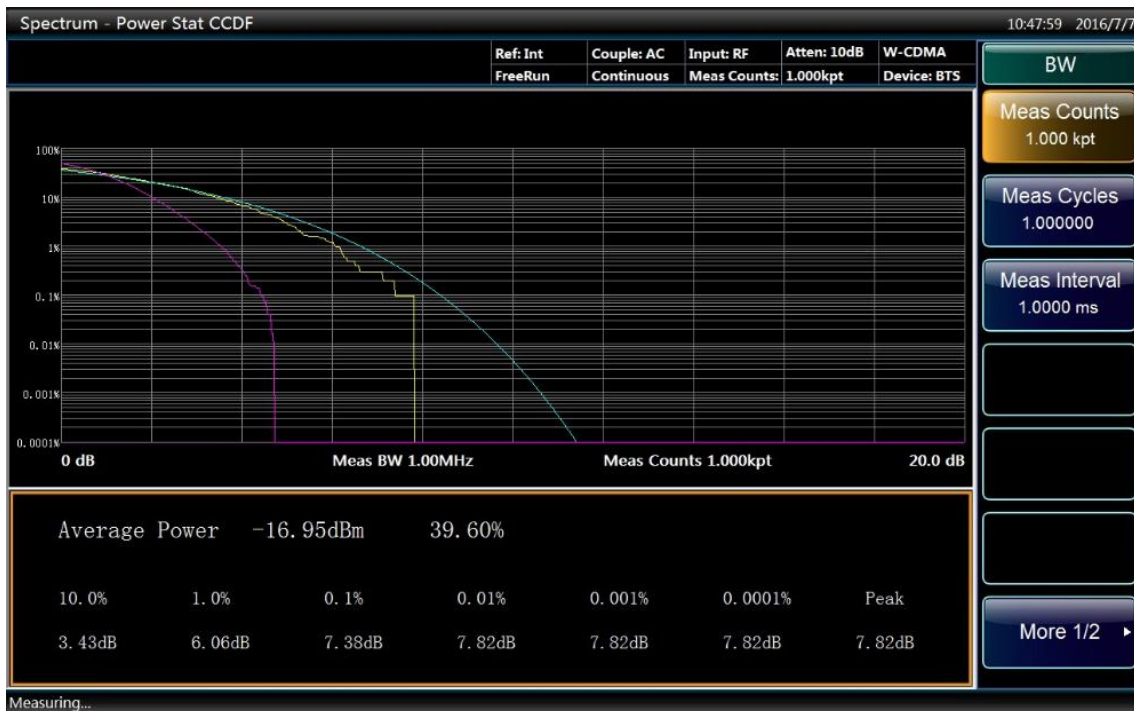


Fig. 4.72 Modify Measurement Points

Step 12. Modify the X-axis scale to 1 dB to optimize special measurement:

- Press [Bandwidth / X-axis], [Scale / Division]. Set the X-axis scale to 1 dB, as shown in Fig. 4.73.

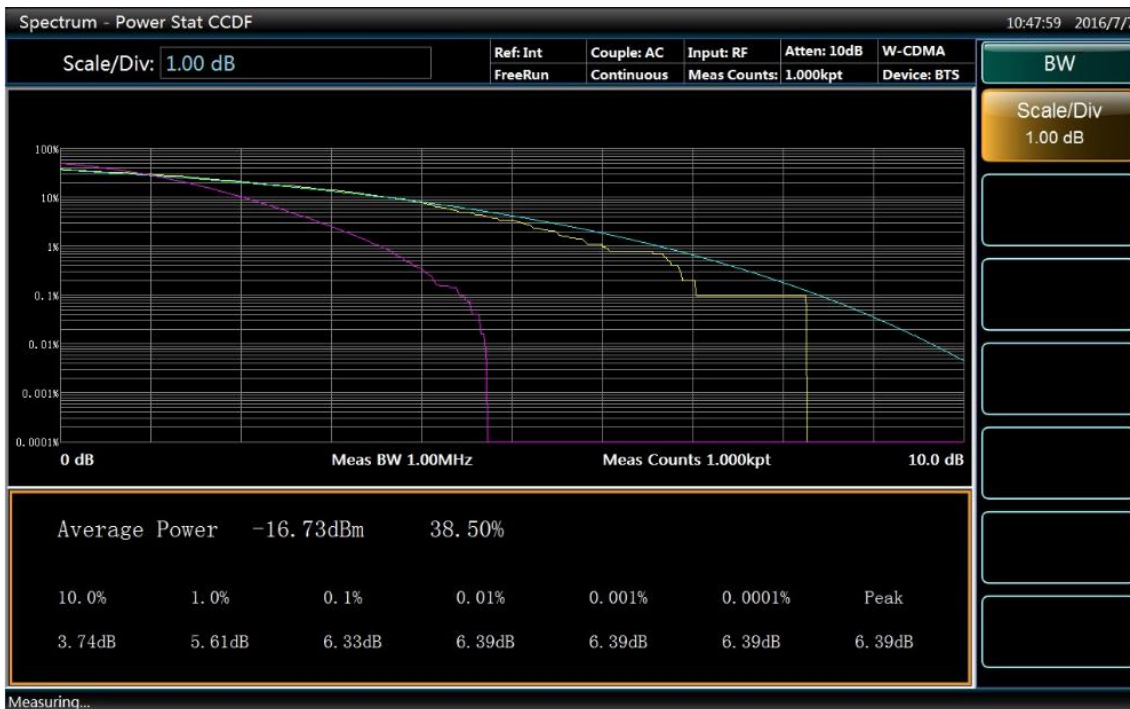


Fig. 4.73 Modify the X-axis Scale

4. 2. 14. Burst Power

4. 2. 14. 1. Basic concept

Burst power is an accurate method to measure specific burst average power. It is the average power of the pulse captured by measurement under zero bandwidth. The measurement is mainly used to measure the pulse modulated signal and burst signal in the time domain. If there is no user-defined, pulse width can be obtained in this way: identify peaks in the captured data, and then find the first position above the threshold on the trace as the starting point of the pulse, while the terminal point of the pulse is the first point below the threshold on the trace. The average carrier power can be calculated by pulse width and threshold.

4. 2. 14. 2. Measurement Example

This section mainly describes how to carry out burst power measurement of a pulse modulated signal of 1.0 GHz frequency.

Step 1: Set signal source as below:

- Set up a pulse modulated signal.
- Set frequency on signal source to 1.960 GHz.
- Set up the period of pulse modulation signal as 100 us.
- Set signal amplitude to -10dBm.

Step 2: Connect the radio frequency output port of the signal source to that of the analyzer. As shown in Fig. 4.74:

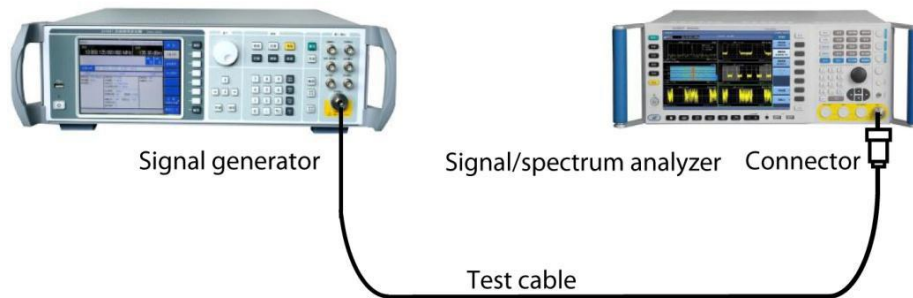


Fig. 4.74 Connection Settings of Burst Power Measurements

Step 3: set the analyzer as spectrum analysis mode and activate swept analysis mode:

Step 4: Resetting of analyzer Press [Mode] and [Spectrum Analysis].

- Press [Reset] key.

Step 5: Initialize burst power measurements:

- Press [Measurement], [Burst Power].

Set up the measurement function as burst power measurements.

Step 6. Set the frequency of the analyzer as 1.960 GHz:

- Press [Frequency], [Center Frequency].

Set the center frequency of the analyzer and input 1.960 GHz.

Step 7. Set the sweep time of the analyzer as 200.0 us:

- Press [Sweep], [Sweep Time].

Set up the sweep time of the instrument, enter 200.0 us.

Step 8. Set analyzer trigger mode to burst power trigger:

- Press, [Trigger], [Burst Power Trigger].

Set up the instrument trigger mode, select burst power trigger.

- Results of burst power measurements are shown in Fig. 4.75.

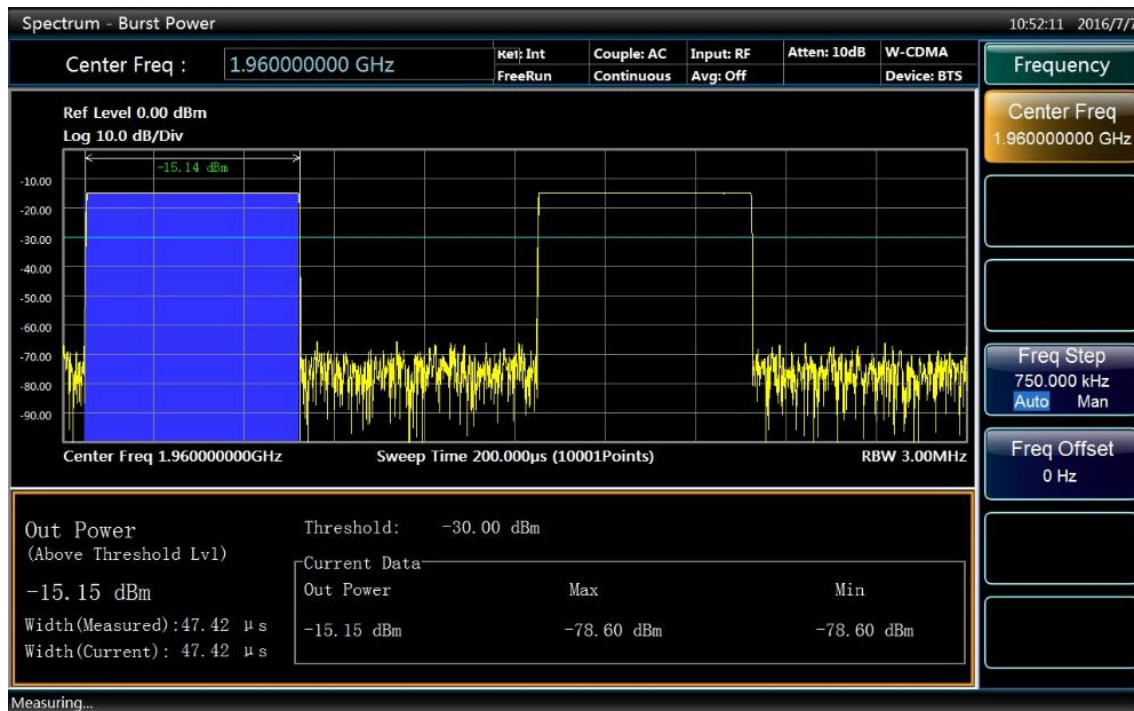


Fig. 4.75 Results of Burst Power Measurements

Step 9. Change the measurement parameters:

- Press [Measurement Setting].

Users can change measurement parameters like the threshold level, measuring method as required.

4. 2. 15. Harmonic Distortion

4. 2. 15. 1. Basic concept

There are two ways adopted for harmonic distortion measurements of signals.

Auto search carrier: at this time range list is closed, the instrument automatically search base-band signal, and measure its harmonics. Specifically, center frequency for each harmonic measured will be set as integer multiples of the fundamental frequency, and perform a scan. Amplitude can be obtained by taking the average of the trace power and displays in the results list of the window. Each harmonic resolution bandwidth can be obtained by fundamental frequency resolution bandwidth multiplied by the number of harmonics. Each harmonic resolution bandwidth value is resolution bandwidth of fundamental frequency multiplied by the number of harmonics. In the minimum resolution bandwidth available, this result is greater than or equal to the calculated value.

Means of range list: open range list, set the required parameter list status, and measure according to the current known list parameters. After the fundamental wave, for each valid range table, set up the center frequency as the frequency of range table. If the current bandwidth is set to 0, the amplitude can be obtained by averagely calculating the trace power, and displays in the list of results window.

After measurement of a specified number of harmonics and amplitude, general harmonic distortion results (Harmonics & THD) will display in the left part of the window. If the measurement is carried out in single sweep mode, the display will remain at the last harmonic setting, and the instrument stop scanning. If the measurement is carried out in a continuous scan mode, it will continuously measure the fundamental wave and harmonic amplitude.

4. 2. 15. 2. Measurement Example

This section mainly describes how to carry out harmonic distortion measurements of signals.

Step 1: Set signal source as below:

- Set frequency on signal source to 1.960 GHz.
- Set signal amplitude to -10dBm.

Step 2: Connect the radio frequency output port of the signal source to that of the analyzer. As shown in Fig. 4.76:

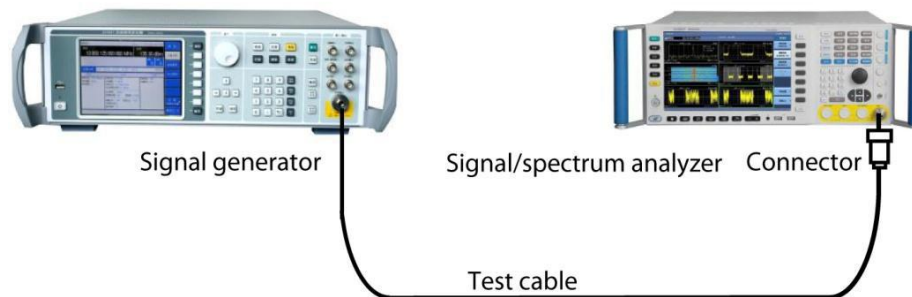


Fig. 4.76 Connection Settings of Harmonic Distortion Measurements

Step 3: set the analyzer as spectrum analysis mode and activate swept analysis mode:

- Press [Mode] and [Spectrum Analysis].

Step 4: Resetting of analyzer

- Press [Reset] key.

Step 5. Set the frequency of the analyzer as 1.960 GHz:

- Press [Frequency], [Center Frequency].

Set the center frequency of the analyzer and input 1.960 GHz.

Step 6. Initialize harmonic distortion measurements, by default, automatically search for the fundamental wave and measure harmonics.

- Press [Measurement] [Menu 1 / 2 ►], [Harmonic Distortion]. Set the measurement function as harmonic distortion measurements.
- The results of harmonic distortion measurements are shown in Fig. 4.77. Text window displays the absolute power value of the fundamental wave and the relative value of harmonic to fundamental frequency, and gives the total harmonic distortion value.

Step 7. Set harmonic parameters manually, the user can edit the list to:

- Press [Measurement Setting], [Harmonics Edit List ON OFF]. Set up harmonic edit list to be open, turn on harmonics edit list.
- Press [Configure Harmonic ►].

Users can select and set measurement parameters like the frequency, resolution bandwidth as required.

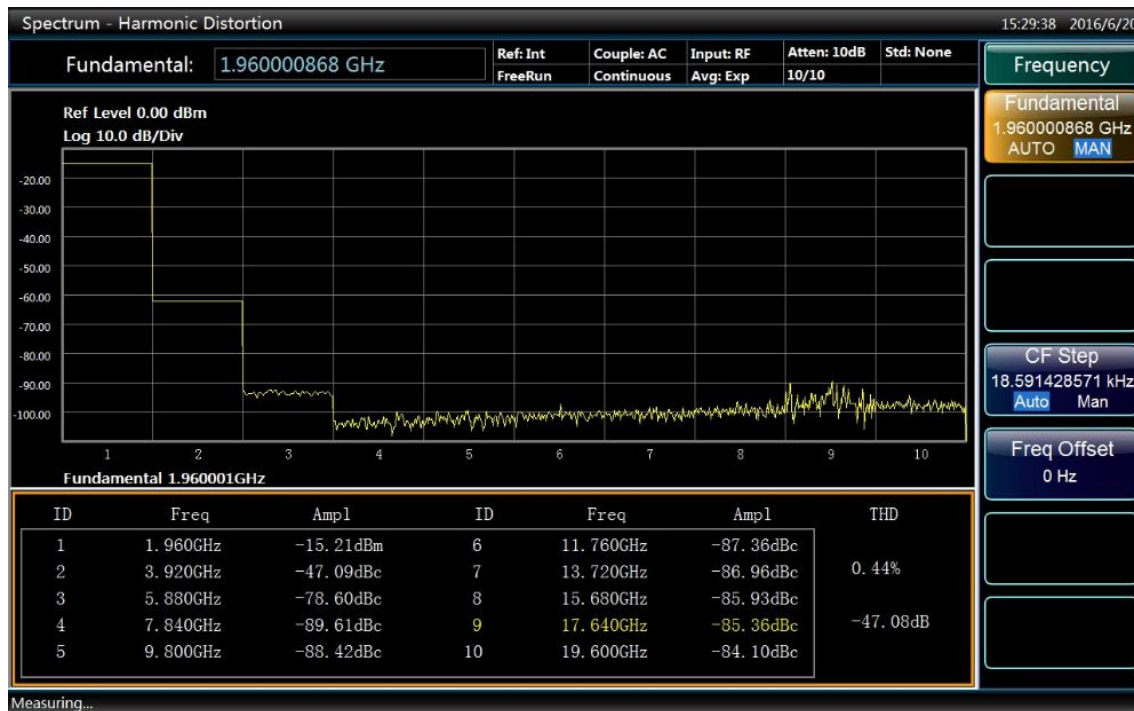


Fig. 4.77 Results of Harmonic Distortion Measurements

4. 2. 16. Three-order intermodulation (TOI)

4. 2. 16. 1. Basic concept

Three-order intermodulation, also known as TOI for short, is a means for analysis and measurement of intermodulation product of communication system equipment. Mutual interference between equipment is very common in communication systems, which is usually caused by distortion products from equipment such as amplifiers and frequency mixer. TOI can measure, calculate and display output intercept points (IP3) and signs on the curve show measured signals and three-order products.

After selecting [Third-order Intermodulation], press [Measurement Setting] key to enter the parameter settings menu of third-order intermodulation measurement, press [Measurement Control] key for remeasuring, continuous switch and single sweep.

4. 2. 16. 2. Measurement Example

This section mainly describes how to measure third-order intermodulation for signals (use a signal generator to simulate an intermodulation signal).

Step 1: Set signal source as below:

- Set up a double-tone signal of 5 MHz frequency interval.
- Set frequency on signal source to 505.0MHz.
- Set signal amplitude to -2.0dBm.

Step 2: Connect the radio frequency output port of the signal source to that of the analyzer. As shown in Fig. 4.78:

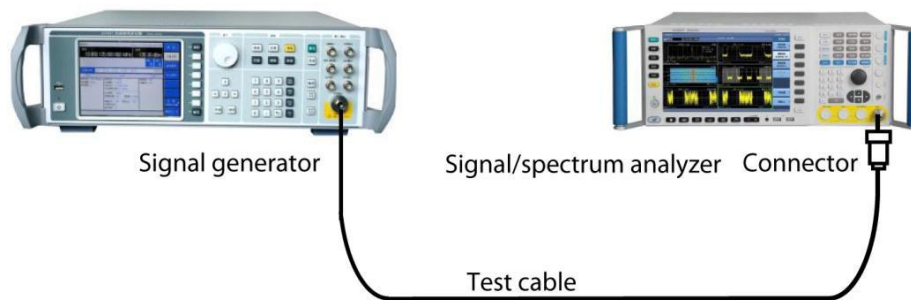


Fig. 4.78 Connection Settings of Third-order Intermodulation Measurements

Step 3: set the analyzer as spectrum analysis mode and activate swept analysis mode:

- Press [Mode] and [Spectrum Analysis].

Step 4: Resetting of analyzer

- Press [Reset] key.

Step 5. Initialize the third-order intermodulation measurements:

- Press [Measuring], [Menu 1 / 2 ►], [Third-order Intermodulation].

Set the measurement function as third-order intermodulation measurements.

Step 6. Set center frequency of the analyzer as 505.0 MHz:

- Press [Frequency], [Center Frequency].

Set the center frequency of the analyzer and input 505.0MHz.

Step 7. Set the analyzer bandwidth as 50.0 MHz:

- Press [Bandwidth / X Axis], [Bandwidth]. Set up the instrument bandwidth, input 50.0 MHz.
- Results of third-order intermodulation measurement are shown in Fig. 4.79. Text window shows the fundamental frequency and power, and third-order inter-modulation frequencies and power, and gives third- order intercept values.

Step 6. The user can apply zero bandwidth mode:

- Press [Measurement Setting], [Zero Bandwidth Mode ►], [Zero Bandwidth Measurement Switch]. Users can set up measurement parameters like the resolution bandwidth, dwell time and other as needed.



Fig. 4.79 Results of Three-order Intermodulation Measurement

4. 2. 17. Spurious emission

4. 2. 17. 1. Basic concept

Spurious emission measurement identifies and defines the power level of spurious emission within certain bandwidth and is mainly used to measure spurious signals, harmonic and intermodulation. In practice, spurious emissions should ensure to be under a lower power level, preferably close to the background noise to avoid interfering with communication of other frequency bands.

4. 2. 17. 2. Measurement Example

This section mainly introduces how to measure the spurious emission of signals, by using spurious signals on frequency spectrum of pulse signal simulation measurement.

Step 1: Set signal source as below:

- Set up the repetition frequency as 1 kHz pulse signal.
- Set frequency on signal source to 1.920GHz.
- Set signal amplitude to -10dBm.

Step 2: Connect the radio frequency output port of the signal source to that of the analyzer. As shown in Fig. 4.80:

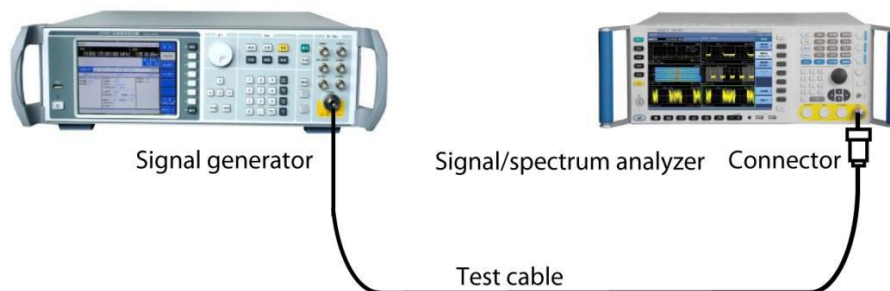


Fig. 4.80 Connection Settings of Spurious Emission Measurements

Step 3: set the analyzer as spectrum analysis mode and activate swept analysis mode:

- Press [Mode] and [Spectrum Analysis].

Step 4: Resetting of analyzer

- Press [Reset] key.

Step 5: Set the frequency of the analyzer as 1.920GHz:

- Press, [Frequency], [Center Frequency], input 1. 920 GHz.

Step 6: Initialize spurious emission measurement:

- Press [Measur], [Menu 1 / 2 ►], [Spurious Emission], set up the measurement mode as spurious emissions.

Step 7: Check the specified spurious signals:

- Press [Measurement Setting], [Stray Choice]. Input checked stray figures.
- Results of spurious emission measurement are shown in Fig. 4.81.

What shows in the text window is the detected stray. Each message includes a spurious frequency range, a stray power and a limited value.

Step 8: The user can change the measurement parameters, and customize measuring range list as needed:

- Press [Measurement Setting], [Range List ►].

Users can select and edit measurement parameters for multiple lists.



Fig. 4.81 Results of Spurious Emission Measurement

4. 2. 18. Spectral emission mask

4. 2. 18. 1. Basic concept

Spectral emission mask (SEM) measurement includes spurious emission inside and outside the band and is targeted at spurious signals inside the frequency range close to carrier signals. Analysis bandwidth for spurious measurement may differ for varied frequency range of carrier shift. To facilitate observation and judgment, spurious threshold level is given for each frequency range starting right from the carrier signal according to relevant standards, which is connected to form the spectral mask. Only spurious

signals located within such spectral mask can be measured. Therefore, the spectral mask can be used as a direct indicators of whether spurious component of one signal exceeds the standard.

Measurement setup key is for detailed setting of relevant parameters of multicarrier measurement, while measurement control key is for single or continuous measurement switch.

4. 2. 18. 2. Measurement Example

This section mainly introduces how to carry out spectrum emission mask measurement of W-CDMA (3GPP) signal (use a signal generator to simulate a W-CDMA signal). SEM will assign power within carrier bandwidth and power within offset channel to compare with power level specified in the Standard.

Step 1: Set signal source as below:

- Set up W-CDMA signals.
- Set frequency on signal source to 1.960 GHz.
- Set signal amplitude to -10dBm.

Step 2: Connect the radio frequency output port of the signal source to that of the analyzer. As shown in Fig. 4.82:

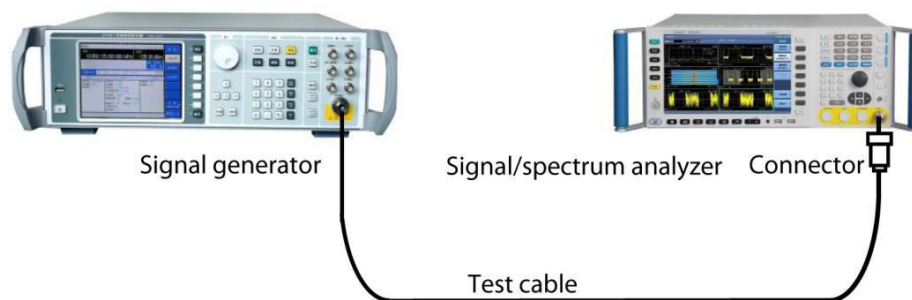


Fig. 4.82 Connection Settings of Spectral Emission Mask Measurements

Step 3: set the analyzer as spectrum analysis mode and activate swept analysis mode:

- Press [Mode] and [Spectrum Analysis].

Step 4: Resetting of analyzer

- Press [Reset] key.

Step 5. Initialize the spectral emission mask measurements:

- Press [Measurement], [Menu 1 / 2 ▶], [Spectral Emission Mask]. Set the measurement function as spectral emission mask measurements.

Step 6: Set up a wireless standard and switch the wireless devices for base station:

- Press [Measurement], [Menu 1/2 ▶], [Wireless Standard ▶], [W-CDMA 3GPP]. Set the wireless standard as W-CDMA.
- Press [Wireless Devices ▶], [BTS].

Switch the wireless devices as BTS.

Step 7. Set the frequency of the analyzer as 1.960 GHz:

- Press [Frequency], [Center Frequency].

Set up the center frequency of the instrument, input 1. 960 GHz.

- Results of spectrum emission mask measurements are shown in Fig. 4.83. Text window shows the reference carrier power and the absolute peak power level within offset band in both sides of the reference channel.



Fig. 4.83 Results of Spectrum Emission Mask Measurements

Step 8. The user can change the measurement parameters:

- Press [Measurement Setting], [Reference Channel ▶].

Users can select and edit measurement parameters of the reference channel as needed.

- Press [Measurement Setting], [Offset / Limited ▶].

Users can select and edit measurement and qualifying parameters of offset channel as required.

4. 2. 19. Display and limit lines

Capability of display and limit lines contribute to further analysis of the measurement trace.

4. 2. 19. 1. Display line

Display line is similar to mark, which can help analyze the measurement trace.

4. 2. 19. 2. Function set of display and limit lines

1) Display line setup

Step 1. Press the key [Display] on the front panel surface.

Step 2. Press soft menu [Display line On / Off], and turn on display line, and the screen will show a green line.

Step 3. Use the numeric keypad, arrow keys or knob to modify the amplitude value of the display line.

2) Settings and functions of the limit line.

Signal / spectrum analyzer can display 6 limit lines simultaneously.

Step 1. Turn on the limit line function:

- Press key [Measurement Setting] on the front panel.
- Press the soft menu [Limit Line ▶], pop up setup sub-menu of limit line function.
- Press [Menu 1 / 2 ▶], [Limit Line Test On / Off], turn on limit line test switch.

Step 2. To edit limit line:

- Press [Measurement Setting], [Limit Line ▶], [Editing ▶], pop up sub-menu of limit line editing, in this case, edit window of the limit line appear, as shown in Fig. 4.84.

ID	Freq	Ampl
1	400.000000 MHz	-147.68 dBm
2	800.000000 MHz	-146.64 dBm
3	1.200000 GHz	-145.90 dBm
4	1.600000 GHz	-145.01 dBm
5	2.040000 GHz	-146.04 dBm

Fig. 4.84 Edit Window of Limit Line

- Press the soft menu [Insert a New Point], and it will automatically generate a new limit line point. The default frequency of the first point is 500 MHz, with amplitude 0 dBm. After the first point, each new point inserted will be created with 500 MHz increased each time based on the above, with default amplitude always as 0 dBm.
- Arrow keys can be used to further edit the generated point of limit line list. Press the soft menu [Frequency] or [Amplitude], and it will modify the frequency or amplitude value of the current edit point.
- Limit line point can be deleted by soft menu [Delete Points].
- [Copy Limit Line ▶] function can copy the selected limit line to the current limit line. Such as, pressing soft menu [Copy Limit Line ▶], [Limit Line 2] can copy all points information of limit line 2 to the current limit line.

Note: This will overwrite the currently edited data of limit line, please be careful!

- [Trace Generation ▶] function will generates a default limit lines based on the currently selected trace data, the default test results of the limit line generated is pass.

Step 3. Save and call limit lines:

- Press [Save Limit Line...] soft menu, pop up Save As dialog box, select save path and save file name, click to save, and it will save the edit data of the current limit line, file name suffixed with ".lim".
- Press [Call Limit Line...] soft menu, pop up file open dialog box, select limit line file which its name suffixed with ".lim", click to open, and reflect the limit line data in the current limit line.

5. Menu

The S3503 Series signal/spectrum analyzer menus comprise: Mode, Measurement, Measurement Setting, Measurement Control, Frequency, Amplitude, Span, Sweep, Bandwidth, Trigger, Marker, Marker->, Marker Function, Peak Search, Trace, Display, Input/Output, Couple, System, File, Print, Save and Help. Detailed menu structure and description will be listed below.

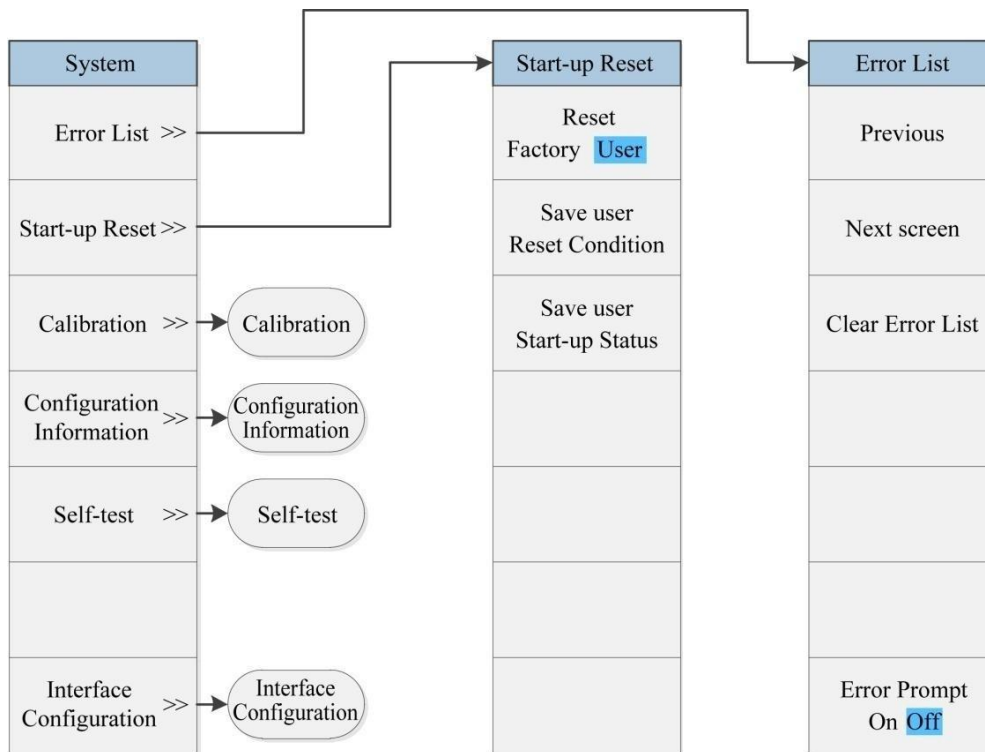
- [Menu structure](#)
- [Menu description](#)

5.1. Menu structure

- [General menu](#)
- [Measurement menu](#)

5.1.1. General menu

5.1.1.1. System



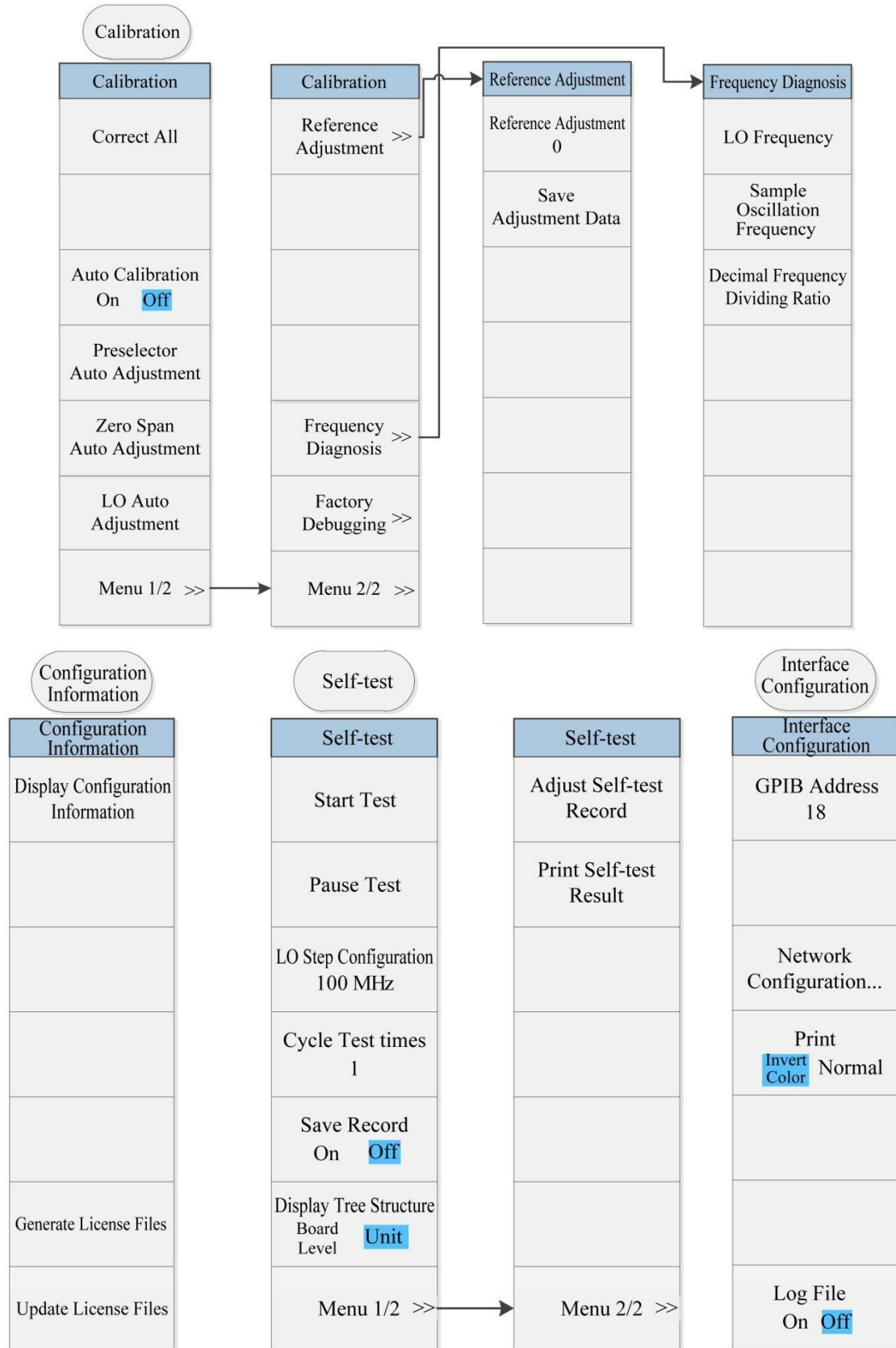


Fig. 5.1-1 System Menu

5. 1. 1. 2. Files

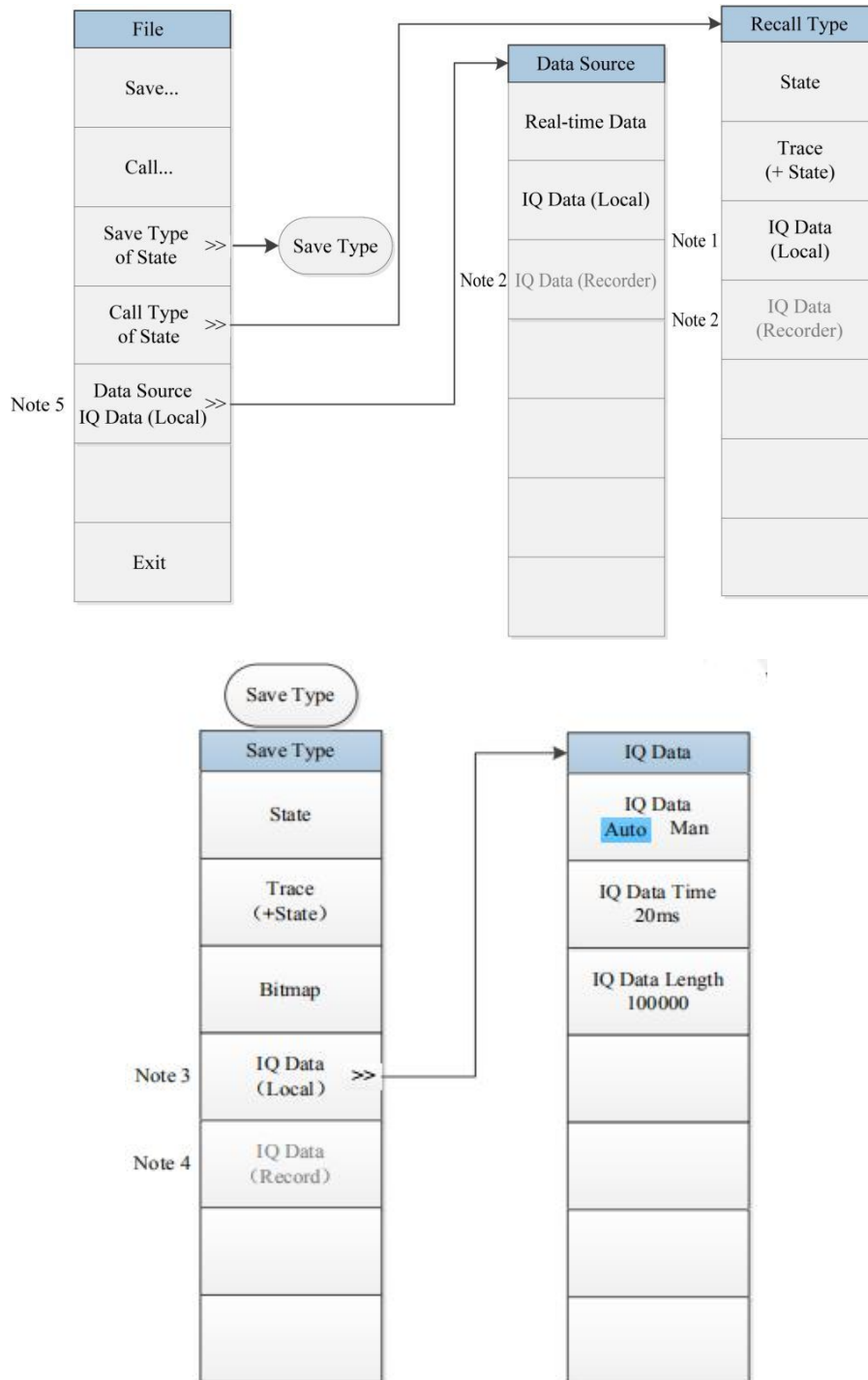


Fig. 5.1-2 File Menu

Note 1: This menu is only enabled under Vector Analysis, Transient Analysis and Pulse Analysis.

Note 2: This menu only appears after Option H22A or H22B (Data Recorder) is purchased and is only enabled under Transient Analysis and Pulse Analysis.

Note 3: This menu is only enabled under Vector Analysis, Transient Analysis, Pulse Analysis and IQ Analysis.

Note 4: This menu only appears after Option H22A or H22B (Data Recorder) is purchased and is only enabled under Transient Analysis and Pulse Analysis.

Note 5: This menu is only enabled under Vector Analysis, Transient Analysis and Pulse Analysis.

5. 1. 1. 3. Mode

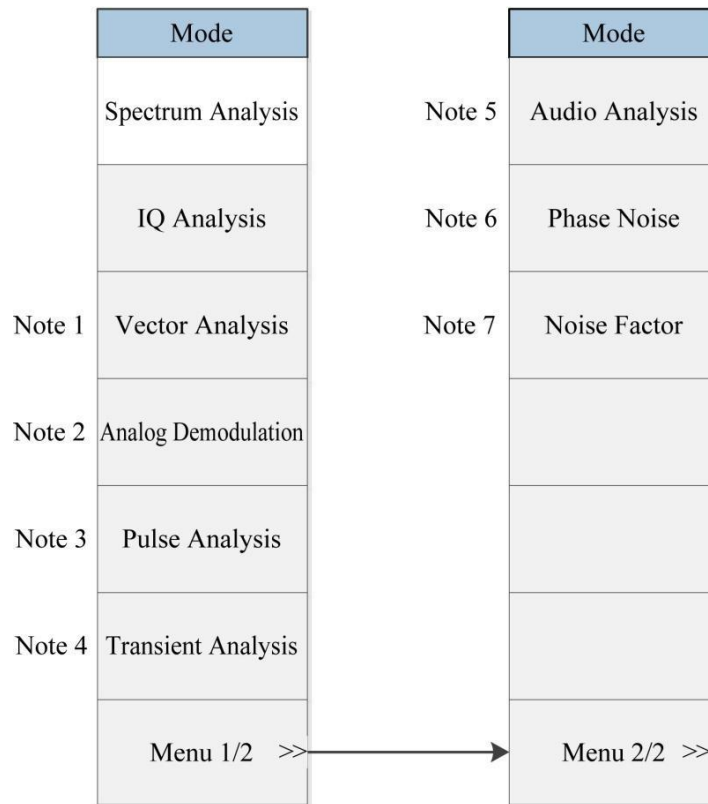


Fig. 5.1-3 Mode Menu

Note 1: this menu is only available when the S12 option (Digital Modulation Signal Analysis) is purchased.

Note 2: this menu is only available when the S09 option (Analog Demodulation Analysis) is purchased.

Note 3: this menu is only available when the S13 option (Pulse Signal Analysis) is purchased.

Note 4: this menu is only available when the S10 option (Transient Analysis) is purchased.

Note 5: this menu is only available when the S08 option (Audio Analysis) is purchased.

Note 6: this menu is only available when the S04 option (Phase Noise Test) is purchased.

Note 7: this menu is only available when the S05 option (Noise Factor Test) is purchased.

5. 1. 1. 4. Reset

5. 1. 1. 5. Print

5. 1. 1. 6. Help

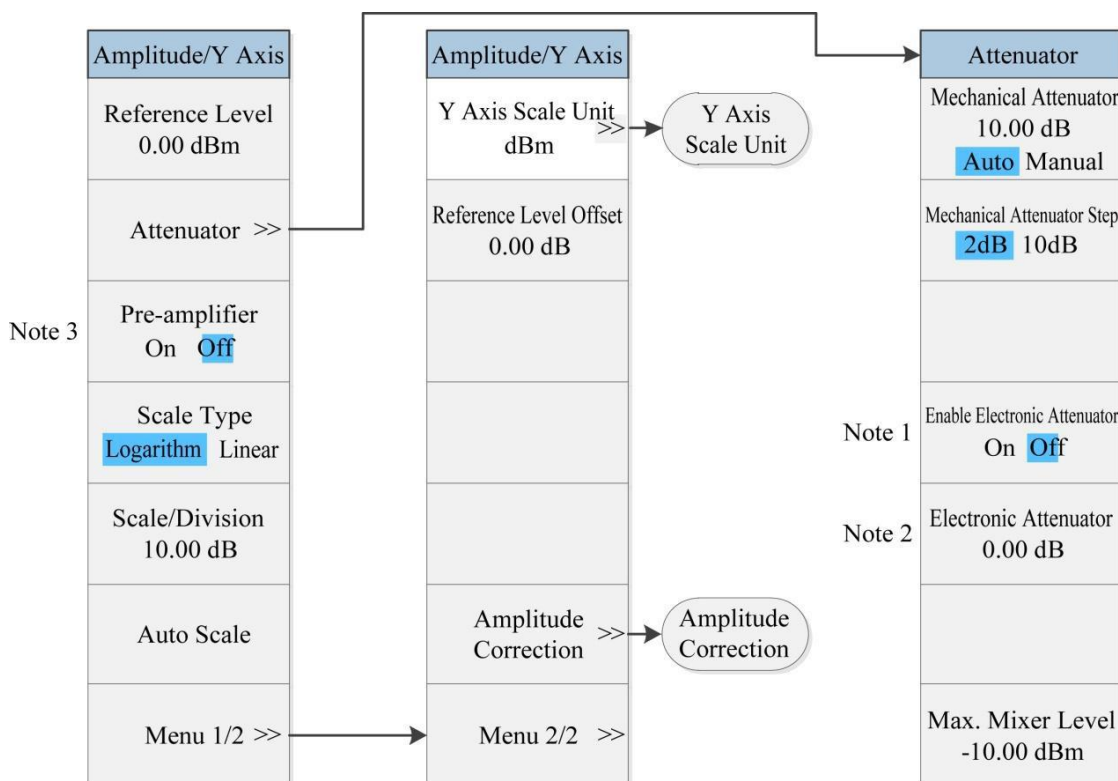
5. 1. 2. Measurement Menu

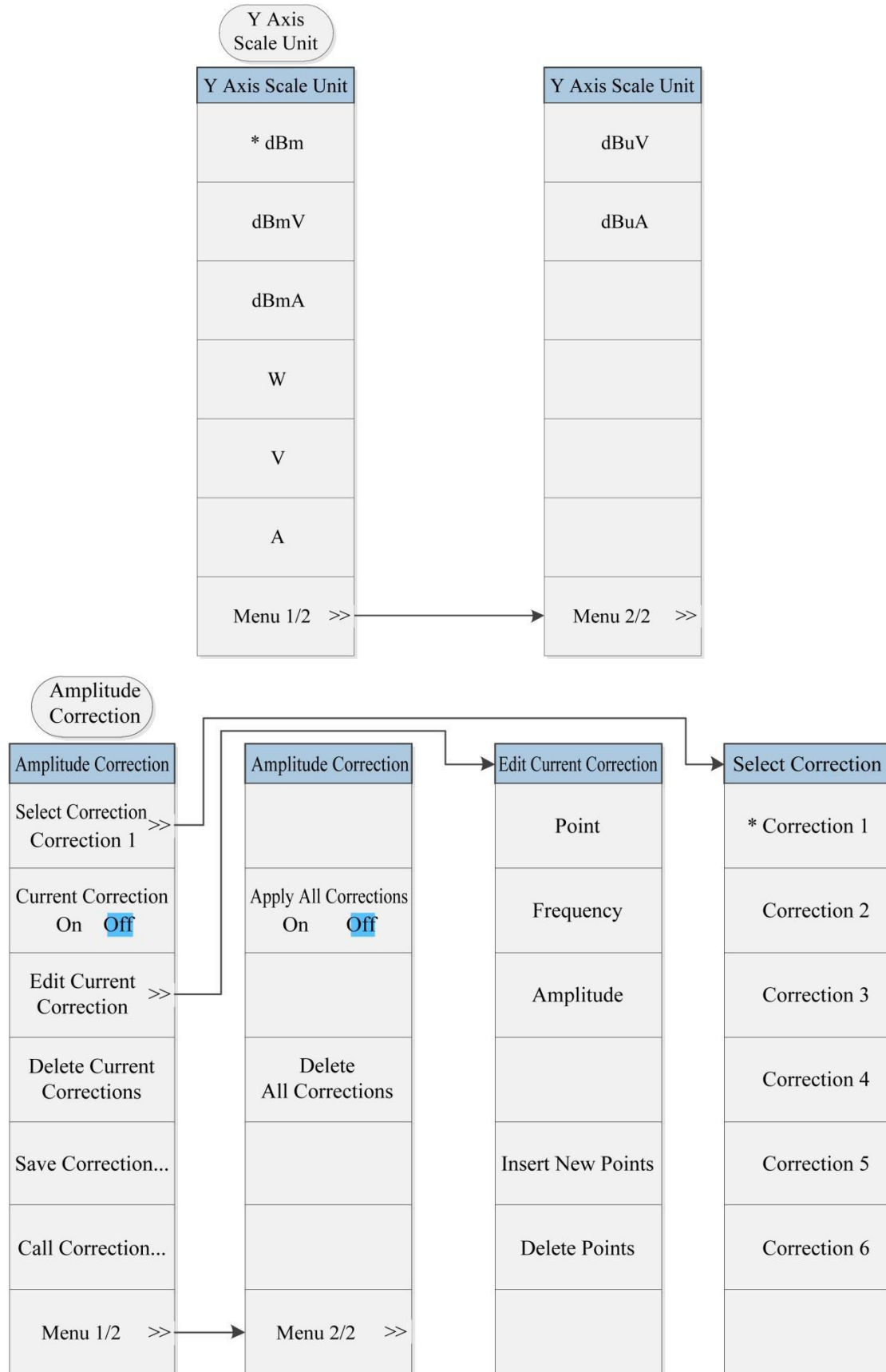
5. 1. 2. 1. Frequency

Frequency
Center frequency 13.250000 GHz
Starting frequency 0.000000 GHz
Ending frequency 26.500000 GHz
Frequency step 10.0000MHz Auto Manual
Frequency Offset 0.000000 GHz
Auto Tune
Signal Track On Off

Fig. 5 2-1 Frequency Menu

5. 1. 2. 2. Amplitude/Y Axis





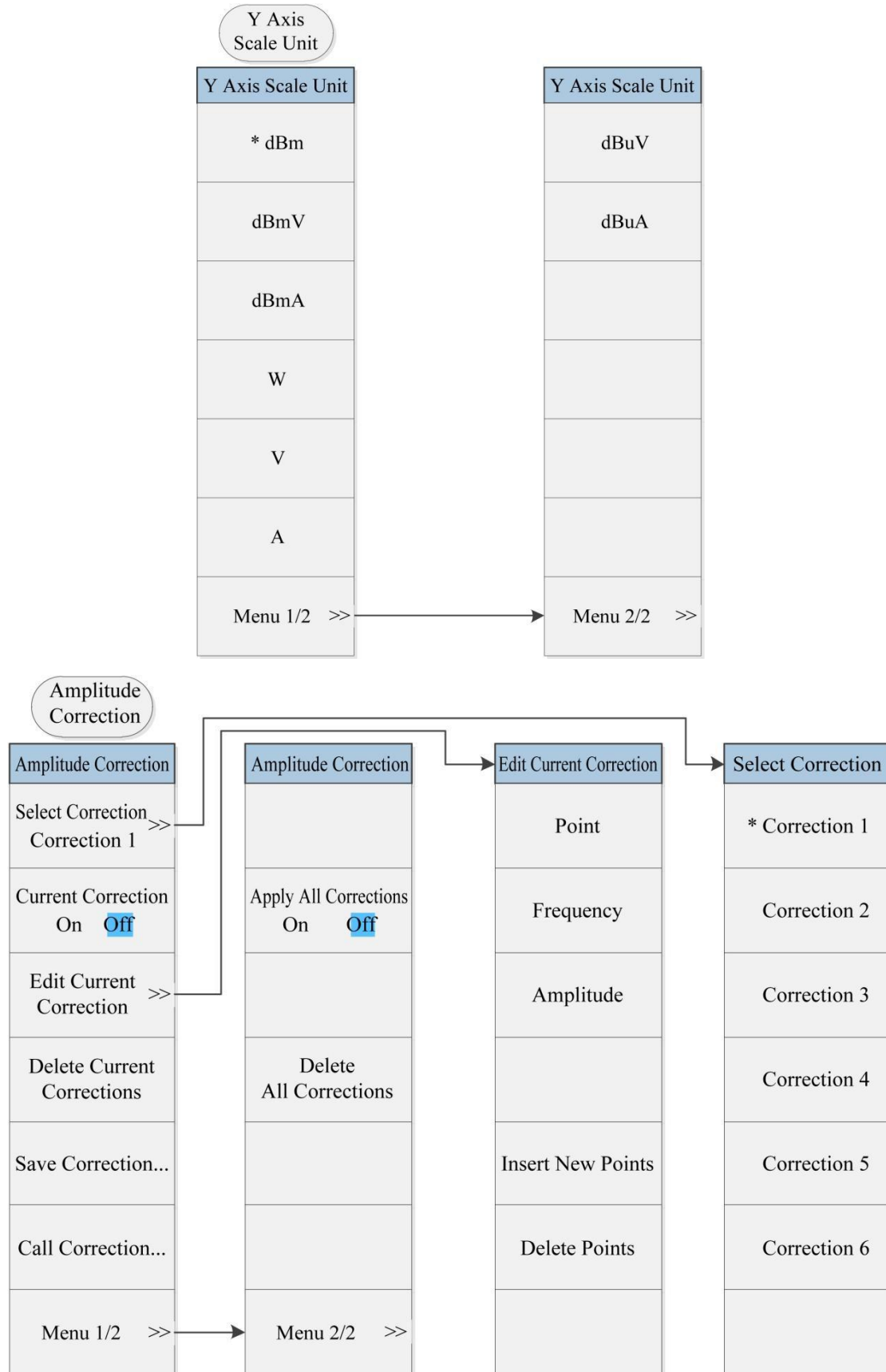


Fig. 5.2-2 Amplitude/Y Axis Menu

Note 1: this menu is only available when the H33 option (Electronic Attenuator) is purchased.

Note 2: this menu is only available when the H33 option (Electronic Attenuator) is purchased.

Note 3: this menu is only available when the H34 option (Low Noise Preamp) is purchased.

5. 1. 2. 3. **Span/X Axis**

Span
Span 40.000000 GHz
Full Span
Zero Span
Previous Span

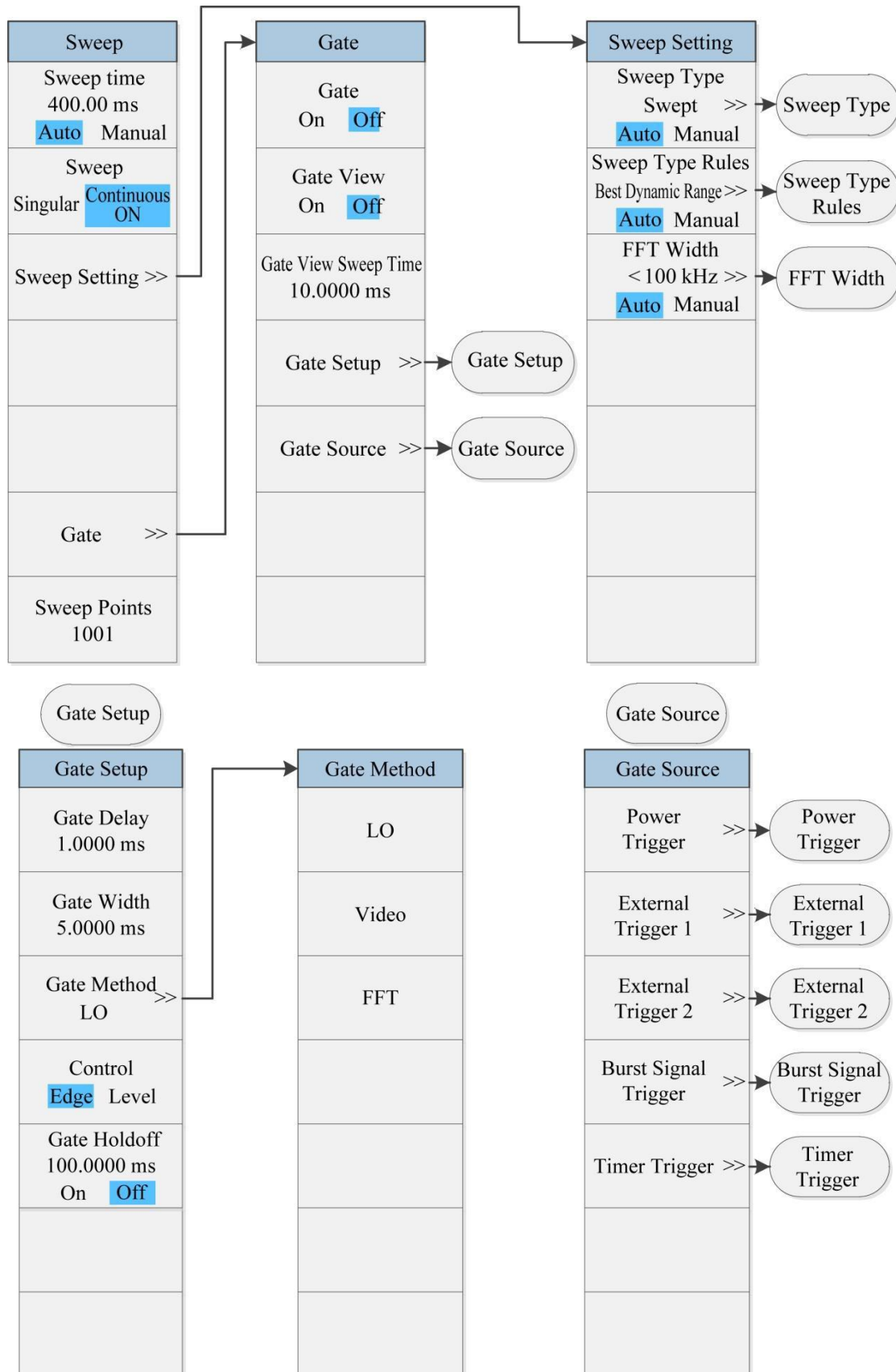
Fig. 5.2-3 Span Menu

5. 1. 2. 4. **Bandwidth**

Bandwidth	
Resolution bandwidth 30.00 kHz Auto Manual	
Video Bandwidth 30.00 kHz Auto Manual	
VBW/RBW 1.000 Auto Manual	
Span/RBW 106 Auto Manual	
Filter Type >> Gaussian	Filter Type
	* Gaussian
	Top Flat

Fig. 5.2-4 Bandwidth Menu

5. 1. 2. 5. Sweep



Sweep Type	Sweep Type Rules	FFT Width	Power Trigger
Sweep Type	Sweep Type Rules	FFT Width	Gate Source Setting
Auto	Auto	Auto	
* Swept	* Best Dynamic Range	* < 100 kHz	Gate Source Polarity Positive Negative
FFT	Best Speed	< 3 MHz	
		< 13 MHz	
		≤ Maximum Value	

External Trigger 1	External Trigger 2	Burst Signal Trigger	Timer Trigger
Gate Source Setting	Gate Source Setting	Gate Source Setting	Gate Source Setting
Trigger level 1.20 V	Trigger level 1.20 V	Trigger level -20.00 dBm	Select Sync Source >> Off
Gate Source Polarity Positive Negative	Gate Source Polarity Positive Negative	Gate Source Polarity Positive Negative	Select Sync Source
			Timer Period 100.0000 ms
			Timer Offset 100.0000 ms
			Sync Holdoff 100.0000 ms

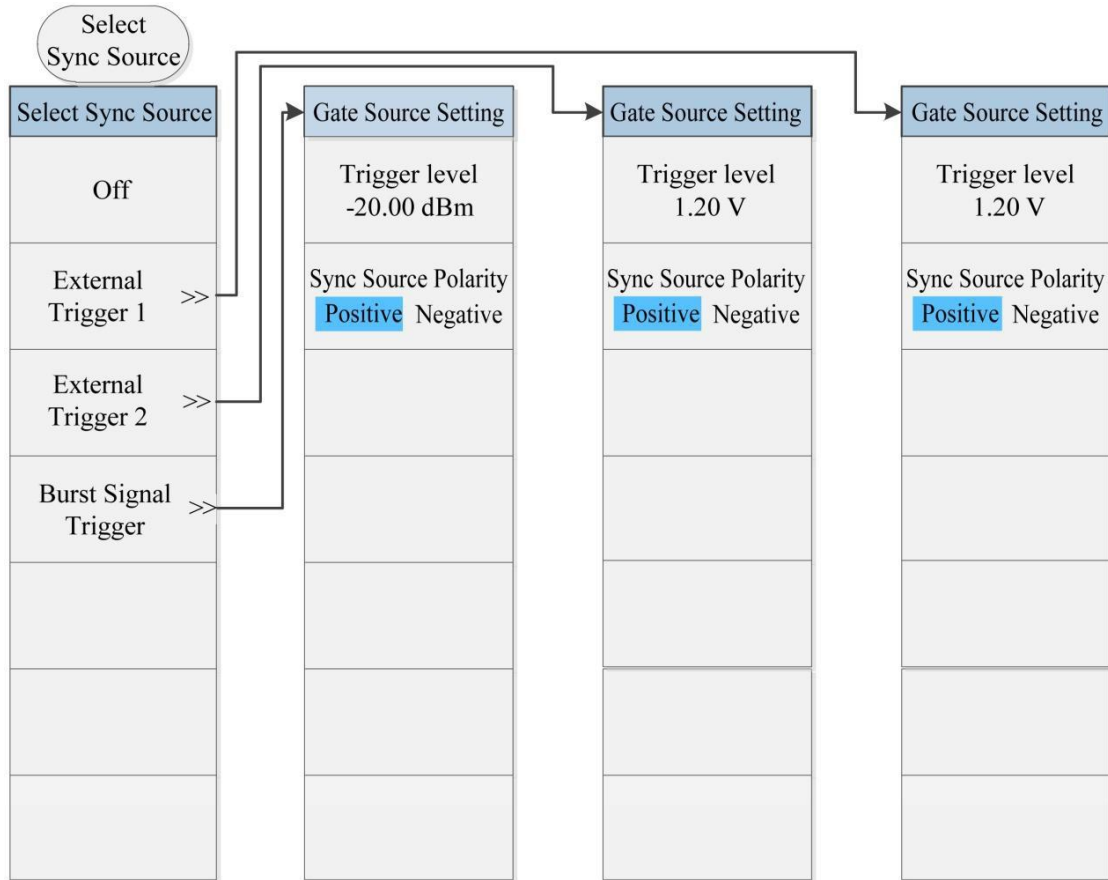
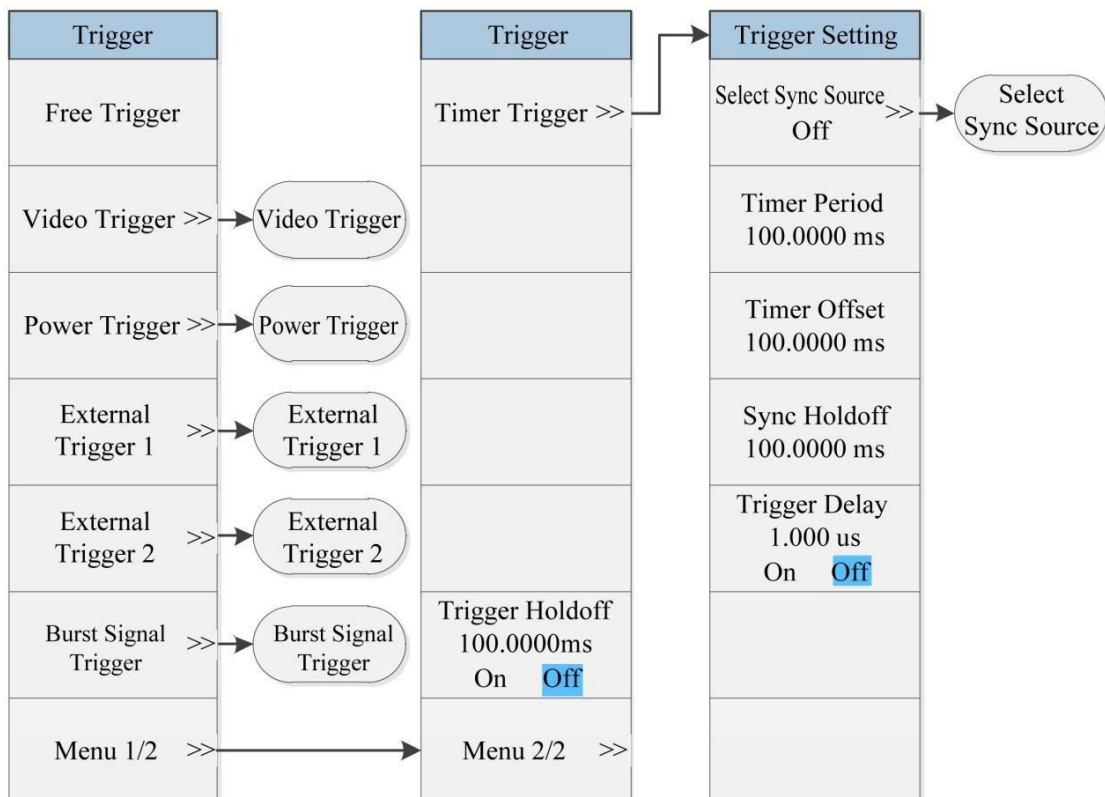


Fig. 5.2-5 Sweep Menu

5. 1. 2. 6. Trigger



Burst Signal Trigger	External Trigger 2	External Trigger 1	Power Trigger	Video Trigger
Trigger Setting	Trigger Setting	Trigger Setting	Trigger Setting	Trigger Setting
Trigger level -25.00 dBm	Trigger level 1.2 V	Trigger level 1.2 V		Trigger level -25.00 dBm
Trigger Polarity Positive Negative	Trigger Polarity Positive Negative	Trigger Polarity Positive Negative	Trigger Polarity Positive Negative	Trigger Polarity Positive Negative
Trigger Delay 100.00 ms On Off	Trigger Delay 100.00 ms On Off	Trigger Delay 100.00 ms On Off	Trigger Delay 100.00 ms On Off	Trigger Delay 100.00 ms On Off

Burst Signal Trigger	External Trigger 2	External Trigger 1	Power Trigger	Video Trigger
Trigger Setting	Trigger Setting	Trigger Setting	Trigger Setting	Trigger Setting
Trigger level -25.00 dBm	Trigger level 1.2 V	Trigger level 1.2 V		Trigger level -25.00 dBm
Trigger Polarity Positive Negative	Trigger Polarity Positive Negative	Trigger Polarity Positive Negative	Trigger Polarity Positive Negative	Trigger Polarity Positive Negative
Trigger Delay 100.00 ms On Off	Trigger Delay 100.00 ms On Off	Trigger Delay 100.00 ms On Off	Trigger Delay 100.00 ms On Off	Trigger Delay 100.00 ms On Off

Fig. 5.2-6 Trigger Menu

5. 1. 2. 7. **Measurement**

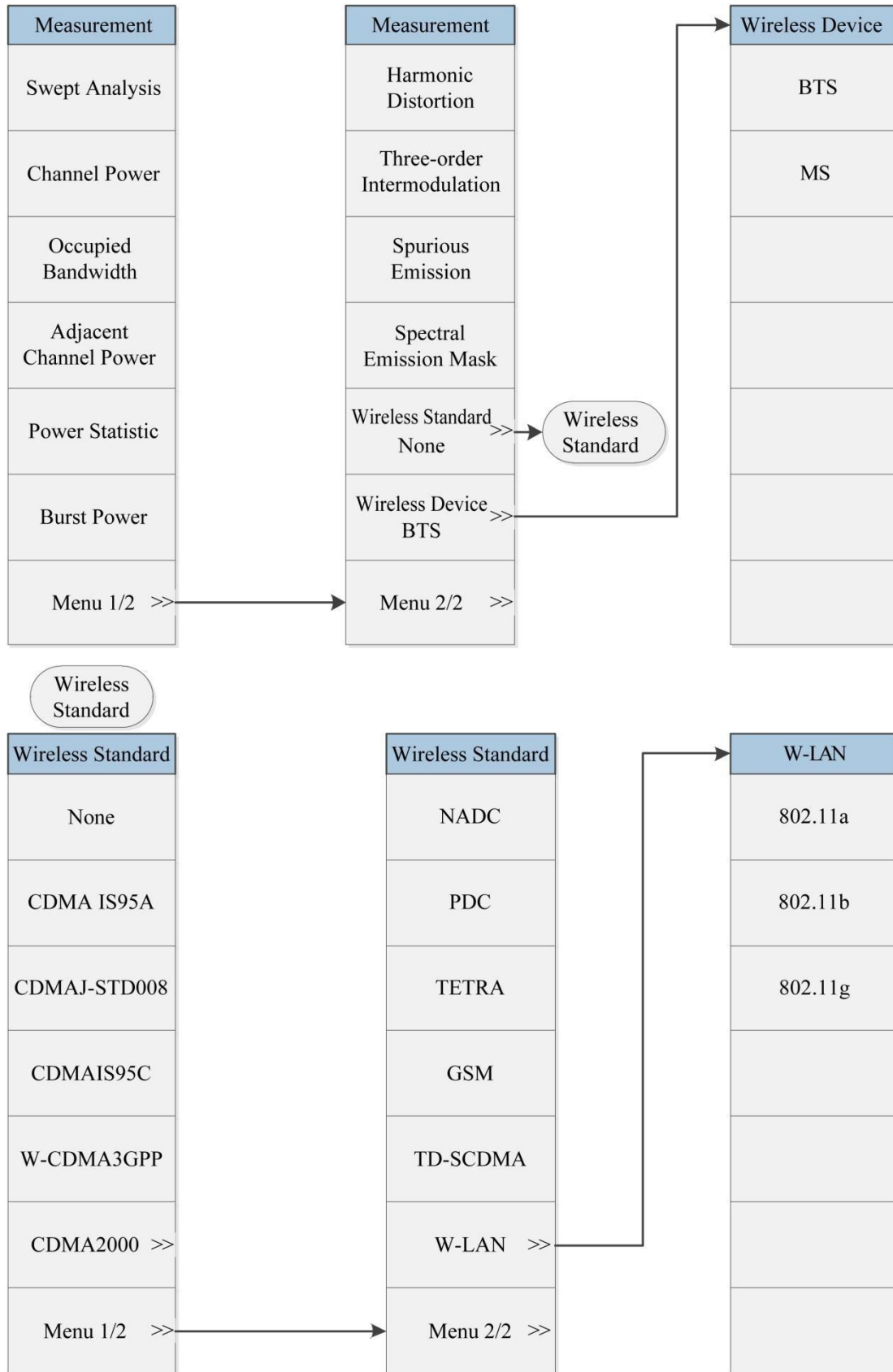
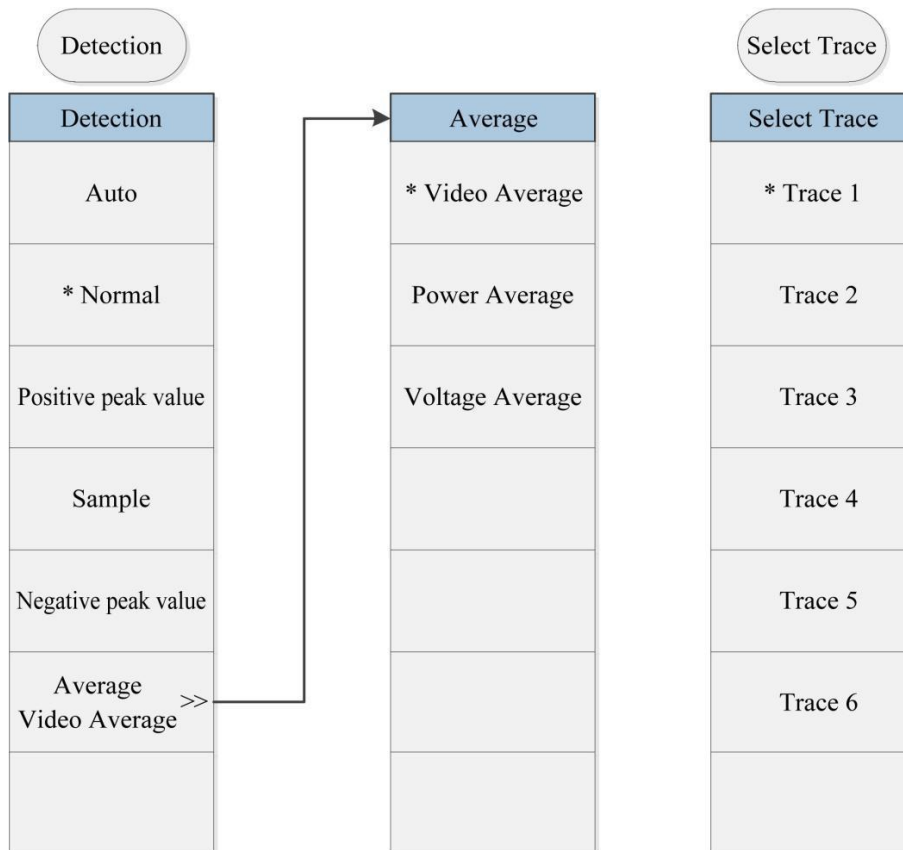
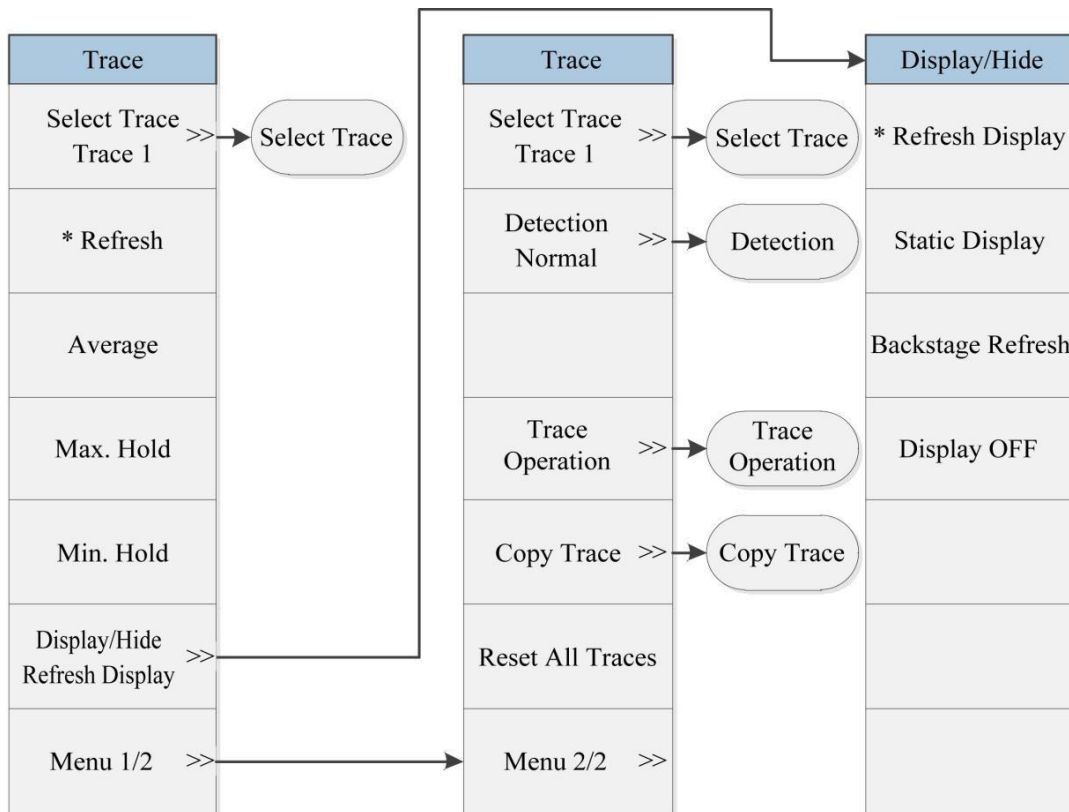


Fig. 5.2-7 Measurement Menu

5. 1. 2. 8. Trace



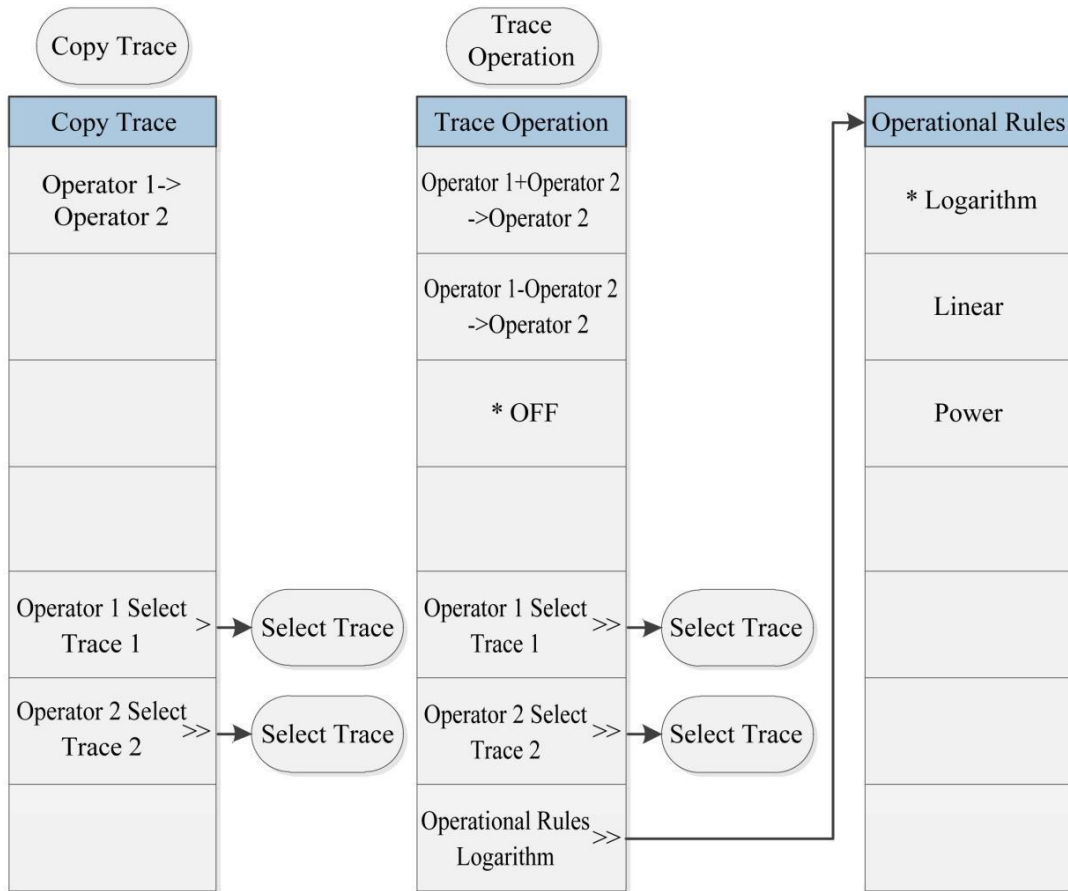
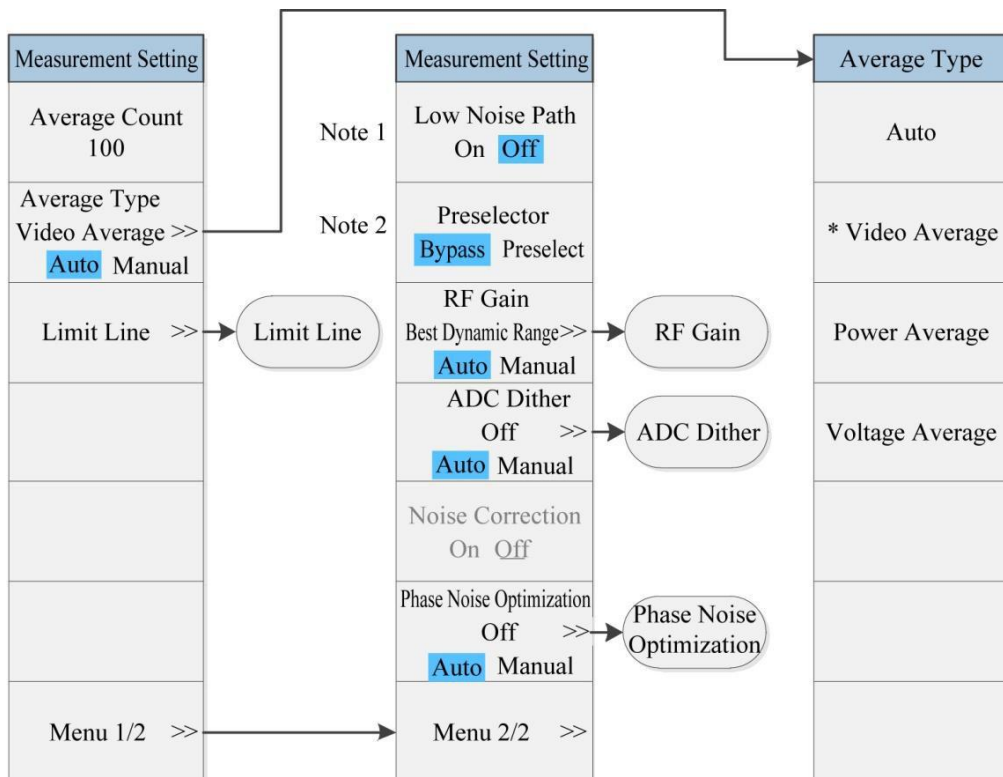
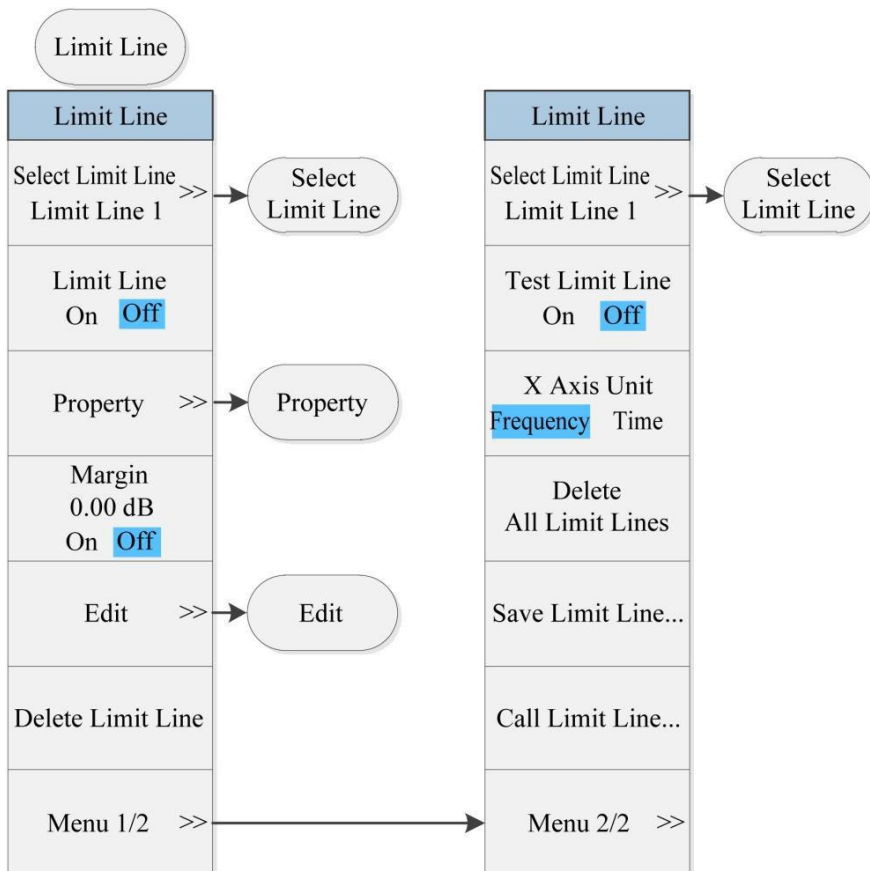
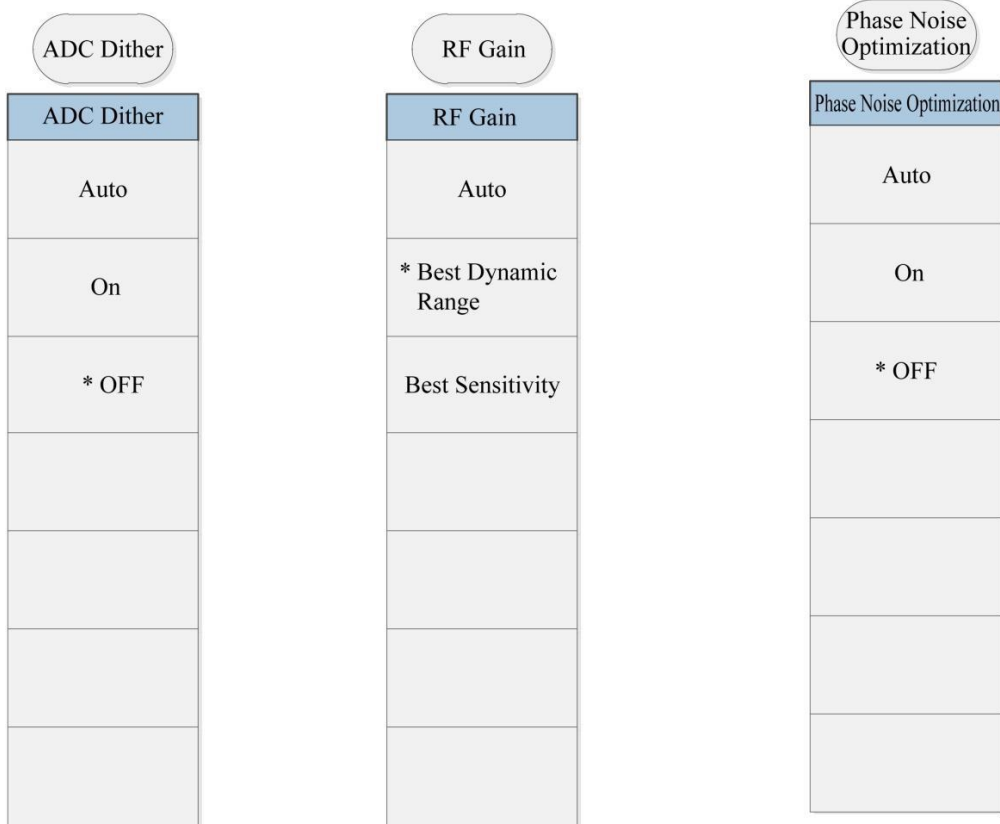


Fig. 5.2-8 Trace Menu

5. 1. 2. 9. Measurement Setting





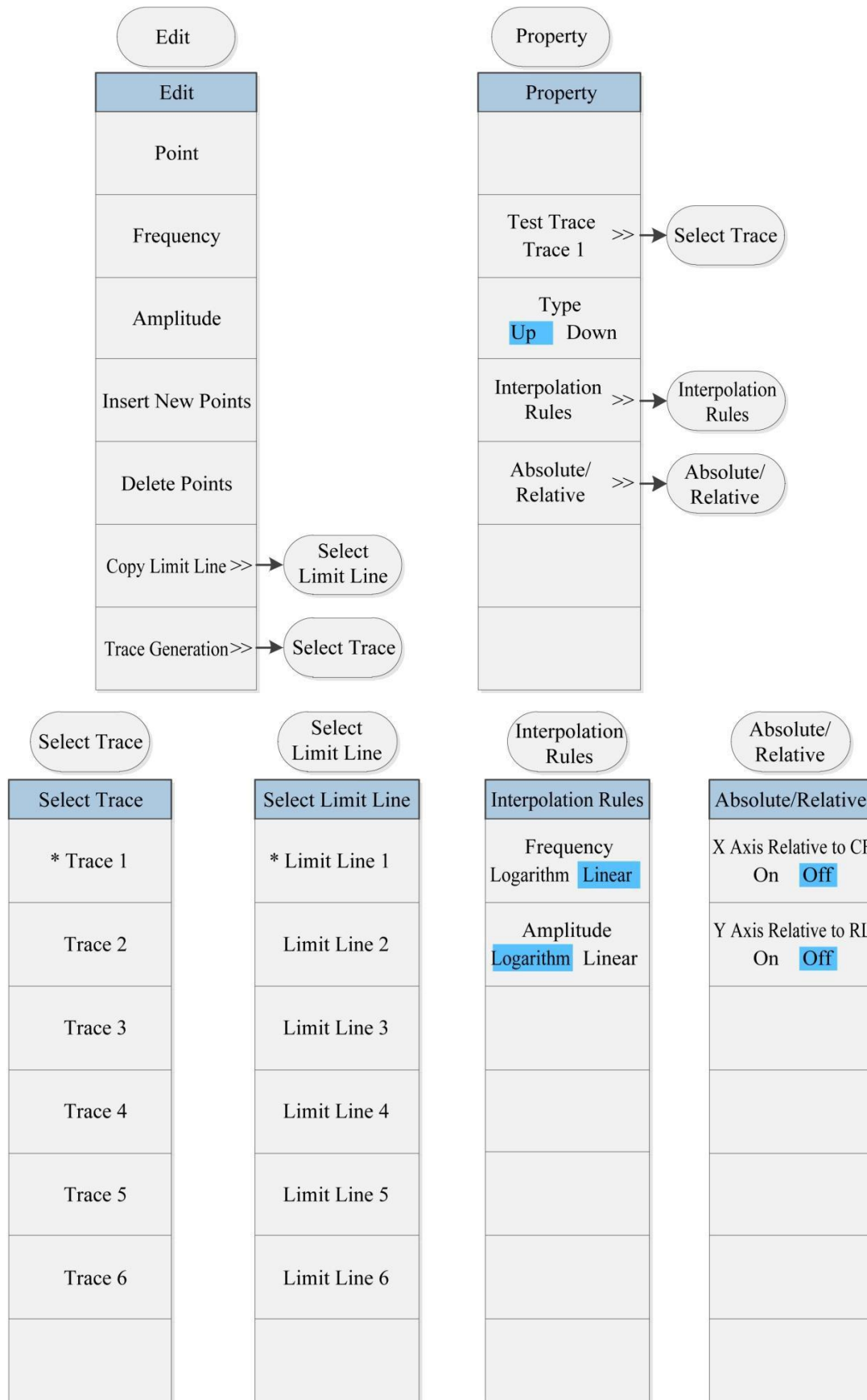


Fig. 5.2-9 Measurement Setting Menu

Note 1: this menu is only available when the H34 option (Low Noise Preamplifier) is purchased. When the preamplifier is ON, the Low Noise Path is OFF and this menu is grayed out; when the preamplifier is OFF, this menu lights on and is switchable.

Note 2: this menu is only available when the H36 option (Preselector Bypass) is purchased.

5. 1. 2. 10. Measurement Control

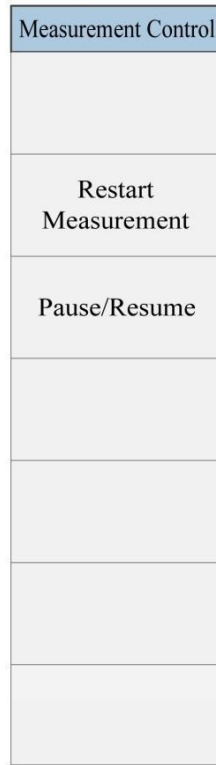


Fig. 5.2-10 Measurement Control Menu

5. 1. 2. 11. Auto Setting

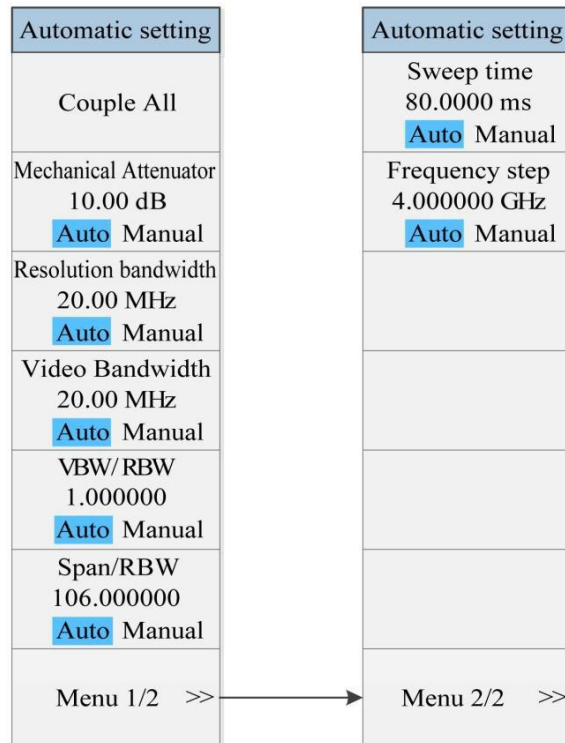


Fig. 5.2-11 Auto Setting Menu

5. 1. 2. 12. Display

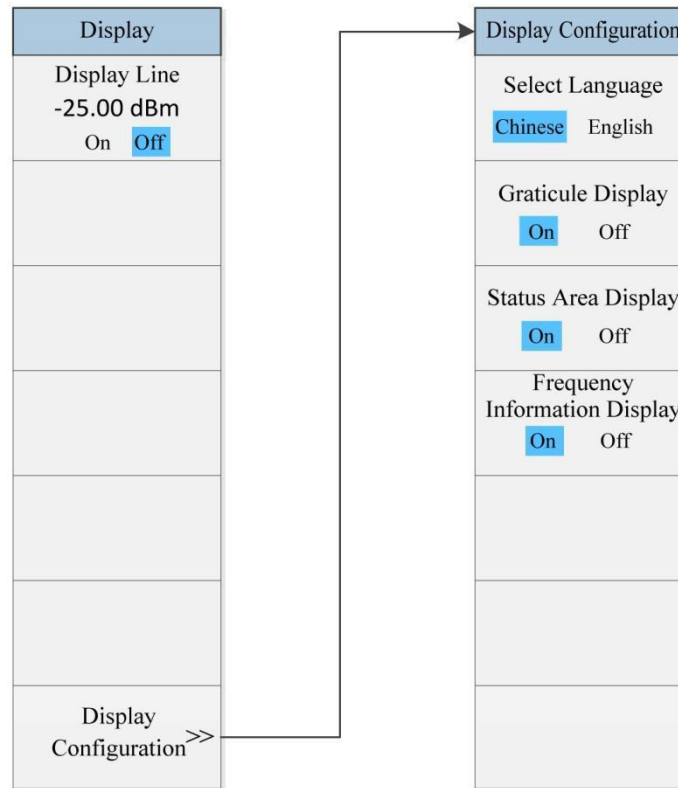
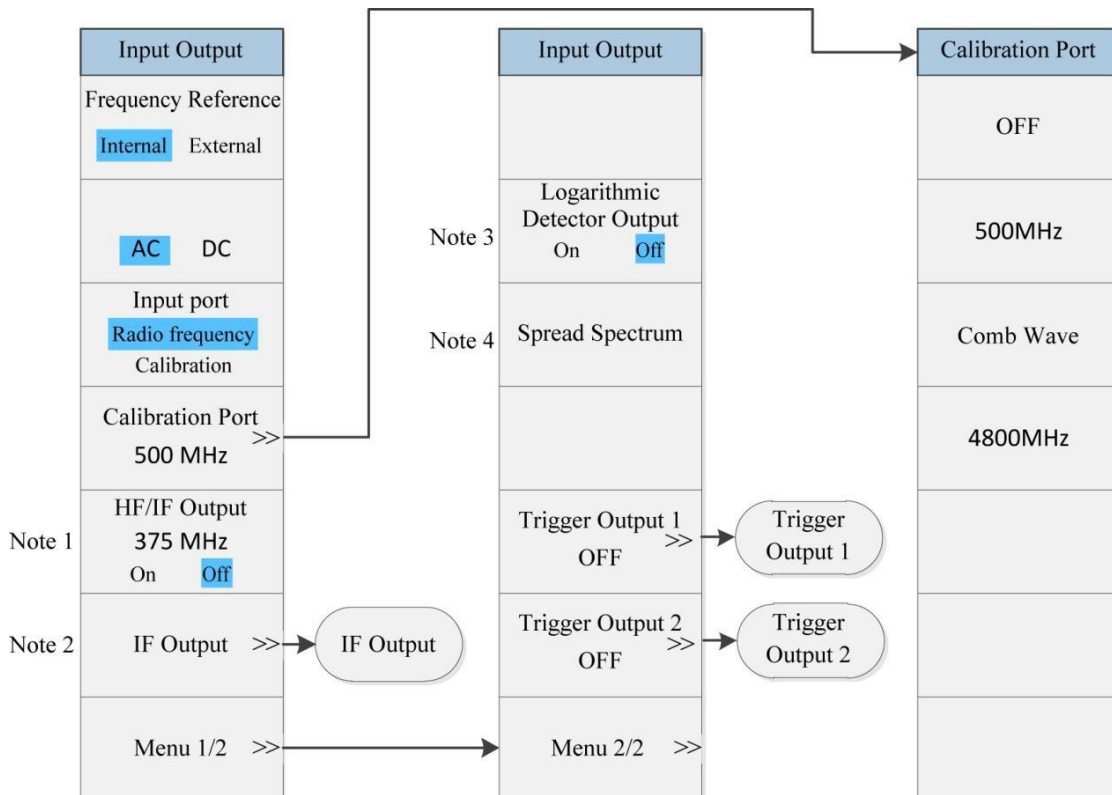


Fig. 5.2-12 Display Menu

5. 1. 2. 13. Input Output



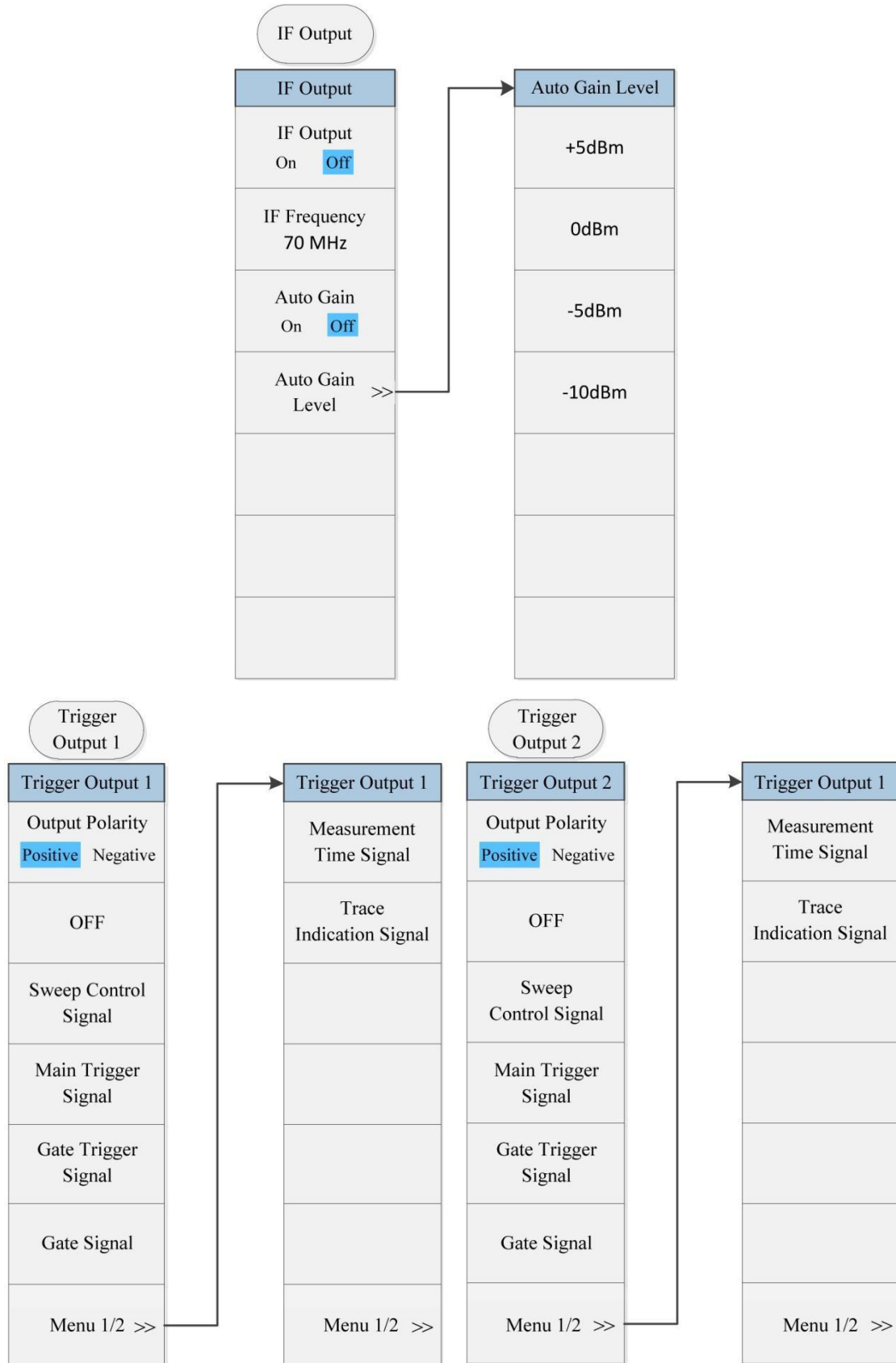


Fig. 5.2-13 Input/Output Menu

Note 1: this menu is only available when the H02 option (HF/IF Output) is purchased.

Note 2: this menu is only available when the H03 option (IF Output) is purchased.

Note 3: this menu is only available when the H08 option (Logarithmic Detector Output) is purchased. Note 4: this menu is only available when the H40 option (MMV Spread Spectrum) is purchased.

5. 1. 2. 14. Marker

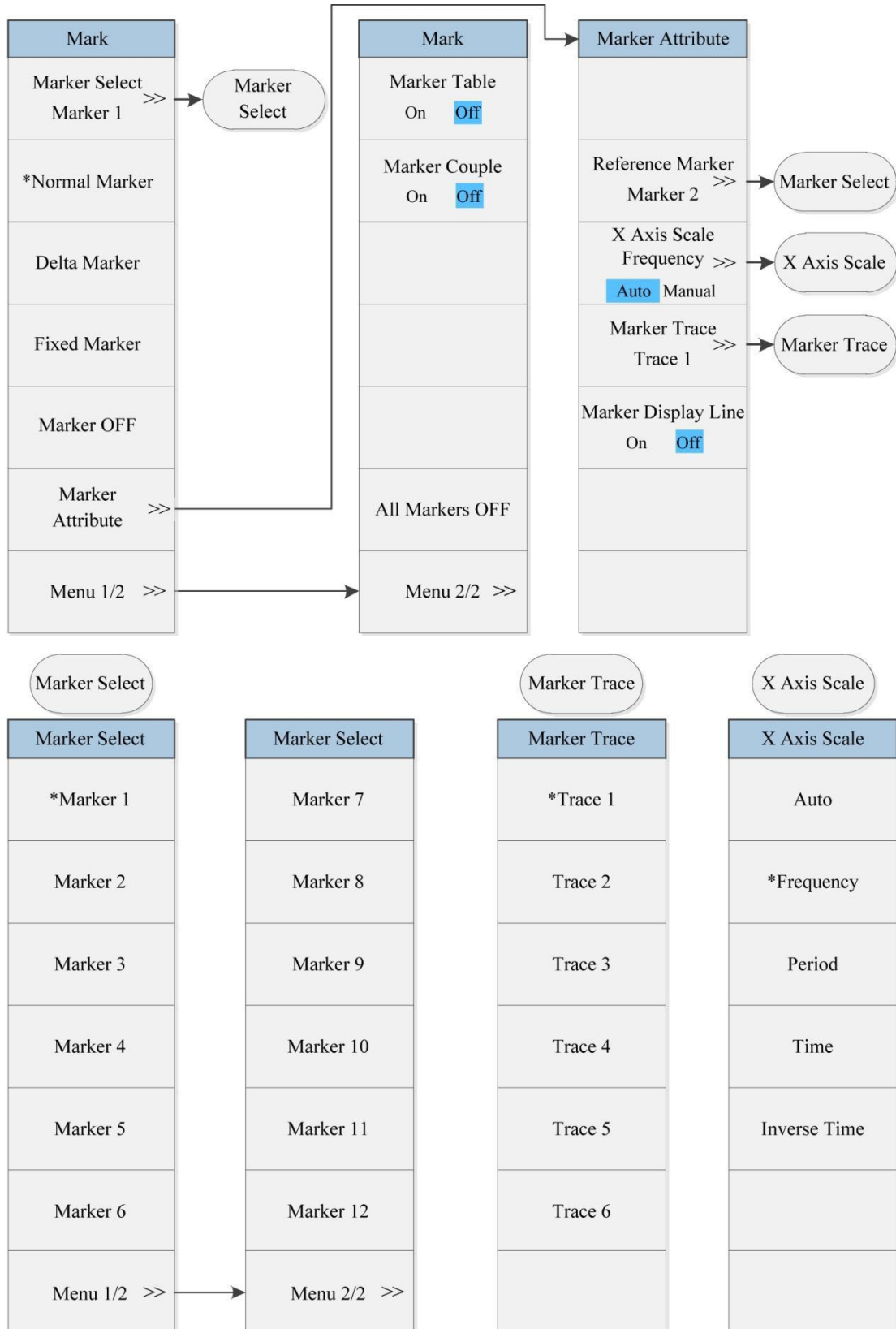


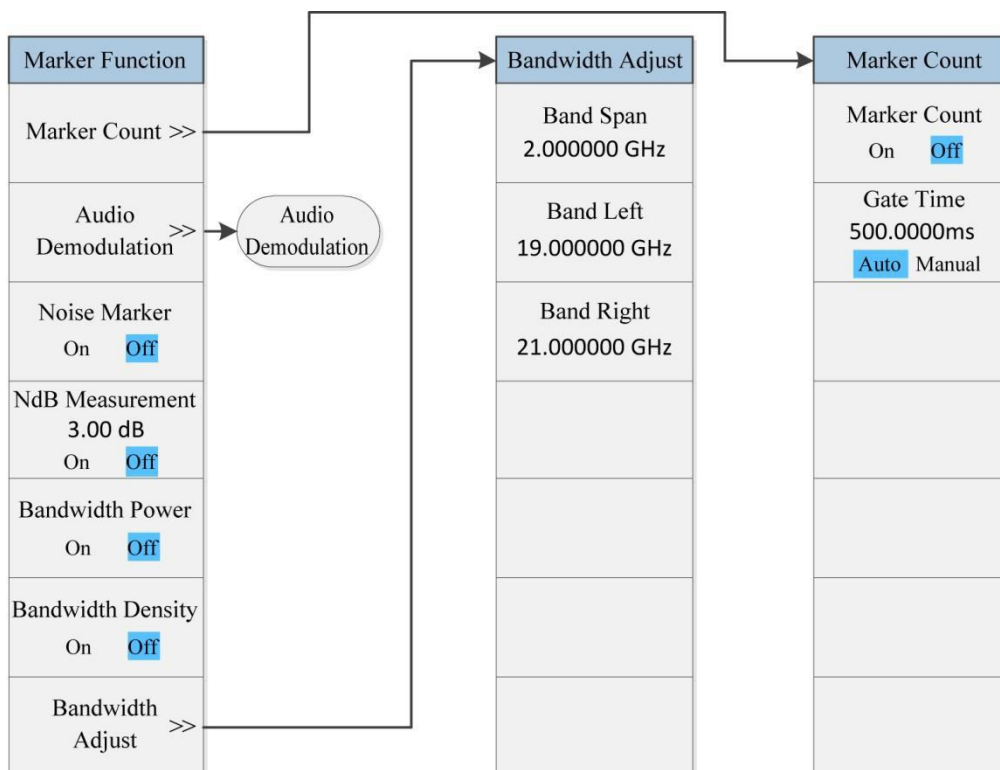
Fig. 5.2-14 Marker Menu

5. 1. 2. 15. Marker->

Marker ->
Marker -> Center Frequency
Marker -> Frequency Step
Marker -> Start Frequency
Marker -> Stop Frequency
Delta Marker > Span
Delta Marker -> Center
Marker -> Reference Level

Fig. 5.2-15 Marker->Menu

5. 1. 2. 16. Marker Function



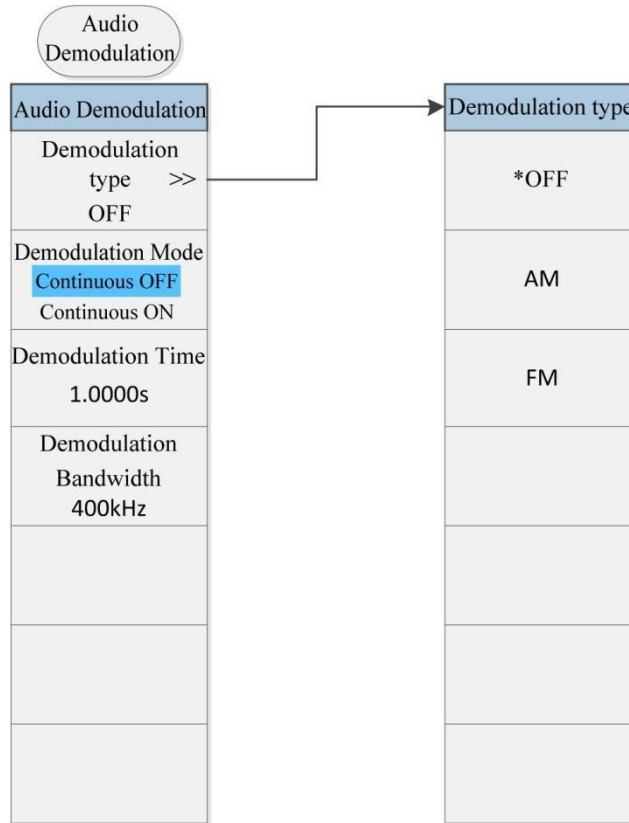
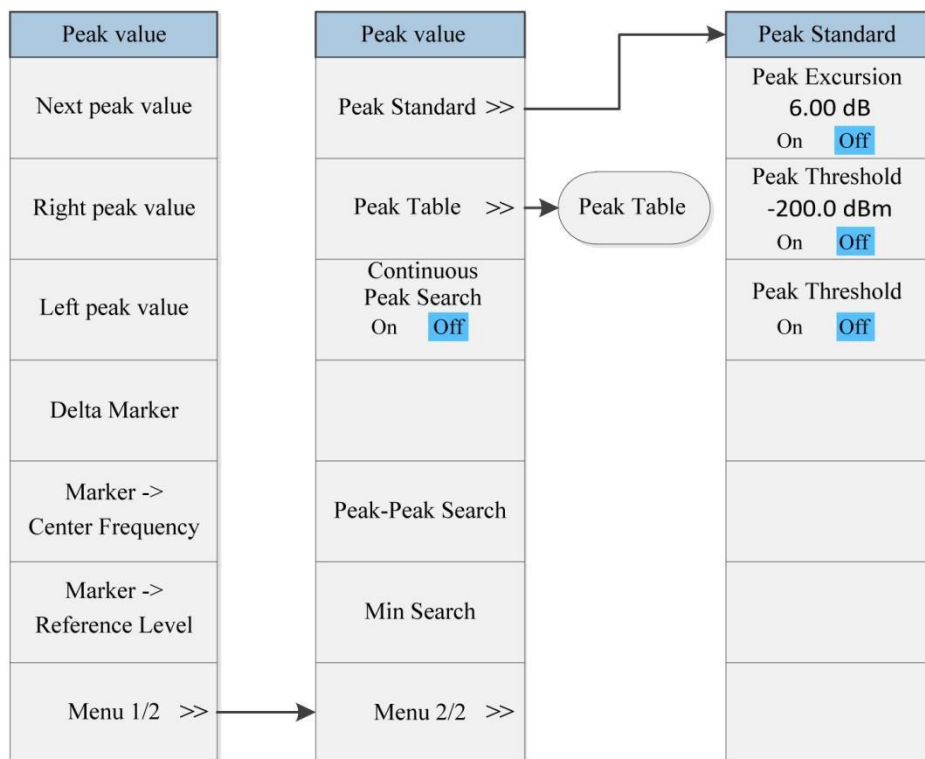


Fig. 5.2-16 Marker Function Menu

5. 1. 2. 17. Marker Search



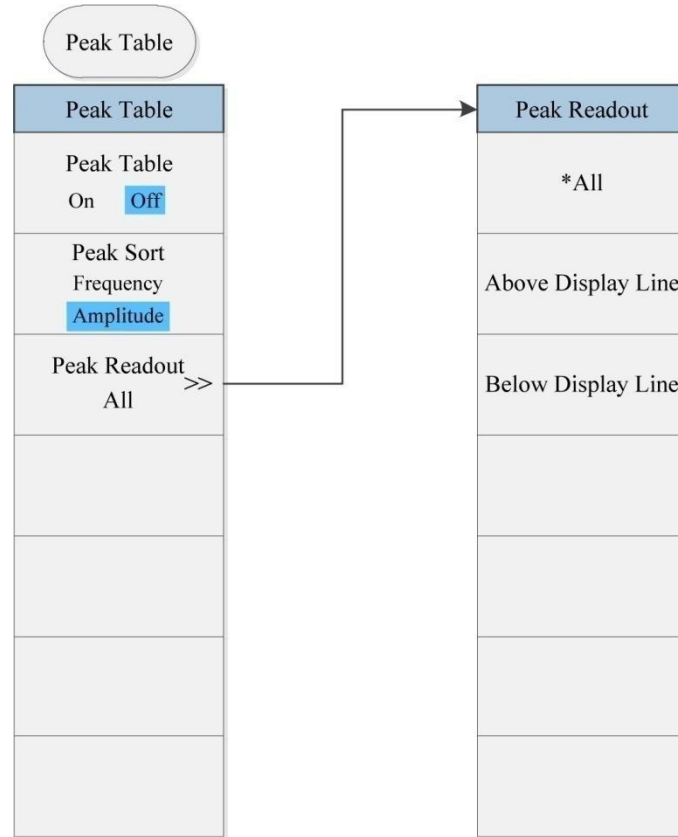


Fig. 5.2-17 Peak Search Menu

5. 2. Description of menu

This section introduces the details of the functions, parameters, etc. of menu items.

- General
- Spectrum Analysis
- Channel Power
- Occupied Bandwidth
- Adjacent Channel Power
- Power Statistic
- Burst Power
- Harmonic Distortion
- Three-order Intermodulation
- Spurious Emission
- Spectral Emission Mask

5. 2. 1. General

5. 2. 1. 1. System

Press the [System Key] to pop up soft menus related to system configuration, including [Error List ▶], [Start-up Reset ▶], [Calibration ▶], [Configuration Information ▶], [Self-test ▶], [Interface Configuration ▶].

[Error List ▶]

Pop up a list displaying current errors of the instrument. When the instrument has any error, the error information prompt column at the screen bottom will provide error prompt.

This menu has no corresponding remote commands, and is mainly for local usage.

[Previous]

When the error list is displayed in several pages, through this menu, you can display previous page. If current page is first page, this menu is unresponsive.

[Next]

When the error list is displayed in several pages, through this menu, you can display next page. If current page is last page, this menu is unresponsive.

[Clear Error List]

Clear all information of current error list. [Error Prompt ON OFF]

With this menu, you can enable or disable the error information prompt column information at the screen bottom. Under default setting, the Error Prompt is ON.

[Start-up Reset ▶]

Pop up three soft menus including [Reset Factory User], [Save User Reset Status], [Save User Start-up Status].

[Reset Factory User]

With the menu, you can select whether the instrument executes Factory Reset or User Reset when the [Reset] key on the front panel is selected for reset. Under default setting, the instrument executes User Reset. If the user fails to save the User Reset Status, the instrument will keep current status.

[Save User Reset Status]

With this menu, you can save the current working status of instrument as User Reset Status. If the [Reset Factory User] is selected as User, when the [Reset] key on the front panel is selected for reset, the instrument working status will automatically recover to the User Reset Status.

[Save User Start-up Status]

With this menu, you can save the current working status of instrument as User Start-up Status. If the user has saved the User Start-up Status, at every start-up, the instrument working status will automatically be User Start-up Status; if not, the instrument working status will automatically be Factory Start-up Status.

[Calibration ▶]

Pop up sub-menus related to calibration, including [Calibrate All], [Auto Calibration ON OFF], [Frequency Diagnosis ▶], [LO Auto Adjustment].

[Calibrate All]

With this menu, you can calibrate all parameters of the signal/spectrum analyzer. Every calibration takes several minutes in general.

- **Program control commands:**

:CALibration[:ALL]

- **Examples:**

:CAL

[Auto Calibration ON OFF]

Control ON and OFF of the Auto Calibration. Under default setting, this function is ON. The signal/spectrum analyzer will automatically judge whether to calibrate any parameters based on start-up time and internal temperature change. When [Auto Calibration ON OFF] is set as ON, automatic calibration will be taken 15 minutes after start-up. If within 15 minutes, the instrument detects that the internal temperature change exceeds 10 °C, the instrument will automatically stop current test and conduct auto calibration. After calibration, the instrument will proceed measurement. For every change of 10 °C for the internal temperature, the instrument takes one auto calibration. You can set the Auto Calibration as OFF to avoid interruption of normal measurement by Auto Calibration. However, the measurement results may be affected if there is large internal temperature change or the auto calibration fails to be taken for a long time.

- **Program control commands:**

:CALibration:AUTO OFF|ON

:CALibration:AUTO?

- **Examples:**

:CAL:AUTO OFF

[Frequency Diagnosis ▶]

Display soft menus related to frequency diagnosis, including [LO Frequency], [Sample Oscillation Frequency] and [Decimal Frequency Dividing Ratio].

Note: in multi-band sweep, the displayed frequency corresponds to the start frequency of the corresponding band for which the oscillator sweeps.

This menu has no corresponding remote commands, and is mainly for local usage.

[LO Frequency]

Display the start frequency of the first LO of the current band. This menu has no corresponding remote commands, and is mainly for local usage.

[Sample Oscillation Frequency]

Display the sample oscillator frequency to which the current band start frequency corresponds and the compensation value of the sample loop bandwidth. This menu has no corresponding remote commands, and is mainly for local usage.

[Decimal Frequency Dividing Ratio]

Display the decimal frequency dividing ratio to which the current band start frequency corresponds. This menu has no corresponding remote commands, and is mainly for usage by local debugger.

[Preselector Auto Adjustment]

With this menu, you can take auto calibration of the preselector center frequency to ensure accuracy and consistency of instrument measurement. This menu has no corresponding remote commands, and is mainly for local usage.

[Zero Span Auto Adjustment]

Realize auto amplitude adjustment for zero span signal to meet test requirements on low frequency signal. This menu has no corresponding remote commands, and is mainly for local usage.

[LO Auto Adjustment]

With this menu, you can control the instrument optimized setting of LO control parameters. In case of sharp change of working environment or internal temperature, the control parameters of internal LO circuit module may in need of change to guarantee normal and stable operation of the LO circuit. The signal/spectrum analyzer will automatically optimize the setting of LO control parameters based on start-up time and internal temperature change. With this menu, you can manually control the instrument optimized setting of LO control parameters.

This menu has no corresponding remote commands, and is mainly for local usage.

[Reference Adjustment ▶]

Pop up soft menus related to reference adjustment. The soft menus include [Reference Adjustment] and [Save Adjustment Data]. This menu has no corresponding remote commands, and is mainly for local usage.

[Reference Adjustment]

When the frequency test accuracy is reduced due to crystal oscillator aging, you can use this menu to calibrate crystal oscillator to improve instrument frequency test accuracy.

This menu has no corresponding remote commands, and is mainly for local usage.

[Save Adjustment Data]

With this menu, you can save the adjusted reference data into file.

This menu has no corresponding remote commands, and is mainly for local usage. Note: be careful about reference adjustment as it may influence test accuracy.

[Configuration Information ▶]

Control and display software/hardware information and option configurations of the instrument. The soft menus include [Display Configuration Information], [Generate License Files] and [Update License Files].

[Display Configuration Information]

Display software/hardware information and option configurations of the current instrument.

[Generate License Files]

Configure software/hardware and options of the instrument and generate license files.

[Update License Files]

Update the software/hardware of the instrument through updating license files.

[Self-test ▶]

Execute instrument self-test. The soft menus include [Start Test], [Pause Test], [LO Step Configuration], [Recycle Test Count], [Save Record ON OFF], [Display Tree Structure Board Level Unit], [Menu 1/2 ▶], [Call Self-test Record], [Print Self-test Result].

[Start Test]

Control the instrument to start self-test at initial access to [Self-test ►] menu or pause self-test.

[Pause Test]

Pause self-test of the instrument.

[LO Step Configuration]

Set LO step frequency (default: 1 MHz) during instrument self-test.

[Cycle Test Count]

Set cycle test count. When executing this function, the instrument will automatically stop self-test.

[Save Record ON OFF]

Set whether to save self-test records after test. Under default setting, the Save Record is ON.

[Display Tree Structure Board Level Unit]

Control the display method of instrument self-test results. When setting to Board Level, the self-test results of internal electric circuits will be displayed; when setting to Unit, the self-test results of instrument unit-level modules will be displayed.

[Call Self-test Record]

Call the self-test results saved in previous time.

[Print Self-test Result]

Control the printing of current instrument self-test results.

[Interface Configuration ►]

Pop up soft menus related to interface configuration of the signal/spectrum analyzer, including [GPIB Address], [Network Configuration...], [Print Invert Color Normal], [Log File ON OFF].

[GPIB Address]

Set GPIB address that is 18 by default.

- **Program control commands:**

```
:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <integer>
```

```
:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess?
```

- **Examples:**

```
:SYST:COMM:GPIB:ADDR 20
```

[Network configuration]

Pop up Windows dialogues for setting IP address and gateway.

IP address and gateway are set as "Automatically Obtain an IP Address" before factory leaving. Both IP address and gateway can be manually changed. For specific operations, refer to Help File of Microsoft Windows7.

[Print Invert Color Normal]

Set the print output color as Normal or Invert. The trace display area background of the instrument screen is black. To facilitate usage, the print output is defaulted as Invert Color.

[Log File ON OFF]

Write some operation instrument information into files, mainly including input remote command information, etc. The log files will be automatically generated under the Factdir/Log of the program run directory at every start-up. This function is defaulted as OFF under factory status.

- **Program control commands:**

:SYSTem:CLOGging ON|OFF

:SYSTem:CLOGging?

- **Examples:**

:SYST:CLOG ON

:SYST:CLOG?

5. 2. 1. 2. Files

Pop up soft menus related to files, including: [Save...], [Call...], [Save Type ►], [Call Type ►] and [Exit]. This menu tree has no corresponding remote commands, and is mainly for local usage.

[Save...]

Files can be saved through the two steps below:

- Firstly, select the file type to be saved and press [File], [Save Type ►]. Select Save Type. The Save Type is defaulted as "Status", i.e., current working status of instrument.
- Press the [Save...] menu to pop up a "Save As" dialog of Windows Standard File. Select file save directory and input file name and press Save. Press Cancel to stop File Save. For details, refer to "3.4 Data Management" of this manual.

[Call...]

Files can be called through the two steps below:

- Firstly, select the file type to be called and press [File], [Call Type ►]. Select Call Type. The Call Type is defaulted as "Status", i.e., saved working status of instrument.
- Press the [Call...] menu to pop up an "Open" dialog for Windows Standard File. Select file call directory and file name and press Open. Press Cancel to stop File Call.

For details, refer to "3.4 Data Management" of this manual.

[Save Type ►]

Select the Save Type of instrument files, including Status, Trace (+ Status), Image, IQ Data (Local) and IQ Data (Recorder). "Status" indicates that the Save Type is the current working status of the instrument; "Trace (+ Status)" indicates that the Save Type is the current measured trace data, including current working status of instrument;

"Image" indicates that the Save Type is current displayed image on the screen; "IQ Data (Local)" indicates that the IQ data will be saved under local files; and "IQ Data (Recorder)" indicates that the IQ data will be saved in recorder. The Save Type is defaulted as "Status".

Note:

1. IQ Data (Local)" is only enabled in IQ Analysis, Transient Analysis and Pulse Analysis.
2. IQ Data (Recorder)" is only enabled in Transient Analysis and Pulse Analysis.

[Call Type ►]

Select the Call Type of instrument files, including Status, Trace (+ Status), IQ Data (Local) and IQ Data (Recorder).

"Status" indicates that the Call Type is the current saved working status of the instrument; "Trace (+ Status)" indicates that the Call Type is the saved trace data and the working status; "IQ Data (Local)" indicates that the IQ data will be called from local folder; and "IQ Data (Recorder)" indicates that the IQ data will be called from the recorder. The Call Type is defaulted as "Status".

Note: "IQ Data (Local)" and "IQ Data (Recorder)" is only enabled in Transient Analysis and Pulse Analysis.

[Exit]

Exit the software program of the signal/spectrum analyzer and get access to the Windows operation system interface.

5. 2. 1. 3. Mode

Select the measurement mode of signal/spectrum analyzer. Spectrum Analysis and IQ Analysis are supported under standard configuration. After purchase of options and updating license documents, menu item entry will be provided in this menu.

[Spectrum Analysis]

Control the signal/spectrum analyzer to get access to the Spectrum Analysis mode.

- **Program control commands:**

:INSTrument[:SElect] SA

:INSTrument[:SElect] ?

- **Examples:**

:INSTrument SA

:INSTrument?

[IQ Analysis]

Control the signal/spectrum analyzer to get access to the IQ Analysis mode.

- **Program control commands:**

:INSTrument[:SElect] BASIC

:INSTrument[:SElect] ?

- **Examples:**

:INSTrument BASIC

:INSTrument?

[Vector Analysis]

Control the signal/spectrum analyzer to get access to the Vector Analysis mode.

- **Program control commands:**

:INSTrument[:SElect] VSA

:INSTrument[:SElect] ?

- **Examples:**

:INSTrument VSA

:INSTrument?

Analog Demodulation

Control the signal/spectrum analyzer to get access to the analog demodulation mode.

- **Program control commands:**

:INSTrument[:SElect] ADEMOM

:INSTrument[:SElect] ?

- **Examples:**

:INSTrument ADEMOM

:INSTrument?

[Pulse Analysis]

Control the signal/spectrum analyzer to get access to the Pulse Analysis mode.

[Transient Analysis]

Control the signal/spectrum analyzer to get access to the Transient Analysis mode.

[Audio Analysis]

Control the signal/spectrum analyzer to get access to the Audio Analysis mode.

[Phase Noise]

Control the signal/spectrum analyzer to get access to the phase noise mode.

- **Program control commands:**

:INSTrument[:SElect] PNOISE

:INSTrument[:SElect] ?

- **Examples:**

:INSTrument PNOISE

:INSTrument?

[Noise Factor]

Control the signal/spectrum analyzer to get access to the noise factor mode.

5. 2. 1. 4. Reset

The [Reset] key on the front panel has no corresponding soft menu. Press the [Reset] key on the front panel to control the reset operation of the signal/spectrum analyzer. Press the [System] Key on the front panel to enter the [Start-up Reset ►], [Reset Factory User] menu to set whether Factory Reset or User Reset is executed when the reset operation is selected.

5. 2. 1. 5. Print

The [Print] key on the front panel has no corresponding menu. Press the [Print] key on the front panel to control the screen shot print of the signal/spectrum analyzer. For details, refer to "3.4 Data Management" of this manual.

5. 2. 1. 6. Help

The [Help] key on the front panel has no corresponding menu. Press the [Help] key on the front panel to display the electronic user manual contents to which the current instrument menu correspond. For details, refer to 3.3.1.5 Help of the manual.

5. 2. 2. Spectrum Analysis

5. 2. 2. 1. Frequency

The [Frequency] key on the front panel is used to set parameters related to the signal/spectrum analyzer frequency, including [Center Frequency], [Start Frequency], [Stop Frequency], [Frequency Step Auto ON OFF], [Frequency Offset], [Auto Tune], [Signal Track ON OFF].

The user can configure the frequency measurement scope through the [Start Frequency] and [Stop Frequency], or through the [Center Frequency] and [Span]. Press the [Frequency] key to enable any soft menu from [Center Frequency], [Start Frequency] and [Stop Frequency], and corresponding parameter input area will display current parameters.

[Center Freq]

- **Menu description:** to enable the center frequency and set the signal/spectrum analyzer into the center frequency/span mode. Use number keys, stepping keys or knob to change the center frequency. If the set center frequency is inconsistent with the current span, the latter will automatically change to the value best suitable for desired frequency.
- **Key path:** [Frequency], [Center Frequency] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** depend on maximum frequency limit of signal/spectrum analyzer.
- **Setting range:** Min.: 0Hz; Max.: maximum frequency limit of signal/spectrum analyzer
- **Default unit:** Hz
- **Program control commands:**

```
[::SENSe]:FREQuency:CENTer <frequency>
```

```
[::SENSe]:FREQuency:CENTer?
```

- **Examples:**

```
:FREQ:CENT 5 GHz
```

[Starting frequency]

- **Menu description:** to enable the start frequency and set the signal/spectrum analyzer into the start frequency/stop frequency mode. Use number keys, stepping keys or knob to change the start frequency. In changing the start frequency, if the selected start frequency is larger than the stop frequency, the latter one will automatically increase till equaling to the sum of start frequency plus minimum span (100Hz multiply N, where, N is the harmonic order of local oscillator).
- **Key Entry:** [Frequency], [Start Frequency] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** depend on maximum frequency limit of signal/spectrum analyzer.
- **Setting range:** Min.: -100MHz; Max.: maximum frequency limit of signal/spectrum analyzer
- **Default unit:** Hz

- **Program control commands:** [:SENSe]:FREQuency:STARt <freq> [:SENSe]:FREQuency:STARt?

- **Examples:**

:FREQ:STAR 200 MHz

[Freq Stop]

- **Menu description:** to enable the stop frequency and set the signal/spectrum analyzer into the start frequency/stop frequency mode. Use number keys, stepping keys or knob to change the stop frequency. In changing stop frequency, if the selected stop frequency is less than the start frequency, the latter one will automatically decrease till equaling to the difference of stop frequency minus minimum span (100Hz multiply N, where, N is the harmonic order of local oscillator).
- **Key path:** [Frequency], [Stop Frequency] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** depend on maximum frequency limit of signal/spectrum analyzer.
- **Setting range:** Min.: 0Hz; Max.: maximum frequency limit of signal/spectrum analyzer
- **Default unit:** Hz
- **Program control commands:**

[:SENSe]:FREQuency:STOP <frequency>

[:SENSe]:FREQuency:STOP?

- **Examples:**

:FREQ:STOP 1600 MHz

[Frequency Step Auto Manual]

- **Menu description:** to change the steps of center frequency, start frequency or stop frequency. When the center frequency is active, press the step key, the frequency step changes by 1, 2, 5 and 10. When it is under Auto OFF mode, use the number keys, stepping keys or knob for change. At this time, reactivate the [Center Frequency], and press the step key, the center frequency will change by set step size. This function is extremely useful to quickly change the center frequency to the input signal harmonic. For example, observe the harmonic of 300MHz input signal, and set the [Frequency Step Auto Manual] as Auto OFF, and input 300MHz. If the current center frequency is 300MHz, press the stepping key to increase the center frequency to 600MHz. Press the stepping key again to increase the center frequency by 300MHz to 900MHz. The shaded status of [Frequency Step Auto Manual] menu indicates whether the step is set as Auto ON or OFF. When the step is under Auto OFF, select the Auto ON from [Frequency Step Auto Manual] to return to Auto ON status.
- **Key path:** [Frequency], [Frequency Step Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** depend on maximum frequency limit of signal/spectrum analyzer.
- **Setting range:** Min.: 1Hz; Max.: maximum frequency limit of signal/spectrum analyzer
- **Default unit:** Hz
- **Program control commands:**

[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>

[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?

[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF|ON|0|1

[:SENSe]:FREQuency:CENTer:STEP:AUTO?

- **Examples:**

:FREQ:CENT:STEP 100 MHz

:FREQ:CENT:STEP:AUTO ON

[Frequency deviation]

- **Menu description:** to add the set frequency offset to the displayed frequency value, including marker frequency value, but this does not affect the signal display position. Use number keys, stepping keys or knob to change the offset.
- **Key path:** [Frequency], [Frequency Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** depend on maximum frequency limit of signal/spectrum analyzer and current measurement mode.
- **Setting range:** Min.: -500GHz, Max.: +500GHz.
- **Default unit:** Hz
- **Program control commands:**

[[:SENSe]:FREQuency:OFFSet <freq>

[[:SENSe]:FREQuency:OFFSet?

- **Examples:**

:FREQ:OFFS 10 MHz

Auto Tune

- **Menu description:** the instrument automatically sets parameters like center frequency, span and reference level based on input signal characteristics. The instrument takes one auto tune when this soft menu key is pressed.
- **Key path:** [Frequency], [Auto Tune] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

[[:SENSe]:FREQuency:TUNE:IMMEDIATE

- **Examples:**

:FREQ:TUNE:IMM

[Signal Track On Off]

- **Menu description:** to turn on or off Signal Track. The enabling marker is on the signal peak point, and the peak frequency is set as the center frequency. In each sweep, perform this function and place the marker at the center frequency. Use [Signal Track ON OFF] to keep the slowly-drifted signal on the center of the screen.
- **Key path:** [Frequency], [Signal Trace On Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF
- **Program control commands:**

:CALCulate:MARKer:TRCKing[:STATe] OFF|ON|0|1

:CALCulate:MARKer:TRCKing[:STATe]?

- **Examples:**

CALC:MARK:TRCK OFF CALC:MARK:TRCK?

5. 2. 2. 2. Amplitude/Y Axis

Pop up menus related to parameter setting of Amplitude/Y Axis, including [Reference Level], [Attenuator ►], [Preamplifier ON OFF], [Scale Type Logarithm Linear], [Scale/Division], [Auto Scale], [Menu 1/2 ►], [Y Axis Scale Unit], [Reference Level Offset], [Amplitude Correction ►].

Reference Level

- **Menu description:** to enable the Reference Level function. The reference level can be adjusted with the number keys, step keys or knob. The reference level corresponds to the top of the coordinate top. Measure signal at reference level position to get highest accuracy. The input attenuator of the signal/spectrum analyzer is coupled to the reference level, which can be automatically changed to avoid compression of input signal.

- **Key path:** [Amplitude/Y Axis], [Reference Level] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** 0dBm

- **Setting range:** Min.: -170dBm, Max.: 30dBm.

- **Default unit:** set based on Y Axis scale unit.

- **Program control commands:**

:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <real>

:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?

- **Examples:**

:DISP:WIND:TRAC:Y:RLEV 20 dBm

[Attenuator ►]

Adjust the mechanical attenuator, mechanical attenuator step, maximum mixer level. When the electronic attenuator options are configured correctly, it can be used for switching on or off the electronic attenuator and setting its attenuation. Soft menu Include [Mechanical Attenuator Auto Manual], [Mechanical Attenuator Step 2dB 10dB], [Electronic Attenuator On Off], [Electronic Attenuator 0.00dB] and [Maximum Mixer Level].

[Mechanical Attenuator Auto Manual]

- **Menu description:** In Auto ON mode, the mechanical attenuator is coupled to the reference level. Under Auto OFF Mode, use number keys, stepping keys or knob to change the attenuation of the attenuator. The attenuation scope of mechanical attenuator is 0dB-70dB. You can set a decrease by 10dB or 2dB through the [Mechanical Attenuator Step 2dB 10dB].

- **Key path:** [Amplitude/Y Axis], [Attenuator ►], [Mechanical Attenuator Auto Manual] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** Auto.

- **Setting range:** Min.:0dB, Max.: 70dB.

- **Default unit:** dB

- **Program control commands:**

[:SENSe]:POWer[:RF]:ATTenuation <rel_power>

[[:SENSe]:POWer[:RF]:ATTenuation?

[[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF|ON|0|1

[[:SENSe]:POWer[:RF]:ATTenuation:AUTO?

- **Examples:**

:POW:ATT 30 dB

:POW:ATT:AUTO ON

- **Other instructions:**

The mechanical attenuator, in general, is set as Auto ON mode. When the reference level changes, the attenuation will automatically change, but this does not change the reference level. This change aims to ensure that the maximum signal amplitude of the input mixer is less than or equals to -10dBm. For example, if the reference level is +23dBm and the mixer input level is -17dBm, the mixer is 40dB (23- 40= -17). The final purpose is to prevent signal compression. When the mechanical attenuator is under Auto OFF mode, press the [Mechanical Attenuator Auto Manual], couple the attenuator to the reference level again.

Note: the maximum input signal amplitude of the input attenuator (at least 10dB input attenuation) is +30dBm, otherwise, this power signal will damage the mechanical attenuator or the input mixer.

[Mechanical Attenuator Step 2dB 10dB]

- **Menu description:** to control the step of the mechanical attenuator. The step size can only be increased or decreased by 10dB or 2dB. For 2dB step, the input mixer level can be set based on input signal optimization to improve measurement dynamic scope.
- **Key path:** [Amplitude/Y Axis], [Attenuator ►], [Mechanical Attenuator Step 2 dB 10 dB] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 2 dB.
- **Program control commands:**

frequency step auto on/off

[[:SENSe]:POWer[:RF]:ATTenuation?

[[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF|ON|0|1

[[:SENSe]:POWer[:RF]:ATTenuation:AUTO?

[Maximum Mixer Level]

- **Menu description:** to set the input maximum mixer level. This level is used as the maximum level limit of the input mixer for assignment of reference level. This value equals to the difference of reference level minus attenuation of the attenuator. When the reference level changes, the mechanical attenuator also changes to ensure that the signal display on the reference level will not be larger than the maximum mixer level. When the maximum mixer level is decreased, the instrument, under default measurement, will automatically optimize the distortion performance. When the maximum mixer level is increased, the mixer may be damaged due to extreme large input signal. If you are not familiar with the signal/spectrum analyzer, please do not change this parameter.
- **Key path:** [Amplitude/Y Axis], [Attenuator ►], [Maximum Mixer Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -10dBm.
- **Setting range:** Min.: -50dBm, Max.: -10dBm.

- **Default unit:** dBm.
- **Program control commands:**

```
[[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <power>
```

```
[[:SENSe]:POWer[:RF]:MIXer:RANGe[UPPer]?
```

- **Examples:**

```
:POW:MIX:RANG -15 dBm
```

Electronic Attenuator ON OFF

- **Menu description:** this menu is only available when Electronic Attenuator option is purchased. It is used to switch on or off the electronic attenuator. The electronic attenuator is only active when measuring signal with frequency between 3Hz and 4GHz. When the measurement frequency scope set by the signal/spectrum analyzer is beyond 3Hz-4GHz, this menu will be void and grayed out.
- **Key path:** [Amplitude/Y Axis], [Attenuator ►], [Electronic Attenuator ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF
- **Program control commands:**

```
[[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF|ON|0|1
```

```
[[:SENSe]:POWer[:RF]:EATTenuation:STATe?
```

[Electronic Attenuator 0.00dB]

- **Menu description:** this menu is only available when Electronic Attenuator option is purchased. It is used to manually set the attenuation of electronic attenuator. The electronic attenuator is only active when measuring signal with frequency between 3Hz and 4GHz. When the measurement frequency scope set by the signal/spectrum analyzer is beyond 3Hz-4GHz, this menu will be void and grayed out.
- **Key path:** [Amplitude/Y Axis], [Attenuator ►], [Electronic Attenuator 0.00dB] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0.00 dB.
- **Setting range:** Min.:0dB, Max.:30dB.
- **Program control commands:**

```
[[:SENSe]:POWer[:RF]:EATTenuation <rel_amp|>
```

```
[[:SENSe]:POWer[:RF]:EATTenuation?
```

- **Examples:**

```
:POWer:EATT 10dB
```

```
:POWer:EATT?
```

[Preamplifier ON OFF]

- **Menu description:** to control the ON OFF status of the preamplifier. This menu is only active when the preamplifier options are configured.

- **Key path:** [Amplitude/Y Axis], [Preamplifier ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF
- **Program control commands:**

`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF|ON|0|1`

`[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

- **Examples:**

`:POWer:GAIN OFF`

`:POWer:GAIN?`

Scale Type

[Logarithm/Linear]

- **Menu description:** to select the Y Axis Scale Type as Logarithm or Linear. In general, the logarithm scale unit is dBm and the linear scale unit is mV. Other unit types will be manually selected through the Y axis scale.
- **Key path:** [Amplitude/Y Axis], [Scale Type Logarithm Linear] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Logarithm
- **Program control commands:**

`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:SPACing LINear|LOGarithmic`

`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:SPACing?`

- **Examples:**

`:DISP:WIND:TRAC:Y:SPAC LOG`

[Scale/Division]

- **Menu description:** to select the scale/division from 0.1dB/division to 20dB/division. This menu is only valid when the scale type is logarithm.
- **Key path:** [Amplitude/Y Axis], [Scale/Division] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 10.00 dB.
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Program control commands:**

`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_amp>`

`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?`

- **Examples:**

`:DISP:WIND:TRAC:Y:PDIV 5`

`:DISP:WIND:TRAC:Y:PDIV?`

[Auto Scale]

- **Menu description:** the instrument automatically sets parameters like reference level and scale/division based on input signal sizes.

When this soft menu key is pressed, the instrument performs one auto scaling. Setting rule for auto scaling: when the [Auto Scale] menu is pressed, firstly obtain the maximum value and the minimum value based on current measurement trace data. Based on the maximum value, place on the 80% graticule of the screen trace Y axis for auto setting of reference level and scale/division.

- **Key path:** [Amplitude/Y Axis], [Auto Scale] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

```
[ :SENSe]:ADJ:LEVel
```

- **Examples:**

```
:ADJ:LEV
```

[Y Axis Scale Unit ►]

- **Menu description:** to select the Y Axis unit from [dBm], [dBmV], [dBmA], [W], [V], [A], [dBμV] and [dBμA]. The instrument will automatically calculate the trace data and marker readout based on the Y axis scale unit.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** dBm
- **Program control commands:**

```
:UNIT:POW:er DBM|DBMV|DBMA|V|W|A|DBUV|DBUA|DBUVM|DBUAM|DBPT|DBG
```

```
:UNIT:POW:er?
```

- **Examples:**

```
:UNIT:POW:DBMV
```

```
:UNIT:POW:?
```

[Reference Level Offset]

- **Menu description:** to introduce offset for all amplitude readout (e.g., reference level and marker amplitude). It will not change the trace position on the screen. This offset unit is dB and is not affected by the scale and unit. Use number keys, stepping keys or knob to input the offset value.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Reference Level Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0 dB.
- **Setting range:** Min.: -1000dB, Max.:1000dB.
- **Program control commands:**

```
:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel:OFFSet <rel_power>
```

```
:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel:OFFSet?
```

- **Examples:**

:DISP:WIND1:TRAC:Y:RLEV:OFFS 12.7

[Amplitude Correction ▶]

Pop up soft menus related to amplitude correction functions to improve measurement system accuracy. The soft menus include: [Correction Select], [Current Correction ON OFF], [Edit Current Correction ▶], [Delete Current Correction], [Save Correction ...], [Call Correction ...], [Apply All Corrections ON OFF], [Delete All Corrections].

[Correction Select ▶]

Pop up corrections to be edited or applied by the user, including [Correction 1], [Correction 2], [Correction 3], [Correction 4], [Correction 5], [Correction 6].

[Current Correction ON OFF]

When the user has not selected or edited correction data, this menu shall not be set as ON. When this menu is set as OFF, the currently edited correction data fails to act. When this menu is set as ON, the currently edited correction data will be reflected on trace.

- **Program control commands:**

```
:SENSe]:CORRection:CSET[1]|2|3|4|5|6[:STATe] ON|OFF|1|0
```

```
:SENSe]:CORRection:CSET[1]|2|3|4|5|6[:STATe]?
```

- **Examples:**

```
:CORR:CSET1 ON
```

```
:CORR:CSET1?
```

[Edit Current Correction ▶]

Pop up sub menus for selected or edited correction, including [Point], [Frequency], [Amplitude], [Insert New Point], [Delete Point].

- **Program control commands:**

```
:SENSe]:CORRection:CSET[1]|2|3|4|5|6:DATA <freq>, <ampl>, ...
```

```
:SENSe]:CORRection:CSET[1]|2|3|4|5|6:DATA?
```

```
:SENSe]:CORRection:CSET[1]|2|3|4|5|6:DATA:MERGe <freq>, <ampl>, ...
```

- **Examples:**

```
:CORR:CSET1:DATA 10000000, -10, 50000000, -30
```

```
:CORR:CSET1:DATA?
```

```
:CORR:CSET1:DATA:MERG 30000000, -20
```

- **Delete All Corrections**

Erase all correction values under editing.

- **Program control commands:**

```
:SENSe]:CORRection:CSET[1]|2|3|4|5|6:DELeTe
```

- **Examples:**

```
:CORR:CSET1:DEL
```

[Save Correction...]

- **Menu description:** to pop up Windows dialogue for saving the currently edited correction data into a file.

- **Program control commands:**

:MMEMory:STORe:CORRection 1|2|3|4|5|6, <filename>

- **Examples:**

:MMEM:STOR:CORR 1,"AmplCor.cor"

[Call Correction...]

- **Menu description:** to pop up Windows dialogue for calling the currently edited correction data into currently selected correction.

- **Program control commands:**

:MMEMory:LOAD:CORRection 1|2|3|4|5|6, <filename>

- **Examples:**

:MMEM:LOAD:CORR 1,"AmplCor.cor"

- **Apply all corrections on/off**

Apply all edited or called correction data on current measurement trace.

- **Program control commands:**

[:SENSe]:CORRection:CSET:ALL[:STATe] ON|OFF|1|0 [:SENSe]:CORRection:CSET:ALL[:STATe]?

- **Examples:**

:CORR:CSET:ALL ON

:CORR:CSET:ALL?

- **Delete All Corrections**

Erase all edited correction values.

- **Program control commands:**

[:SENSe]:CORRection:CSET:ALL:DELeTe

- **Examples:**

CORR:CSET:ALL:DEL

5. 2. 2. 3. Span/X Axis

Press the [Span/X Axis] on the front panel to enable the span function and set the signal/spectrum analyzer into center frequency/span mode. Press the [Span] key to pop up [Span], [Full Span], [Zero Span] and [Previous Span] at the same time.

[Bandwidth]

- **Menu description:** the span can be set by number keys, stepping keys or knob. Use number keys or select [Zero Span] to set the span as zero.
- **Key path:** [Span/X Axis], [Span] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** maximum frequency limit - start frequency.

- **Setting range:** Min.:0Hz (for non-zero span, Min.:10Hz); Max.: related to the maximum working frequency limit of the instrument.

- **Program control commands:**

[[:SENSe]:FREQuency:SPAN <frequency>

[[:SENSe]:FREQuency:SPAN?

- **Examples:**

:FREQ:SPAN 22 GHz

[Full Span]

- **Menu description:** to set the signal/spectrum analyzer into the center frequency/span mode. Set the span as maximum value.

- **Program control commands:**

[[:SENSe]:FREQuency:SPAN:FULL

- **Examples:**

:FREQ:SPAN:FULL

[Zero Span]

- **Menu description:** to set span as 0Hz. It is good for observing signal at time domain, in particular, good for observation of modulating signal.

- **Program control commands:**

[[:SENSe]:FREQ:SPAN 0 Hz

- **Examples:**

:FREQ:SPAN 0 Hz

[Previous Span]

- **Menu description:** to set the signal/spectrum analyzer back to the previous span.

- **Program control commands:**

[[:SENSe]:FREQuency:SPAN:PREVious

- **Examples:**

:FREQ:SPAN:PREV

5. 2. 2. 4. Bandwidth

Pop up the soft menus for setting resolution bandwidth and video bandwidth, including [Resolution Bandwidth Auto Manual], [Video Bandwidth Auto Manual], [VBW/RBW Auto Manual], [Span/RBW Auto Manual], [Filter Type ►].

[Resolution Bandwidth Auto Manual]

- **Menu description:** to change the resolution bandwidth of spectrum analysis, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode.

- **Key path:** [Bandwidth], [Resolution Bandwidth Auto Manual] on the front panel.

- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

```
[:SENSe]:BANDwidth|BWIDth[:RESolution] <freq>
```

```
[:SENSe]:BANDwidth|BWIDth[:RESolution]?
```

```
[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO OFF|ON|0|1
```

```
[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO?
```

- **Examples:**

```
BAND 1 kHz
```

```
BWID:AUTO On
```

[Video bandwidth Auto Manual]

- **Menu description:** to change the video bandwidth within the active function area, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. Use number keys, stepping keys or knob to change The current mode is shaded. **Command description:** to change video bandwidth displayed at the active function zone ranging from 1Hz to 20MHz. When it is above 3MHz, take 4 MHz, 5 MHz, 6 MHz, 8 MHz, 10 MHz and 20 MHz; when it is between 1Hz and 3MHz, change by 10% step. Such value may be changed via number keys, stepping keys or the knob. The mode with a underline is the current mode. When set as Auto Off, press [Frequency Bandwidth Auto Manual] to select Auto ON and return to auto mode.
- **Key path:** [Bandwidth], [Video Bandwidth Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto, same as the Resolution Bandwidth setting.
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

```
[:SENSe]:BANDwidth|BWIDth:VIDeo <freq>
```

```
[:SENSe]:BANDwidth|BWIDth:VIDeo?
```

```
[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO OFF|ON|0|1
```

```
[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO?
```

- **Examples:**

```
:BAND:VID 1 kHz
```

```
:BWID:VID:AUTO ON
```

[VBW/RBW Auto Manual]

- **Menu description:** to set the ratio between the current video bandwidth and resolution bandwidth with the default value as 1. As the resolution bandwidth changes, the video bandwidth changes to maintain this ratio. The ratio should be displayed on the input area and used for the coupling mode of those two kinds of bandwidth. When a new ratio is selected, change the video bandwidth

to meet this new ratio and the resolution bandwidth should remain unchanged.

- **Key path:** [Bandwidth], [VBW/RBW Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** auto with VBW/RBW as 1.
- **Setting range:** Min.:0.0001, Max.: 300000.
- **Program control commands:**

```
[::SENSe]:BANDwidth|BWIDth:VIDeo:RATio <number>
```

```
[::SENSe]:BANDwidth|BWIDth:VIDeo:RATio?
```

```
[::SENSe]:BANDwidth|BWIDth:VIDeo:RATio:AUTO OFF|ON|0|1
```

```
[::SENSe]:BANDwidth|BWIDth:VIDeo:RATio:AUTO?
```

- **Examples:**

```
:BAND:VID:RAT 2
```

[Span/RBW Auto Manual]

- **Menu description:** to set the ratio between the current span and resolution bandwidth and display it in the input area. This ratio is used in coupling mode of the resolution bandwidth.
- **Key path:** [Bandwidth], [Span/RBW Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** auto with span/RBW as 106.
- **Setting range:** Min.:1.0, Max.: 60.0.
- **Program control commands:**

```
[::SENSe]:FREQuency:SPAN:BANDwidth[:RESolution]:RATio <integer>
```

```
[::SENSe]:FREQuency:SPAN:BANDwidth[:RESolution]:RATio?
```

```
[::SENSe]:FREQuency:SPAN:BANDwidth[:RESolution]:RATio:AUTO OFF|ON|0|1
```

```
[::SENSe]:FREQuency:SPAN:BANDwidth[:RESolution]:RATio:AUTO?
```

- **Examples:**

```
:SPAN:BAND:RAT 20
```

[Filter Type ►]

- **Menu description:** comprising [Gaussian] and [Flat Top]. In general, the signal/spectrum analyzer uses Gaussian filter, i.e., use filter approximate to the Gaussian shape to complete filtering of resolution bandwidth. If the flat top filter is used, the signal/spectrum analyzer adopts filter approximate to the rectangular shape to complete filtering of resolution bandwidth. The response time of flat top filter is about 3 times of that of the Gaussian filter. The sweep speed of the flat top filter is smaller than that of the Gaussian filter. The flat top filter has better selectivity than the Gaussian filter and therefore is more capable of distinguishing two signals with unequal amplitude.
- **Key path:** [Bandwidth], [Filter Type ►] on the front panel.
- **Status saved:** saved in the instrument status.

- **Factory preset:** Gaussian.
- **Program control commands:**

```
[:SENSe]:BANDwidth|BWIDth:SHAPE GAUSSian|FLATtop
```

```
[:SENSe]:BANDwidth|BWIDth:SHAPE?
```

- **Examples:**

```
:BAND:SHAP GAUS
```

```
:BAND:SHAP?
```

5. 2. 2. 5. Sweep

Enable sweep-related parameter setup function to pop up corresponding soft menu, including [Sweep Time Auto Manual], [Sweep Single Continuous], [Sweep Setting ▶], [Gate ▶], [Sweep Points].

[Scanning time Auto Manual]

- **Menu description:** to change the sweep time of signal/spectrum analyzer by number keys, stepping keys or knob. When it is under Auto OFF mode (shaded), it indicates that sweep time can be set manually. When it is under Auto ON status, the sweep time will be automatically coupled based on resolution bandwidth, span and video bandwidth

Under Swept type, when the swept time is limited within the minimum sweep time, it can be set from 1ms to 6000s. Under zero span, the sweep time can be 1μs at minimum. When the sweep type is FFT, the sweep time is mainly used to meet the requirements of FFT sampling and processing time.

The sweep time is coupled with the sweep type, resolution bandwidth, video bandwidth and span. Changing those parameters will result in change of the sweep time or triggering of the limit setting of sweep time.

- **Key path:** [Sweep], [Sweep Time Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep time Auto.
- **Setting range:** Min.: 1ms and Max.: 6000s (for non-zero span); and Min.: 1us, Max.: 6000s (for zero span).
- **Default unit:** s
- **Program control commands:**

```
[:SENSe]:SWEep:TIME <seconds>
```

```
[:SENSe]:SWEep:TIME?
```

```
[:SENSe]:SWEep:TIME:AUTO OFF|ON|0|1
```

```
[:SENSe]:SWEep:TIME:AUTO?
```

- **Examples:**

```
:SWE:TIME 500 ms
```

```
:SWE:TIME:AUTO OFF
```

[Sweep Continuous Single]

- **Menu description:** to set continuous sweep OFF or ON. When the [Sweep Continuous Single] is set as Continuous ON, Continuous On will be triggered and continuous sweep will be the default measurement control method; when the [Sweep Continuous Single] is set as Continuous OFF, single sweep will be triggered. Press [Sweep Continuous OFF] to restart sweep

when the next trigger signal arrives. When single sweep mode is triggered, the information prompt column at the screen top will display: Sweep Continuous OFF.

- **Key path:** [Sweep], [Sweep Single Continuous] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Sweep Continuous ON.
- **Program control commands:**

```
:INITiate:CONTinuous OFF|ON|0|1
```

```
:INITiate:CONTinuous?
```

- **Examples:**

```
:INIT:CONT OFF
```

[Scanning setting ►]

Pop up the soft menu related to Sweep type, including [Sweep Type Auto Manual], [Sweep Type Rules Auto Manual] and [FFT Width Auto ON OFF].

[Scanning type ► Auto Manual]

- **Menu description:** to set sweep type. is used to determine whether Swept or FFT is adopted for the signal/spectrum analyzer. Also set the FFT step bandwidth for FFT sweep. The soft menus include [Auto], [Swept] and [FFT]. When under Auto ON mode, the signal/spectrum analyzer will automatically select the sweep type based on sweep type rules.
- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep type: Auto.
- **Program control commands:**

```
[:SENSe]:SWEep:TYPE FFT|SWEep
```

```
[:SENSe]:SWEep:TYPE?
```

```
[:SENSe]:SWEep:TYPE:AUTO OFF|ON|0|1
```

```
[:SENSe]:SWEep:TYPE:AUTO?
```

- **Examples:**

```
:SWE:TYPE FFT
```

```
:SWE:TYPE?
```

```
:SWE:TYPE:AUTO OFF
```

```
:SWE:TYPE:AUTO?
```

[Sweep Type Rules Auto Manual]

- **Menu description:** to set rules for auto sweep type. While the sweep type rules include "Best Dynamic Range" and "Best Speed".
 - i. "Best Dynamic Range" rules: when RBW is or larger than 1kHz, the sweep type is Swept; when RBW is less than 1kHz, the sweep type is FFT.

- ii. "Best Speed" rules: when RBW is or larger than 30kHz, the sweep type is Swept; when RBW is less than 30kHz, the sweep type is FFT.

- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Rules Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** the sweep type rules are automatically set as "Best Dynamic Range".
- **Program control commands:**

```
[:SENSe]:SWEep:TYPE:AUTO:RULEs SPEed|DRANge
```

```
[:SENSe]:SWEep:TYPE:AUTO:RULEs?
```

```
[:SENSe]:SWEep:TYPE:AUTO:RULEs:AUTO[:STATe] OFF|ON|0|1
```

```
[:SENSe]:SWEep:TYPE:AUTO:RULEs:AUTO[:STATe]?
```

- **Examples:**

```
:SWE:TYPE:AUTO:RUL SPE
```

```
:SWE:TYPE:AUTO:RUL?
```

```
:SWE:TYPE:AUTO:RUL:AUTO OFF
```

```
:SWE:TYPE:AUTO:RUL:AUTO?
```

[FFT Width Auto Manual]

- **Menu description:** to set FFT Width. The FFT width includes [Auto], [<100kHz], [<3MHz], [<13MHz], [<=Max.]. FFT width is only active when the FFT sweep type is selected. Under Auto type, when the signal/spectrum analyzer performs FFT spectrum measurement, the maximum resolution bandwidth is 30kHz. To guarantee best dynamic measurement range, the signal/spectrum analyzer automatically optimizes the FFT width within 100kHz. The larger is the FFT width, the faster is FFT spectrum measurement, but the dynamic range performance will be affected.

Under FFT sweep, the FFT width setup limits the maximum value for center frequency step of each tune. For example, if [<100Hz] is selected, the maximum value for center frequency step of each tune is 100Hz. As the FFT width gets larger, the count of instrument center frequencies get smaller when performing measurement of same frequency scope, and the response measurement gets faster. Therefore, to improve measurement speed, you can manually change the FFT width.

- **Key path:** [Sweep], [Sweep Setting ►], [FFT Width ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** FFT Width is set as Auto.
- **Program control commands:**

```
[:SENSe]:SWEep:FFT:WIDTh <real>
```

```
[:SENSe]:SWEep:FFT:WIDTh?
```

```
[:SENSe]:SWEep:FFT:WIDTh:AUTO OFF|ON|0|1
```

```
[:SENSe]:SWEep:FFT:WIDTh:AUTO?
```

- **Examples:**

```
:SWE:FFT:WIDT 100kHz
```

```
:SWE:FFT:WIDT?
```

:SWE:FFT:WIDT:AUTO OFF

:SWE:FFT:WIDT:AUTO?

[Gate ►]

Pop up soft menu related to gate, including [Gate ON OFF], [Gate View ON OFF], [View Sweep Time], [Gate Setup ►] and [Gate Sources ►] items.

Gate ON OFF

- **Menu description:** to turn on or off Gate. When the Gate function is on, the signal/spectrum analyzer will sweep and refresh traces based on the set Gate Method in combination with related gate parameters and Gate Source signals. Not all types of gating are available for all measurements.

The Gate function is unavailable (grayed out) when: the FFT Sweep Type is manually selected; the Gate Method is LO or Video; Sweep is manually selected; and the Marker Count is ON.

The Gate ON/OFF status is displayed on the status zone at top right corner of the window.

- **Key path:** [Sweep], [Gate ►], [Gate ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

```
[[:SENSe]:SWEep:EGATe[:STATe] OFF|ON|0|1
```

```
[[:SENSe]:SWEep:EGATe[:STATe]?
```

- **Examples:**

```
:SWE:EGAT OFF
```

```
:SWE:EGAT OFF
```

Gate View ON OFF

- **Menu description:** to turn on or off Gate View. It is realized by Swept Analysis under Zero Span. At this time, the trigger source is the Gate Source.

When the Gate View is on, the Sweep Setting and the Sweep Time menus are unavailable (grayed out). The analyzer automatically switches to the sweep frequency under Zero Span. At this time, the current span is Zero Span. When the Sweep Time is selected as the Gate View time, the Gate ON OFF function is unavailable; when the Gate View is OFF, the Sweep Time menu, Sweep Setting menu and Span recover to the status before the View is ON. The Gate ON or OFF is determined by the current menu status.

When the Gate View is ON, if the Span is as non-zero, the Gate View will turn off.

- **Key path:** [Sweep], [Gate ►], [Gate View ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

```
[[:SENSe]:SWEep:EGATe:VIEW ON|OFF|1|0
```

```
[[:SENSe]:SWEep:EGATe:VIEW?
```

- **Examples:**

:SWE:EGAT:VIEW ON

:SWE:EGAT:VIEW?

Gate View Sweep Time

- **Menu description:** to set the sweep time in the Gate View.
- **Key path:** [Sweep], [Gate ▶], [Gate View Sweep Time] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.0ms
- **Setting range:** 1us-6000s.
- **Program control commands:**

[:SENSe]:SWEep:EGATe:TIME <time>

[:SENSe]:SWEep:EGATe:TIME?

- **Examples:**

:SWE:EGAT:TIME 10ms

:SWE:EGAT:TIME 10ms

[Gate Setup ▶]

Pop up soft menus related to gate setup, including [Gate Delay], [Gate Length], [Gate Method ▶], [Control Edge Level] and [Gate Holdoff ON OFF] items.

[Gate Delay]

- **Menu description:** to set gate delay time, and control the length of time from the time when the gate signal is TRUE until the gate is turned on.
- **Key path:** [Sweep], [Gate ▶], [Gate Setup ▶], [Gate Delay] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1ms.
- **Setting range:** 0s-40s.
- **Program control commands:**

[:SENSe]:SWEep:EGATe:DELay <time>

[:SENSe]:SWEep:EGATe:DELay?

- **Examples:**

:SWE:EGAT:DEL 1ms

:SWE:EGAT:DEL?

[Gate width]

- **Menu description:** to set the gate length, and control the length of time that the gate is on after it opens.

- **Key path:** [Sweep], [Gate ▶], [Gate Setup ▶], [Gate Length] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 5ms.
- **Setting range:** 100us-5s
- **Program control commands:**

```
[::SENSe]:SWEep:EGATe:LENGth <time>
```

```
[::SENSe]:SWEep:EGATe:LENGth?
```

- **Examples:**

```
:SWE:EGAT:LENGth 5ms
```

```
:SWE:EGAT:LENGth?
```

[Gate Method ▶]

Pop up soft menus for selecting gate methods, including [LO], [Video], [FFT] items. Not all types of gating are available for all measurements.

[LO]

- **Menu description:** to set the gate method as LO.

LO is a smart way for gating. It only sweeps LO when Gate is ON and passes through signal. The Gate signal controls when the sweep generator scans and when it passes through or shields signal. This enables that the signal/spectrum analyzer only sweeps when Gate is ON, that means, the Gate LO only sweeps LO and passes through signal when Gate is ON.

When set to Gate ON, the LO sweeps whenever the specified gate parameters are satisfied. This form of gating is more sophisticated, and results in faster measurements. With Gated LO, the analyzer only sweeps while the specified gate parameters are satisfied. This means that a sweep could take place over several gate events. It would start when the gate signal goes TRUE and stop when it goes FALSE, then continue when it goes TRUE again. But since the LO is sweeping as long as the gate conditions are satisfied, the sweep typically finishes much more quickly than with Gated Video.

When in zero span, there is no actual sweep performed. But data is only taken while the gate conditions are satisfied. So even though there is no sweep, the gate settings will still function when data is acquired.

- **Key path:** [Sweep], [Gate ▶], [Gate Setup ▶], [Gate Method ▶], [LO] on the front panel.
- **Program control commands:**

```
[::SENSe]:SWEep:EGATe:METhod LO
```

```
[::SENSe]:SWEep:EGATe:METhod?
```

- **Examples:**

```
:SWE:EGAT:METh LO
```

```
:SWE:EGAT:METh?
```

[Video]

- **Menu description:** to set the gate method as Video.

This form of gating may be thought of as a simple switch, which connects the input signal to the signal/spectrum analyzer. When the switch is ON (Gate ON), the video signal is allowed to pass through; and the switch is off (Gate OFF), the signal is blocked. Under

Gated Video, whether the gate is ON or OFF, the signal/spectrum analyzer measures signals and never stops sweeping. The Gate Switch is between the signal pathway envelope detector and video filter, therefore is called as Gated Video. Since the Gate Switch is behind the envelope detector, whether the Gate is on or off, the signal/spectrum analyzer measurement path will respond to the input signal; therefore, it is necessary to reduce the sweep speed to the extent that the signal/spectrum analyzer can measure input signal during Gate ON period, which results in certain limits for applying Gated Video measurements. For this reason, in general, Video method results in slower measurement compared with Gated LO and FFT.

- **Key path:** [Sweep], [Gate ▶], [Gate Setup ▶], [Gate Method ▶], [Video] on the front panel.

- **Program control commands:**

```
[::SENSe]:SWEep:EGATe:METhod VIdEo
```

```
[::SENSe]:SWEep:EGATe:METhod?
```

- **Examples:**

```
:SWE:EGAT:METh VID
```

```
:SWE:EGAT:METh?
```

[FFT]

- **Menu description:** to the gate method as Gated FFT.

The way of FFT spectrum measurement if the trigger conditions are satisfied, which is called as the gated FFT. The FFT spectrum is the input signal spectrum through FFT calculation from a time domain waveform during collection. The time for collecting the domain waveform is similar to the gate length. The time for collecting the domain waveform is similar to the gate length. Different from the Sweep Time Gate, under Gated FFT, the gate length is determined by the currently set resolution bandwidth and cannot be set and modified through menu. When the Span is less than 10MHz, in particular for small resolution bandwidth, the FFT measurement is faster than the Sweep measurement; therefore, for a given signal period, compared with Gated LO, the Gated FFT gets higher frequency resolution.

When set to Gate ON, an FFT is performed whenever the specified gate conditions are satisfied. This is an FFT measurement which begins when the predefined conditions are satisfied. Since the time period of an FFT is approximately $2.57/\text{RBW}$, you get a measurement which starts under predefined conditions and takes place over a predefined period. So, in essence, this is a gated measurement.

Gated FFT cannot be done in zero span. So in zero span, the Gated LO and Video methods are used. Data is still only taken while the specified gate parameters are satisfied, so the gate settings do impact when data is acquired.

- **Key path:** [Sweep], [Gate ▶], [Gate Setup ▶], [Gate Method ▶], [FFT] on the front panel.

- **Program control commands:**

```
[::SENSe]:SWEep:EGATe:METhod FFT
```

```
[::SENSe]:SWEep:EGATe:METhod?
```

- **Examples:**

```
:SWE:EGAT:METh FFT
```

```
:SWE:EGAT:METh?
```

[Control Edge Level]

- **Menu description:** set the method of controlling the gating function. Edge

When the selected edge (positive or negative edge) of the trigger signal arrives, whether the Gate is ON is determined by the

subsequent gate delay and gate length (both can be set by the menu). The Gate is ON whenever the trigger event arrives and the gate delay time has passed. During the gate length, the signal passes through; when the gate length ends, the signal is blocked. In general, for edge triggering, the trigger signal is an TTL periodic signal, whose positive and negative edges are synchronous with those of the measured pulse signal. Gate delay time refers to the time during which the signal/spectrum analyzer needs to wait from the trigger event to Gate ON.

Level

When the gate signal has achieved a certain level (high level or low level. In signal/spectrum analyzer, positive polarity indicates high level; and negative polarity indicates low level), the signal passes through; and when the gate signal fails to achieve specified level, the signal is blocked. In Level triggering, the Gate Delay and Gate Length parameters are void.

- **Key path:** [Sweep], [Gate ►], [Gate Setup ►], [Control Edge Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Edge.
- **Program control commands:**

```
[::SENSe]:SWEep:EGATe:CONTRol EDGE|LEVel
```

```
[::SENSe]:SWEep:EGATe:CONTRol?
```

- **Examples:**

```
:SWE:EGAT:CONT EDGE
```

```
:SWE:EGAT:CONT?
```

Gate Holdoff ON OFF

- **Menu description:** to increase or decrease the wait time after a gate event ends before the signal/spectrum analyzer will respond to the next gate signal.

When Method is set to LO, after any gate event finishes, the signal/spectrum analyzer must wait for the sweep status reset before it can respond to another gate signal. When the Gate Holdoff is ON, the user can adjust the wait time; shortening holdoff period can improve speed, but it may reduce measurement accuracy; if accuracy is insufficient, the user may consider extending holdoff period.

When Method is set to Video or FFT, the Gate Holdoff function still functions and has no effect on measurement accuracy.

- **Key path:** [Sweep], [Gate ►], [Gate Setup ►], [Gate Holdoff ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** gate time: 100ms; status: OFF.
- **Program control commands:**

```
[::SENSe]:SWEep:EGATe:HOLDoff <time>
```

```
[::SENSe]:SWEep:EGATe:HOLDoff?
```

```
[::SENSe]:SWEep:EGATe:HOLDoff:AUTO OFF|ON|0|1
```

```
[::SENSe]:SWEep:EGATe:HOLDoff:AUTO?
```

- **Examples:**

```
:SWE:EGAT:HOLD 100ms
```

```
:SWE:EGAT:HOLD?
```

```
:SWE:EGAT:HOLD:AUTO OFF
```

:SWE:EGAT:HOLD:AUTO?

[Gate Source ▶]

Pop up soft menus related to gate source setting, including [Power Trigger ▶], [External Trigger 1 ▶], [External Trigger 2 ▶], [Burst Signal Trigger ▶] and [Timer Trigger ▶].

[Power Trigger ▶]

- **Menu description:** to set the Gate Source as Power Trigger. The soft menu is [Gate Source Polarity Positive Negative].
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [Power Trigger ▶] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

[:SENSe]:SWEep:EGATe:SOURce LINE

[:SENSe]:SWEep:EGATe:SOURce?

- **Examples:**

:SWE:EGAT:SOUR LINE

:SWE:EGAT:SOUR?

[Gate Source Polarity Positive Negative]

- **Menu description:** to set the Gate Source Polarity ON OFF of Power Trigger.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [Power Trigger ▶] [Gate Source Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:LINE:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:LINE:SLOPe?

- **Examples:**

:TRIG:LINE:SLOP POS

:TRIG:LINE:SLOP?

[External Trigger 1 ▶]

- **Menu description:** to set the Gate Source as External Trigger Signal 1. The soft menus are [Trigger Level], [Gate Source Polarity Positive Negative].
- **Program control commands:**

[:SENSe]:SWEep:EGATe:SOURce EXTernal1

[:SENSe]:SWEep:EGATe:SOURce?

- **Examples:**

:SWE:EGAT:SOUR EXT1

:SWE:EGAT:SOUR?

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the External Trigger Signal 1.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [External Trigger 1 ▶], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.2V
- **Setting range:** -5V-5V.
- **Default unit:** V
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal1:LEVel <level>

:TRIGger[:SEQuence]:EXTErnal1:LEVel?

- **Examples:**

:TRIG:EXT1:LEV 1.2V

:TRIG:EXT1:LEV?

[Gate Source Polarity Positive Negative]

- **Menu description:** to set the Gate Source Polarity of the External Trigger Signal 1.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [External Trigger 1 ▶], [Gate Source Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal1:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:EXTErnal1:SLOPe?

- **Examples:**

:TRIG:EXT1:SLOP POS

:TRIG:EXT1:SLOP?

[External Trigger 2 ▶]

- **Menu description:** to set the Gate Source as External Trigger Signal 2. The soft menus are [Trigger Level], [Gate Source Polarity Positive Negative].
- **Program control commands:**

[:SENSe]:SWEep:EGATe:SOURce EXTErnal2

[:SENSe]:SWEep:EGATe:SOURce?

- **Examples:**

:SWE:EGAT:SOUR EXT2

:SWE:EGAT:SOUR?

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the External Trigger Signal 2.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [External Trigger 2 ▶], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.2V
- **Setting range:** -5V-5V.
- **Default unit:** V
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal2:LEVel <level>

:TRIGger[:SEQuence]:EXTErnal2:LEVel?

- **Examples:**

:TRIG:EXT2:LEV 1.2V

:TRIG:EXT2:LEV?

[Gate Source Polarity Positive Negative]

- **Menu description:** to set the Gate Source Polarity of the External Trigger Signal 2.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [External Trigger 2 ▶], [Gate Source Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal2:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:EXTErnal2:SLOPe?

- **Examples:**

:TRIG:EXT2:SLOP POS

:TRIG:EXT2:SLOP?

[Burst Signal Trigger ▶]

- **Menu description:** to set the Gate Source as Burst Signal Trigger. The soft menus are [Trigger Level], [Gate Source Polarity Positive Negative].
- **Program control commands:**

[:SENSe]:SWEep:EGATe:SOURce RFBurst

[:SENSe]:SWEep:EGATe:SOURce?

- **Examples:**

:SWE:EGAT:SOUR RFB

:SWE:EGAT:SOUR?

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the burst signal.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [Burst Signal Trigger ▶], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -20dBm.
- **Setting range:** max.: -270dBm-30dBm. The current settable range is coupled with the current reference level and scale/division. The maximum is the level represented by the top graticule, and the minimum value is the level represented by the bottom graticule.
- **Default unit:** dBm.
- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl>

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?

- **Examples:**

:TRIG:RFB:LEV:ABS -20dBm

:TRIG:RFB:LEV:ABS?

[Gate Source Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the Burst Signal Trigger.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [Burst Signal Trigger ▶], [Gate Source Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:RFBurst:SLOPe?

- **Examples:**

:TRIG:RFB:SLOP POS

:TRIG:RFB:SLOP?

[Timer Trigger ▶]

- **Menu description:** to set the Gate Source as Timer Trigger. The soft menus include [Select Sync Source ▶], [Timer Period], [Timer Offset], [Sync Holdoff].
- **Program control commands:**

:TRIG:SOUR FRAM

[Select Sync Source ▶]

- **Menu description:** to select and set the Timer Sync Source parameters. The soft menus include [OFF], [External Trigger 1 ▶], [External Trigger 2 ▶], [Burst Signal Trigger ▶]. OFF means that the timer is not synchronous.

- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal1|EXTernal2|RFBurst|OFF

:TRIGger[:SEQuence]:FRAMe:SYNC?

[External Trigger 1 ▶]

- **Menu description:** to set the Timer Sync Source as External Trigger Signal 1. The soft menus are [Trigger Level], [Sync Source Polarity Positive Negative].

- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal1

- **Examples:**

:TRIG:FRAM:SYNC EXT1

:TRIG:FRAM:SYNC?

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the External Trigger Signal 1.

- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [Timer Trigger ▶], [Select Sync Source ▶], [External Trigger 1 ▶], [Trigger Level] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** 1.2V

- **Setting range:** -5V-5V.

- **Default unit:** V

- **Program control commands:**

:TRIGger[:SEQuence]:EXTernal1:LEVel <level>

:TRIGger[:SEQuence]:EXTernal1:LEVel?

- **Examples:**

:TRIG:EXT1:LEV 1.2V

:TRIG:EXT1:LEV?

[Sync Source Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the External Trigger Signal 1.

- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [Timer Trigger ▶], [Select Sync Source ▶], [External Trigger 1 ▶], [Sync Source Polarity Positive Negative] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** Positive.

- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal1:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:EXTErnal1:SLOPe?

- **Examples:**

:TRIG:EXT1:SLOP

:TRIG:EXT1:SLOP?

[External Trigger 2 ►]

Set the Sync Source as External Trigger Signal 2. The soft menus are [Trigger Level], [Sync Source Polarity Positive Negative].

- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:SYNC EXTErnal2

- **Examples:**

:TRIG:FRAM:SYNC EXT2

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the External Trigger Signal 2.

- **Key path:** [Sweep], [Gate ►], [Gate Source ►], [Timer Trigger ►], [Select Sync Source ►], [External Trigger 2 ►], [Trigger Level] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** 1.2V

- **Setting range:** -5V-5V.

- **Default unit:** V

- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal2:LEVel <level>

:TRIGger[:SEQuence]:EXTErnal2:LEVel?

- **Examples:**

:TRIG:EXT2:LEV 1.2V

:TRIG:EXT2:LEV?

[Sync Source Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the External Trigger Signal 2.

- **Key path:** [Sweep], [Gate ►], [Gate Source ►], [Timer Trigger ►], [Select Sync Source ►], [External Trigger 2 ►], [Sync Source Polarity Positive Negative] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** Positive.

- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal2:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:EXTernal2:SLOPe?

- **Examples:**

:TRIG:EXT2:SLOP POS

:TRIG:EXT2:SLOP?

[Burst Signal Trigger ▶]

Set the Timer Sync Source as Burst Signal. The soft menus are [Trigger Level], [Sync Source Polarity Positive Negative].

- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:SYNC RFBurst

- **Examples:**

:TRIG:FRAM:SYNC RFB

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the burst signal.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [Timer Trigger ▶], [Select Sync Source ▶], [Burst Signal Trigger ▶], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -20dBm.
- **Setting range:** max.: -270dBm-30dBm. The current settable range is coupled with the current reference level and scale/division. The maximum is the level represented by the top graticule, and the minimum value is the level represented by the bottom graticule.
- **Default unit:** dBm.
- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl>

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?

- **Examples:**

:TRIG:RFB:LEV:ABS -20dBm

:TRIG:RFB:LEV:ABS?

[Sync Source Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the Burst Signal.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [Timer Trigger ▶], [Select Sync Source ▶], [Burst Signal Trigger ▶], [Sync Source Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:RFBurst:SLOPe?

- **Examples:**

:TRIG:RFBurst:SLOP POS

:TRIG:RFBurst:SLOP?

[Timer Period]

- **Menu description:** to set the Trigger Mode as Timer Period.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [Timer Trigger ▶], [Timing Cycle] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100ms.
- **Setting range:** 100ns-20s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:PERiod <time>

:TRIGger[:SEQuence]:FRAMe:PERiod?

- **Examples:**

:TRIG:FRAM:PER 100ms

:TRIG:FRAM:PER?

[Timer Offset]

- **Menu description:** to set the Trigger Mode as Timer Offset, which is not more than the Timer Period.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [Timer Trigger ▶], [Timer Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100ms.
- **Setting range:** 10ns-20s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:OFFSet <time>

:TRIGger[:SEQuence]:FRAMe:OFFSet?

- **Examples:**

:TRIG:FRAM:OFFS 100ms

:TRIG:FRAM:OFFS?

[Sync Holdoff]

- **Menu description:** to set the Trigger Mode as Sync Holdoff.
- **Key path:** [Sweep], [Gate ▶], [Gate Source ▶], [Timer Trigger ▶], [Sync Holdoff] on the front panel.

- **Status saved:** saved in the instrument status.
- **Factory preset:** 100ms.
- **Setting range:** 100ns-20s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff <time>

:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff?

- **Examples:**

:TRIG:FRAM:SYNC:HOLD 100ms

:TRIG:FRAM:SYNC:HOLD?

[Number of scanning points]

- **Menu description:** to set the trace points.
- **Key path:** [Sweep], [Sweep Points] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1001.
- **Setting range:** 101-30001.
- **Program control commands:**

[:SENSe]:SWEep:POINts <integer>

[:SENSe]:SWEep:POINts?

- **Examples:**

:SWE:POIN 1001

:SWE:POIN?

5. 2. 2. 6. Trigger

Select the trigger method of sweep or measurement, including [Free Trigger], [Video Trigger ▶], [Power Trigger ▶], [External Trigger 1 ▶], [External Trigger 2 ▶], [Burst Signal Trigger ▶], [Timer Trigger ▶], [Trigger Holdoff ON OFF]. Different triggers will be expressed in different ways on the parameter zone of the screen.

[Free Trigger]

- **Menu description:** when the previous single or continuous sweep finishes, the next sweep or measurement is automatically triggered.
- **Program control commands:**

:TRIG:SOUR IMM

[Video Trigger ▶]

- **Menu description:** to set the Trigger Mode as Video Trigger. When the positive slope part of input trigger signal passes through the video trigger level determined by [Trigger Polarity Positive Negative], the sweep will be triggered. The trigger level value can be set by the number keys, stepping keys or knob. The red line on the screen indicates the selected trigger level. The soft menus

include [Trigger Level], [Trigger Polarity Positive Negative], [Trigger Delay ON OFF].

- **Program control commands:**

:TRIG:SOUR VID

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the Video Trigger.
- **Key path:** [Trigger], [Video Trigger ►], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -25dBm.
- **Setting range:** max.: -270dBm-30dBm. The current settable range is coupled with the current reference level and scale/division. The maximum is the level represented by the top graticule, and the minimum value is the level represented by the bottom graticule.
- **Default unit:** dBm.
- **Program control commands:**

:TRIGger[:SEquence]:VIDeo:LEVel <ampl>

:TRIGger[:SEquence]:VIDeo:LEVel?

- **Examples:**

:TRIG:VID:LEV -25dBm

:TRIG:VID:LEV?

[Trigger Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the Video Trigger, where Positive means positive edge trigger, and Negative means negative edge trigger.
- **Key path:** [Trigger], [Video Trigger ►], [Trigger Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEquence]:VIDeo:SLOPe POSitive|NEGative

:TRIGger[:SEquence]:VIDeo:SLOPe?

- **Examples:**

:TRIG:VID:SLOP POS

:TRIG:VID:SLOP?

[Trigger Delay ON OFF]

- **Menu description:** to set the Video Trigger Delay ON OFF and delay time.
- **Key path:** [Trigger], [Video Trigger ►], [Trigger Delay ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.

- **Factory preset:** OFF.
- **Setting range:** 20ns-60s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQuence]:VIDeo:DELaY <time>

:TRIGger[:SEQuence]:VIDeo:DELaY?

:TRIGger[:SEQuence]:VIDeo:DELaY:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:VIDeo:DELaY:STATe?

- **Examples:**

:TRIG:VID:DEL 1ms

:TRIG:VID:DEL?

:TRIG:VID:DEL:STAT OFF

:TRIG:VID:DEL:STAT?

[Power Trigger ►]

- **Menu description:** to set the Trigger Mode as Power Trigger. The soft menus include [Trigger Polarity Positive Negative], [Trigger Delay ON OFF].
- **Key path:** [Trigger], [Power Trigger ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:TRIG:SOUR LINE

[Trigger Polarity Positive Negative]

- **Menu description:** to set the trigger polarity ON OFF of the Power Trigger.
- **Key path:** [Trigger], [Power Trigger ►], [Trigger Source Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:LINE:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:LINE:SLOPe?

- **Examples:**

:TRIG:LINE:SLOP POS

:TRIG:LINE:SLOP?

[Trigger Delay ON OFF]

- **Menu description:** to set the trigger delay ON OFF of the Power Trigger and trigger delay time.

- **Key path:** [Trigger], [Power Trigger ▶], [Trigger Delay ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Setting range:** 20ns-60s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQuence]:LINE:DELay <time>

:TRIGger[:SEQuence]:LINE:DELay?

:TRIGger[:SEQuence]:LINE:DELay:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:LINE:DELay:STATe?

- **Examples:**

:TRIG:LINE:DEL 1ms

:TRIG:LINE:DEL?

:TRIG:LINE:DEL:STAT OFF

:TRIG:LINE:DEL:STAT?

[External Trigger 1 ▶]

- **Menu description:** to set the Trigger Mode as External Trigger Signal 1. The soft menus include [Trigger Level], [Trigger Polarity Positive Negative], [Trigger Delay ON OFF].
- **Program control commands:**

:TRIG:SOUR EXT1

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the External Trigger Signal 1.
- **Key path:** [Trigger], [External Trigger 1 ▶], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.2V
- **Setting range:** -5V-5V.
- **Default unit:** V
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal1:LEVel <level>

:TRIGger[:SEQuence]:EXTErnal1:LEVel?

- **Examples:**

:TRIG:EXT1:LEV 1.2V

:TRIG:EXT1:LEV?

[Trigger Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the External Trigger Signal 1.
- **Key path:** [Trigger], [External Trigger 1 ►], [Trigger Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal1:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:EXTErnal1:SLOPe?

- **Examples:**

:TRIG:EXT1:SLOP POS

:TRIG:EXT1:SLOP?

[Trigger Delay ON OFF]

- **Menu description:** to set the trigger delay ON OFF of the External Trigger 1 and trigger delay time.
- **Key path:** [Trigger], [External Trigger 1 ►], [Trigger DelayON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Setting range:** 20ns-60s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal1:DELAy <time>

:TRIGger[:SEQuence]:EXTErnal1:DELAy?

:TRIGger[:SEQuence]:EXTErnal1:DELAy:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:EXTErnal1:DELAy:STATe?

- **Examples:**

:TRIG:EXT1:DEL 1ms

:TRIG:EXT1:DEL?

:TRIG:EXT1:DEL:STAT OFF

:TRIG:EXT1:DEL:STAT?

[External Trigger 2 ►]

- **Menu description:** to set the Trigger Mode as External Trigger Signal 2. The soft menus include [Trigger Level], [Trigger Polarity Positive Negative], [Trigger DelayON OFF].
- **Program control commands:**

:TRIG:SOUR EXT2

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the External Trigger Signal 2.
- **Key path:** [Trigger], [External Trigger 2 ►], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.2V
- **Setting range:** -5V-5V.
- **Default unit:** V
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal2:LEVel <level>

:TRIGger[:SEQuence]:EXTErnal2:LEVel?

- **Examples:**

:TRIG:EXT2:LEV 1.2V

:TRIG:EXT2:LEV?

[Trigger Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the External Trigger Signal 2.
- **Key path:** [Trigger], [External Trigger 2 ►], [Trigger Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal2:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:EXTErnal2:SLOPe?

- **Examples:**

:TRIG:EXT2:SLOP POS

:TRIG:EXT2:SLOP?

[Trigger Delay ON OFF]

- **Menu description:** to set the trigger delay ON OFF of the External Trigger 2 and trigger delay time.
- **Key path:** [Trigger], [External Trigger 2 ►], [Trigger DelayON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Setting range:** 20ns-60s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal2:DELaY <time>

:TRIGger[:SEQuence]:EXTErnal2:DELaY?

:TRIGger[:SEQuence]:EXTeRnal2:DELAy:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:EXTeRnal2:DELAy:STATe?

- **Examples:**

:TRIG:EXT1:DEL 1ms

:TRIG:EXT2:DEL?

:TRIG:EXT1:DEL:STAT OFF

:TRIG:EXT1:DEL:STAT?

[Burst Signal Trigger ►]

- **Menu description:** to set the Trigger Mode as Burst Signal. The soft menus include [Trigger Level], [Trigger Polarity Positive Negative], [Trigger Delay ON OFF].

- **Program control commands:**

:TRIG:SOUR RFB

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the burst signal.
- **Key path:** [Trigger], [Burst Signal Trigger ►], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -20dBm.
- **Setting range:** max.: -270dBm-30dBm. The current settable range is coupled with the current reference level and scale/division. The maximum is the level represented by the top graticule, and the minimum value is the level represented by the bottom graticule.
- **Default unit:** dBm.
- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl>

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?

- **Examples:**

:TRIG:RFB:LEV:ABS -20dBm

:TRIG:RFB:LEV:ABS?

[Trigger Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the Burst Signal Trigger.
- **Key path:** [Trigger], [Burst Signal Trigger ►], [Trigger Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:RFBurst:SLOPe?

- **Examples:**

:TRIG:RFB:SLOP POS

:TRIG:RFB:SLOP?

[Trigger Delay ON OFF]

- **Menu description:** to set the trigger delay ON OFF of Burst Signal Trigger and the trigger delay time.

- **Key path:** [Trigger], [Burst Signal Trigger ►], [Trigger Delay ON OFF] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** OFF.

- **Setting range:** 20ns-60s.

- **Default unit:** s

- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:DELay <time>

:TRIGger[:SEQuence]:RFBurst:DELay?

:TRIGger[:SEQuence]:RFBurst:DELay:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:RFBurst:DELay:STATe?

- **Examples:**

:TRIG:RFB:DEL 1ms

:TRIG:RFB:DEL?

:TRIG:RFB:DEL:STAT OFF|ON|0|1

:TRIG:RFB:DEL:STAT?

:TRIG:SOUR LINE

[Trigger Polarity Positive Negative]

- **Menu description:** to set the trigger polarity ON OFF of the Power Trigger.

- **Key path:** [Trigger], [Power Trigger ►], [Trigger Source Polarity Positive Negative] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** Positive.

- **Program control commands:**

:TRIGger[:SEQuence]:LINE:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:LINE:SLOPe?

- **Examples:**

:TRIG:LINE:SLOP POS

:TRIG:LINE:SLOP?

[Trigger Delay ON OFF]

- **Menu description:** to set the trigger delay ON OFF of the Power Trigger and trigger delay time.
- **Key path:** [Trigger], [Power Trigger ►], [Trigger Delay ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Setting range:** 20ns-60s.
- **Default unit:** s
- **Program control commands:**

```
:TRIGger[:SEquence]:LINE:DElay <time>
```

```
:TRIGger[:SEquence]:LINE:DElay?
```

```
:TRIGger[:SEquence]:LINE:DElay:STATe OFF|ON|0|1
```

```
:TRIGger[:SEquence]:LINE:DElay:STATe?
```

- **Examples:**

```
:TRIG:LINE:DEL 1ms
```

```
:TRIG:LINE:DEL?
```

```
:TRIG:LINE:DEL:STAT OFF
```

```
:TRIG:LINE:DEL:STAT?
```

[External Trigger 1 ►]

- **Menu description:** to set the Trigger Mode as External Trigger Signal 1. The soft menus include [Trigger Level], [Trigger Polarity Positive Negative], [Trigger Delay ON OFF].
- **Program control commands:**

```
:TRIG:SOUR EXT1
```

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the External Trigger Signal 1.
- **Key path:** [Trigger], [External Trigger 1 ►], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.2V
- **Setting range:** -5V-5V.
- **Default unit:** V
- **Program control commands:**

```
:TRIGger[:SEquence]:EXTErnal1:LEVel <level>
```

```
:TRIGger[:SEquence]:EXTErnal1:LEVel?
```

- **Examples:**

```
:TRIG:EXT1:LEV 1.2V
```

:TRIG:EXT1:LEV?

[Trigger Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the External Trigger Signal 1.
- **Key path:** [Trigger], [External Trigger 1 ►], [Trigger Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:EXTernal1:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:EXTernal1:SLOPe?

- **Examples:**

:TRIG:EXT1:SLOP POS

:TRIG:EXT1:SLOP?

[Trigger Delay ON OFF]

- **Menu description:** to set the trigger delay ON OFF of the External Trigger 1 and trigger delay time.
- **Key path:** [Trigger], [External Trigger 1 ►], [Trigger DelayON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Setting range:** 20ns-60s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQuence]:EXTernal1:DELay <time>

:TRIGger[:SEQuence]:EXTernal1:DELay?

:TRIGger[:SEQuence]:EXTernal1:DELay:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:EXTernal1:DELay:STATe?

- **Examples:**

:TRIG:EXT1:DEL 1ms

:TRIG:EXT1:DEL?

:TRIG:EXT1:DEL:STAT OFF

:TRIG:EXT1:DEL:STAT?

[External Trigger 2 ►]

- **Menu description:** to set the Trigger Mode as External Trigger Signal 2. The soft menus include [Trigger Level], [Trigger Polarity Positive Negative], [Trigger DelayON OFF].
- **Program control commands:**

:TRIG:SOUR EXT2

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the External Trigger Signal 2.
- **Key path:** [Trigger], [External Trigger 2 ►], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.2V
- **Setting range:** -5V-5V.
- **Default unit:** V
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal2:LEVel <level>

:TRIGger[:SEQuence]:EXTErnal2:LEVel?

- **Examples:**

:TRIG:EXT2:LEV 1.2V

:TRIG:EXT2:LEV?

[Trigger Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the External Trigger Signal 2.
- **Key path:** [Trigger], [External Trigger 2 ►], [Trigger Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal2:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:EXTErnal2:SLOPe?

- **Examples:**

:TRIG:EXT2:SLOP POS

:TRIG:EXT2:SLOP?

[Trigger Delay ON OFF]

- **Menu description:** to set the trigger delay ON OFF of the External Trigger 2 and trigger delay time.
- **Key path:** [Trigger], [External Trigger 2 ►], [Trigger DelayON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Setting range:** 20ns-60s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQuence]:EXTErnal2:DELay <time>

:TRIGger[:SEQuence]:EXTErnal2:DELay?

:TRIGger[:SEQuence]:EXTeRnal2:DELaY:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:EXTeRnal2:DELaY:STATe?

- **Examples:**

:TRIG:EXT1:DEL 1ms

:TRIG:EXT2:DEL?

:TRIG:EXT1:DEL:STAT OFF

:TRIG:EXT1:DEL:STAT?

[Burst Signal Trigger ►]

- **Menu description:** to set the Trigger Mode as Burst Signal. The soft menus include [Trigger Level], [Trigger Polarity Positive Negative], [Trigger Delay ON OFF].

- **Program control commands:**

:TRIG:SOUR RFB

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the burst signal.
- **Key path:** [Trigger], [Burst Signal Trigger ►], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -20dBm.
- **Setting range:** max.: -270dBm-30dBm. The current settable range is coupled with the current reference level and scale/division. The maximum is the level represented by the top graticule, and the minimum value is the level represented by the bottom graticule.
- **Default unit:** dBm.
- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl>

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?

- **Examples:**

:TRIG:RFB:LEV:ABS -20dBm

:TRIG:RFB:LEV:ABS?

[Trigger Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the Burst Signal Trigger.
- **Key path:** [Trigger], [Burst Signal Trigger ►], [Trigger Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:RFBurst:SLOPe?

- **Examples:**

:TRIG:RFB:SLOP POS

:TRIG:RFB:SLOP?

[Trigger Delay ON OFF]

- **Menu description:** to set the trigger delay ON OFF of Burst Signal Trigger and the trigger delay time.
- **Key path:** [Trigger], [Burst Signal Trigger ▶], [Trigger Delay ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Setting range:** 20ns-60s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:DELay <time>

:TRIGger[:SEQuence]:RFBurst:DELay?

:TRIGger[:SEQuence]:RFBurst:DELay:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:RFBurst:DELay:STATe?

- **Examples:**

:TRIG:RFB:DEL 1ms

:TRIG:RFB:DEL?

:TRIG:RFB:DEL:STAT OFF|ON|0|1

:TRIG:RFB:DEL:STAT?

[Timer Trigger ▶]

- **Menu description:** to set the Trigger Mode as Timer Trigger. The soft menus include [Select Sync Source ▶], [Timer Period], [Timer Offset], [Sync Holdoff], [Trigger Delay ON OFF].
- **Program control commands:**

:TRIG:SOUR FRAM

[Select Sync Source ▶]

- **Menu description:** to select and set the Timer Sync Source parameters. The soft menus include [OFF], [External Trigger 1 ▶], [External Trigger 2 ▶], [Burst Signal Trigger ▶]. OFF means that the timer is not synchronous.
- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal1|EXTernal2|RFBurst|OFF

:TRIGger[:SEQuence]:FRAMe:SYNC?

[External Trigger 1 ▶]

- **Menu description:** to set the Timer Sync Source as External Trigger Signal 1. The soft menus are [Trigger Level], [Sync Source Polarity Positive Negative].

- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal1

- **Examples:**

:TRIG:FRAM:SYNC EXT1

:TRIG:FRAM:SYNC?

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the External Trigger Signal 1.
- **Key path:** [Trigger], [Menu 1/2 ▶], [Timer Trigger ▶], [Select Sync Source ▶], [External Trigger 1 ▶], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.2V
- **Setting range:** -5V-5V.
- **Default unit:** V
- **Program control commands:**

:TRIGger[:SEQuence]:EXTernal1:LEVel <level>

:TRIGger[:SEQuence]:EXTernal1:LEVel?

- **Examples:**

:TRIG:EXT1:LEV 1.2V

:TRIG:EXT1:LEV?

[Sync Source Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the External Trigger Signal 1.
- **Key path:** [Trigger], [Menu 1/2 ▶], [Timer Trigger ▶], [Select Sync Source ▶], [External Trigger 1 ▶], [Sync Source Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:EXTernal1:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:EXTernal1:SLOPe?

- **Examples:**

:TRIG:EXT1:SLOP POS

:TRIG:EXT1:SLOP?

[External Trigger 2 ▶]

Set the Sync Source as External Trigger Signal 2. The soft menus are [Trigger Level], [Sync Source Polarity Positive Negative].

- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal2

- **Examples:**

:TRIG:FRAM:SYNC EXT2

:TRIG:FRAM:SYNC?

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the External Trigger Signal 2.

- **Key path:** [Trigger], [Menu 1/2 ▶], [Timer Trigger ▶], [Select Sync Source ▶], [External Trigger 2 ▶], [Trigger Level] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** 1.2V

- **Setting range:** -5V-5V.

- **Default unit:** V

- **Program control commands:**

:TRIGger[:SEQuence]:EXTernal2:LEVel <level>

:TRIGger[:SEQuence]:EXTernal2:LEVel?

- **Examples:**

:TRIG:EXT2:LEV 1.2V

:TRIG:EXT2:LEV?

[Sync Source Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the External Trigger Signal 2.

- **Key path:** [Trigger], [Menu 1/2 ▶], [Timer Trigger ▶], [Select Sync Source ▶], [External Trigger 2 ▶], [Sync Source Polarity Positive Negative] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** Positive.

- **Program control commands:**

:TRIGger[:SEQuence]:EXTernal2:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:EXTernal2:SLOPe?

- **Examples:**

:TRIG:EXT2:SLOP POS

:TRIG:EXT2:SLOP?

[Burst Signal Trigger ▶]

Set the Timer Sync Source as Burst Signal. The soft menus are [Trigger Level], [Sync Source Polarity Positive Negative].

- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:SYNC RFBurst

- **Examples:**

:TRIG:FRAM:SYNC RFB

[Trigger Level]

- **Menu description:** to set the Trigger Level Threshold of the burst signal.
- **Key path:** [Trigger], [Menu 1/2 ▶], [Timer Trigger ▶], [Select Sync Source ▶], [Burst Signal Trigger ▶], [Trigger Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -20dBm.
- **Setting range:** max.: -270dBm-30dBm. The current settable range is coupled with the current reference level and scale/division. The maximum is the level represented by the top graticule, and the minimum value is the level represented by the bottom graticule.
- **Default unit:** dBm.
- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl>

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?

- **Examples:**

:TRIG:RFB:LEV:ABS -20dBm

:TRIG:RFB:LEV:ABS?

[Sync Source Polarity Positive Negative]

- **Menu description:** to set the trigger polarity of the Burst Signal.
- **Key path:** [Trigger], [Menu 1/2 ▶], [Timer Trigger ▶], [Select Sync Source ▶], [Burst Signal Trigger ▶], [Sync Source Polarity Positive Negative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Positive.
- **Program control commands:**

:TRIGger[:SEQuence]:RFBurst:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:RFBurst:SLOPe?

- **Examples:**

:TRIG:RFB:SLOP POS

:TRIG:RFB:SLOP?

[Timer Period]

- **Menu description:** to set the Trigger Mode as Timer Period.

- **Key path:** [Trigger], [Menu 1/2 ►], [Timer Trigger ►], [Timer Period] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100ms.
- **Setting range:** 100ns-20s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQUence]:FRAMe:PERiod <time>

:TRIGger[:SEQUence]:FRAMe:PERiod?

- **Examples:**

:TRIG:FRAM:PER 100ms

:TRIG:FRAM:PER?

[Timer Offset]

- **Menu description:** to set the Trigger Mode as Timer Offset, which is not more than the Timer Period.
- **Key path:** [Trigger], [Menu 1/2 ►], [Timer Trigger ►], [Timer Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100ms.
- **Setting range:** 10ns-20s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQUence]:FRAMe:OFFSet <time>

:TRIGger[:SEQUence]:FRAMe:OFFSet?

- **Examples:**

:TRIG:FRAM:OFFS 100ms

:TRIG:FRAM:OFFS?

[Sync Holdoff]

- **Menu description:** to set the Trigger Mode as Sync Holdoff.
- **Key path:** [Trigger], [Menu 1/2 ►], [Timer Trigger ►], [Sync Source Holdoff] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100ms.
- **Setting range:** 100ns-20s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQUence]:FRAMe:SYNC:HOLDoff <time>

:TRIGger[:SEQUence]:FRAMe:SYNC:HOLDoff?

- **Examples:**

:TRIG:FRAM:SYNC:HOLD 100ms

:TRIG:FRAM:SYNC:HOLD?

[Trigger Delay ON OFF]

- **Menu description:** to set the trigger delay ON OFF of the Timer Trigger and trigger delay time.
- **Key path:** [Trigger], [Menu 1/2 ►], [Timer Trigger ►], [Trigger Delay ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Setting range:** 20ns-60s.
- **Default unit:** s
- **Program control commands:**

:TRIGger[:SEQuence]:FRAMe:DELay <time>

:TRIGger[:SEQuence]:FRAMe:DELay?

:TRIGger[:SEQuence]:FRAMe:DELay:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:FRAMe:DELay:STATe?

- **Examples:**

:TRIG:FRAM:DEL 1

:TRIG:FRAM:DEL?

:TRIG:FRAM:DEL:STAT OFF

:TRIG:FRAM:DEL:STAT?

[Trigger Holdoff ON OFF]

- **Menu description:** to set the trigger holdoff time.
- **Key path:** [Trigger], [Menu 1/2 ►], [Trigger Holdoff ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100ms.
- **Setting range:** 100ns-20s.
- **Default unit:** s
- **Program control commands:**

[:SENSe]:SWEep:EGATe:HOLDoff <time>

[:SENSe]:SWEep:EGATe:HOLDoff?

[:SENSe]:SWEep:EGATe:HOLDoff:AUTO OFF|ON|0|1

[:SENSe]:SWEep:EGATe:HOLDoff:AUTO?

- **Examples:**

:SWE:EGAT:HOLD 100ms

:SWE:EGAT:HOLD?

:SWE:EGAT:HOLD:AUTO OFF

:SWE:EGAT:HOLD:AUTO?

5. 2. 2. 7. Trace

Press [Trace] key on the front panel to pop up corresponding soft menu. Including: [Select Trace ►], [Refresh], [Average], [Max. Hold], [Min. Hold], [Display ON OFF ►], [Menu 1/2 ►], [Detector ►], [Trace Operation ►], [Copy Trace ►], [Reset All Traces].

[Select Trace ► Trace 1]

- **Menu description:** to select trace. The signal/spectrum analyzer provides six trace lines including Trace 1, Trace 2, Trace 3, Trace 4, Trace 5 and Trace 6. The selected trace number will be marked in the menu, and the trace processing method, display method and detector will be displayed on the graticule top. After one trace is selected, the corresponding menu trace processing, display method and detector type setting are only active for the selected trace.
- **Key path:** [Trace], [Select Trace ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** to activate Trace 1 with processing method as Refresh, display method as Refresh Display and detector mode as Normal.

[Refresh]

- **Command description:** to set the current trace processing as Refresh, i.e., clear all data of displayed trace and continue the signal trace receipt under sweep status.
- **Key path:** [Trace], [Refresh] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** after all traces are selected, the trace mode is defaulted as Refresh.
- **Program control commands:**

```
:TRACe<1|2|3|4|5|6>:TYPE WRITe
```

```
:TRACe<1|2|3|4|5|6>:TYPE?
```

- **Examples:**

```
:TRAC1:TYPE WRIT
```

```
:TRAC1:TYPE?
```

[Averaging]

- **Command description:** to set the current trace processing method as Average, i.e., based on the average count N set in the [Measurement Setting], update trace after averaging the performance index of the measurement trace.

Detailed algorithm:

New trace = ((K-1) previous trace + current measurement trace)/K where, K is accumulated average count.

Under continuous measurement, when K is accumulated to the average count N set in the [Measurement Setting], the K will always equal to N. Under single measurement status, when K is accumulated to the average count N set in the [Measurement Setting], the measurement will stop.

- **Key path:** [Trace], [Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** after all traces are selected, the trace mode is defaulted as Refresh.
- **Program control commands:**

:TRACe<1|2|3|4|5|6>:TYPE AVERAge

:TRACe<1|2|3|4|5|6>:TYPE?

- **Examples:**

:TRAC1:TYPE AVER

:TRAC1:TYPE?

[Max. Hold]

- **Menu description:** to set the current trace processing method as maximum hold, i.e., the new trace data will be assigned with maximum value of previous measured trace data.
- **Key path:** [Trace], [Max Hold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** after all traces are selected, the trace mode is defaulted as Refresh.
- **Program control commands:**

:TRACe<1|2|3|4|5|6>:TYPE MAXHold

:TRACe<1|2|3|4|5|6>:TYPE?

- **Examples:**

:TRAC1:TYPE MAX

:TRAC1:TYPE?

[Min. Hold]

- **Menu description:** to set the current trace processing method as minimum hold, i.e., the new trace data will be assigned with minimum value of previous measured trace data.
- **Key path:** [Trace], [Min Hold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** after all traces are selected, the trace mode is defaulted as Refresh.
- **Program control commands:**

:TRACe<1|2|3|4|5|6>:TYPE MINHold

:TRACe<1|2|3|4|5|6>:TYPE?

- **Examples:**

:TRAC1:TYPE MIN

:TRAC1:TYPE?

[Display ON/OFF ► Refresh Display]

- **Menu description:** to set the display method for the selected trace from [Refresh Display], [Static Display], [Backstage Refresh] and [Display OFF].
- **Key path:** [Trace], [Display ON/OFF ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Except Trace 1, after selection of other traces, the trace display is defaulted as Display OFF.
- **Program control commands:**

```
:TRACe<1|2|3|4|5|6>:DISPlay[:STATe] ON|OFF|0|1
```

```
:TRACe<1|2|3|4|5|6>:DISPlay[:STATe]?
```

- **Examples:**

```
:TRAC1:DISP ON
```

```
:TRAC1:DISP?
```

- Other descriptions:

➤ "Refresh Display" indicates that a new trace will execute refresh in the internal part of application (backstage) and will be displayed on the display area of the front panel. When the trace [Display ON/OFF] is set as "Static Display", the signal/spectrum analyzer will keep the most recent trace and do not go through trace processing. The latest trace will be displayed in the display area of the front panel. "Backstage Refresh" indicates that a new trace will execute refresh in the internal part of application (backstage) and but will not be displayed on the display area of the front panel. This type is commonly applied in remote control.

➤ "Display OFF" indicates that the signal/spectrum analyzer neither goes through backstage trace processing nor display. That means, the trace is not activated and is OFF.

[Detector ►]

Pop up soft menus related to setting the detector type for the currently selected trace, including [Auto], [Normal], [Positive Peak], [Sample], [Negative Peak], [Average ►], where, the average detector type includes video average, power average and voltage average.

[Auto]

- **Menu description:** to set the detector command for the currently selected trace as Auto. That means, the signal/spectrum analyzer will automatically select most suitable detector based on the parameter setting of currently selected trace, including trace processing method, trace average type, noise marker function, etc.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Auto] on the front panel
- **Status saved:** saved in the instrument status.
- **Factory preset:** after trace selection, all Trace Detector Types are selected as Auto.
- **Program control commands:** [:SENSe]:DETEctor:AUTO ON|OFF|1|0 [:SENSe]:DETEctor:AUTO?
- **Examples:**

```
:DET:AUTO ON
```

```
:DET:AUTO?
```

[Normal]

- **Menu description:** to set the detector command for the currently selected trace as Normal. i.e., display the measurement

results of positive peak and negative peak at the same time to achieve display effect similar to the analog instrument.

- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Normal] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
[::SENSe]:DETECTOR[:FUNCTION] NORMAl
```

```
[::SENSe]:DETECTOR[:FUNCTION]?
```

- **Examples:**

```
:DET NORM
```

```
:DET?
```

[Positive Peak]

- **Menu description:** to set the detector command for the currently selected trace as Positive Peak. i.e., take the maximum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Positive Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
[::SENSe]:DETECTOR[:FUNCTION] POSitive
```

```
[::SENSe]:DETECTOR[:FUNCTION]?
```

- **Examples:**

```
:DET POS
```

```
:DET?
```

[Sample]

- **Menu description:** to set the detector command for the currently selected trace as Sample. i.e., take the last value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Sample] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
[::SENSe]:DETECTOR[:FUNCTION] SAMPlE
```

```
[::SENSe]:DETECTOR[:FUNCTION]?
```

- **Examples:**

```
:DET SAMP
```

```
:DET?
```

[Negative Peak]

- **Menu description:** to set the detector command for the currently selected trace as Negative Peak. i.e., take the minimum value from sampling data assigned to each trace point.

- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Negative Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
[:SENSe]:DETECTOR[:FUNCTION] NEGative
```

```
[:SENSe]:DETECTOR[:FUNCTION]?
```

- **Examples:**

```
:DET NEG
```

```
:DET?
```

[Average ▶ Video Average]

- **Menu description:** to set the detector command for the currently selected trace as Video Average. Also called Logarithm Power Average Detector, i.e., take the logarithm power average value for all data assigned to each trace point; earlier signal/spectrum analyzer generally displays the measurement trace of logarithm scale, and all filtering and averaging are based on the logarithm power data; the trace is generally called as video signal.

After digital IF processing is adopted, to make measurement results same as the earlier signal/spectrum analyzer, the video average detector function is added.

- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Average ▶], [Video Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
[:SENSe]:DETECTOR[:FUNCTION] AVERage
```

```
[:SENSe]:DETECTOR[:FUNCTION]?
```

- **Examples:**

```
:DET AVER
```

```
:DET?
```

[Average ▶ Power Average]

- **Menu description:** to set the detector command for the currently selected trace as Power Average. Also called root mean square (RMS) detector. Calculate the root mean square of all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After square these voltage values, take sum and divide the count of sampling data points corresponding to each trace point. Finally, take square root. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those RMS values are trace data.

- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Average ▶], [Power Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
[:SENSe]:DETECTOR[:FUNCTION] RMS
```

```
[:SENSe]:DETECTOR[:FUNCTION]?
```

- **Examples:**

:DET RMS

:DET?

[Average ► Average Voltage]

- **Menu description:** to set the detector command for the currently selected trace as Voltage Average. Also called average (AVG) detector. Take linear average for all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After summing those voltage values, divide the number of sampling data points corresponding to each trace point. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those average values are trace data.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Voltage Average]
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
[:SENSe]:DETECTOR[:FUNCTION] SCALAR
```

```
[:SENSe]:DETECTOR[:FUNCTION]?
```

- **Examples:**

```
:DET SCAL
```

```
:DET?
```

[Trace Operation ►]

- **Menu description:** to start up trace mathematical operation and set the methods and rules. The soft menus include [Operator 1+Operator 2->Operator 2], [Operator 1-Operator 2->Operator 2], [OFF], [Operator 1 Select ►], [Operator 2 Select ►], [Math Rule ►].

The signal/spectrum analyzer can take mathematical operation for any two traces from the active 6 ones, and save the results to the update data of the second trace. The mathematical operation includes addition and subtraction.

The math rule is used for specifying the data type of two traces under processing, including logarithmic power, linear voltage (current) or linear power. For details, refer to "4.1.3.1 Trace Detector and Trace Math".

- **Key path:** [Trace], [Menu 1/2 ►], [Trace operation ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Trace Operation OFF.
- **Program control commands:**

```
:CALCulate:MATH:MODE <LINear|LOGarithmic|POWER>
```

```
:CALCulate:MATH TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6,PDifference|PSUM|LOFFset|LDifference|OFF,TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6,TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6,<real>,<real>
```

```
:CALCulate:MATH? TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6
```

- **Examples:**

```
:CALC:MATH:MODE LIN
```

```
:CALC:MATH TRACE1,PDIF,TRACE2,TRACE1,0.0,0.0
```

:CALC:MATH? TRACE1

[Copy Trace ►]

- **Menu description:** to copy the data for the selected trace to the other trace. The soft menus include: [Operator 1->Operator 2], [Operator 1 Select ►], [Operator 2 Select ►].

Note that Copy Trace is only an operation rather than parameter setting; therefore, it is only performed once and not for every sweep and measurement. For details, refer to "4.1.3.1 Trace Detector and Trace Math".

- **Key path:** [Trace], [Menu 1/2 ►], [Copy Trace ►] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

```
:TRACe:COPI TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6,TRACE1|TRACE2|TRACE3|TRACE4
```

```
|TRACE5|TRACE6
```

```
:TRACe:COPI?
```

- **Examples:**

```
:TRAC:COPI TRACE1,TRACE2
```

```
:TRAC:COPI?
```

Reset All Traces

- **Menu description:** to recover all current traces back to the default status, including trace processing method, display method and detector type.

Note that Reset All Traces is only an operation rather than parameter setting; therefore, it is only performed once and not for every sweep and measurement.

- **Key path:** [Trace], [Menu 1/2 ►], [Reset All Traces] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

```
:TRACe:PRESet:ALL
```

- **Examples:**

```
:TRAC:PRE:ALL
```

5. 2. 2. 8. Measurement Setting

Pop up the soft menu related to measurement setting Include [Average Count], [Average Type Auto Manual], [Limit Line ►], [Phase Noise Optimization], [Low Noise Path ON OFF], [Preselector Preselecting Bypass], [RF Gain ►], [ADC Dither Auto Manual].

[average frequency]

- **Menu description:** to define the average count for trace averaging. This function is only active when the Average is selected in the [Trace] menu.
- **Key path:** [Measurement Setting], [Average Count] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 10.

- **Setting range:** 1-10000.

- **Program control commands:**

[[:SENSe]:AVERAge:COUNt <integer> [[:SENSe]:AVERAge:COUNt? [[:SENSe]:AVERAge:CLEAr

- **Examples:**

:AVER:COUN 100

:AVER:COUN?

:AVER:CL

[Average Type ► Auto Manual]

- **Menu description:** to set the trace average type. The soft menus include [Auto], [Video Average], [Power Average], [Voltage Average].
- **Key path:** [Measurement Setting], [Average Type Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**

[[:SENSe]:AVERAge:TYPE RMS|LOG|SCALAr [[:SENSe]:AVERAge:TYPE?

- **Examples:**

:AVER:TYPE RMS

:AVER:TYPE?

[Video Average]

- **Menu description:** to set the trace average type as Video Average.
- **Key path:** [Measurement Setting], [Average Type Auto Manual], [Power Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**

[[:SENSe]:AVERAge:TYPE LOG

- **Examples:**

:AVER:TYPE LOG

[Power Average]

- **Menu description:** to set the trace average type as Power Average.
- **Key path:** [Measurement Setting], [Average Type Auto Manual], [Power Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**

[[:SENSe]:AVERAge:TYPE RMS

- **Examples:**

:AVER:TYPE RMS

[Voltage Average]

- **Menu description:** to set the trace average type as Voltage Average.
- **Key path:** [Measurement Setting], [Average Type Auto Manual], [Voltage Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**

[:SENSe]:AVERage:TYPE SCALar

- **Examples:**

:AVER:TYPE SCAL

[Limit Line ►]

Pop up soft menus related to limit line editing and application, including [Select Limit Line ►], [Limit Line ON OFF], [Property ►], [Margin ON OFF], [Edit ►], [Delete Limit Line], [Test Limit Line ON OFF], [X Axis Unit Frequency Time], [Delete All Limit Lines], [Save Save Limit Line...], [Call Limit Line...].

[Select Limit Line ►]

- **Menu description:** to select and apply Limit Line. The signal/signal/spectrum analyzer has 6 limit lines for selection and application.
- **Key path:** Measurement Setting], [Limit Line ►], [Select Limit Line ►]
- **Status saved:** saved in the instrument status.
- **Factory preset:** Limit Line 1.

[Limit Line ON OFF]

- **Menu description:** to turn on or off Limit Line Display.
- **Key path:** Measurement Setting], [Limit Line ►], [Limit Line ON OFF]
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:LLINe<1|2|3|4|5|6>:DISPlay OFF|ON|0|1

:CALCulate:LLINe<1|2|3|4|5|6>:DISPlay?

:CALCulate:LIMit<1|2|3|4|5|6>:FAIL?

- **Examples:**

:CALC:LLIN1:DISP OFF

:CALC:LLIN1:DISP?

:CALC:LLIN1:FAIL?

[Property ▶]

Set the properties for currently selected limit line, including [Test Trace], [Type Upper Lower], [Interpolation Rules ▶], [Absolute/Relative ▶].

[Test Trace]

- **Menu description:** to designate the trace which currently selected limit line will be applied. There are 6 traces for selection, including [Trace 1], [Trace 2],[Trace 3],[Trace 4],[Trace 5], [Trace 6].
- **Key path:** [Measurement Setting], [Limit Line ▶], [Property ▶], [Test Trace] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** the trace active in current trace menu.
- **Program control commands:**

:CALCulate:LLINe<1|2|3|4|5|6>:TRACe 1|2|3|4|5|6

:CALCulate:LLINe<1|2|3|4|5|6>:TRACe 1|2|3|4|5|6

- **Examples:**

:CALC:LLIN1:TRAC 1

:CALC:LLIN1:TRAC?

[Type Upper Lower]

- **Menu description:** to specify when the test trace data, higher or lower than the limit line, will FAIL. Upper means that the limit line fails as long as one data in the test trace is higher than the limit; and Lower means that the limit line fails as long as one data in the test trace is lower than the limit.
- **Key path:** [Measurement Setting], [Limit Line ▶], [Property ▶], [Type Upper/Lower] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** upper.
- **Program control commands:**

:CALCulate:LLINe<1|2|3|4|5|6>:TYPE UPPer|LOWer

:CALCulate:LLINe<1|2|3|4|5|6>:TYPE?

- **Examples:**

:CALC:LLIN1:TYPE UPP

:CALC:LLIN1:TYPE?

[Interpolation Rules ▶]

- **Menu description:** to select the interpolation rules on which the data are based during edit of the currently selected limit line. Including [Log Lin Frequency], [Log Lin Amplitude]
- **Key path:** [Measurement Setting], [Limit Line ▶], [Property ▶], [Interpolation Rules ▶] on the front panel.
- **Status saved:** saved in the instrument status.

- **Program control commands:**

:CALCulate:LLINe<1|2|3|4|5|6>:AMPLitude:INTerpolate:TYPE LOGarithmic|LINear

:CALCulate:LLINe<1|2|3|4|5|6>:AMPLitude:INTerpolate:TYPE?

:CALCulate:LLINe<1|2|3|4|5|6>:CONTrol:INTerpolate:TYPE LOGarithmic|LINear

:CALCulate:LLINe<1|2|3|4|5|6>:CONTrol:INTerpolate:TYPE?

- **Examples:**

:CALC:LLIN1:AMPL:INT:TYPE LOG

:CALC:LLIN1:AMPL:INT:TYPE?

:CALC:LLIN1:CONT:INT:TYPE LOG

:CALC:LLIN1:CONT:INT:TYPE?

[Log Lin Frequency]

- **Menu description:** to select the interpolation rules on which data interpolation by the frequency axis is based during edit of the currently selected limit line. logarithmic rules or linear rules can be used.

- **Key path:** [Measurement Setting], [Limit Line ►], [Property ►], [Interpolation Rules ►] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** linear.

- **Program control commands:**

:CALCulate:LLINe<1|2|3|4|5|6>:CONTrol:INTerpolate:TYPE LOGarithmic|LINear

:CALCulate:LLINe<1|2|3|4|5|6>:CONTrol:INTerpolate:TYPE?

- **Examples:**

:CALC:LLIN1:CONT:INT:TYPE LOG

:CALC:LLIN1:CONT:INT:TYPE?

[Log Lin Amplitude]

- **Menu description:** to select the interpolation rules on which data interpolation by the amplitude axis is based during edit of the currently selected limit line. logarithmic rules or linear rules can be used.

- **Key path:** [Measurement Setting], [Limit Line ►], [Property ►], [Interpolation Rules ►], [Log/Lin Amplitude] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** Logarithm

- **Program control commands:**

:CALCulate:LLINe<1|2|3|4|5|6>:AMPLitude:INTerpolate:TYPE LOGarithmic|LINear

:CALCulate:LLINe<1|2|3|4|5|6>:AMPLitude:INTerpolate:TYPE?

- **Examples:**

:CALC:LLIN1:AMPL:INT:TYPE LOG

:CALC:LLIN1:AMPL:INT:TYPE?

[Absolute/Relative ▶]

- **Menu description:** to specify whether the X and Y axis data are absolute or relative during edit of the currently selected limit line. The soft menu includes [X Axis Relative to CF ON/OFF], [Y Axis Relative to RL ON/OFF].
- **Key path:** [Measurement Setting], [Limit Line ▶], [Property ▶], [Absolute/Relative ▶] on the front panel.
- **Status saved:** saved in the instrument status.

[X Axis Relative to CF On Off]

- **Menu description:** to specify whether the X axis data are absolute or relative during edit of the currently selected limit line.
- **Key path:** [Measurement Setup], [Limit Line ▶], [Property ▶], [Absolute/Relative ▶], [X Axis Relative to CF ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

```
:CALCulate:LLINe<1|2|3|4|5|6>:FREQuency:CMODE:RELative ON|OFF|1|0
```

```
:CALCulate:LLINe<1|2|3|4|5|6>:FREQuency:CMODE:RELative?
```

- **Examples:**

```
:CALC:LLIN1:FREQ:CMOD:REL ON
```

```
:CALC:LLIN1:FREQ:CMOD:REL?
```

[Y Axis Relative to RL On Off]

- **Menu description:** to specify whether the Y axis data are absolute or relative during edit of the currently selected limit line.
- **Key path:** [Measurement Setup], [Limit Line ▶], [Property ▶], [Absolute/Relative ▶], [Y Axis Relative to RL ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

```
:CALCulate:LLINe<1|2|3|4|5|6>:AMPLitude:CMODE:RELative ON|OFF|1|0
```

```
:CALCulate:LLINe<1|2|3|4|5|6>:AMPLitude:CMODE:RELative?
```

- **Examples:**

```
:CALC:LLIN1:AMPL:CMOD:REL ON
```

```
:CALC:LLIN1:AMPL:CMOD:REL?
```

[Margin ON OFF]

- **Menu description:** to specify a limit line margin dB which will cause the amplitude data exceed the limit during test of the currently selected limit line.
- **Key path:** [Measurement Setting], [Limit Line ▶], [Margin ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.

- **Factory preset:** OFF.
- **Setting range:** -40 dB - 40 dB.
- **Default unit:** dB.
- **Program control commands:**

:CALCulate:LLINe<1|2|3|4|5|6>:MARGin <rel_amp>

:CALCulate:LLINe<1|2|3|4|5|6>:MARGin?

:CALCulate:LLINe<1|2|3|4|5|6>:MARGin:STATe OFF|ON|0|1

:CALCulate:LLINe<1|2|3|4|5|6>:MARGin:STATe?

- **Examples:**

:CALC:LLIN1:MARG -10dB

:CALC:LLIN1:MARG?

:CALC:LLIN1:MARG:STAT OFF|ON|0|1

:CALC:LLIN1:MARG:STAT?

[Edit ►]

- **Menu description:** to pop up the menu for limit line editing. including [Point], [Frequency], [Amplitude], [Insert New Point], [Delete Point], [Copy Limit Line ►], [Trace Generation].
- **Key path:** [Measurement Setting], [Limit Line ►], [Edit ►] on the front panel.
- **Status saved:** not saved in instrument status.

[Test Limit Line On Off]

- **Menu description:** to specify whether the limit line test is ON or OFF.
- **Key path:** [Measurement Setting], [Limit Line ►], [Menu 1/2], [Test Limit Line ON/OFF] on the front panel.
- **Status saved:** not saved in instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:LLINe:TEST OFF|ON|0|1

:CALCulate:LLINe:TEST?

- **Examples:**

:CALC:LLIN:TEST OFF

:CALC:LLIN:TEST?

[X Axis Unit Frequency Time]

- **Menu description:** to specify that the X Axis unit of the Limit Line is set to Frequency or Time.
- **Key path:** [Measurement Setting], [Limit Line ►], [Menu 1/2], [X Axis Unit Frequency Time] on the front panel.
- **Status saved:** saved in the instrument status.

- **Factory preset:** frequency.
- **Program control commands:**

:CALCulate:LLINe:CONTrol:DOMain FREQuency|TIME

:CALCulate:LLINe:CONTrol:DOMain?

- **Examples:**

:CALC:LLIN:CONT:DOMain FREQ

:CALC:LLIN:CONT:DOM?

[Delete All Limit Lines]

- **Menu description:** to clear all limit line data.
- **Key path:** [Measurement Setting], [Limit Line], [Menu 1/2 ►], [Delete All Limit Lines] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:LLINe:ALL:DELeTe

- **Examples:**

:CALC:LLIN:ALL:DEL

[Save Limit Line...]

- **Menu description:** to pop up a dialog box for saving currently edited limit line data into a file.
- **Key path:** [Measurement Setting], [Limit Line ►], [Menu 1/2], [Save Limit Line...] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:MMEMory:STORe:LIMit LLINE1|LLINE2,<filename>

- **Examples:**

:MMEM:STOR:LIM LLINE1,"D:\limitline.lim"

[Call Limit Line...]

- **Menu description:** to pop up a dialog box for applying currently saved limit line file data to currently selected limit line.
- **Key path:** [Measurement Setting], [Limit Line ►], [Menu 1/2], [Call Limit Line...] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:MMEMory:LOAD:LIMit LLINE1|LLINE2,<filename>

- **Examples:**

:MMEM:LOAD:LIM LLINE1,"D:\limitline.lim"

[Low Noise Path On Off]

- **Menu description:** this menu is only available when the H34 option (Low Noise Preamp) is purchased. When the

preamplifier is ON, the Low Noise Path is OFF and this menu is grayed out; when the preamplifier is OFF, this menu lights on and is switchable.

- **Key path:** [Measurement Setting], [Menu 1/2 ►], [Low Noise Path ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

[::SENSe]:POWer[:RF]:MW:PATH STD|LNPath

[::SENSe]:POWer[:RF]:MW:PATH?

- **Examples:**

:POW:MW:PATH STD

:POW:MW:PATH?

[Preselector Bypass Preselect]

- **Menu description:** this menu is only available when the H36 option is purchased. It is used for setting whether to bypass the front-end preselector of the signal/spectrum analyzer. In analyzing bandwidth signal, bypass is usually required.
- **Key path:** [Measurement Setting], [Menu 1/2 ►], [Preselector Preselecting Bypass] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

INPut:FILTer:YIG[:STATe] OFF|ON|0|1 INPut:FILTer:YIG[:STATe]?

- **Examples:**

INP:FILT:YIG OFF INP:FILT:YIG?

[RF Gain ►]

- **Menu description:** to set the Auto ON/OFF of the RF Gain and best allocation algorithm for RF Gain. The soft menus includes [Auto], [Best Dynamic Range] and [Best Sensitivity].
- **Key path:** [Measurement Setting], [Menu 1/2 ►], [RF Gain ►] on the front panel.
- **Status saved:** saved in the instrument status.

[Auto]

- **Menu description:** to set the RF Gain distribution algorithm to Auto. In this case, the RF Gain distribution is "Best Dynamic Range".
- **Key path:** [Measurement Setting], [Menu 1/2 ►], [RF Gain ►], [Auto] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

[::SENSe]:RF:GAIN:AUTO[:STATe] OFF|ON|0|1 [::SENSe]:RF:GAIN:AUTO[:STATe]?

- **Examples:**

:RF:GAIN:AUTO OFF

:RF:GAIN:AUTO?

[Best Dynamic Range]

- **Menu description:** to set the RF Gain distribution algorithm to Best Dynamic Range. In this case, the RF Gain is switched to "Auto OFF"
- **Key path:** [Measurement Setting], [Menu 1/2 ►], [RF Gain ►], [Best Dynamic Range] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:** [:SENSe]:RF:GAIN:AUTO:RULes RANGE [:SENSe]:RF:GAIN:AUTO:RULes?
- **Examples:**

```
:RF:GAIN:AUTO:RUL RANGE
```

```
:RF:GAIN:AUTO:RUL?
```

[Best Sensitivity]

- **Menu description:** to set the RF Gain distribution algorithm to Best Sensitivity. In this case, the RF Gain is switched to "Auto OFF"
- **Key path:** [Measurement Setting], [Menu 1/2 ►], [RF Gain ►], [Best Sensitivity] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
[:SENSe]:RF:GAIN:AUTO:RULes SENSITIVITY
```

```
[:SENSe]:RF:GAIN:AUTO:RULes?
```

- **Examples:**

```
:RF:GAIN:AUTO:RUL SENSITIVITY
```

```
:RF:GAIN:AUTO:RUL?
```

[ADC Dither Auto ON OFF]

- **Menu description:** to control opening/closing of ADC dither of the frequency acquisition circuit in the analyzer. Under default mode, the signal/spectrum analyzer will automatically control whether the ADC Dither is ON based on current working condition. When the ADC Dither is under Auto mode, the ON or OFF status depends on the span, resolution bandwidth and sweep type (continuous swept or step sweep); when it is continuous swept, the ADC Dither status will force to switch to Auto and turns off; when it is step sweep, under Auto mode, if the span is 2MHz or below, the ADC Dither is ON; if the span is below 2MHz, the ADC Dither is OFF. Under Auto OFF mode, if the span is above 2MHz, turning on the ADC Dither may affect the measurement results based on selected dither status. You can access the submenu for manual control You can access the submenu for manual control.
- **Key path:** [Measurement Setting], [Menu 1/2 ►], [ADC Dither Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**

```
[:SENSe]:ADC:DITHer[:STATe] OFF|ON|HIGH
```

```
[:SENSe]:ADC:DITHer[:STATe]?
```

```
[:SENSe]:ADC:DITHer:AUTO[:STATe] OFF|ON|0|1
```

[[:SENSe]:ADC:DITH:Her:AUTO[:STATe]?

- **Examples:**

:ADC:DITH OFF

:ADC:DITH?

:ADC:DITH:AUTO OFF

:ADC:DITH:AUTO?

[Phase Noise Optimization>> Auto Manual]

Pop up the soft menu related to phase noise optimization, including [Auto], [ON] and [OFF]. If Auto is selected, the signal/spectrum analyzer will automatically control the LO circuit parameters and phase noise optimization based on current span, center frequency, RF Gain ON OFF. In principle, Phase Noise Optimization is defaulted as Auto mode.

- **Program control commands:**

[[:SENSe]:FREQuency:SYNTHeSis:AUTO[:STATe] OFF|ON|0|1

[[:SENSe]:FREQuency:SYNTHeSis:AUTO[:STATe]?

[[:SENSe]:FREQuency:SYNTHeSis:[[:STATe] OFF|ON|0|1

[[:SENSe]:FREQuency:SYNTHeSis:[[:STATe]?

- **Examples:**

:FREQ:SYNT:AUTO OFF|ON|0|1

:FREQ:SYNT:AUTO?

:FREQ:SYNT: OFF|ON|0|1

:FREQ:SYNT:?

5. 2. 2. 9. Measurement Control

Pop up the menu of measurement control, including [Restart Measurement] and [Pause/Resume].

[Restart Measurement]

- **Menu description:** to stop current measurement and restart measurement for the signal/spectrum analyzer.
- **Key path:** [Measurement Control], [Restart Measurement] on the front panel
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:REST

- **Examples:**

:INIT:REST

[Pause]

- **Menu description:** when the signal/spectrum analyzer is in operation, this menu is used for pausing current measurement; when in Paused status, this menu is used for continuing measurement.
- **Key path:** [Measurement Control], [Pause] on the front panel.

- **Status saved:** not saved in instrument status.

- **Program control commands:**

:INITiate:PAUS

:INITiate:RES

- **Examples:**

:INIT:PAUS

:INIT:RES

5. 2. 2. 10. Auto Setting

Pop up the soft menu related to auto setting including [Couple All], [Mechanical Attenuator Auto Manual], [Resolution Bandwidth Auto Manual], [Video Bandwidth Auto Manual], [VBW/RBW Auto Manual], [Span/RBW Auto Manual], [Sweep Time Auto Manual] and [Frequency Step Auto Manual].

[Couple All]

- **Menu description:** to set the sweep mode, resolution bandwidth, video bandwidth, sweep time, mechanical attenuator and frequency step as auto coupling mode. The signal/spectrum analyzer will select most suitable values for those functions based on set frequency and bandwidth (or start frequency and stop frequency). These values will be set based on span and coupling ratio saved under [VBW/RBW] or the [Span/RBW]. If no ratio is pre-saved, use default ratio.

- **Key path:** [Auto Setting], [Couple All] on the front panel.

- **Status saved:** not saved in instrument status.

- **Factory preset:** Couple All.

- **Program control commands:**

:COUPle ALL|NONE

- **Examples:**

:COUP ALL

[Mechanical Attenuator Auto Manual]

- **Menu description:** In Auto ON mode, the mechanical attenuator is coupled to the reference level. Under Auto OFF Mode, use number keys, stepping keys or knob to change the attenuation of the attenuator. Such menu is used for another port of the mechanical attenuator and the setting can also be made via [Amplitude/Y Axis], [Attenuator ►], [Mechanical Attenuator Auto Manual] on the front panel.

- **Key path:** [Auto Setting], [Mechanical Attenuator Auto Manual] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** Auto.

- **Setting range:** Min.:0dB, Max.: 70dB.

- **Default unit:** dB.

- **Program control commands:**

[:SENSe]:POWer[:RF]:ATTenuation <rel_power>

[:SENSe]:POWer[:RF]:ATTenuation?

```
[[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF|ON]0|1
```

```
[[:SENSe]:POWer[:RF]:ATTenuation:AUTO?
```

- **Examples:**

```
:POW:ATT 30 dB
```

```
:POW:ATT:AUTO ON
```

[Resolution Bandwidth Auto Manual]

- **Menu description:** to change the resolution bandwidth of spectrum analysis, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode.
- **Key path:** [Auto Setting], [Resolution Bandwidth Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

```
[[:SENSe]:BANDwidth|BWIDth[:RESolution] <freq>
```

```
[[:SENSe]:BANDwidth|BWIDth[:RESolution]?
```

```
[[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO OFF|ON]0|1
```

```
[[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO?
```

- **Examples:**

```
BAND 1 kHz BWID:AUTO On
```

[Video bandwidth Auto Manual]

- **Menu description:** to change the video bandwidth within the active function area, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. Use number keys, stepping keys or knob to change The current mode is shaded. **Command description:** to change video bandwidth displayed at the active function zone ranging from 1Hz to 20MHz. When it is above 3MHz, take 4 MHz, 5 MHz, 6 MHz, 8 MHz, 10 MHz and 20 MHz; when it is between 1Hz and 3MHz, change by 10% step. Such value may be changed via number keys, stepping keys or the knob. The mode with a underline is the current mode. When set as Auto Off, press [Frequency Bandwidth Auto Manual] to select Auto ON and return to auto mode.
- **Key path:** [Auto Setting], [Video Bandwidth Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto, same as the Resolution Bandwidth setting.
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

```
[[:SENSe]:BANDwidth|BWIDth:VIDeo <freq>
```

```
[[:SENSe]:BANDwidth|BWIDth:VIDeo?
```

[[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO OFF|ON|0|1

[[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO?

- **Examples:**

:BAND:VID 1 kHz

:BWID:VID:AUTO ON

[VBW/RBW Auto Manual]

- **Menu description:** to set the ratio between the current video bandwidth and resolution bandwidth with the default value as 1. As the resolution bandwidth changes, the video bandwidth changes to maintain this ratio. The ratio should be displayed on the input area and used for the coupling mode of those two kinds of bandwidth. When a new ratio is selected, change the video bandwidth to meet this new ratio and the resolution bandwidth should remain unchanged.

- **Key path:** [Auto Setting], [VBW/RBW Auto Manual] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** auto with VBW/RBW as 1.

- **Setting range:** Min.:0.0001, Max.: 300000.

- **Program control commands:**

[[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio <number>

[[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio?

- **Examples:**

:BAND:VID:RAT 2

[Span/RBW Auto Manual]

- **Menu description:** to set the ratio between the current span and resolution bandwidth and display it in the input area. This ratio is used in coupling mode of the resolution bandwidth.

- **Key path:** [Auto Setting], [Frequency Bandwidth/RBW Auto Manual] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** auto with span/RBW as 106.

- **Setting range:** Min.:2, Max.: 10000.

- **Program control commands:**

[[:SENSe]:FREQuency:SPAN:BANDwidth[:RESolution]:RATio <integer>

[[:SENSe]:FREQuency:SPAN:BANDwidth[:RESolution]:RATio?

[[:SENSe]:FREQuency:SPAN:BANDwidth[:RESolution]:RATio:AUTO OFF|ON|0|1

[[:SENSe]:FREQuency:SPAN:BANDwidth[:RESolution]:RATio:AUTO?

- **Examples:**

:SPAN:BAND:RAT 20

[Frequency Step Auto Manual]

- **Menu description:** to change the steps of center frequency, start frequency or stop frequency. When the center frequency is

active, press the step key, the frequency step changes by 1, 2, 5 and 10. When it is under Auto OFF mode, use the number keys, stepping keys or knob for change. At this time, reactivate the [Center Frequency], and press the step key, the center frequency will change by set step size. This function is extremely useful to quickly change the center frequency to the input signal harmonic. For example, observe the harmonic of 300MHz input signal, and set the [Frequency Step Auto Manual] as Auto OFF, and input 300MHz. If the current center frequency is 300MHz, press the stepping key to increase the center frequency to 600MHz. Press the stepping key again to increase the center frequency by 300MHz to 900MHz. The shaded status of [Frequency Step Auto Manual] menu indicates whether the step is set as Auto ON or OFF. When the step is under Auto OFF, select the Auto ON from [Frequency Step Auto Manual] to return to Auto ON status.

- **Key path:** [Auto Setting], [Menu 1/2 ►], [Frequency Step Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** depend on maximum frequency limit of signal/spectrum analyzer and current measurement mode.
- **Setting range:** Min.: 1 Hz, Max.: maximum center frequency.
- **Default unit:** Hz
- **Program control commands:**

```
[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>
```

```
[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?
```

```
[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF|ON|0|1
```

```
[:SENSe]:FREQuency:CENTer:STEP:AUTO?
```

- **Examples:**

```
:FREQ:CENT:STEP 100 MHz
```

```
:FREQ:CENT:STEP:AUTO ON
```

5. 2. 2. 11. Display

Pop up the soft menu related to display, including [Display Line ON OFF], [Display Configuration ►].

[Display Line On Off]

- **Menu description:** when this menu is ON, it activates an adjustable horizontal reference line Which indicates an amplitude value corresponding to the reference level. The value of the display line can be adjusted using the stepping keys, knob or number keys. The display line unit depends on [Y Axis Scale Unit] under [Amplitude] menu.
- **Key path:** [Display], [Display Line ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -25dBm.
- **Setting range:** -200 dBm - 30 dBm.
- **Default unit:** dBm.
- **Program control commands:**

```
:DISPlay:WINDow[1]:TRACe:Y:DLINe <ampl>
```

```
:DISPlay:WINDow[1]:TRACe:Y:DLINe?
```

```
:DISPlay:WINDow[1]:TRACe:Y:DLINe:STATe OFF|ON|0|1
```

```
:DISPlay:WINDow[1]:TRACe:Y:DLINe:STATe?
```


- **Examples:**

:DISP:WIND:TRAC:Y:DLIN -20dBm

:DISP:WIND:TRAC:Y:DLIN?

:DISP:WIND:TRAC:Y:DLIN:STAT ON

:DISP:WIND:TRAC:Y:DLIN:STAT?

[Display Configuration ►]

It is used for configurations of interface language, status area display on interface. The soft menus include [Select Language Chinese English], [Graticule Display ON OFF], Status Area Display ON OFF], [Frequency Information Display ON OFF].

[Graticule Display On Off]

- **Menu description:** to select whether to display the graticule in the screen trace area.
- **Key path:** [Display], [Display Configuration ►], [Graticule Display ON/OFF] on the front panel.
- **Program control commands:**

:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF|ON|0|1

:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?

- **Examples:**

:DISP:WIND:TRAC:GRAT:GRID OFF

:DISP:WIND:TRAC:GRAT:GRID?

[Display Status Area On Off]

- **Menu description:** to select whether to display the status area information.
- **Key path:** [Display], [Display Configuration ►], [Display Status Area ON/OFF] on the front panel.
- **Program control commands:**

:DISPlay:WINDow[1]:ANNotation[:ALL] OFF|ON|0|1

:DISPlay:WINDow[1]:ANNotation[:ALL]?

- **Examples:**

:DISP:WIND:ANN OFF

:DISP:WIND:ANN?

[Frequency Information Display On Off]

- **Menu description:** to select whether to display the status area frequency information.
- **Key path:** [Display], [Display Configuration ►], [Frequency Information Display ON OFF] on the front panel.
- **Program control commands:**

:DISPlay:ANNotation:FREQuency OFF|ON|0|1

:DISPlay:ANNotation:FREQuency?

- **Examples:**

:DISP:ANN:FREQ OFF

:DISP:ANN:FREQ?

5. 2. 2. 12. Input Output

This menu pops up the menus related to external input and output interfaces of the signal/spectrum analyzer and the soft menu includes [Freq Ref In Ext], [Coupling Method AC DC], [Input Interface RF Calibration], [Calibration Interface ►], [HF IF Output ON/OFF], [IF Output ►], [Log Detector Output ON/OFF], [Ext Mixer...], [Input Impedance 50Ω/75Ω].

[Frequency reference In Ext]

- **Menu description:** to select internal or external frequency reference. The external frequency reference should be 10MHz±100Hz and amplitude 0dBm (Limit range: -2dBm - +10dBm). The external frequency reference should be input through the "10MHz Reference Input" interface on the rear panel. In selecting external reference, the information prompt area will display "Reference: External".
- **Key path:** [Input Output], [Freq Ref In Ext] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** internal.
- **Program control commands:**

[::SENSE]:ROSCillator:SOURce INTernal|EXTernal

[::SENSE]:ROSCillator:SOURce?

- **Examples:**

:ROSC:SOUR INT

:ROSC:SOUR?

[Coupling Method AC DC]

- **Menu description:** to select the coupling method of the input interface of the signal/spectrum analyzer as DC or AC coupling. The DC coupling is useful for measuring input signal less than 10MHz. However, the external input DC signal may damage the instrument. AC coupling prevents external DC signal from entering the instrument, and is suitable for measuring RF signal larger than 10MHz.
- **Key path:** [Input Output], [Coupling Method AC DC] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** DC.
- **Program control commands:**

:INPut:COUPling AC|DC

:INPut:COUPling?

- **Examples:**

:INP:COUP AC

:INP:COUP?

[Input Interface RF Calibration]

- **Menu description:** to select the input interface type as RF input signal or internal calibration signal.

- **Key path:** [Input Output], [Input Interface RF Calibration] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** RF.
- **Program control commands:**

```
[[:SENSe]:FEED RF|AREFERENCE
```

```
[[:SENSe]:FEED?
```

- **Examples:**

```
:FEED RF
```

```
:FEED?
```

[Calibration Interface ►]

The menu is used to select internal calibration signal for the signal/spectrum analyzer. When setting the input interface to Calibration, you can measure those calibration signals through screen measurement. The soft menu includes [OFF], [500MHz], [Comb Wave], [4800MHz].

- **Program control commands:**

```
[[:SENSe]:FEED:AREFERENCE REF500|REFCOMB|REF4800|OFF
```

```
[[:SENSe]:FEED:AREFERENCE?
```

- **Examples:**

```
:FEED:AREF REF500
```

```
:FEED:AREF?
```

[Close]

- **Menu description:** to turn off the internal calibration signal.
- **Key path:** [Input Output], [Input Interface ►], [Close] on the front panel.
- **Status saved:** saved in the instrument status.

[500MHz]

- **Menu description:** to select 500 MHz internal sine wave calibration signal with a power of -20 dBm.
- **Key path:** [Input Output], [Input Interface ►], [500MHz] on the front panel.
- **Status saved:** saved in the instrument status.

[Comb Wave]

- **Menu description:** to select internal comb wave calibration signal with a frequency interval of 500 MHz.
- **Key path:** [Input Output], [Calibration Interface ►], [Comb Wave] on the front panel.
- **Status saved:** saved in the instrument status.

[4800MHz]

- **Menu description:** to select 4800MHz internal sine wave calibration signal with a power of -20 dBm.

- **Key path:** [Input Output], [Input Interface ►], [4800MHz] on the front panel.
- **Status saved:** saved in the instrument status.

[HF/IF Output On Off]

- **Menu description:** the HF/IF Output menu is only available when H02 option is purchased. This function can output IF signal between 275MHz and 475MHz, which can be set by the knob, number keys or stepping keys on the front panel.
- **Key path:** [Input Output], [HF/IF Output ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.

Factory preset: OFF.

- **Setting range:** 275 MHz - 475 MHz.
- **Default unit:** Hz.
- **Program control commands:**

```
:OUTPut:AUX SIF|AIF| OFF
```

```
:OUTPut:AUX?
```

```
:OUTPut:AUX:SIF <value>
```

```
:OUTPut:AUX:SIF?
```

- **Examples:**

```
:OUTP:AUX SIF
```

```
:OUTP:AUX?
```

```
:OUTP:AUX:SIF 275MHz
```

```
:OUTP:AUX:SIF?
```

[IF Output ►]

The IF Output menu is only available when H03 option is purchased. It is used for controlling the IF output frequency and gain. The soft menu includes [IF Output ON/OFF], [IF Frequency], [Auto Gain ON/OFF], [Auto Gain Level ►].

[IF Output On Off]

- **Menu description:** to turn on or off IF Output. When the IF Output is on, the front panel may display no or incorrect trace.
- **Key path:** [Input Output], [IF Output ►], [IF Output ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

```
:OUTPut:AUX SIF|AIF| OFF
```

```
:OUTPut:AUX?
```

- **Examples:**

```
:OUTP:AUX AIF
```

:OUTP:AUX?

[IF Frequency]

- **Menu description:** to set frequency of IF output. Which can be set by the knob, number keys or stepping keys on the front panel.
- **Key path:** [Input Output], [IF Output ►], [IF Frequency] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 70MHz
- **Setting range:** 10MHz-160MHz.
- **Default unit:** MHz.
- **Program control commands:**

:OUTPut:AUX:AIF <value>

:OUTPut:AUX:AIF?

- **Examples:**

:OUTP:AUX:AIF 70MHz

:OUTP:AUX:AIF?

[Auto Gain On Off]

- **Menu description:** to turn on or off IF Output Auto Gain.
- **Key path:** [Input Output], [IF Output ►], [Auto Gain ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

[:SENSe]:IF:GAIN:AUTO OFF[ON]0|1

[:SENSe]:IF:GAIN:AUTO?

- **Examples:**

:IF:GAIN:AUTO OFF

:IF:GAIN:AUTO?

[Auto Gain Level ►]

- **Menu description:** to set the Auto Gain Level. including +5dBm, 0dBm, -5dBm and -10dBm.
- **Key path:** [Input Output], [IF Output ►], [Auto Gain Level ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0dBm
- **Program control commands:**

[:SENSe]:IF:GAIN:AUTO:LEVEL 5|0|-5|-10

[SENSe]:IF:GAIN:AUTO:LEVEL?

- **Examples:**

:IF:GAIN:AUTO:LEVEL 5

:IF:GAIN:AUTO:LEVEL?

[Logarithmic Detector Output On Off]

- **Menu description:** the logarithmic detector output menu is only available when H08 option is purchased. The analyzer can be used as a wideband detector for logarithmic detector output to output logarithmic detector envelop signal of the RF signal to the rear panel.
- **Key path:** [Input Output], [Menu 1/2], [Logarithmic Detector Output ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:OUTPut:AUX:LOGVideo OFF|ON|0|1

:OUTPut:AUX:LOGVideo?

- **Examples:**

:OUTP:AUX:LOGV OFF

:OUTP:AUX:LOGV?

[Ext Mixer...]

- **Menu description:** the Ext Mixer menu is only available when H40 option is purchased. Press this menu to pop up the parameter setting dialogs for external mixer test. For details, refer to other related manuals.
- **Key path:** [Input Output], [Menu 1/2], [Ext Mixer...] on the front panel.
- **Status saved:** not saved in instrument status.

5. 2. 2. 13. Marker

Pop up the soft menu related to markers, including [Marker Select ►], [Normal Markers], [Delta Marker], [Fixed Marker], [Marker OFF], [Marker Attribute ►], [Marker Report ON/OFF], [Marker Couple ON/OFF], and [All Markers OFF].

[Marker Select ► Marker 1]

- **Command description:** to select among 12 different markers of the analyzer. When one marker is selected, the menu will indicate the current marker and the type and the attribute of the selected marker can be set. Select and trigger another marker and place it at the center of the current trace, and then users can read amplitude and frequency information (when the frequency span is 0 Hz, time information will be displayed) at the marker display area at the top right corner of the screen.
- **Key path:** [Marker], [Marker Select ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Marker 1.

[Normal Marker]

- **Menu description:** to set the selected marker as the Normal Marker.

- **Key path:** [Marker], [Normal Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE POSition

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

- **Examples:**

:CALC:MARK1:MODE POS

:CALC:MARKer1:MODE?

[Delta Marker]

- **Menu description:** to set the selected marker as the Delta Marker. Display the amplitude difference and frequency difference (or time difference, when span is zero) between two markers at the marker display area at the top right corner of the screen. If there exists a single marker, a [Delta Marker] operation will generate a reference marker in the active marker position. Move the active marker through the knob, stepping keys or number keys. The display amplitude difference unit is dB.
- **Key path:** [Marker], [Delta Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE DELTa

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

- **Examples:**

:CALC:MARK1:MODE DELT

:CALC:MARK1:MODE?

[Fixed Marker]

- **Menu description:** to set the selected marker as the Fixed Marker. The X Axis and Y Axis positions of the fixed marker are fixed. The Fixed Marker can be used as reference marker.
- **Key path:** [Marker], [Fixed Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE FIXed

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

- **Examples:**

:CALC:MARK1:MODE FIX

:CALC:MARK1:MODE?

[Marker OFF]

- **Menu description:** to turn off the selected marker.
- **Key path:** [Marker], [Marker Off] on the front panel.

- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE OFF

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

- **Examples:**

:CALC:MARK1:MODE OFF

:CALC:MARK1:MODE?

[Marker Attribute ►]

Pop up the corresponding menu of currently selected marker attribute setup, including [Reference Marker ►], [X Axis Scale Auto Manual], [Marker Trace ►] and [Marker Display Line ON OFF].

[Reference Marker ►]

- **Menu description:** to select reference marker for current marker. It can be any one from 11 markers except the currently selected marker.
- **Key path:** [Marker], [Marker Attribute ►], [Reference Marker ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence <integer>

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence?

- **Examples:**

:CALC:MARK1:REF 2

:CALC:MARK1:REF?

[X Axis Scale ► Auto Manual]

- **Menu description:** to set X Axis (horizontal axis) data type of current marker. The soft menu includes [Auto], [Frequency], [Period], [Time], [Inverse Time].
- **Key path:** [Marker], [Marker Attribute ►], [X Axis Scale Auto Manual] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.

[Auto]

- **Menu description:** to set X Axis (horizontal axis) data type of current marker as Auto Select. When the current marker trace is time waveform data, the X Axis scale automatically sets as Time; when spectrum data, the marker X axis scale automatically sets as Frequency.
- **Key path:** [Marker], [Marker Attribute ►], [X Axis Scale Auto Manual], [Auto] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:X:READout:AUTO ON|OFF|1|0

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:X:READout:AUTO?

- **Examples:**

:CALC:MARK1:X:READ:AUTO ON

:CALC:MARK1:X:READ:AUTO ON

[Frequency]

- **Menu description:** to set X Axis (horizontal axis) data type of current marker as frequency.
- **Key path:** [Marker], [Marker Attribute ►], [X Axis Scale Auto Manual], [Frequency] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:X:READout FREQuency

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:X:READout?

- **Examples:**

:CALC:MARK1:X:READ FREQ

:CALC:MARK1:X:READ?

[Cycle]

- **Menu description:** to set X Axis (horizontal axis) data type of current marker as period.
- **Key path:** [Marker], [Marker Attribute ►], [X Axis Scale Auto Manual], [Period] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:X:READout PERiod

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:X:READout?

- **Examples:**

:CALC:MARK1:X:READ PER

:CALC:MARK1:X:READ?

[Time]

- **Menu description:** to set X Axis (horizontal axis) data type of current marker as Time.
- **Key path:** [Marker], [Marker Attribute ►], [X Axis Scale Auto Manual], [Time] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:X:READout TIME

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:X:READout?

- **Examples:**

:CALC:MARK1:X:READ TIME

:CALC:MARK1:X:READ?

[Inverse Time]

- **Menu description:** to set X Axis (horizontal axis) data type of current marker as Inverse Time.
- **Key path:** [Marker], [Marker Attribute ►], [X Axis Scale Auto Manual], [Inverse Time] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:X:READout ITIME

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:X:READout?

- **Examples:**

:CALC:MARK1:X:READ ITIM

:CALC:MARK1:X:READ?

[Marker Trace ►]

- **Menu description:** to select trace data for current marker. The marker trace can be any active trace.
- **Key path:** [Marker], [Marker Attribute ►], [Marker Trace ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:TRACe 1|2|3|4|5|6

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:TRACe?

- **Examples:**

:CALC:MARK1:TRAC 1

:CALC:MARK1:TRAC?

[Marker Display Line ► On Off]

- **Menu description:** to set whether the current marker is displayed as a line on the screen, which is easy to observe.
- **Key path:** [Marker], [Marker Attribute ►] and [Marker Display Line On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINes[:STATe] OFF|ON|0|1

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINes[:STATe]?

- **Examples:**

:CALC:MARK1:LIN OFF

:CALC:MARK1:LIN?

[Marker Table On Off]

- **Menu description:** to turn on the marker table display. Where there are many markers, it is convenient for data measurement.
- **Key path:** [Marker], [Menu 1/2 ►], [Marker Report ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:MARKer:TABLE[:STATe] OFF|ON|0|1

:CALCulate:MARKer:TABLE[:STATe]?

- **Examples:**

:CALC:MARK:TABL OFF

:CALC:MARK:TABL?

[Marker Couple On Off]

- **Menu description:** to turn on or off Marker Couple. When it is ON, moving any marker horizontal axis position will cause an equal movement of horizontal axis position of every other marker which is ON. When the marker is moved to less than Start Frequency or larger than Stop Frequency, the marker is limited to the value of the Start Frequency or the Stop Frequency; when the span is zero, the minimum value is limited as 0, and the maximum value is limited as the Sweep Time.
- **Key path:** [Marker], [Menu 1/2 ►], [Marker Couple ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:MARKer:COUPlE[:STATe] OFF|ON|0|1

:CALCulate:MARKer:COUPlE[:STATe]?

- **Examples:**

:CALC:MARK:COUP OFF

:CALC:MARK:COUP?

[All Markers OFF]

- **Menu description:** to turn off all current markers which are ON and related soft keys, e.g. [Noise Marker].
- **Key path:** [Marker], [Menu 1/2 ►], [All Markers OFF] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:MARKer:AOFF

- **Examples:**

:CALC:MARK:AOFF

5. 2. 2. 14. Marker->

Pop up soft menus related to Marker->Function. Such menus are related to the frequency, span and marker type (Normal or Delta Marker):

Table 5.1 Relationship between Span and Marker->Function

Span >0Hz	Span =0Hz
[Marker → Center Frequency]	[Marker → Reference Level]
[Marker → Frequency Step]	
[Marker → Start Frequency]	
[Marker → Stop Frequency]	
[Delta Marker →Span]	
[Delta Marker → CF]	
[Marker → Reference Level]	

Those marker functions allow the user to change the signal/spectrum analyzer positions using markers as reference.

[Marker → Center Frequency]

- **Menu description:** to set the Center Frequency equal to the Marker Frequency. It can quickly move the signal to the center position of the screen.
- **Key path:** [Marker->], [Marker → Center Frequency] on the front panel.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:[.SET]:CENTer

- **Examples:**

:CALC:MARK1:CENT

[Marker → Frequency Step]

- **Menu description:** to set the Frequency Step equal to the Marker Frequency. The menu changes the value of frequency step.
- **Key path:** [Marker->], [Marker → Frequency Step] on the front panel.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:[.SET]:STEP

- **Examples:**

:CALC:MARK1:STEP

[Marker → Start Frequency]

- **Menu description:** to set the Start Frequency equal to the Marker Frequency. The menu changes the value of start frequency.
- **Key path:** [Marker->], [Marker →Start Frequency] on the front panel.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:[.SET]:START

- **Examples:**

:CALC:MARK1:STAR

[Marker → Stop Frequency]

- **Menu description:** to set the Stop Frequency equal to the Marker Frequency. The menu changes the value of stop frequency.
- **Key path:** [Marker->], [Marker → Stop Frequency] on the front panel.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:[SET]:STOP

- **Examples:**

:CALC:MARK1:STOP

[Delta Marker → Span]

- **Menu description:** to set the Span equaling to frequency difference of the Delta Marker. The menu changes the value of frequency span.
- **Key path:** [Marker->], [Delta Marker → Span] on the front panel.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:[SET]:DELTA:SPAN

- **Examples:**

:CALC:MARK1:DELT:SPAN

[Delta Marker → CF]

- **Menu description:** to set the Center Frequency equal to frequency difference of the Delta Marker. The menu changes the value of center frequency.
- **Key path:** [Marker->], [Delta Marker → CF] on the front panel.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:[SET]:DELTA:CENTER

- **Examples:**

:CALC:MARK1:DELT:CENT

[Marker → Reference Level]

- **Menu description:** to set the Reference Level equal to the Marker Amplitude. The menu changes the value of reference level.
- **Key path:** [Marker->], [Marker → Reference Level] on the front panel.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:[SET]:RLEVEL

- **Examples:**

:CALC:MARK1:RLEV

5. 2. 2. 15. Marker Function

The [Marker Function] key on the front panel. is used for turning on the control instrument marker functions. The Marker Function performs post-processing on the marker data. Its soft menu includes [Marker Count ►], [Audio Demodulation], [Noise Marker ON/OFF], [N dB Measurement ON/OFF], [Bandwidth Power ON/OFF], [Bandwidth Density ON/OFF], [Bandwidth Adjust ►].

[Maker Count ►]

- **Menu description:** to open Marker Count menu. Its soft menu includes [Marker Count ON/OFF], [Gate Time].

[Marker Count On Off]

- **Menu description:** to turn on or off Marker Count. If there is no active marker, enabling this function will activate an active marker at the center of screen. The Marker Count readout is not affected by the Frequency Offset. To facilitate normal function of Marker Count, the SPAN/RBW should be less than 500. In Zero Span, the Marker Count continues operation and counts the signals close to the Center Frequency of the signal/spectrum analyzer.

- **Key path:** [Marker Function], [Marker Count], [Marker Count ON OFF] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** OFF.

- **Program control commands:**

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FCOunt[:STATe] OFF|ON|0|1
```

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FCOunt[:STATe]?
```

- **Examples:**

```
:CALC:MARK1:FCO OFF
```

```
:CALC:MARK1:FCO?
```

[Gate Time Auto Manual]

- **Menu description:** to control the length of time during which the Marker Count measures the signal frequency. Gate time of 500ms or longer allows for less than 0.1Hz count accuracy. However, the longer is the gate time, the slower is the key response.

- **Key path:** [Marker Function], [Marker Count], [Marker Count ON OFF] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** 0.5s.

- **Setting range:** Min.: 1.0E-3s, Max.: 8s.

- **Value resolution:** 100 ns.

- **Default unit:** s

- **Program control commands:**

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FCOunt:GATetime <time>
```

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FCOunt:GATetime?
```

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FCOunt:GATetime:AUTO OFF|ON|0|1
```

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FCOunt:GATetime:AUTO?
```

- **Examples:**

```
CALC:MARK:FCO:GAT:AUTO On
```

```
CALC:MARK:FCO:GAT 1e-2
```

[Audio Demodulation]

- **Menu description:** to open Audio Demodulation menu. Its soft menu includes [Demodulation Mode ►], [Demodulation Mode Inter/Cont], [Demodulation Time].

[Demodulation Mode ► Close]

- **Menu description:** to open Demodulation Mode menu. You can turn off demodulation or select AM Demodulation or FM Demodulation.
- **Key path:** [Marker Function], [Audio Demodulation ►], [OFF], [AM], [FM] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:DEMod AM|FM|OFF

:DEMod?

:DEMod:STATe OFF|ON|0|1

:DEMod:STATe?

- **Examples:**

:DEM AM

:DEM?

:DEM:STAT OFF

:DEM:STAT?

[Demodulation Mode Inter Cont]

- **Menu description:** to select the Demodulation Mode as Inter or Cont.
- **Key path:** [Marker Function], [Audio Demodulation ►], [Demodulation Mode Inter/Cont] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

[:SENSe]:DEMod:STATe:MODE INTER|CONT

[:SENSe]:DEMod:STATe:MODE?

- **Examples:**

:DEM:STAT:MODE INTER

:DEM:STAT:MODE?

[Demodulation Time 1.0000s]

- **Menu description:** to control the length of time of the Audio Demodulation.
- **Key path:** [Marker Function], [Audio Demodulation ►], [Demodulation Time] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1s.
- **Setting range:** Min.:0.01s, Max.: 100s.

- **Value resolution:** 0.01 s.
- **Default unit:** s
- **Program control commands:**

:DEMod:TIME <time>

:DEMod:TIME?

- **Examples:**

:DEM:TIME 1s

:DEM:TIME?

[Noise Marker On Off]

- **Menu description:** when this menu is ON, it activates the noise maker. Read out the noise power that normalizes the noise into 1Hz bandwidth near the active marker. At that time, the detector is under Sample Detector mode. The Noise Marker averages the values of the 32 data points (including 16 at the left side and 15 on and at the right of marker) near the frequency axis or time axis. In measuring the ratio between the signal and noise, place the marker on the signal peak and select the Delta Marker mode. Place the active marker to the noise to be measured with number keys or knob. Then select the [Noise Marker ON OFF]. At that time, the display value unit at the marker display area is dBc/Hz.
- **Key path:** [Marker Function], [Noise Marker ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FUNCTion? NOISe|BPOWer|BDENsity|OFF

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FUNCTion?

- **Examples:**

:CALC:MARK1:FUNC NOIS

:CALC:MARK:FUNC?

[N dB Measurement On Off]

- **Menu description:** to turn on or off the NdB measurement of bandwidth values descending from signal peak point. You can input the NdB value to be measured from the front panel.
- **Key path:** [Marker Function], [N dB Measurement 3.00dB ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 3.0.
- **Setting range:** Min.:1.0, Max.: 60.0.
- **Value resolution:** 1.
- **Program control commands:**

:CALCulate:BWIDth|BANDwidth:NDB <rel_amp>

:CALCulate:BWIDth|BANDwidth:NDB?

:CALCulate:BWIDth|BANDwidth[:STATe] OFF|ON|0|1

:CALCulate:BWIDth|BANDwidth[:STATe]?

:CALCulate:BWIDth|BANDwidth:RESult?

- **Examples:**

:CALC:BWID:NDB 6dB

:CALC:BWID:NDB?

:CALC:BWID OFF

:CALC:BWID?

:CALC:BWID:RES?

[Bandwidth Power On Off]

- **Menu description:** to turn on or off Bandwidth Power. Initialize the Bandwidth Power width as 5% of the total span.
- **Key path:** [Marker Function], [Bandwidth Power ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FUNCTion BPOWer

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FUNCTion?

- **Examples:**

:CALC:MARK1:FUNC BPOW

:CALC:MARK1:FUNC?

[Bandwidth Density On Off]

- **Menu description:** to turn on or off Bandwidth Density. Initialize the Bandwidth Density width as 5% of the total span.
- **Key path:** [Marker Function], [Bandwidth Density ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FUNCTion BDENsity

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:FUNCTion?

- **Examples:**

:CALC:MARK1:FUNC BDEN

:CALC:MARK1:FUNC?

5. 2. 2. 16. Peak Search

The [Peak Search] key on the front panel. is used to turn on the peak search for traces by the control instrument and turn on marker for display, including [Next Peak], [Next Peak Right], [Next Peak Left], [Delta Marker], [Marker->Center Frequency], [Marker->Reference Level], [Peak Criteria ►], [Peak Table ►], [Continuous Peak Search ON OFF], [Peak-peak Search], [Min Search].

- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum

- **Examples:**

:CALC:MARK1:MAX

[Next Peak]

- **Menu description:** Taking the Amplitude of the point where the current marker is located, search for the next peak of current test trace.

- **Key path:** [Peak Search], [Next Peak] on the front panel.

- **Status saved:** not saved in instrument status.

- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:NEXT

- **Examples:**

:CALC:MARK1:MAX:NEXT

[Next Peak Right]

- **Menu description:** to search for the peak to the right of the current test trace marker position.

- **Key path:** [Peak Search], [Next Peak Right] on the front panel.

- **Status saved:** not saved in instrument status.

- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:RIGHT

- **Examples:**

:CALC:MARK1:MAX:RIGH

[Next Peak Left]

- **Menu description:** to search for the peak to the left of the current test trace marker position.

- **Key path:** [Peak Search], [Next Peak Left] on the front panel.

- **Status saved:** not saved in instrument status.

- **Program control commands:**

:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:LEFT

- **Examples:**

:CALC:MARK1:MAX:LEFT

[Delta Marker]

- **Menu description:** to set the selected marker as the Delta Marker. Display the amplitude difference and frequency difference (or time difference, when span is zero) between two markers at the marker display area at the top right corner of the screen. If there exists a single marker, a [Delta Marker] operation will generate a reference marker in the active marker position. Move the active marker through the knob, stepping keys or number keys. The display amplitude difference unit is dB.

- **Key path:** [Peak Search], [Delta Marker] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE DELTa
```

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?
```

- **Examples:**

```
:CALC:MARK1:MODE DELT
```

```
:CALC:MARK1:MODE?
```

[Marker → Center Frequency]

- **Menu description:** to set the Center Frequency equal to the Marker Frequency. It can quickly move the signal to the center position of the screen.
- **Key path:** [Peak Search], [Marker →Center Frequency] on the front panel.
- **Program control commands:**

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:[SET]:CENTer
```

- **Examples:**

```
:CALC:MARK1:CENT
```

[Marker → Reference Level]

- **Menu description:** to set the Reference Level equal to the Marker Amplitude. The menu changes the value of reference level.
- **Key path:** [Peak Search], [Marker →Reference Level] on the front panel.
- **Program control commands:**

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:[SET]:RLEVel
```

- **Examples:**

```
:CALC:MARK1:RLEV
```

[Peak Standard ►]

Pop up rules for peak search. The soft menu includes [Peak Excursion ON/OFF], [Peak Threshold ON/OFF], [Peak Threshold Line ON/OFF].

[Peak Excursion On Off]

- **Menu description:** to define the value (dB) than which the rise or fall edge time is larger required for a peak point identified as signal peak in defining of the peak search.
- **Key path:** [Peak Search], [Peak Standard ►], [Peak Excursion ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** off, with peak defined value of 6 dB.
- **Setting range:** Min.:0dB, Max.: 100dB.
- **Program control commands:**

:CALCulate:MARKer:PEAK:EXCursion <rel_ampl>

:CALCulate:MARKer:PEAK:EXCursion?

:CALCulate:MARKer:PEAK:EXCursion:STATe OFF|ON|0|1

:CALCulate:MARKer:PEAK:EXCursion:STATe?

- **Examples:**

:CALC:MARK:PEAK:EXC 10

:CALC:MARK:PEAK:EXC?

:CALC:MARK:PEAK:EXC:STAT OFF

:CALC:MARK:PEAK:EXC:STAT?

[Peak Threshold On Off]

- **Menu description:** to define the value than which the signal peak value is larger (dBm) required a peak to be identified.
- **Key path:** [Peak Search], [Peak Standard ►], [Peak Threshold ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** default OFF, with all peak values valid.
- **Setting range:** Min.: -200dBm, Max.: Reference Level.
- **Program control commands:**

:CALCulate:MARKer:PEAK:THReshold <ampl>

:CALCulate:MARKer:PEAK:THReshold?

:CALCulate:MARKer:PEAK:THReshold:STATe OFF|ON|0|1

:CALCulate:MARKer:PEAK:THReshold:STATe?

- **Examples:**

:CALC:MARK:PEAK:THR -100

:CALC:MARK:PEAK:THR?

:CALC:MARK:PEAK:THR:STAT OFF

:CALC:MARK:PEAK:THR:STAT?

[Peak Threshold Line On Off]

- **Menu description:** to turn on or off Peak Threshold Line.
- **Key path:** [Peak Search], [Peak Standard ►], [Peak Threshold Line ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** off.

[Peak Table ►]

Pop up commands related to peak table, including [Peak Table ON/OFF], [Peak Sort Frequency/Amplitude], [Peak Readout ►].

[Peak Table On Off]

- **Menu description:** to turn on or off Peak Table.
- **Key path:** [Peak Search], [Peak Table ►], [Peak Table ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** off.
- **Program control commands:**

:CALCulate:MARKer:PEAK:TABLE:STATe OFF|ON|0|1

:CALCulate:MARKer:PEAK:TABLE:STATe?

- **Examples:**

:CALC:MARK:PEAK:TABL:STAT OFF

:CALC:MARK:PEAK:TABL:STAT?

[Peak Sort Frequency Amplitude]

- **Menu description:** to set the peak lists in the Peak Table in order of ascending frequency or descending amplitude.
- **Key path:** [Peak Search], [Peak Table ►], [Peak Sort Frequency/Amplitude] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** in descending order of amplitude.
- **Program control commands:**

:CALCulate:MARKer:PEAK:SORT FREQuency|AMPLitude

:CALCulate:MARKer:PEAK:SORT?

- **Examples:**

:CALC:MARK:PEAK:SORT FREQ

:CALC:MARK:PEAK:SORT?

[Peak Readout ►] All]

- **Command description:** to show up the peak lists in the Peak Table by Above Display Line or Below Display Line or All.
- **Key path:** [Peak Search], [Peak Table ►], [Peak Readout ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** default ALL.
- **Program control commands:**

:CALCulate:MARKer:PEAK:TABLE:READout ALL|GTDLine|LTDLine

:CALCulate:MARKer:PEAK:TABLE:READout?

- **Examples:**

:CALC:MARK:PEAK:TABL:READ ALL

:CALC:MARK:PEAK:TABL:READ?

[Continuous Peak Search On Off]

- **Menu description:** when Continuous Peak Search is ON, the current marker will perform one Peak Search after each sweep. If the Continuous Peak Search is OFF, no operation is made.
- **Key path:** [Peak Search], [Menu 1/2 ▶], [Peak Track ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** off.
- **Program control commands:**

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:CPSearch[:STATe] ON|OFF|1|0
```

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:CPSearch[:STATe]?
```

- **Examples:**

```
:CALC:MARK1:CPS ON
```

```
:CALC:MARK1:CPS?
```

[Peak-peak Search]

- **Menu description:** to turn on the Peak-to-peak Search.
- **Key path:** [Peak Search], [Peak-peak Search] on the front panel.
- **Program control commands:**

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:PTPeak
```

- **Examples:**

```
:CALC:MARK1:PTPeak
```

[Min Search]

- **Menu description:** to turn on the Min Search.
- **Key path:** [Peak Search], [Min Search] on the front panel.
- **Program control commands:**

```
:CALCulate:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MINimum
```

- **Examples:**

```
:CALC:MARK1:MIN
```

5. 2. 2. 17. Single

- **Menu description:** the [Continuous Off] key on the front panel has no corresponding soft menu. This function is mainly used for manual trigger of a sweep. When the Video Average is ON, this function performs the sweeps at the count specified by the video average count.

In remote control programming and system establishment, this function combined with *WAI can effectively synchronize the sweep process and enable the trace data obtained after the *WAI finishes directly correspond to the sweep process one by one.

- **Program control commands:**

```
:INITiate
```

- **Examples:**

```
:INIT
```

5. 2. 2. 18. Continuous ON

The [Continuous] key on the front panel has no corresponding soft menu. This function is mainly used for changing the Continuous OFF into Continuous ON; if the current sweep is Continuous ON, the instrument performs no operation.

5. 2. 3. Channel power

5. 2. 3. 1. Frequency

The [Frequency] key on the front panel is used to set parameters related to the signal/spectrum analyzer frequency, including [Center Frequency], [Frequency Step Auto ON/OFF], [Frequency Offset]. See the [Frequency] menu of the sweep analysis function for more details.

[Center Freq]

See the [Center Frequency] under [Frequency] of the sweep analysis function for more details.

[Frequency Step Auto ON OFF]

See the [Frequency Step Auto ON/OFF] under [Frequency] of the sweep analysis function for more details.

[Frequency deviation]

See the [Frequency Offset] under [Frequency] of the sweep analysis function for more details.

5. 2. 3. 2. Amplitude/Y Axis

Pop up menus related to parameter setting of Amplitude/Y Axis, including [Reference Level], [Attenuator ►], [Preamplifier ON/OFF], [Scale/Division], [Auto Scale], [Menu 1/2 ►], [Y Axis Scale Unit], [Reference Level Offset].

Reference Level

- **Menu description:** to enable the Reference Level function. The reference level can be adjusted with the number keys, step keys or knob. The reference level corresponds to the top of the coordinate top. Measure signal at reference level position to get highest accuracy. The input attenuator of the signal/spectrum analyzer is coupled to the reference level, which can be automatically changed to avoid compression of input signal.
- **Key path:** [Amplitude/Y Axis], [Reference Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0dBm
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Default unit:** set based on Y Axis scale unit.
- **Program control commands:**

:DISPlay:CHPower:VIEW:WINDow:TRACe:Y:RLEVel <real>

:DISPlay:CHPower:VIEW:WINDow:TRACe:Y:RLEVel?

- **Examples:**

:DISPlay:CHPower:VIEW:WINDow:TRACe:Y:RLEVel 20dBm

[Attenuator ►]

See [Attenuator ►] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Preamplifier ON OFF]

See [Preamplifier ON/OFF] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Scale/Division]

- **Menu description:** to select the scale/division from 0.1dB/division to 20dB/division. This menu is only valid when the scale type is logarithm.
- **Key path:** [Amplitude/Y Axis], [Scale/Division] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 10.00 dB.
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Program control commands:**

```
:DISPlay:CHPower:VIEW:WINDow:TRACe:Y:PDIVision <rel_amp>
```

```
:DISPlay:CHPower:VIEW:WINDow:TRACe:Y:PDIVision?
```

[Auto Scale]

- **Menu description:** the instrument automatically sets parameters like reference level and scale/division based on input signal sizes. When this soft menu key is pressed, the instrument performs one auto scaling. Setting rule for auto scaling: when the [Auto Scale] menu is pressed, firstly obtain the maximum value and the minimum value based on current measurement trace data. Based on the maximum value, place on the 80% graticule of the screen trace Y axis for auto setting of reference level and scale/division.
- **Key path:** [Amplitude/Y Axis], [Auto Scale] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

```
:CHPower:ADJust:LEVel
```

[Y Axis Scale Unit ►]

- **Menu description:** to select the Y Axis unit from [dBm], [dBmV], [dBmA], [W], [V], [A], [dBμV] and [dBμA]. The instrument will automatically calculate the trace data and marker readout based on the Y axis scale unit.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** dBm

```
:UNIT:CHPower:POWer DBM|DBMV|DBMA|V|W|A|DBUV|DBUA
```

```
:UNIT:CHPower:POWer?
```

[Reference Level Offset]

- **Menu description:** to introduce offset for all amplitude readout (e.g., reference level and marker amplitude). It will not change the trace position on the screen. This offset unit is dB and is not affected by the scale and unit. Use number keys, stepping keys or knob to input the offset value.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Reference Level Offset] on the front panel.

- **Status saved:** saved in the instrument status.
- **Factory preset:** 0 dB.
- **Setting range:** Min.: -1000dB, Max.:1000dB.
- **Program control commands:**

:DISPlay:CHPower:WINDow:TRACe:Y:RLEVel:OFFSet <rel_amp>

:DISPlay:CHPower:WINDow:TRACe:Y:RLEVel:OFFSet?

- **Examples:**

:DISPlay:CHPower:WINDow:TRACe:Y:RLEVel:OFFSet 12

5. 2. 3. 3. Span/X Axis

Press the [Span/X Axis] on the front panel to enable the span function and set the signal/spectrum analyzer into center frequency/span mode. Press the [Span] key to pop up [Span], [Full Span] and [Previous Span].

[Bandwidth]

- **Menu description:** the span can be set by number keys, stepping keys or knob. Use number keys or select [Zero Span] to set the span as zero.
- **Key path:** [Span/X Axis], [Span] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** maximum frequency limit - start frequency.
- **Setting range:** Min.: 10Hz, Max.: related to the maximum working frequency limit of the instrument.
- **Program control commands:**

:CHPower:FREQuency:SPAN <freq>

:CHPower:FREQuency:SPAN?

- **Examples:**

:CHPower:FREQuency:SPAN10MHz

[Full Span]

- **Menu description:** to set the signal/spectrum analyzer into the center frequency/span mode. Set the span as maximum value.
- **Program control commands:**

:CHPower:FREQuency:SPAN:FULL

[Previous Span]

- **Menu description:** to set the signal/spectrum analyzer back to the previous span.
- **Program control commands:**

:CHPower:FREQuency:SPAN:PREVious

5. 2. 3. 4. Bandwidth

Pop up the soft menus for setting resolution bandwidth and video bandwidth, including [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF] and [Filter Type].

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to change the resolution bandwidth of spectrum analysis, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode.
- **Key path:** [Bandwidth], [Resolution Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz.
- **Program control commands:**

:CHPower:BANDwidth <bandwidth>

:CHPower:BANDwidth?

:CHPower:BANDwidth:AUTO ON|OFF|1|0

:CHPower:BANDwidth:AUTO?

- **Examples:**

:CHPower:BANDwidth 1kHz

:CHPower:BANDwidth:AUTO ON On

[Video bandwidth Auto ON OFF]

- **Menu description:** to change the video bandwidth within the active function area, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode. **Command description:** to change video bandwidth displayed at the active function zone ranging from 1Hz to 20MHz. When it is above 3MHz, take 4 MHz, 5 MHz, 6 MHz, 8 MHz, 10 MHz and 20 MHz; when it is between 1Hz and 3MHz, change by 10% step. Such value may be changed via number keys, stepping keys or the knob. The mode with a underline is the current mode. When set as Auto Off, press [Frequency Bandwidth Auto ON OFF] to select Auto ON and return to auto mode.
- **Key path:** [Bandwidth], [Video Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto, same as the Resolution Bandwidth setting.
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

:CHPower:BANDwidth:VIDeo <bandwidth>

:CHPower:BANDwidth:VIDeo?

:CHPower:BANDwidth:VIDeo:AUTO ON|OFF|1|0

:CHPower:BANDwidth:VIDeo:AUTO?

- **Examples:**

:CHPower:BANDwidth:VIDeo 1 kHz

:CHPower:BANDwidth:VIDeo:AUTO ON

[Filter Type ►]

- **Menu description:** comprising [Gaussian] and [Flat Top]. In general, the signal/spectrum analyzer uses Gaussian filter, i.e., use filter approximate to the Gaussian shape to complete filtering of resolution bandwidth. If the flat top filter is used, the signal/spectrum analyzer adopts filter approximate to the rectangular shape to complete filtering of resolution bandwidth. The response time of flat top filter is about 3 times of that of the Gaussian filter. The sweep speed of the flat top filter is smaller than that of the Gaussian filter. The flat top filter has better selectivity than the Gaussian filter and therefore is more capable of distinguishing two signals with unequal amplitude.
- **Key path:** [Bandwidth], [Filter Type ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Gaussian.
- **Program control commands:**

:CHPower:BANDwidth:SHAPE GAUSSian|FLATtop

:CHPower:BANDwidth:SHAPE?

5. 2. 3. 5. Auto Setting

Pop up the soft menu related to auto setting Which includes [Couple All], [Mechanical Attenuator Auto ON OFF], [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF], [Sweep Time Auto ON OFF] and [Frequency Step Auto ON OFF].

[Couple All]

- **Menu description:** to set the resolution bandwidth, video bandwidth, sweep time, mechanical attenuator and frequency step as auto coupling mode. The signal/spectrum analyzer will select most suitable values for those functions based on set frequency and bandwidth (or start frequency and stop frequency). If no ratio is pre- saved, use default ratio.
- **Key path:** [Auto Setting], [Couple All] on the front panel.
- **Status saved:** not saved in instrument status.
- **Factory preset:** Couple All.
- **Program control commands:**

:COUPle ALL

- **Examples:**

:COUP ALL

[Mechanical Attenuator Auto ON OFF]

See [Attenuator ►] under [Amplitude/Y Axis] for more details.

[Resolution Bandwidth Auto ON OFF]

See [Resolution Bandwidth Auto ON/OFF] under [Bandwidth] for more details.

[Video bandwidth Auto ON OFF]

See [Video Bandwidth Auto ON/OFF] under [Bandwidth] for more details.

[Scanning time Auto ON OFF]

See [Sweep Time Auto ON/OFF] under [Sweep] for more details.

[Frequency Step Auto ON OFF]

See [Frequency Step Auto ON/OFF] under [Frequency] for more details.

5. 2. 3. 6. Trace

Press [Trace] key on the front panel to pop up corresponding soft menu. Including [Refresh], [Average], [Max. Hold], [Min. Hold], [Display ON/OFF ▶] [Menu 1/2 ▶] and [Detector ▶].

[Refresh]

- **Command description:** to set the current trace processing as Refresh, i.e., clear all data of displayed trace and continue the signal trace receipt under sweep status.
- **Key path:** [Trace], [Refresh] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** after all traces are selected, the trace mode is defaulted as Refresh.
- **Program control commands:**

```
:TRACe:CHPower:TYPE WRITe|AVERAge|MAXHold|MINHold
```

```
:TRACe:CHPower:TYPE?
```

[Averaging]

- **Command description:** to set the current trace processing method as Average, i.e., based on the average count N set in the [Measurement Setting], update trace after averaging the performance index of the measurement trace.
- **Key path:** [Trace], [Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

```
:TRACe:CHPower:TYPE AVERAge
```

```
:TRACe:CHPower:TYPE?
```

[Max. Hold]

- **Menu description:** to set the current trace processing method as maximum hold, i.e., the new trace data will be assigned with maximum value of previous measured trace data.
- **Key path:** [Trace], [Max Hold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

```
:TRACe:CHPower:TYPE MAXHold
```

```
:TRACe:CHPower:TYPE?
```

[Min. Hold]

- **Menu description:** to set the current trace processing method as minimum hold, i.e., the new trace data will be assigned with minimum value of previous measured trace data.
- **Key path:** [Trace], [Min Hold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:CHPower:TYPE MINHold

:TRACe:CHPower:TYPE?

[Display ON/OFF ► Refresh Display]

- **Menu description:** to set the display method for the selected trace from [Refresh Display], [Static Display], [Backstage Refresh] and [Display OFF].
- **Key path:** [Trace], [Display ON/OFF ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace display modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:CHPower:DISPlay[:STATe] ON|OFF|0|1

:TRACe:CHPower:DISPlay[:STATe]?

:TRACe:CHPower:UPDate[:STATe] ON|OFF|0|1

:TRACe:CHPower:UPDate[:STATe]?

[Detector ►]

Pop up soft menus related to setting the detector type for the currently selected trace, including [Auto], [Normal], [Positive Peak], [Sample], [Negative Peak], [Average ►]], where, the average detector type includes video average, power average and voltage average.

[Auto]

- **Menu description:** to set the detector command for the currently selected trace as Auto. That means, the signal/spectrum analyzer will perform based on the parameter setting of currently selected trace.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Auto] on the front panel
- **Status saved:** saved in the instrument status.
- **Factory preset:** the trace detector type is Power Average.
- **Program control commands:**

:CHPower:DETEctor:AUTO ON|OFF|1|0

:CHPower:DETEctor:AUTO?

[Normal]

- **Menu description:** to set the detector command for the currently selected trace as Normal. i.e., display the measurement results of positive peak and negative peak at the same time to achieve display effect similar to the analog instrument.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Normal] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CHPower:DETECTOR NORMAL

:CHPower:DETECTOR?

[Positive Peak]

- **Menu description:** to set the detector command for the currently selected trace as Positive Peak. i.e., take the maximum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Positive Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CHPower:DETECTOR POSITIVE

:CHPower:DETECTOR?

[Sample]

- **Menu description:** to set the detector command for the currently selected trace as Sample. i.e., take the last value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Sample] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CHPower:DETECTOR SAMPLE

:CHPower:DETECTOR?

[Negative Peak]

- **Menu description:** to set the detector command for the currently selected trace as Negative Peak. i.e., take the minimum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Negative Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CHPower:DETECTOR NEGATIVE

:CHPower:DETECTOR?

[Average ► Video Average]

- **Menu description:** to set the detector command for the currently selected trace as Video Average. Also called Logarithm Power Average Detector, i.e., take the logarithm power average value for all data assigned to each trace point; earlier signal/spectrum

analyzer generally displays the measurement trace of logarithm scale, and all filtering and averaging are based on the logarithm power data; the trace is generally called as video signal. After digital IF processing is adopted, to make measurement results same as the earlier signal/spectrum analyzer, the video average detector function is added.

- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Video Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
[:SENSe]:CHPower:DETEctor[:FUNCTION] LOG
```

```
[:SENSe]:CHPower:DETEctor[:FUNCTION]?
```

[Average ► Power Average]

- **Menu description:** to set the detector command for the currently selected trace as Power Average. Also called root mean square (RMS) detector. Calculate the root mean square of all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After square these voltage values, take sum and divide the count of sampling data points corresponding to each trace point. Finally, take square root. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those RMS values are trace data.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Power Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
[:SENSe]:CHPower:DETEctor[:FUNCTION] AVERage or
```

```
[:SENSe]:CHPower:DETEctor[:FUNCTION] RMS
```

```
[:SENSe]:CHPower:DETEctor[:FUNCTION]?
```

[Average ► Average Voltage]

- **Menu description:** to set the detector command for the currently selected trace as Voltage Average. Also called average (AVG) detector. Take linear average for all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After summing those voltage values, divide the number of sampling data points corresponding to each trace point. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those average values are trace data.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Voltage Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
[:SENSe]:CHPower:DETEctor[:FUNCTION] SCALar
```

```
[:SENSe]:CHPower:DETEctor[:FUNCTION]?
```

5. 2. 3. 7. Sweep

Enable sweep-related parameter setup function to pop up corresponding soft menu, including [Sweep Time Auto ON OFF], [Sweep Setting ►] and [Sweep Points].

[Scanning time Auto ON OFF]

- **Menu description:** to change the sweep time of signal/spectrum analyzer by number keys, stepping keys or knob. When it is under Auto OFF mode (shaded), it indicates that sweep time can be set manually. When it is under Auto ON status, the sweep time will be automatically coupled based on resolution bandwidth, span and video bandwidth
- **Key path:** [Sweep], [Sweep Time Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep time Auto.
- **Setting range:** Min.: 1ms, Max.: 6000s.
- **Default unit:** s
- **Program control commands:**

:CHPower:SWEep:TIME <time>

:CHPower:SWEep:TIME?

:CHPower:SWEep:TIME:AUTO OFF|ON|0|1

:CHPower:SWEep:TIME:AUTO?

- **Examples:**

:CHPower:SWEep:TIME 500ms

:CHPower:SWEep:TIME:AUTO OFF

[Scanning setting ►]

Pop up the soft menu related to Sweep type, including [Sweep Type Auto ON OFF], [Sweep Type Rules Auto ON OFF] and [FFT Width Auto ON OFF].

[Scanning type ► Auto ON OFF]

- **Menu description:** to set sweep type. is used to determine whether Swept or FFT is adopted for the signal/spectrum analyzer. Also set the FFT step bandwidth for FFT sweep. The soft menus include [Auto], [Swept] and [FFT]. When under Auto ON mode, the signal/spectrum analyzer will automatically select the sweep type based on sweep type rules.
- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep type: Auto.
- **Program control commands:**

:CHPower:SWEep:TYPE FFT|SWEep

:CHPower:SWEep:TYPE?

:CHPower:SWEep:TYPE:AUTO OFF|ON|0|1

:CHPower:SWEep:TYPE:AUTO?

[Sweep Type Rules Auto ON OFF]

- **Menu description:** to set rules for auto sweep type. While the sweep type rules include "Best Dynamic Range" and "Best Speed". "Best Dynamic Range" rules: when RBW is or larger than 1kHz, the sweep type is Swept; when RBW is less than 1kHz, the sweep type is FFT. "Best Speed" rules: when RBW is or larger than 30kHz, the sweep type is Swept; when RBW is less than 30kHz, the sweep type is FFT.

- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Rules Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** the sweep type rules are automatically set as "Best Dynamic Range".
- **Program control commands:**

:CHPower:SWEep:TYPE:AUTO:RULEs SPEed|DRANge

:CHPower:SWEep:TYPE:AUTO:RULEs?

:CHPower:SWEep:TYPE:AUTO:RULEs:AUTO OFF|ON|0|1

:CHPower:SWEep:TYPE:AUTO:RULEs:AUTO?

[FFT Width Auto ON OFF]

- **Menu description:** to set FFT Width. The FFT width includes [Auto], [<100kHz], [<3MHz], [<13MHz], [<=Max.]. FFT width is only active when the FFT sweep type is selected. Under Auto type, when the signal/spectrum analyzer performs FFT spectrum measurement, the maximum resolution bandwidth is 30kHz. To guarantee best dynamic measurement range, the signal/spectrum analyzer automatically optimizes the FFT width within 100kHz. The larger is the FFT width, the faster is FFT spectrum measurement, but the dynamic range performance will be affected.

Under FFT sweep, the FFT width setup limits the maximum value for center frequency step of each tune. For example, if [<100Hz] is selected, the maximum value for center frequency step of each tune is 100Hz. As the FFT width gets larger, the count of instrument center frequencies get smaller when performing measurement of same frequency scope, and the response measurement gets faster. Therefore, to improve measurement speed, you can manually change the FFT width.

- **Key path:** [Sweep], [Sweep Setting ►], [FFT Width ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** FFT Width is set as Auto.
- **Program control commands:**

:CHPower:SWEep:FFT:WIDTh <real>

:CHPower:SWEep:FFT:WIDTh?

:CHPower:SWEep:FFT:WIDTh:AUTO OFF|ON|0|1

:CHPower:SWEep:FFT:WIDTh:AUTO?

[Number of scanning points]

- **Menu description:** to set the trace points.
- **Key path:** [Sweep], [Sweep Points] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1001.
- **Setting range:** 101-30001.
- **Program control commands:**

:CHPower:SWEep:POINts <integer>

:CHPower:SWEep:POINts?

5. 2. 3. 8. Single

- **Menu description:** the [Continuous Off] key on the front panel has no corresponding soft menu. This function is mainly used for manual trigger of a sweep. When the Average is ON, this function performs the sweeps at the count specified by the Average Count.

In remote control programming and system establishment, this function combined with *WAI can effectively synchronize the sweep process and enable the trace data obtained after the *WAI finishes directly correspond to the sweep process one by one.

- **Program control commands:**

:INITiate:CHPower

5. 2. 3. 9. Continuous

The [Continuous] key on the front panel has no corresponding soft menu. This function is mainly used for changing the Continuous OFF into Continuous ON; if the current sweep is Continuous ON, the instrument performs no operation.

- **Program control commands:**

:INITiate:CONTInuous ON

5. 2. 3. 10. Trigger

See [Trigger] menu of the sweep analysis function for more details.

5. 2. 3. 11. Display

Pop up soft menus related to display, including [Display Line ON OFF], [Bar Graph ON OFF], [Display Configuration ►].

[Display Line On Off]

See [Display Line ON/OFF] under [Display] of the sweep analysis function for more details.

[Display Configuration ►]

It is used for configurations of interface language, status area display on interface. The soft menus include [Select Language Chinese English], [Graticule Display ON OFF], Status Area Display ON OFF], [Frequency Information Display ON OFF]. See [Display Configuration ►] under [Display] of the sweep analysis function for more details.

[Bar Graph On Off]

- **Menu description:** to turn on or off Bar Graph Display.
- **Key path:** [Display] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** ON
- **Program control commands:**

:DISPlay:CHPower:VIEW:WINDow:BGRaph ON|OFF|1|0

:DISPlay:CHPower:VIEW:WINDow:BGRaph?

5. 2. 3. 12. Input Output

See the [Input Output] menu of the sweep analysis function for more details.

5. 2. 3. 13. Marker

Pop up the soft menu related to markers, including [Marker Select ►], [Normal Markers], [Delta Marker], [Fixed Marker], [Marker

OFF], [Marker Attribute ►], [Marker Couple ON OFF], and [All Markers OFF].

[Marker Select ► Marker 1]

- **Command description:** to select among 12 different markers of the analyzer. When one marker is selected, the menu will indicate the current marker and the type and the attribute of the selected marker can be set. Select and trigger another marker and place it at the center of the current trace, and then users can read amplitude and frequency information (when the frequency span is 0 Hz, time information will be displayed) at the marker display area at the top right corner of the screen.
- **Key path:** [Marker], [Marker Select ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Marker 1

[Normal Marker]

- **Menu description:** to set the selected marker as the Normal Marker.
- **Key path:** [Marker], [Normal Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE POSition

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Delta Marker]

- **Menu description:** to set the selected marker as the Delta Marker. Display the amplitude difference and frequency difference (or time difference, when span is zero) between two markers at the marker display area at the top right corner of the screen. If there exists a single marker, a [Delta Marker] operation will generate a reference marker in the active marker position. Move the active marker through the knob, stepping keys or number keys. The display amplitude difference unit is dB.
- **Key path:** [Marker], [Delta Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE DELTa

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Fixed Marker]

- **Menu description:** to set the selected marker as the Fixed Marker. The X Axis and Y Axis positions of the fixed marker are fixed. The Fixed Marker can be used as reference marker.
- **Key path:** [Marker], [Fixed Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE FIXEd

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker OFF]

- **Menu description:** to turn off the selected marker.
- **Key path:** [Marker], [Marker Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE OFF

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker Attribute ►]

Pop up the corresponding menu of currently selected marker attribute setup, including [Marker Select ►], [Reference Marker ►], [Marker Display Line ON/OFF].

[Reference Marker ►]

- **Menu description:** to select reference marker for current marker. It can be any one from 11 markers except the currently selected marker.
- **Key path:** [Marker], [Marker Attribute ►], [Reference Marker ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence <integer>

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence?

[Marker Display Line ►] On Off

- **Menu description:** to set whether the current marker is displayed as a line on the screen, which is easy to observe.
- **Key path:** [Marker], [Marker Attribute ►] and [Marker Display Line On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate: CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINES[:STATe] OFF|ON|0|1

:CALCulate: CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINES[:STATe]?

[Marker Couple On Off]

- **Menu description:** to turn on or off Marker Couple. When it is ON, moving any marker horizontal axis position will cause an equal movement of horizontal axis position of every other marker which is ON. When the marker is moved to less than Start Frequency or larger than Stop Frequency, the marker is limited to the value of the Start Frequency or the Stop Frequency; when the span is zero, the minimum value is limited as 0, and the maximum value is limited as the Sweep Time.
- **Key path:** [Marker], [Menu 1/2 ►], [Marker Couple ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.

- **Program control commands:**

:CALCulate:CHPower:MARKer:COUPl[e]:STATe] ON|OFF|1|0

:CALCulate:CHPower:MARKer:COUPl[e]:STATe]?

[All Markers OFF]

- **Menu description:** to turn off all current markers which are ON and related soft keys, e.g. [Noise Marker].

- **Key path:** [Marker], [Menu 1/2 ►], [All Markers OFF] on the front panel.

- **Status saved:** not saved in instrument status.

- **Program control commands:**

:CALCulate:CHPower:MARKer:AOff

5. 2. 3. 14. Marker->

This key has no soft menu.

5. 2. 3. 15. Marker Function

This key has no soft menu.

Peak

The [Peak Search] key on the front panel is used for turning on the peak search for traces by the control instrument and turning on marker for display, including [Next Peak], [Next Peak Right], [Next Peak Left].

- **Program control commands:**

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum

[Next Peak]

- **Menu description:** Taking the Amplitude of the point where the current marker is located, search for the next peak of current test trace.

- **Key path:** [Peak Search], [Next Peak] on the front panel.

- **Status saved:** not saved in instrument status.

- **Program control commands:**

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:NEXT

[Next Peak Right]

- **Menu description:** to search for the peak to the right of the current test trace marker position.

- **Key path:** [Peak Search], [Next Peak Right] on the front panel.

- **Status saved:** not saved in instrument status.

- **Program control commands:**

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:RIGHT

[Next Peak Left]

- **Menu description:** to search for the peak to the left of the current test trace marker position.

- **Key path:** [Peak Search], [Next Peak Left] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:LEFT

5. 2. 3. 16. Measurement Setting

Pop up the soft menu related to measurement setting, including [Average Count ON OFF], [Average State Exponential Repeat], [Integration Bandwidth], [RRC Filter ON OFF], [Filter Bandwidth], [Filter Factor a], [Phase Noise Optimization], [Low Noise Path ON OFF], [Preselector Preselecting Bypass], [RF Gain ►], [ADC Dither Auto ON OFF] and [Measurement Reset].

[Average frequency On Off]

- **Menu description:** to turn on or off Average. When Average Count is ON, the user can specify the average count required for measurement. The Average Count can be adjusted by number keys, stepping keys or knob.
- **Key path:** [Measurement Setting], [Average Count ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100/OFF
- **Setting range:** 1 - 10000
- **Default unit:** none
- **Program control commands:**

[:SENSe]:CHPower:AVERage:COUNT <integer>

[:SENSe]:CHPower:AVERage:COUNT?

[:SENSe]:CHPower:AVERage[:STATe] ON|OFF|1|0 [:SENSe]:CHPower:AVERage[:STATe]?

[Average State Exponential Repeat]

- **Menu description:** when Average Count is ON, the user can select Average State required for measurement.

Exponential - Different from Linear Average, in Exponential State, the weight of new data is larger than that of old data. This is good for tracking data change in terms of time. In this case, the selected averaging count determines the weight of the old data on the new data. As the average count increases, the weight of new data gradually decreases.

Repeat - Similarly, it takes exponential averaging. However, when the average count is met, clear all previous results, restart average till the set average count and repeat this process.

- **Key path:** [Measurement Setting], [Average State Exponential Repeat] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Exponential
- **Program control commands:**

[:SENSe]:CHPower:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:CHPower:AVERage:TCONtrol?

[Integration Bandwidth]

- **Menu description:** to designate the bandwidth integration range for calculating power within the channel. The integration

bandwidth is displayed in the trace window and indicated with a pair of vertical lines connected with arrows. It ensures that the set instrument span is not less than the integral bandwidth. Such commands may be adjusted via number keys, stepping keys or the knob.

- **Key path:** [Measurement Setting], [Integration Bandwidth] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 2.0MHz
- **Setting range:** 100Hz - 1.0GHz
- **Default unit:** Hz.
- **Program control commands:**

```
[::SENSe]:CHPower:BANDwidth:INTegration <bandwidth>
```

```
[::SENSe]:CHPower:BANDwidth:INTegration?
```

[RRC Filter On Off]

- **Menu description:** to turn on or off RRC Filter. When RRC Filter is ON, the influence factor of RRC Filter will be considered in calculating the measurement result.
- **Key path:** [Measurement Setting], [Menu 1/3 ►], [RRC Filter ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

```
[::SENSe]:CHPower:FILTer[:RRC][:STATe] OFF|ON|0|1
```

```
[::SENSe]:CHPower:FILTer[:RRC][:STATe]?
```

[Filter Bandwidth]

- **Menu description:** to set bandwidth value for the RRC Filter. When RRC Filter is ON, the influence factor of RRC Filter will be considered in calculating the measurement result. Use number keys, stepping keys or knob to adjust occupied power percentage.
- **Key path:** [Measurement Setting], [Menu 1/3 ►], [Filter Bandwidth] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 3.84MHz
- **Setting range:** 100Hz - 100MHz
- **Default unit:** Hz.
- **Program control commands:**

```
[::SENSe]:CHPower:FILTer[:RRC]:BANDwidth <real>
```

```
[::SENSe]:CHPower:FILTer[:RRC]:BANDwidth?
```

[Filter Factor a]

- **Menu description:** to turn on or off RRC Filter. When RRC Filter is ON, the influence factor of RRC Filter will be considered in calculating the measurement result. Use number keys, stepping keys or knob to change the Filter Factor a.

- **Key path:** [Measurement Setting], [Menu 1/3 ►], [Filter Factor a] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0.22
- **Setting range:** 0.01 - 1.0
- **Default unit:** none
- **Program control commands:**

```
[:SENSe]:CHPower:FILTer[:RRC]:ALPHA <real>
```

```
[:SENSe]:CHPower:FILTer[:RRC]:ALPHA?
```

[Low Noise Path On Off]

- **Menu description:** this menu is only available when the H34 option (Low Noise Preamplifier) is purchased. When the preamplifier is ON, the Low Noise Path is OFF and this menu is grayed out; when the preamplifier is OFF, this menu lights on and is switchable.
- **Key path:** [Measurement Setting], [Menu 1/3 ►], [Menu 2/3 ►], [Low Noise Path ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:CHPower:POWer:MW:PATH STD|LNPath
```

```
:CHPower:POWer:MW:PATH?
```

[Preselector Preselecting Bypass]

- **Menu description:** this menu is only available when the H36 option is purchased. It is used for setting whether to bypass the front-end preselector of the signal/spectrum analyzer. In analyzing bandwidth signal, bypass is usually required.
- **Key path:** [Measurement Setting], [Menu 1/3 ►], [Menu 2/3 ►], [Preselector Bypass Preselect] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:INPut:CHPower:FILTer:YIG OFF|ON|0|1
```

```
:INPut:CHPower:FILTer:YIG?
```

[RF Gain ►]

- **Menu description:** to set the Auto ON/OFF of the RF Gain and best allocation algorithm for RF Gain. The soft menus includes [Auto], [Best Dynamic Range] and [Best Sensitivity].
- **Key path:** [Measurement Setting], [Menu 1/3 ►], [Menu 2/3 ►], [RF Gain] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:CHPower:RF:GAIN:AUTO OFF|ON|0|1
```

```
:CHPower:RF:GAIN:AUTO?
```

```
:CHPower:RF:GAIN:AUTO:RULes RANGE|SENSITIVITY
```


:CHPower:RF:GAIN:AUTO:RULes?

[Auto]

- **Menu description:** to set the RF Gain distribution algorithm to Auto. In this case, the RF Gain distribution is "Best Dynamic Range".
- **Key path:** [Measurement Setting], [Menu 1/3 ▶], [Menu 2/3 ▶], [RF Gain], [Auto] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Dynamic Range]

- **Menu description:** to set the RF Gain distribution algorithm to Best Dynamic Range. In this case, the RF Gain is switched to "Auto OFF".
- **Key path:** [Measurement Setting], [Menu 1/3 ▶], [Menu 2/3 ▶], [RF Gain ▶], [Best Dynamic Range] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Sensitivity]

- **Menu description:** to set the RF Gain distribution algorithm to Best Sensitivity. In this case, the RF Gain is switched to "Auto OFF".
- **Key path:** [Measurement Setting], [Menu 1/3 ▶], [Menu 2/3 ▶], [RF Gain ▶], [Best Sensitivity] on the front panel.
- **Status saved:** saved in the instrument status.

[ADC Dither Auto ON OFF]

- **Menu description:** to control opening/closing of ADC dither of the frequency acquisition circuit in the analyzer. Under default mode, the signal/spectrum analyzer will automatically control whether the ADC Dither is ON based on current working condition. When the ADC Dither is under Auto mode, the ON or OFF status depends on the span, resolution bandwidth and sweep type (continuous swept or step sweep); when it is continuous swept, the ADC Dither status will force to switch to Auto and turns off; when it is step sweep, under Auto mode, if the span is 2MHz or below, the ADC Dither is ON; if the span is below 2MHz, the ADC Dither is OFF. Under Auto OFF mode, if the span is above 2MHz, turning on the ADC Dither may affect the measurement results based on selected dither status. You can access the submenu for manual control.
- **Key path:** [Measurement Setting], [Menu 1/3 ▶], [Menu 2/3 ▶], [ADC Dither Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**

```
[::SENSe]:CHPower:ADC:DITHer[:STATe] OFF|ON|HIGH
```

```
[::SENSe]:CHPower:ADC:DITHer[:STATe]?
```

```
[::SENSe]:CHPower:ADC:DITHer:AUTO[:STATe] OFF|ON|0|1
```

```
[::SENSe]:CHPower:ADC:DITHer:AUTO[:STATe]?
```

[Measurement Reset]

- **Menu description:** to reset the measurement parameters to the factory preset status or user saved parameter status
- **Key path:** [Measurement Setting], [Menu 1/3 ▶], [Menu 2/3 ▶], [Measurement Reset] on the front panel.

- **Factory preset:** factory reset.
- **Program control commands:**

:CONFigure:CHPower

5. 2. 3. 17. Measurement Control

Pop up the menu related to measurement control, including [Measurement Continuous On/Off], [Restart Measurement] and [Pause/Resume].

[Measurement Continuous ON OFF]

- **Menu description:** to set continuous measurement OFF or ON. When [Measurement Continuous On/Off] is pressed, Continuous On will be triggered and continuous sweep will be the default measurement control method; when Continuous Off is selected, single measurement will be triggered. Press [Sweep Continuous OFF] to restart sweep when the next trigger signal arrives.
- **Key path:** [Measurement Control], [Measurement Continuous ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Continuous On.
- **Program control commands:**

:INITiate:CONTinuous OFF|ON|0|1

:INITiate:CONTinuous?

- **Examples:**

:INIT:CONT OFF

[Restart Measurement]

- **Menu description:** to stop current measurement and restart measurement for the signal/spectrum analyzer.
- **Key path:** [Measurement Control], [Restart Measurement] on the front panel
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:REST

[Pause]

- **Menu description:** when the signal/spectrum analyzer is in operation, this menu is used for pausing current measurement; when in Paused status, this menu is used for continuing measurement.
- **Key path:** [Measurement Control], [Pause] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:PAUS

:INITiate:RES

5. 2. 4. Occupied Bandwidth

5. 2. 4. 1. Frequency

The [Frequency] key on the front panel is used to set parameters related to the signal/spectrum analyzer frequency, including [Center Frequency], [Frequency Step Auto ON/OFF], [Frequency Offset]. See the [Frequency] menu of the sweep analysis function for more details.

[Center Freq]

See the [Center Frequency] under [Frequency] of the sweep analysis function for more details.

[Frequency Step Auto ON OFF]

See the [Frequency Step Auto ON/OFF] under [Frequency] of the sweep analysis function for more details.

[Frequency deviation]

See the [Frequency Offset] under [Frequency] of the sweep analysis function for more details.

5. 2. 4. 2. Amplitude/Y Axis

Pop up menus related to parameter setting of Amplitude/Y Axis, including [Reference Level], [Attenuator ►], [Preamplifier ON/OFF], [Scale/Division], [Auto Scale], [Menu 1/2 ►], [Y Axis Scale Unit], [Reference Level Offset].

Reference Level

- **Menu description:** to enable the Reference Level function. The reference level can be adjusted with the number keys, step keys or knob. The reference level corresponds to the top of the coordinate top. Measure signal at reference level position to get highest accuracy. The input attenuator of the signal/spectrum analyzer is coupled to the reference level, which can be automatically changed to avoid compression of input signal.
- **Key path:** [Amplitude/Y Axis], [Reference Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0dBm
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Default unit:** set based on Y Axis scale unit.
- **Program control commands:**

```
:DISPlay:OBWidth:VIEW:WINDow:TRACe:Y:RLEVel <real>
```

```
:DISPlay:OBWidth:VIEW:WINDow:TRACe:Y:RLEVel?
```

- **Examples:**

```
:DISPlay:OBWidth:VIEW:WINDow:TRACe:Y:RLEVel20dBm
```

[Attenuator ►]

See [Attenuator ►] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Pre-amplifier On Off]

See [Preamplifier ON/OFF] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Scale/Division]

- **Menu description:** to select the scale/division from 0.1dB/division to 20dB/division. This menu is only valid when the scale type is logarithm.

- **Key path:** [Amplitude/Y Axis], [Scale/Division] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 10.00 dB.
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Program control commands:**

:DISPlay:OBWidth:VIEW:WINDow:TRACe:Y:PDIVision <rel_amp>

:DISPlay:OBWidth:VIEW:WINDow:TRACe:Y:PDIVision?

[Auto Scale]

- **Menu description:** the instrument automatically sets parameters like reference level and scale/division based on input signal sizes. When this soft menu key is pressed, the instrument performs one auto scaling. Setting rule for auto scaling: when the [Auto Scale] menu is pressed, firstly obtain the maximum value and the minimum value based on current measurement trace data. Based on the maximum value, place on the 80% graticule of the screen trace Y axis for auto setting of reference level and scale/division.
- **Key path:** [Amplitude/Y Axis], [Auto Scale] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:OBWidth:ADJust:LEVel

[Y Axis Scale Unit ►]

- **Menu description:** to select the Y Axis unit from [dBm], [dBmV], [dBmA], [W], [V], [A], [dBμV] and [dBμA]. The instrument will automatically calculate the trace data and marker readout based on the Y axis scale unit.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** dBm
- **Program control commands:**

:UNIT:OBWidth:POWer DBM|DBMV|DBMA|V|W|A|DBUV|DBUA

:UNIT:OBWidth:POWer?

[Reference Level Offset]

- **Menu description:** to introduce offset for all amplitude readout (e.g., reference level and marker amplitude). It will not change the trace position on the screen. This offset unit is dB and is not affected by the scale and unit. Use number keys, stepping keys or knob to input the offset value.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Reference Level Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0 dB.
- **Setting range:** Min.: -1000dB, Max.:1000dB.
- **Program control commands:**

:DISPlay:OBWidth:WINDow:TRACe:Y:RLEVel:OFFSet <rel_ampl>

:DISPlay:OBWidth:WINDow:TRACe:Y:RLEVel:OFFSet?

- **Examples:**

:DISPlay:OBWidth:WINDow:TRACe:Y:RLEVel:OFFSet 12

5. 2. 4. 3. Span/X Axis

Press the [Span/X Axis] on the front panel to enable the span function and set the signal/spectrum analyzer into center frequency/span mode. Press the [Span] key to pop up [Span], [Full Span] and [Previous Span].

[Bandwidth]

- **Menu description:** the span can be set by number keys, stepping keys or knob. Use number keys or select [Zero Span] to set the span as zero.
- **Key path:** [Span/X Axis], [Span] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** maximum frequency limit - start frequency.
- **Setting range:** Min.: 10Hz, Max.: related to the maximum working frequency limit of the instrument.
- **Program control commands:**

:OBWidth:FREQuency:SPAN <freq>

:OBWidth:FREQuency:SPAN?

- **Examples:**

:OBWidth:FREQuency:SPAN 10MHz

[Full Span]

- **Menu description:** to set the signal/spectrum analyzer into the center frequency/span mode. Set the span as maximum value.
- **Program control commands:**

:OBWidth:FREQuency:SPAN:FULL

[Previous Span]

- **Menu description:** to set the signal/spectrum analyzer back to the previous span.
- **Program control commands:**

:OBWidth:FREQuency:SPAN:PREVious

5. 2. 4. 4. Bandwidth

Pop up the soft menus for setting resolution bandwidth and video bandwidth, including [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF] and [Filter Type].

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to change the resolution bandwidth of spectrum analysis, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode.

- **Key path:** [Bandwidth], [Resolution Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

:OBWidth:Bandwidth <bandwidth>

:OBWidth:Bandwidth?

:OBWidth:Bandwidth:AUTO ON|OFF|1|0

:OBWidth:Bandwidth:AUTO?

- **Examples:**

:OBWidth:Bandwidth 1kHz

:OBWidth:Bandwidth:AUTO ON On

[Video bandwidth Auto ON OFF]

- **Menu description:** to change the video bandwidth within the active function area, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode. **Command description:** to change video bandwidth displayed at the active function zone ranging from 1Hz to 20MHz. When it is above 3MHz, take 4 MHz, 5 MHz, 6 MHz, 8 MHz, 10 MHz and 20 MHz; when it is between 1Hz and 3MHz, change by 10% step. Such value may be changed via number keys, stepping keys or the knob. The mode with a underline is the current mode. When set as Auto Off, press [Frequency Bandwidth Auto ON OFF] to select Auto ON and return to auto mode.
- **Key path:** [Bandwidth], [Video Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto, same as the Resolution Bandwidth setting.
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

:OBWidth:Bandwidth:VIDeo <bandwidth>

:OBWidth:Bandwidth:VIDeo?

:OBWidth:Bandwidth:VIDeo:AUTO ON|OFF|1|0

:OBWidth:Bandwidth:VIDeo:AUTO?

- **Examples:**

:OBWidth:Bandwidth:VIDeo 1 kHz

:OBWidth:Bandwidth:VIDeo:AUTO ON

[Filter Type ▶]

- **Menu description:** comprising [Gaussian] and [Flat Top]. In general, the signal/spectrum analyzer uses Gaussian filter, i.e., use

filter approximate to the Gaussian shape to complete filtering of resolution bandwidth. If the flat top filter is used, the signal/spectrum analyzer adopts filter approximate to the rectangular shape to complete filtering of resolution bandwidth. The response time of flat top filter is about 3 times of that of the Gaussian filter. The sweep speed of the flat top filter is smaller than that of the Gaussian filter. The flat top filter has better selectivity than the Gaussian filter and therefore is more capable of distinguishing two signals with unequal amplitude.

- **Key path:** [Bandwidth], [Filter Type ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Gaussian.
- **Program control commands:**

:OBWidth:Bandwidth:SHAPE GAUSSian|FLATtop

:OBWidth:Bandwidth:SHAPE?

5. 2. 4. 5. Auto Setting

Pop up the soft menu related to auto setting including [Couple All], [Mechanical Attenuator Auto ON OFF], [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF], [VBW/RBW Auto ON OFF], [Span/RBW Auto ON OFF], [Sweep Time Auto ON OFF] and [Frequency Step Auto ON OFF].

[Couple All]

- **Menu description:** to set the resolution bandwidth, video bandwidth, sweep time, mechanical attenuator and frequency step as auto coupling mode. The signal/spectrum analyzer will select most suitable values for those functions based on set frequency and bandwidth (or start frequency and stop frequency). If no ratio is pre- saved, use default ratio.
- **Key path:** [Auto Setting], [Couple All] on the front panel.
- **Status saved:** not saved in instrument status.
- **Factory preset:** Couple All.
- **Program control commands:**

:COUPlE ALL

- **Examples:**

:COUP ALL

[Mechanical Attenuator Auto ON OFF]

See [Attenuator ►] under [Amplitude/Y Axis] for more details.

[Resolution Bandwidth Auto ON OFF]

See [Resolution Bandwidth Auto ON/OFF] under [Bandwidth] for more details.

[Video bandwidth Auto Manual]

See [Video Bandwidth Auto ON/OFF] under [Bandwidth] for more details.

[Scanning time Auto ON OFF]

See [Sweep Time Auto ON/OFF] under [Sweep] for more details.

[Frequency Step Auto ON OFF]

See [Frequency Step Auto ON/OFF] under [Frequency] for more details.

5. 2. 4. 6. Trace

Press [Trace] key on the front panel to pop up corresponding soft menu. Including [Refresh], [Average], [Max. Hold], [Min. Hold], [Display ON/OFF ▶] [Menu 1/2 ▶] and [Detector ▶].

[Refresh]

- **Command description:** to set the current trace processing as Refresh, i.e., clear all data of displayed trace and continue the signal trace receipt under sweep status.
- **Key path:** [Trace], [Refresh] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** after all traces are selected, the trace mode is defaulted as Refresh.
- **Program control commands:**

:TRACe:OBWidth:TYPE WRITe

:TRACe:OBWidth:TYPE?

[Averaging]

- **Command description:** to set the current trace processing method as Average, i.e., based on the average count N set in the [Measurement Setting], update trace after averaging the performance index of the measurement trace.
- **Key path:** [Trace], [Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:OBWidth:TYPE AVERAge

:TRACe:OBWidth:TYPE?

[Max. Hold]

- **Menu description:** to set the current trace processing method as maximum hold, i.e., the new trace data will be assigned with maximum value of previous measured trace data.
- **Key path:** [Trace], [Max. Hold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:OBWidth:TYPE MAXHold

:TRACe:OBWidth:TYPE?

[Min. Hold]

- **Menu description:** to set the current trace processing method as minimum hold, i.e., the new trace data will be assigned with

minimum value of previous measured trace data.

- **Key path:** [Trace], [Min. Hold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:OBWidth:TYPE MINHold

:TRACe:OBWidth:TYPE?

[Display ON/OFF ► Refresh Display]

- **Menu description:** to set the display method for the selected trace from [Refresh Display], [Static Display], [Backstage Refresh] and [Display OFF].
- **Key path:** [Trace], [Display ON/OFF ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace display modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:OBWidth:DISPlay[:STATe] ON|OFF|0|1

:TRACe:OBWidth:DISPlay[:STATe]?

:TRACe:OBWidth:UPDate[:STATe] ON|OFF|0|1

:TRACe:OBWidth:UPDate[:STATe]?

[Detector ►]

Pop up soft menus related to setting the detector type for the currently selected trace, including [Auto], [Normal], [Positive Peak], [Sample], [Negative Peak], [Average ►], where, the average detector type includes video average, power average and voltage average.

[Auto]

- **Menu description:** to set the detector command for the currently selected trace as Auto. That means, the signal/spectrum analyzer will perform based on the parameter setting of currently selected trace.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Auto] on the front panel
- **Status saved:** saved in the instrument status.
- **Factory preset:** the trace detector type is Power Average.
- **Program control commands:**

:OBWidth:DETEctor:AUTO ON|OFF|1|0

:OBWidth:DETEctor:AUTO?

[Normal]

- **Menu description:** to set the detector command for the currently selected trace as Normal. i.e., display the measurement results of positive peak and negative peak at the same time to achieve display effect similar to the analog instrument.

- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Normal] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:OBWidth:DETECTOR NORMAL

:OBWidth:DETECTOR?

[Positive Peak]

- **Menu description:** to set the detector command for the currently selected trace as Positive Peak. i.e., take the maximum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Positive Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:OBWidth:DETECTOR POSITIVE

:OBWidth:DETECTOR?

[Sample]

- **Menu description:** to set the detector command for the currently selected trace as Sample. i.e., take the last value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Sample] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:OBWidth:DETECTOR SAMPLE

:OBWidth:DETECTOR?

[Negative Peak]

- **Menu description:** to set the detector command for the currently selected trace as Negative Peak. i.e., take the minimum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Negative Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:OBWidth:DETECTOR NEGATIVE

:OBWidth:DETECTOR?

[Average ► Video Average]

- **Menu description:** to set the detector command for the currently selected trace as Video Average. Also called Logarithm Power Average Detector, i.e., take the logarithm power average value for all data assigned to each trace point; earlier signal/spectrum analyzer generally displays the measurement trace of logarithm scale, and all filtering and averaging are based on the logarithm power data; the trace is generally called as video signal. After digital IF processing is adopted, to make measurement results same as the earlier signal/spectrum analyzer, the video average detector function is added.

- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Video Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:OBWidth:DETECTOR LOG

:OBWidth:DETECTOR?

[Average ► Power Average]

- **Menu description:** to set the detector command for the currently selected trace as Power Average. Also called root mean square (RMS) detector. Calculate the root mean square of all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After square these voltage values, take sum and divide the count of sampling data points corresponding to each trace point. Finally, take square root. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those RMS values are trace data.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Power Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:OBWidth:DETECTOR AVERAGE Or

:OBWidth:DETECTOR RMS

:OBWidth:DETECTOR?

[Average ► Average Voltage]

- **Menu description:** to set the detector command for the currently selected trace as Voltage Average. Also called average (AVG) detector. Take linear average for all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After summing those voltage values, divide the number of sampling data points corresponding to each trace point. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those average values are trace data.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Voltage Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:OBWidth:DETECTOR SCALAR

:OBWidth:DETECTOR?

5. 2. 4. 7. Sweep

Enable sweep-related parameter setup function to pop up corresponding soft menu, including [Sweep Time Auto ON OFF], [Sweep Setting ►] and [Sweep Points].

[Scanning time Auto ON OFF]

- **Menu description:** to change the sweep time of signal/spectrum analyzer by number keys, stepping keys or knob. When it is under Auto OFF mode (shaded), it indicates that sweep time can be set manually. When it is under Auto ON status, the sweep time will be automatically coupled based on resolution bandwidth, span and video bandwidth

- **Key path:** [Sweep], [Sweep Time Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep time Auto.
- **Setting range:** Min.: 1ms, Max.: 6000s.
- **Default unit:** s
- **Program control commands:**

:OBWidth:SWEep:TIME <time>

:OBWidth:SWEep:TIME?

:OBWidth:SWEep:TIME:AUTO OFF|ON|0|1

:OBWidth:SWEep:TIME:AUTO?

- **Examples:**

:OBW:SWE:TIME 500 ms

:OBW:SWE:TIME:AUTO OFF

[Scanning setting ►]

Pop up the soft menu related to Sweep type, including [Sweep Type Auto ON OFF], [Sweep Type Rules Auto ON OFF] and [FFT Width Auto ON OFF].

[Scanning type ► Auto ON OFF]

- **Menu description:** to set sweep type. is used to determine whether Swept or FFT is adopted for the signal/spectrum analyzer. Also set the FFT step bandwidth for FFT sweep. The soft menus include [Auto], [Swept] and [FFT]. When under Auto ON mode, the signal/spectrum analyzer will automatically select the sweep type based on sweep type rules.
- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep type: Auto.
- **Program control commands:**

:OBWidth:SWEep:TYPE FFT|SWEep

:OBWidth:SWEep:TYPE?

:OBWidth:SWEep:TYPE:AUTO OFF|ON|0|1

:OBWidth:SWEep:TYPE:AUTO?

[Sweep Type Rules Auto ON OFF]

- **Menu description:** to set rules for auto sweep type. While the sweep type rules include "Best Dynamic Range" and "Best Speed".

"Best Dynamic Range" rules: when RBW is or larger than 1kHz, the sweep type is Swept; when RBW is less than 1kHz, the sweep type is FFT.

"Best Speed" rules: when RBW is or larger than 30kHz, the sweep type is Swept; when RBW is less than 30kHz, the sweep type is FFT.

- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Rules Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** the sweep type rules are automatically set as "Best Dynamic Range".
- **Program control commands:**

:OBWidth:SWEep:TYPE:AUTO:RULEs SPEed|DRANge

:OBWidth:SWEep:TYPE:AUTO:RULEs?

:OBWidth:SWEep:TYPE:AUTO:RULEs:AUTO OFF|ON|0|1

:OBWidth:SWEep:TYPE:AUTO:RULEs:AUTO?

[FFT Width Auto ON OFF]

- **Menu description:** to set FFT Width. The FFT width includes [Auto], [<100kHz], [<3MHz], [<13MHz], [<=Max.]. FFT width is only active when the FFT sweep type is selected. Under Auto type, when the signal/spectrum analyzer performs FFT spectrum measurement, the maximum resolution bandwidth is 30kHz. To guarantee best dynamic measurement range, the signal/spectrum analyzer automatically optimizes the FFT width within 100kHz. The larger is the FFT width, the faster is FFT spectrum measurement, but the dynamic range performance will be affected.

Under FFT sweep, the FFT width setup limits the maximum value for center frequency step of each tune. For example, if [<100Hz] is selected, the maximum value for center frequency step of each tune is 100Hz. As the FFT width gets larger, the count of instrument center frequencies get smaller when performing measurement of same frequency scope, and the response measurement gets faster. Therefore, to improve measurement speed, you can manually change the FFT width.

- **Key path:** [Sweep], [Sweep Setting ►], [FFT Width ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** FFT Width is set as Auto.
- **Program control commands:**

:OBWidth:SWEep:FFT:WIDTh <real>

:OBWidth:SWEep:FFT:WIDTh?

:OBWidth:SWEep:FFT:WIDTh:AUTO OFF|ON|0|1

:OBWidth:SWEep:FFT:WIDTh:AUTO?

[Number of scanning points]

- **Menu description:** to set the trace points.
- **Key path:** [Sweep], [Sweep Points] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1001.
- **Setting range:** 101-30001.
- **Program control commands:**

:OBWidth:SWEep:POINts <integer>

:OBWidth:SWEep:POINts?

5. 2. 4. 8. Single

- **Menu description:** the [Continuous Off] key on the front panel has no corresponding soft menu. This function is mainly used for manual trigger of a sweep. When the Average is ON, this function performs the sweeps at the count specified by the Average Count.

In remote control programming and system establishment, this function combined with *WAI can effectively synchronize the sweep process and enable the trace data obtained after the *WAI finishes directly correspond to the sweep process one by one.

- **Program control commands:**

:INITiate:OBWidth

5. 2. 4. 9. Continuous

The [Continuous] key on the front panel has no corresponding soft menu. This function is mainly used for changing the Continuous OFF into Continuous ON; if the current sweep is Continuous ON, the instrument performs no operation.

5. 2. 4. 10. Trigger

See [Trigger] menu of the sweep analysis function for more details.

5. 2. 4. 11. Display

Pop up the soft menu related to display, including [Display Line ON OFF], [Display Configuration ▶].

[Display Line On Off]

See [Display Line ON/OFF] under [Display] of the sweep analysis function for more details.

[Display Configuration ▶]

It is used for configurations of interface language, status area display on interface. The soft menus include [Select Language Chinese English], [Graticule Display ON OFF], Status Area Display ON OFF], [Frequency Information Display ON OFF]. See [Display Configuration ▶] under [Display] of the sweep analysis function for more details.

5. 2. 4. 12. Input Output

See the [Input Output] menu of the sweep analysis function for more details.

5. 2. 4. 13. Marker

Pop up the soft menu related to markers, including [Marker Select ▶], [Normal Markers], [Delta Marker], [Fixed Marker], [Marker OFF], [Marker Attribute ▶], [Marker Couple ON OFF], and [All Markers OFF].

[Marker Select ▶ Marker 1]

- **Command description:** to select among 12 different markers of the analyzer. When one marker is selected, the menu will indicate the current marker and the type and the attribute of the selected marker can be set. Select and trigger another marker and place it at the center of the current trace, and then users can read amplitude and frequency information (when the frequency span is 0 Hz, time information will be displayed) at the marker display area at the top right corner of the screen.
- **Key path:** [Marker], [Marker Select ▶] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Marker 1.

[Normal Marker]

- **Menu description:** to set the selected marker as the Normal Marker.

- **Key path:** [Marker], [Normal Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE POSition

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Delta Marker]

- **Menu description:** to set the selected marker as the Delta Marker. Display the amplitude difference and frequency difference (or time difference, when span is zero) between two markers at the marker display area at the top right corner of the screen. If there exists a single marker, a [Delta Marker] operation will generate a reference marker in the active marker position. Move the active marker through the knob, stepping keys or number keys. The display amplitude difference unit is dB.
- **Key path:** [Marker], [Delta Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE DELTa

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Fixed Marker]

- **Menu description:** to set the selected marker as the Fixed Marker. The X Axis and Y Axis positions of the fixed marker are fixed. The Fixed Marker can be used as reference marker.
- **Key path:** [Marker], [Fixed Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE FIXed

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker OFF]

- **Menu description:** to turn off the selected marker.
- **Key path:** [Marker], [Marker Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE OFF

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker Attribute ►]

Pop up the corresponding menu of currently selected marker attribute setup, including [Reference Marker ►], [X Axis Scale Auto ON OFF], [Marker Trace ►] and [Marker Display Line ON OFF].

[Reference Marker ►]

- **Menu description:** to select reference marker for current marker. It can be any one from 11 markers except the currently selected marker.
- **Key path:** [Marker], [Marker Attribute ►], [Reference Marker ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence <integer>

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence?

[Marker Display Line ►] On Off]

- **Menu description:** to set whether the current marker is displayed as a line on the screen, which is easy to observe.
- **Key path:** [Marker], [Marker Attribute ►] and [Marker Display Line On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINES[:STATe] OFF|ON|0|1

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINES[:STATe]?

[Marker Couple On Off]

- **Menu description:** to turn on or off Marker Couple. When it is ON, moving any marker horizontal axis position will cause an equal movement of horizontal axis position of every other marker which is ON. When the marker is moved to less than Start Frequency or larger than Stop Frequency, the marker is limited to the value of the Start Frequency or the Stop Frequency; when the span is zero, the minimum value is limited as 0, and the maximum value is limited as the Sweep Time.
- **Key path:** [Marker], [Menu 1/2 ►], [Marker Couple ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:OBWidth:MARKer:COUPlE[:STATe] ON|OFF|1|0

:CALCulate:OBWidth:MARKer:COUPlE[:STATe]?

[All Markers OFF]

- **Menu description:** to turn off all current markers which are ON and related soft keys, e.g. [Noise Marker].
- **Key path:** [Marker], [Menu 1/2 ►], [All Markers OFF] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:OBWidth:MARKer:AOff

5. 2. 4. 14. Marker->

This key has no soft menu.

5. 2. 4. 15. Marker Function

This key has no soft menu.

5. 2. 4. 16. Peak

The [Peak Search] key on the front panel is used for turning on the peak search for traces by the control instrument and turning on marker for display, including [Next Peak], [Next Peak Right], [Next Peak Left].

- Program control commands:

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum

[Next Peak]

- **Menu description:** Taking the Amplitude of the point where the current marker is located, search for the next peak of current test trace.
- **Key path:** [Peak Search], [Next Peak] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:NEXT

[Next Peak Right]

- **Menu description:** to search for the peak to the right of the current test trace marker position.
- **Key path:** [Peak Search], [Next Peak Right] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:RIGHT

[Next Peak Left]

- **Menu description:** to search for the peak to the left of the current test trace marker position.
- **Key path:** [Peak Search], [Next Peak Left] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:OBWidth:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:LEFT

5. 2. 4. 17. Measurement Setting

Pop up the soft menu related to measurement setting Which includes [Average Count ON OFF], [Average State Exponential Repeat], [Occupied Power%], [x dB], [Limit Bandwidth ON OFF], [Phase Noise Optimization ►], [Low Noise Path ON OFF], [Preselector Preselecting Bypass], [RF Gain ►], [ADC Dither Auto ON OFF ►] and [Measurement Reset].

[Average frequency On Off]

- **Menu description:** to turn on or off Average. When Average Count is ON, the user can specify the average count required for measurement. The Average Count can be adjusted by number keys, stepping keys or knob.
- **Key path:** [Measurement Setting], [Average Count ON OFF] on the front panel.

- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Setting range:** 1 - 10000
- **Default unit:** none
- **Program control commands:**

[::SENSe]: OBWidth: AVERage: COUNT <integer>

[::SENSe]: OBWidth: AVERage: COUNT?

[::SENSe]: OBWidth: AVERage[:STATe] ON|OFF|1|0

[::SENSe]: OBWidth: AVERage[:STATe]?

[Average State Exponential Repeat]

- **Menu description:** when Average Count is ON, the user can select Average State required for measurement.

Exponential - Different from Linear Average, in Exponential State, the weight of new data is larger than that of old data. This is good for tracking data change in terms of time. In this case, the selected averaging count determines the weight of the old data on the new data. As the average count increases, the weight of new data gradually decreases.

Repeat - Similarly, it takes exponential averaging. However, when the average count is met, clear all previous results, restart average till the set average count and repeat this process.

- **Key path:** [Measurement Setting], [Average State Exponential Repeat] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Exponential
- **Program control commands:**

[::SENSe]: OBWidth: AVERage: TCONtrol EXPonential|REPeat

[::SENSe]: OBWidth: AVERage: TCONtrol?

[Occupied Power %]

- **Menu description:** to set the signal power percentage that determines the occupied bandwidth. Use number keys, stepping keys or knob to adjust occupied power percentage.
- **Key path:** [Measurement Setting], [Occupied Power %] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 99.0%.
- **Setting range:** 10% - 99.99%
- **Default unit:** %
- **Program control commands:**

[::SENSe]: OBWidth: PERCent <real>

[::SENSe]: OBWidth: PERCent?

[x dB]

- **Menu description:** to designate the power level that determines the transmission bandwidth within the range of occupied

bandwidth and frequency span. The value is the decreased dB value at the signal peak point P. This function is independent from the occupied bandwidth calculation. x dB bandwidth is also called as the transmission bandwidth, which sets the arrow marker pair based on specified decreased dB value at the maximum power point and calculates the total power between two markers. x dB bandwidth is also called as the transmission bandwidth, which sets the arrow marker pair based on specified decreased dB value at the maximum power point and calculates the total power between two markers. Use number keys, stepping keys or knob to adjust x dB value.

- **Key path:** [Measurement Setting], [x dB] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -26.0 dB.
- **Setting range:** -100.0dB - -0.1dB
- **Default unit:** dB.
- **Program control commands:**

```
[:SENSe]:OBWidth:XDB <rel_amp> [:SENSe]:OBWidth:XDB?
```

[Limit Bandwidth On Off]

- **Menu description:** to turn on or off the limit test for occupied bandwidth. When it is ON, take the set limit bandwidth as reference, and judge whether the measured occupied bandwidth value exceeds the limit. If so, F indicates that the test fails. Use number keys, stepping keys or knob to change the Limit Bandwidth.
- **Key path:** [Measurement Setting], [Limit Bandwidth ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 5.0 MHz/off.
- **Setting range:** 1.0kHz - 100.0MHz
- **Default unit:** Hz.
- **Program control commands:**

```
:CALCulate:OBWidth:LIMit:FBLimit <freq>
```

```
:CALCulate:OBWidth:LIMit:FBLimit?
```

```
:CALCulate:OBWidth:LIMit[:TEST] ON|OFF|1|0
```

```
:CALCulate:OBWidth:LIMit[:TEST]?
```

[Low Noise Path On Off]

- **Menu description:** this menu is only available when the H34 option (Low Noise Preamplifier) is purchased. When the preamplifier is ON, the Low Noise Path is OFF and this menu is grayed out; when the preamplifier is OFF, this menu lights on and is switchable.
- **Key path:** [Measurement Setting], [Menu 1/2], [Low Noise Path ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:OBWidth:POWer:MW:PATH STD|LNPath
```

```
:OBWidth:POWer:MW:PATH?
```

[Preselector Bypass Preselect]

- **Menu description:** this menu is only available when the H36 option is purchased. It is used for setting whether to bypass the front-end preselector of the signal/spectrum analyzer. In analyzing bandwidth signal, bypass is usually required.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Preselector Preselecting Bypass] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

INPut:OBWidth:FILTer:YIG[:STATe] OFF|ON|0|1

INPut:OBWidth:FILTer:YIG[:STATe]?

[RF Gain ▶]

- **Menu description:** to set the Auto ON/OFF of the RF Gain and best allocation algorithm for RF Gain. The soft menus includes [Auto], [Best Dynamic Range] and [Best Sensitivity].
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [RF Gain ▶] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:OBWidth:RF:GAIN:AUTO OFF|ON|0|1

:OBWidth:RF:GAIN:AUTO?

:OBWidth:RF:GAIN:AUTO:RULEs RANGE|SENSITIVITY

:OBWidth:RF:GAIN:AUTO:RULEs?

[Auto]

- **Menu description:** to set the RF Gain distribution algorithm to Auto. In this case, the RF Gain distribution is "Best Dynamic Range".
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [RF Gain ▶], [Auto] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Dynamic Range]

- **Menu description:** to set the RF Gain distribution algorithm to Best Dynamic Range. In this case, the RF Gain is switched to "Auto OFF".
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [RF Gain ▶], [Best Dynamic Range] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Sensitivity]

- **Menu description:** to set the RF Gain distribution algorithm to Best Sensitivity. In this case, the RF Gain is switched to "Auto OFF".
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [RF Gain ▶], [Best Sensitivity] on the front panel.
- **Status saved:** saved in the instrument status.

[ADC Dither Auto ON OFF]

- **Menu description:** to control opening/closing of ADC dither of the frequency acquisition circuit in the analyzer. Under default mode, the signal/spectrum analyzer will automatically control whether the ADC Dither is ON based on current working condition. When the ADC Dither is under Auto mode, the ON or OFF status depends on the span, resolution bandwidth and sweep type (continuous swept or step sweep); when it is continuous swept, the ADC Dither status will force to switch to Auto and turns off; when it is step sweep, under Auto mode, if the span is 2MHz or below, the ADC Dither is ON; if the span is below 2MHz, the ADC Dither is OFF. Under Auto OFF mode, if the span is above 2MHz, turning on the ADC Dither may affect the measurement results based on selected dither status. You can access the submenu for manual control.
- **Key path:** [Measurement Setting], [Menu 1/2 ►], [ADC Dither Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**

```
[::SENSe]:OBWidth:ADC:DITHer[:STATe] OFF|ON|HIGH
```

```
[::SENSe]:OBWidth:ADC:DITHer[:STATe]?
```

```
[::SENSe]:OBWidth:ADC:DITHer:AUTO[:STATe] OFF|ON|0|1
```

```
[::SENSe]:OBWidth:ADC:DITHer:AUTO[:STATe]?
```

[Measurement Reset]

- **Menu description:** to reset the measurement parameters to the factory preset status or user saved parameter status
- **Key path:** [Measurement Setting], [Menu 1/2], [Measurement Reset] on the front panel.
- **Factory preset:** factory reset.
- **Program control commands:**

```
:CONFigure:OBWidth
```

5. 2. 4. 18. Measurement Control

Pop up the menu related to measurement control, including [Measurement Continuous On/Off], [Restart Measurement] and [Pause/Resume].

[Measurement Continuous ON OFF]

- **Menu description:** to set continuous measurement OFF or ON. When [Measurement Continuous On/Off] is pressed, Continuous On will be triggered and continuous sweep will be the default measurement control method; when Continuous Off is selected, single measurement will be triggered. Press [Sweep Continuous OFF] to restart sweep when the next trigger signal arrives.
- **Key path:** [Measurement Control], [Measurement Continuous ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Continuous On.
- **Program control commands:**

```
:INITiate:CONTInuous OFF|ON|0|1
```

```
:INITiate:CONTInuous?
```

- **Examples:**

:INIT:CONT OFF

[Restart Measurement]

- **Menu description:** to stop current measurement and restart measurement for the signal/spectrum analyzer.
- **Key path:** [Measurement Control], [Restart Measurement] on the front panel
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:REST

[Pause]

- **Menu description:** when the signal/spectrum analyzer is in operation, this menu is used for pausing current measurement; when in Paused status, this menu is used for continuing measurement.
- **Key path:** [Measurement Control], [Pause] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:PAUS

:INITiate:RES

5. 2. 5. Adjacent Channel Power

5. 2. 5. 1. Frequency

The [Frequency] key on the front panel is used to set parameters related to the signal/spectrum analyzer frequency, including [Center Frequency], [Frequency Step Auto ON/OFF], [Frequency Offset]. See the [Frequency] menu of the sweep analysis function for more details.

[Center Freq]

See the [Center Frequency] under [Frequency] of the sweep analysis function for more details.

[Frequency Step Auto ON OFF]

See the [Frequency Step Auto ON/OFF] under [Frequency] of the sweep analysis function for more details.

[Frequency deviation]

See the [Frequency Offset] under [Frequency] of the sweep analysis function for more details.

5. 2. 5. 2. Amplitude/Y Axis

Pop up menus related to parameter setting of Amplitude/Y Axis, including [Reference Level], [Attenuator ▶], [Preamplifier ON/OFF], [Scale/Division], [Auto Scale], [Menu 1/2 ▶], [Y Axis Scale Unit ▶], [Reference Level Offset].

Reference Level

- **Menu description:** to enable the Reference Level function. The reference level can be adjusted with the number keys, step keys or knob. The reference level corresponds to the top of the coordinate top. Measure signal at reference level position to get highest accuracy. The input attenuator of the signal/spectrum analyzer is coupled to the reference level, which can be automatically changed to avoid compression of input signal.

- **Key path:** [Amplitude/Y Axis], [Reference Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0dBm
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Default unit:** set based on Y Axis scale unit.
- **Program control commands:**

```
:DISPlay:ACPower:VIEW:WINDow:TRACe:Y:RLEVel <real>
```

```
:DISPlay:ACPower:VIEW:WINDow:TRACe:Y:RLEVel?
```

- **Examples:**

```
:DISPlay:ACPower:VIEW:WINDow:TRACe:Y:RLEVel20dBm
```

[Attenuator ►]

See [Attenuator ►] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Preamplifier ON OFF]

See [Preamplifier ON/OFF] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Scale/Division]

- **Menu description:** to select the scale/division from 0.1dB/division to 20dB/division. This menu is only valid when the scale type is logarithm.
- **Key path:** [Amplitude/Y Axis], [Scale/Division] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 10.00 dB.
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Program control commands:**

```
:DISPlay:ACPower:VIEW:WINDow:TRACe:Y:PDIVision <rel_amp>
```

```
:DISPlay:ACPower:VIEW:WINDow:TRACe:Y:PDIVision?
```

[Auto Scale]

- **Menu description:** the instrument automatically sets parameters like reference level and scale/division based on input signal sizes. When this soft menu key is pressed, the instrument performs one auto scaling. Setting rule for auto scaling: when the [Auto Scale] menu is pressed, firstly obtain the maximum value and the minimum value based on current measurement trace data. Based on the maximum value, place on the 80% graticule of the screen trace Y axis for auto setting of reference level and scale/division.
- **Key path:** [Amplitude/Y Axis], [Auto Scale] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

```
:ACPower:ADJust:LEVel
```

[Y Axis Scale Unit ►]

- **Menu description:** to select the Y Axis unit from [dBm], [dBmV], [dBmA], [W], [V], [A], [dBμV] and [dBμA]. The instrument will automatically calculate the trace data and marker readout based on the Y axis scale unit.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** dBm

:UNIT:ACPower:POWER DBM|DBMV|DBMA|V|W|A|DBUV|DBUA

:UNIT:ACPower:POWER?

[Reference Level Offset]

- **Menu description:** to introduce offset for all amplitude readout (e.g., reference level and marker amplitude). It will not change the trace position on the screen. This offset unit is dB and is not affected by the scale and unit. Use number keys, stepping keys or knob to input the offset value.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Reference Level Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0 dB.
- **Setting range:** Min.: -1000dB, Max.:1000dB.
- **Program control commands:**

:DISPlay:ACPower:WINDow:TRACe:Y:RLEVel:OFFSet <rel_amp>

:DISPlay:ACPower:WINDow:TRACe:Y:RLEVel:OFFSet?

- **Examples:**

:DISPlay:ACPower:WINDow:TRACe:Y:RLEVel:OFFSet 12

5. 2. 5. 3. Span/X Axis

Press the [Span/X Axis] on the front panel to enable the span function and set the signal/spectrum analyzer into center frequency/span mode. Press the [Span] key to pop up [Span], [Full Span] and [Previous Span].

[Bandwidth]

- **Menu description:** the span can be set by number keys, stepping keys or knob. Use number keys or select \[Zero Span] to set the span as zero.
- **Key path:** [Span/X Axis], [Span] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** maximum frequency limit - start frequency.
- **Setting range:** Min.: 10Hz, Max.: related to the maximum working frequency limit of the instrument.
- **Program control commands:**

:ACPower:FREQUency:SPAN <freq>

:ACPower:FREQUency:SPAN?

- **Examples:**

:ACPower:FREQUENCY:SPAN10MHz

[Full Span]

- **Menu description:** to set the signal/spectrum analyzer into the center frequency/span mode. Set the span as maximum value.
- **Program control commands:**

:ACPower:FREQUENCY:SPAN:FULL

[Previous Span]

- **Menu description:** to set the signal/spectrum analyzer back to the previous span.
- **Program control commands:**

:ACPower:FREQUENCY:SPAN:PREVIOUS

5. 2. 5. 4. Bandwidth

Pop up the soft menus for setting resolution bandwidth and video bandwidth, including [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF] and [Filter Type].

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to change the resolution bandwidth of spectrum analysis, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode.
- **Key path:** [Bandwidth], [Resolution Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz.
- **Program control commands:**

:ACPower:BANDwidth <bandwidth>

:ACPower:BANDwidth?

:ACPower:BANDwidth:AUTO ON|OFF|1|0

:ACPower:BANDwidth:AUTO?

- **Examples:**

:ACPower:BANDwidth 1kHz

:ACPower:BANDwidth:AUTO ON On

[Video bandwidth Auto ON OFF]

- **Menu description:** to change the video bandwidth within the active function area, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode. **Command description:** to change video bandwidth displayed at the active function zone ranging from 1Hz to 20MHz. When it is above 3MHz, take 4 MHz, 5 MHz, 6 MHz, 8 MHz, 10 MHz and 20 MHz; when it is between 1Hz and 3MHz, change by 10% step. Such value may be changed via number keys, stepping keys or the knob. The

mode with a underline is the current mode. When set as Auto Off, press [Frequency Bandwidth Auto ON OFF] to select Auto ON and return to auto mode.

- **Key path:** [Bandwidth], [Video Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto, same as the Resolution Bandwidth setting.
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

:ACPower:BANDwidth:VIDeo <bandwidth>

:ACPower:BANDwidth:VIDeo?

:ACPower:BANDwidth:VIDeo:AUTO ON|OFF|1|0

:ACPower:BANDwidth:VIDeo:AUTO?

- **Examples:**

:ACPower:BANDwidth:VIDeo 1 kHz

:ACPower:BANDwidth:VIDeo:AUTO ON

[Filter Type ►]

- **Menu description:** comprising [Gaussian] and [Flat Top]. In general, the signal/spectrum analyzer uses Gaussian filter, i.e., use filter approximate to the Gaussian shape to complete filtering of resolution bandwidth. If the flat top filter is used, the signal/spectrum analyzer adopts filter approximate to the rectangular shape to complete filtering of resolution bandwidth. The response time of flat top filter is about 3 times of that of the Gaussian filter. The sweep speed of the flat top filter is smaller than that of the Gaussian filter. The flat top filter has better selectivity than the Gaussian filter and therefore is more capable of distinguishing two signals with unequal amplitude.
- **Key path:** [Bandwidth], [Filter Type ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Gaussian.
- **Program control commands:**

:ACPower:BANDwidth:SHAPE GAUSSian|FLATtop

:ACPower:BANDwidth:SHAPE?

5. 2. 5. 5. Auto Setting

Pop up the soft menu related to auto setting Which includes [Couple All], [Mechanical Attenuator Auto ON OFF], [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF], [Sweep Time Auto ON OFF] and [Frequency Step Auto ON OFF].

[Couple All]

- **Menu description:** to set the resolution bandwidth, video bandwidth, sweep time, mechanical attenuator and frequency step as auto coupling mode. The signal/spectrum analyzer will select most suitable values for those functions based on set frequency and bandwidth (or start frequency and stop frequency). If no ratio is pre- saved, use default ratio.
- **Key path:** [Auto Setting], [Couple All] on the front panel.

- **Status saved:** not saved in instrument status.
- **Factory preset:** Couple All.
- **Program control commands:**

:COUPle ALL

- **Examples:**

:COUP ALL

[Mechanical Attenuator Auto ON OFF]

See [Attenuator ►] under [Amplitude/Y Axis] for more details.

[Resolution Bandwidth Auto ON OFF]

See [Resolution Bandwidth Auto ON/OFF] under [Bandwidth] for more details.

[Video bandwidth Auto ON OFF]

See [Video Bandwidth Auto ON/OFF] under [Bandwidth] for more details.

[Scanning time Auto ON OFF]

See [Sweep Time Auto ON/OFF] under [Sweep] for more details.

[Frequency Step Auto ON OFF]

See [Frequency Step Auto ON/OFF] under [Frequency] for more details.

5. 2. 5. 6. Trace

Press [Trace] key on the front panel to pop up corresponding soft menu. Including [Refresh], [Average], [Max. Hold], [Min. Hold], [Display ON/OFF] [Menu 1/2 ►] and [Detector ►].

[Refresh]

- **Command description:** to set the current trace processing as Refresh, i.e., clear all data of displayed trace and continue the signal trace receipt under sweep status.
- **Key path:** [Trace], [Refresh] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** after all traces are selected, the trace mode is defaulted as Refresh.
- **Program control commands:**

:TRACe:ACPower:TYPE WRITe

:TRACe:ACPower:TYPE?

[Averaging]

- **Command description:** to set the current trace processing method as Average, i.e., based on the average count N set in the [Measurement Setting], update trace after averaging the performance index of the measurement trace.
- **Key path:** [Trace], [Average] on the front panel.
- **Status saved:** saved in the instrument status.

- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:ACPower:TYPE AVERage

:TRACe:ACPower:TYPE?

[Max. Hold]

- **Menu description:** to set the current trace processing method as maximum hold, i.e., the new trace data will be assigned with maximum value of previous measured trace data.
- **Key path:** [Trace], [Max. Hold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:ACPower:TYPE MAXHold

:TRACe:ACPower:TYPE?

[Min. Hold]

- **Menu description:** to set the current trace processing method as minimum hold, i.e., the new trace data will be assigned with minimum value of previous measured trace data.
- **Key path:** [Trace], [Min. Hold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:ACPower:TYPE MINHold

:TRACe:ACPower:TYPE?

[Display ON/OFF ► Refresh Display]

- **Menu description:** to set the display method for the selected trace from [Refresh Display], [Static Display], [Backstage Refresh] and [Display OFF].
- **Key path:** [Trace], [Display ON/OFF ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace display modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:ACPower:DISPlay[:STATe] ON|OFF|0|1

:TRACe:ACPower:DISPlay[:STATe]?

:TRACe:ACPower:UPDate[:STATe] ON|OFF|0|1

:TRACe:ACPower:UPDate[:STATe]?

[Detector ►]

Pop up soft menus related to setting the detector type for the currently selected trace, including [Auto], [Normal], [Positive Peak], [Sample], [Negative Peak], [Average ▶], where, the average detector type includes video average, power average and voltage average.

[Auto]

- **Menu description:** to set the detector command for the currently selected trace as Auto. That means, the signal/spectrum analyzer will perform based on the parameter setting of currently selected trace.
- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Auto] on the front panel
- **Status saved:** saved in the instrument status.
- **Factory preset:** the trace detector type is Power Average.
- **Program control commands:**

```
:ACPower:DETECTOR:AUTO ON|OFF|1|0
```

```
:ACPower:DETECTOR:AUTO?
```

[Normal]

- **Menu description:** to set the detector command for the currently selected trace as Normal. i.e., display the measurement results of positive peak and negative peak at the same time to achieve display effect similar to the analog instrument.
- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Normal] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:ACPower:DETECTOR:NORMAL
```

```
:ACPower:DETECTOR?
```

[Positive Peak]

- **Menu description:** to set the detector command for the currently selected trace as Positive Peak. i.e., take the maximum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Positive Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:ACPower:DETECTOR:POSITIVE
```

```
:ACPower:DETECTOR?
```

[Sample]

- **Menu description:** to set the detector command for the currently selected trace as Sample. i.e., take the last value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Sample] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:ACPower:DETECTOR SAMPLE

:ACPower:DETECTOR?

[Negative Peak]

- **Menu description:** to set the detector command for the currently selected trace as Negative Peak. i.e., take the minimum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Negative Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:ACPower:DETECTOR NEGATIVE

:ACPower:DETECTOR?

[Average ► Video Average]

- **Menu description:** to set the detector command for the currently selected trace as Video Average. Also called Logarithm Power Average Detector, i.e., take the logarithm power average value for all data assigned to each trace point; earlier signal/spectrum analyzer generally displays the measurement trace of logarithm scale, and all filtering and averaging are based on the logarithm power data; the trace is generally called as video signal. After digital IF processing is adopted, to make measurement results same as the earlier signal/spectrum analyzer, the video average detector function is added.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Video Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:ACPower:DETECTOR LOG

:ACPower:DETECTOR?

[Average ► Power Average]

- **Menu description:** to set the detector command for the currently selected trace as Power Average. Also called root mean square (RMS) detector. Calculate the root mean square of all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After square these voltage values, take sum and divide the count of sampling data points corresponding to each trace point. Finally, take square root. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those RMS values are trace data.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Power Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:ACPower:DETECTOR AVERAGE or

:ACPower:DETECTOR RMS

:ACPower:DETECTOR?

[Average ► Average Voltage]

- **Menu description:** to set the detector command for the currently selected trace as Voltage Average. Also called average (AVG)

detector. Take linear average for all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After summing those voltage values, divide the number of sampling data points corresponding to each trace point. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those average values are trace data.

- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Average ▶], [Voltage Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:ACPower:DETECTOR SCALAR

:ACPower:DETECTOR?

5. 2. 5. 7. Sweep

Enable sweep-related parameter setup function to pop up corresponding soft menu, including [Sweep Time Auto ON OFF], [Sweep Setting ▶] and [Sweep Points].

[Scanning time Auto ON OFF]

- **Menu description:** to change the sweep time of signal/spectrum analyzer by number keys, stepping keys or knob. When it is under Auto OFF mode (shaded), it indicates that sweep time can be set manually. When it is under Auto ON status, the sweep time will be automatically coupled based on resolution bandwidth, span and video bandwidth
- **Key path:** [Sweep], [Sweep Time Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep time Auto.
- **Setting range:** Min.: 1ms, Max.: 6000s.
- **Default unit:** s
- **Program control commands:**

:ACPower:SWEPT:TIME <time>

:ACPower:SWEPT:TIME?

:ACPower:SWEPT:TIME:AUTO OFF|ON|0|1

:ACPower:SWEPT:TIME:AUTO?

- **Examples:**

:ACP:SWE:TIME 500 ms

:ACP:SWE:TIME:AUTO OFF

[Scanning setting ▶]

Pop up the soft menu related to Sweep type, including [Sweep Type Auto ON OFF], [Sweep Type Rules Auto ON OFF] and [FFT Width Auto ON OFF].

[Scanning type ▶ Auto ON OFF]

- **Menu description:** to set sweep type. is used to determine whether Swept or FFT is adopted for the signal/spectrum analyzer. Also set the FFT step bandwidth for FFT sweep. The soft menus include [Auto], [Swept] and [FFT]. When under Auto ON mode,

the signal/spectrum analyzer will automatically select the sweep type based on sweep type rules.

- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep type: Auto.
- **Program control commands:**

```
:ACPower:SWEep:TYPE FFT|SWEep
```

```
:ACPower:SWEep:TYPE?
```

```
:ACPower:SWEep:TYPE:AUTO OFF|ON|0|1
```

```
:ACPower:SWEep:TYPE:AUTO?
```

[Sweep Type Rules Auto ON OFF]

- **Menu description:** to set rules for auto sweep type. While the sweep type rules include "Best Dynamic Range" and " Best Speed".
 - i. Best Dynamic Range" rules: when RBW is or larger than 1kHz, the sweep type is Swept; when RBW is less than 1kHz, the sweep type is FFT.
 - ii. Best Speed" rules: when RBW is or larger than 30kHz, the sweep type is Swept; when RBW is less than 30kHz, the sweep type is FFT.

- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Rules Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** the sweep type rules are automatically set as "Best Dynamic Range".
- **Program control commands:**

```
:ACPower:SWEep:TYPE:AUTO:RULes SPEed|DRANge
```

```
:ACPower:SWEep:TYPE:AUTO:RULes?
```

```
:ACPower:SWEep:TYPE:AUTO:RULes:AUTO OFF|ON|0|1
```

```
:ACPower:SWEep:TYPE:AUTO:RULes:AUTO?
```

[FFT Width Auto ON OFF]

- **Menu description:** to set FFT Width. The FFT width includes [Auto], [<100kHz], [<3MHz], [<13MHz], [<=Max.]. FFT width is only active when the FFT sweep type is selected. Under Auto type, when the signal/spectrum analyzer performs FFT spectrum measurement, the maximum resolution bandwidth is 30kHz. To guarantee best dynamic measurement range, the signal/spectrum analyzer automatically optimizes the FFT width within 100kHz. The larger is the FFT width, the faster is FFT spectrum measurement, but the dynamic range performance will be affected.

Under FFT sweep, the FFT width setup limits the maximum value for center frequency step of each tune. For example, if [<100Hz] is selected, the maximum value for center frequency step of each tune is 100Hz. As the FFT width gets larger, the count of instrument center frequencies get smaller when performing measurement of same frequency scope, and the response measurement gets faster. Therefore, to improve measurement speed, you can manually change the FFT width.

- **Key path:** [Sweep], [Sweep Setting ►], [FFT Width ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** FFT Width is set as Auto.

- **Program control commands:**

:ACPower:SWEep:FFT:WIDTh <real>

:ACPower:SWEep:FFT:WIDTh?

:ACPower:SWEep:FFT:WIDTh:AUTO OFF|ON|0|1

:ACPower:SWEep:FFT:WIDTh:AUTO?

[Number of scanning points]

- **Menu description:** to set the trace points.
- **Key path:** [Sweep], [Sweep Points] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1001.
- **Setting range:** 101-30001.
- **Program control commands:**

:ACPower:SWEep:POINts <integer>

:ACPower:SWEep:POINts?

5. 2. 5. 8. Single

- **Menu description:** the [Continuous Off] key on the front panel has no corresponding soft menu. This function is mainly used for manual trigger of a sweep. When the Average is ON, this function performs the sweeps at the count specified by the Average Count.

In remote control programming and system establishment, this function combined with *WAI can effectively synchronize the sweep process and enable the trace data obtained after the *WAI finishes directly correspond to the sweep process one by one.

- **Program control commands:**

:INITiate:ACPower

5. 2. 5. 9. Continuous

The [Continuous] key on the front panel has no corresponding soft menu. This function is mainly used for changing the Continuous OFF into Continuous ON; if the current sweep is Continuous ON, the instrument performs no operation.

- **Program control commands:**

:INITiate:CONTinuous ON

5. 2. 5. 10. Trigger

See [Trigger] menu of the sweep analysis function for more details.

5. 2. 5. 11. Display

Pop up soft menus related to display, including [Display Line ON OFF], [Bar Graph ON OFF], [Display Configuration ►].

[Display Line On Off]

See [Display Line ON/OFF] under [Display] of the sweep analysis function for more details.

[Display Configuration ►]

It is used for configurations of interface language, status area display on interface. The soft menus include [Select Language Chinese English], [Graticule Display ON OFF], [Status Area Display ON OFF], [Frequency Information Display ON OFF]. See [Display Configuration ►] under [Display] of the sweep analysis function for more details.

[Bar Graph On Off]

- **Menu description:** to turn on or off Bar Graph Display.
- **Key path:** [Display] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** ON
- **Program control commands:**

```
:DISPlay:ACPower:VIEW:WINDow:BGRaph ON|OFF|1|0
```

```
:DISPlay:ACPower:VIEW:WINDow:BGRaph?
```

5. 2. 5. 12. Input Output

See the [Input/Output] menu of the sweep analysis function for more details.

5. 2. 5. 13. Marker

Pop up the soft menu related to markers, including [Marker Select ►], [Normal Markers], [Delta Marker], [Fixed Marker], [Marker OFF], [Marker Attribute ►], [Marker Couple ON OFF], and [All Markers OFF].

[Marker Select ► Marker 1]

- **Command description:** to select among 12 different markers of the analyzer. When one marker is selected, the menu will indicate the current marker and the type and the attribute of the selected marker can be set. Select and trigger another marker and place it at the center of the current trace, and then users can read amplitude and frequency information (when the frequency span is 0 Hz, time information will be displayed) at the marker display area at the top right corner of the screen.
- **Key path:** [Marker], [Marker Select ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Marker 1.

[Normal Marker]

- **Menu description:** to set the selected marker as the Normal Marker.
- **Key path:** [Marker], [Normal Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE POSITION
```

```
:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?
```

[Delta Marker]

- **Menu description:** to set the selected marker as the Delta Marker. Display the amplitude difference and frequency difference (or time difference, when span is zero) between two markers at the marker display area at the top right corner of the screen. If there exists a single marker, a [Delta Marker] operation will generate a reference marker in the active marker position. Move the active

marker through the knob, stepping keys or number keys. The display amplitude difference unit is dB.

- **Key path:** [Marker], [Delta Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE DELTa
```

```
:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?
```

[Fixed Marker]

- **Menu description:** to set the selected marker as the Fixed Marker. The X Axis and Y Axis positions of the fixed marker are fixed. The Fixed Marker can be used as reference marker.
- **Key path:** [Marker], [Fixed Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE FIXEd
```

```
:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?
```

[Marker OFF]

- **Menu description:** to turn off the selected marker.
- **Key path:** [Marker], [Marker Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:CALCulate:CHPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE OFF
```

```
:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?
```

[Marker Attribute ►]

Pop up the corresponding menu of currently selected marker attribute setup, including [Marker Select ►], [Reference Marker ►], [Marker Display Line ON/OFF].

[Reference Marker ►]

- **Menu description:** to select reference marker for current marker. It can be any one from 11 markers except the currently selected marker.
- **Key path:** [Marker], [Marker Attribute ►], [Reference Marker ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence <integer>
```

```
:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence?
```

[Marker Display Line On Off]

- **Menu description:** to set whether the current marker is displayed as a line on the screen, which is easy to observe.
- **Key path:** [Marker], [Marker Attribute ►] and [Marker Display Line On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINES[:STATe] OFF|ON|0|1

:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINES[:STATe]?

[Marker Couple On Off]

- **Menu description:** to turn on or off Marker Couple. When it is ON, moving any marker horizontal axis position will cause an equal movement of horizontal axis position of every other marker which is ON. When the marker is moved to less than Start Frequency or larger than Stop Frequency, the marker is limited to the value of the Start Frequency or the Stop Frequency; when the span is zero, the minimum value is limited as 0, and the maximum value is limited as the Sweep Time.
- **Key path:** [Marker], [Menu 1/2 ►], [Marker Couple ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:ACPower:MARKer:COUple[:STATe] ON|OFF|1|0

:CALCulate:ACPower:MARKer:COUple[:STATe]?

[All Markers OFF]

- **Menu description:** to turn off all current markers which are ON and related soft keys, e.g. [Noise Marker].
- **Key path:** [Marker], [Menu 1/2 ►], [All Markers OFF] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:ACPower:MARKer:AOff

5. 2. 5. 14. Marker->

This key has no soft menu.

5. 2. 5. 15. Marker Function

This key has no soft menu.

5. 2. 5. 16. Peak

The [Peak Search] key on the front panel is used for turning on the peak search for traces by the control instrument and turning on marker for display, including [Next Peak], [Next Peak Right], [Next Peak Left].

- **Program control commands:**

:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum

[Next Peak]

- **Menu description:** Taking the Amplitude of the point where the current marker is located, search for the next peak of current test trace.
- **Key path:** [Peak Search], [Next Peak] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:NEXT

[Next Peak Right]

- **Menu description:** to search for the peak to the right of the current test trace marker position.
- **Key path:** [Peak Search], [Next Peak Right] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:RIGHT

[Next Peak Left]

- **Menu description:** to search for the peak to the left of the current test trace marker position.
- **Key path:** [Peak Search], [Next Peak Left] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:ACPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:LEFT

5. 2. 5. 17. Measurement Setting

Pop up the soft menu related to measurement setting Including [Average Count ON/OFF], [Average State Exponential Repeat], [Carrier Setting ►], [Offset Limit ►], [Phase Noise Optimization ►], [Reference Type ►], [Measurement Method ►], [Limit Test ON/OFF], [Low Noise Path ON/OFF], [Preselector Preselecting Bypass], [RF Gain ►], [ADC Dither Auto ON/OFF] and [Measurement Reset].

[Average frequency On Off]

- **Menu description:** to turn on or off Average. When Average Count is ON, the user can specify the average count required for measurement. The Average Count can be adjusted by number keys, stepping keys or knob.
- **Key path:** [Measurement Setting], [Average Count ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Setting range:** 1 - 10000
- **Default unit:** none
- **Program control commands:**

[:SENSe]:ACPower:AVERage:COUNT <integer>

[:SENSe]:ACPower:AVERage:COUNT?

[:SENSe]:ACPower:AVERage[:STATe] ON|OFF|1|0

[:SENSe]:ACPower:AVERage[:STATe]?

[Average State Exponential Repeat]

- **Menu description:** when Average Count is ON, the user can select Average State required for measurement.

Exponential - Different from Linear Average, in Exponential State, the weight of new data is larger than that of old data. This is good for tracking data change in terms of time. In this case, the selected averaging count determines the weight of the old data on the new data. As the average count increases, the weight of new data gradually decreases.

Repeat - Similarly, it takes exponential averaging. However, when the average count is met, clear all previous results, restart average till the set average count and repeat this process.

- **Key path:** [Measurement Setting], [Average State Exponential Repeat] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Exponential
- **Program control commands:**

[:SENSe]:ACPower:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:ACPower:AVERage:TCONtrol?

[Carrier Setting ►]

- **Menu description:** to access the Carrier Setting menu to set the Carrier Count and Reference Carrier parameters.
- **Key path:** [Measurement Setting], [Carrier Setting] on the front panel.

[Carrier Count]

- **Menu description:** to select the Carrier Count menu to specify the number of carriers to be measured. Use number keys, stepping keys or knob to change the Carrier Count.
- **Key path:** [Measurement Setting], [Carrier Setting ►], [Carrier Count] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.
- **Setting range:** 1 - 12
- **Default unit:** none
- **Program control commands:**

[:SENSe]:ACPower:CARRier:COUNT <integer>

[:SENSe]:ACPower:CARRier:COUNT?

[Reference Carrier Auto ON OFF]

- **Command description:** to select the Reference Carrier (Auto ON) menu to specify a carrier. Other related power measurements will be made according to this carrier. When the Reference Carrier is set to Auto ON, the instrument selects the one with largest power as reference; when set to Auto OFF, use number keys, stepping keys or knob to change the Reference Carrier.
- **Key path:** [Measurement Setting], [Carrier Setting ►], [Reference Carrier Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.

- **Factory preset:** Auto.
- **Setting range:** 1 - current carrier count.
- **Default unit:** none
- **Program control commands:**

[::SENSe]:ACPower:CARRier:RCARrier <integer>

[::SENSe]:ACPower:CARRier:RCARrier?

[::SENSe]:ACPower:CARRier:RCARrier:AUTO OFF|ON|0|1

[::SENSe]:ACPower:CARRier:RCARrier:AUTO?

[Carrier Configure ►]

- **Menu description:** to access the Carrier Configure menu to further define each carrier.
- **Key path:** [Measurement Setting], [Carrier Setting ►], [Carrier Configure] on the front panel.

[Carrier]

- **Menu description:** to select the carrier index to be configured. Use number keys, stepping keys or knob to change the carrier.
- **Key path:** [Measurement Setting], [Carrier Setting ►], [Carrier Configure ►], [Carrier] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1
- **Setting range:** 1 - current carrier count.
- **Default unit:** none

[Power Display Absolute Relative]

- **Menu description:** to specify the carrier with power display. Firstly, press the [Carrier] key and use stepping keys, knob or number keys to select the Carrier Count to be defined. Then switch the [Power Display] as Absolute or Relative. If a carrier is defined as non-power display, the displayed power is relative to the reference carrier; otherwise, an absolute power is displayed.
- **Key path:** [Measurement Setting], [Carrier Setting ►], [Carrier Configure ►], [Power Display Absolute/Relative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Absolute
- **Program control commands:**

[::SENSe]:ACPower:CARRier:LIST:PPResent YES|NO,..

[::SENSe]:ACPower:CARRier:LIST:PPResent?

[Carrier Width]

- **Menu description:** to specify the width between adjacent carriers. Firstly, press the [Carrier] key and use stepping keys, knob or number keys to select the carrier to be defined. Then, press the [Carrier Width] key and use stepping keys, knob or number keys to set the Carrier Width.
- **Key path:** [Measurement Setting], [Carrier Setting ►], [Carrier Configure ►], [Carrier Interval] on the front panel.

- **Status saved:** saved in the instrument status.
- **Factory preset:** 0MHz
- **Setting range:** 0Hz - 1.0GHz
- **Default unit:** Hz.
- **Program control commands:**

[[:SENSe]:ACPower:CARRier:LIST:WIDTh <bandwidth>,...

[[:SENSe]:ACPower:CARRier:LIST:WIDTh?

[Integration Bandwidth]

- **Menu description:** to set the integration bandwidth for calculating carrier power. Firstly, press the [Carrier] key and use stepping keys, knob or number keys to select the carrier to be defined. Then, press the [Integration Bandwidth] key and use stepping keys, knob or number keys to set the Integration Bandwidth.
- **Key path:** [Measurement Setting], [Carrier Setting ▶], [Carrier Configure ▶], [Integration Bandwidth] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 2.0MHz
- **Setting range:** 100Hz - 1.0GHz
- **Default unit:** Hz.
- **Program control commands:**

[[:SENSe]:ACPower:CARRier:LIST:BANDwidth[:INTegration] <freq>,...

[[:SENSe]:ACPower:CARRier:LIST:BANDwidth[:INTegration]?

[Method ▶]

- **Menu description:** to select the calculation method for measuring carrier power.
- **Key path:** [Measurement Setting], [Carrier Setting ▶], [Carrier Configure ▶], [Method] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Bandwidth Integration.
- **Program control commands:**

[[:SENSe]:ACPower:CARRier:LIST:FILTer[:RRC][:STATe] ON|OFF|1|0, ...

[[:SENSe]:ACPower:CARRier:LIST:FILTer[:RRC][:STATe] ?

[Bandwidth Integration]

- **Menu description:** to select the calculation method as Bandwidth Integration method.
- **Key path:** [Measurement Setting], [Carrier Setting ▶], [Carrier Configure ▶], [Method ▶], [Bandwidth Integration] on the front panel.

[RRC Weighting]

- **Menu description:** to select the calculation method as RRC Weighting.
- **Key path:** [Measurement Setting], [Carrier Setting ▶], [Carrier Configure ▶], [Method ▶], [RRC Weighting] on the front

panel.

[Filter Factor a]

- **Menu description:** to set the Filter Factor as if RRC Weighting method is used. The influence factors of RRC Filter will be considered in calculating the measurement results. Use number keys, stepping keys or knob to change the Filter Factor a.
- **Key path:** [Measurement Setting], [Carrier Setting ▶], [Carrier Configure ▶], [Filter Factor a] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0.22
- **Setting range:** 0.01 - 1.0
- **Default unit:** none
- **Program control commands:**

```
[[:SENSe]:ACPower:CARRier:LIST:FILTer:ALPHa <real>,...
```

```
[[:SENSe]:ACPower:CARRier:LIST:FILTer:ALPHa?
```

[Offset/Limit ▶]

- **Menu description:** to set the measurement offset and limit.
- **Key path:** [Measurement Setting] [Offset/Limit] on the front panel.

[Offset ▶]

- **Menu description:** to select the offset to be set.
- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Offset ▶] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** A

[Offset Frequency]

- **Menu description:** to set the center frequency difference between the offset channel and carrier channel. Upper channel offset is the frequency difference between the offset channel center and the highest carrier channel center, while lower channel offset is the frequency difference between the offset channel center and the lowest carrier channel center. If set to 0Hz, the Offset Channel will close. Use stepping keys, knob or number keys to set the Offset Frequency.
- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Offset Frequency] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 3.0MHz
- **Setting range:** 0Hz - 500.0MHz
- **Default unit:** Hz.
- **Program control commands:**

```
[[:SENSe]:ACPower:OFFSet:LIST[:FREQUENCY] <freq>,...
```

```
[[:SENSe]:ACPower:OFFSet:LIST[:FREQUENCY]?
```

```
[[:SENSe]:ACPower:OFFSet:LIST:STATe OFF|ON|0|1,...
```

[:SENSe]:ACPower:OFFSet:LIST:STATe?

[Integration Bandwidth]

- **Menu description:** to set the Power Integration bandwidth under the selected offset. Use stepping keys, knob or number keys to set the Integration Bandwidth.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Integration Bandwidth] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 2.0MHz
- **Setting range:** 10Hz - 1.0GHz
- **Default unit:** Hz.
- **Program control commands:**

[:SENSe]:ACPower:OFFSet:LIST:BANDwidth[:INTegration] <bandwidth>,...

[:SENSe]:ACPower:OFFSet:LIST:BANDwidth[:INTegration]?

[Offset Bandwidth ►]

- **Menu description:** to set the bandwidth parameters for measuring offset.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Offset Bandwidth ►] on the front panel.

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to set the instrument Resolution Bandwidth for measuring offset. Use stepping keys, knob or number keys to set the Resolution Bandwidth.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Offset Bandwidth ►], [Resolution Bandwidth Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 220kHz
- **Setting range:** 1Hz - 20MHz
- **Default unit:** Hz.
- **Program control commands:**

[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:RESolution <bandwidth>, ...

[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:RESolution?

[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:RESolution? AUTO N|OFF|1|0,...

[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:RESolution? AUTO?

[Video bandwidth Auto ON OFF]

- **Menu description:** to set the instrument Video Bandwidth for measuring offset. Use stepping keys, knob or number keys to set the Video Bandwidth.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Offset Bandwidth ►], [Video Bandwidth Auto ON/OFF] on the front panel.

- **Status saved:** saved in the instrument status.
- **Factory preset:** 2.2MHz
- **Setting range:** 1Hz - 20MHz
- **Default unit:** Hz.
- **Program control commands:**

[[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:VIDeo <freq>,...

[[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:VIDeo?

[[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:VIDeo:AUTO OFF|ON|0|1,...

[[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:VIDeo:AUTO?

[Filter Type ▶]

- **Menu description:** to set the Bandwidth Filter Type for measuring offset.
- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Offset Bandwidth ▶], [Filter Type ▶] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Gaussian.
- **Program control commands:**

[[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:SHAPE GAUSSian|FLATtop,...

[[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:SHAPE?

[Gaussian]

- **Menu description:** to select the Bandwidth Filter Type as Gaussian.
- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Offset Bandwidth ▶], [Filter Type ▶], [Gaussian] on the front panel.

[Top Flat]

- **Menu description:** to select the Bandwidth Filter Type as Top Flat.
- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Offset Bandwidth ▶], [Filter Type ▶], [Top Flat] on the front panel.

[Filter Bandwidth ▶]

- **Menu description:** to set the Filter Bandwidth type.
- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Offset Bandwidth ▶], [Filter Bandwidth ▶] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -3 dB.
- **Program control commands:**

[[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:TYPE DB3|DB6,...

[[:SENSe]:ACPower:OFFSet:LIST:BANDwidth:TYPE?

[-3dB]

- **Menu description:** to set the Filter Bandwidth type as 3 dB bandwidth.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Offset Bandwidth ►], [Filter Bandwidth ►], [-3dB] on the front panel.

[-6dB]

- **Menu description:** to set the Filter Bandwidth type as 6 dB Bandwidth.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Offset Bandwidth ►], [Filter Bandwidth ►], [-6dB] on the front panel.

[Limit ►]

- **Menu description:** to set the offset limit and test template type.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Limit ►].

[Absolute Limit]

- **Menu description:** to set the limit absolute power value. Use stepping keys, knob or number keys to set the Absolute Limit.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Offset Bandwidth ►], [Limit ►], [Absolute Limit] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0dBm
- **Setting range:** -200dBm - 50dBm
- **Default unit:** dBm.
- **Program control commands:**

[:SENSe]:ACPower:OFFSet:LIST:ABSolute <real>,...

[:SENSe]:ACPower:OFFSet:LIST:ABSolute?

[Relative Limit (Car)]

- **Menu description:** to set the limit power value relative to the carrier power. Use stepping keys, knob or number keys to set the Limit.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Offset Bandwidth ►], [Limit ►], [Relative Limit (Car)] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -45 dB.
- **Setting range:** -200.0dB -50dB
- **Default unit:** dB.
- **Program control commands:**

[:SENSe]:ACPower:OFFSet:LIST:RCARrier <real>,...

[:SENSe]:ACPower:OFFSet:LIST:RCARrier?

[Relative Limit (PSD)]

- **Menu description:** to set the limit power value relative to the spectral density. Use stepping keys, knob or number keys to set the Limit.

- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Offset Bandwidth ▶], [Limit ▶], [Relative Limit (PSD)] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -28.87 dB.
- **Setting range:** -200.0dB -50dB
- **Default unit:** dB.
- **Program control commands:**

[:SENSe]:ACPower:OFFSet:LIST:RPSDensity <rel_amp>,...

[:SENSe]:ACPower:OFFSet:LIST:RPSDensity?

[Limit Template ▶]

- **Menu description:** to set the Limit Test Type for currently selected offset, including:
 - **Absolute:** When measured absolute result exceeds the absolute limit value, the test failed.
 - **Relative:** When measured relative result exceeds the relative limit value, the test failed.
 - **Absolute and relative:** When measured absolute results exceeds the absolute limit value, and measured relative result exceeds the relative limit value, the test failed.
 - **Absolute or relative:** When measured absolute results exceeds the absolute limit value, or measured relative result exceeds the relative limit value, the test failed.
- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Offset Bandwidth ▶], [Limit ▶], [Limit Template ▶] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Absolute
- **Program control commands:**

[:SENSe]:ACPower:OFFSet:LIST:TEST ABSolute|AND|OR|RELative,...

[:SENSe]:ACPower:OFFSet:LIST:TEST?

[Method ▶]

- **Menu description:** to select the calculation method for measuring the offset channel power.
- **Key path:** [Measurement Setting][Offset/Limit ▶], [Method ▶] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Bandwidth Integration.
- **Program control commands:**

[:SENSe]:ACPower:OFFSet:LIST:FILTer[:RRC][:STATe] ON|OFF|1|0,...

[:SENSe]:ACPower:OFFSet:LIST:FILTer[:RRC][:STATe]?

[Bandwidth Integration]

- **Menu description:** to select the calculation method as Bandwidth Integration method.

- **Key path:** [Measurement Setting][Offset/Limit ►], [Method ►], [Bandwidth Integration] on the front panel.

[RRC Weighting]

- **Menu description:** to select the calculation method as RRC Weighting.
- **Key path:** [Measurement Setting][Offset/Limit ►], [Method ►], [RRC Weighting] on the front panel.

[Filter Factor a]

- **Menu description:** to set the Filter Factor when using RRC method. The influence factor of RRC Filter will be considered in calculating the measurement result. Use number keys, stepping keys or knob to change the Filter Factor a.
- **Key path:** [Measurement Setting] [Offset/Limit ►], [Filter Factor a] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0.22
- **Setting range:** 0.01 - 1.0
- **Default unit:** none
- **Program control commands:**

```
[:SENSe]:ACPower:OFFSet:LIST:FILTer:ALPHa <real>,...
```

```
[:SENSe]:ACPower:OFFSet:LIST:FILTer:ALPHa?
```

[View Carrier Result]

- **Menu description:** to view the carrier power value by inputting carrier index, stepping keys or knob to select the viewed carrier.
- **Key path:** [Measurement Setting], [View Carrier Result] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1
- **Setting range:** 1 - Carrier Count
- **Default unit:** none

[Measurement Method ►]

- **Menu description:** to select the Measurement Method for usage.
- **Key path:** [Measurement Setting], [Menu 1/3 ►], [Measurement Method ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Bandwidth Integration method
- **Program control commands:**

```
[:SENSe]:ACPower:METhod IBW|FAST|RBW
```

```
[:SENSe]:ACPower:METhod?
```

[Bandwidth Integration Method]

- **Menu description:** to select the Measurement Method as Bandwidth Integration method.
- **Key path:** [Measurement Setting], [Menu 1/3 ►], [Measurement Method ►], [Bandwidth Integration Method] on the front

panel.

- **Status saved:** saved in the instrument status.

[Fast Measurement Method]

- **Method description:** to select the Measurement Method as Fast Measurement Method.
- **Key path:** [Measurement Setting], [Menu 1/3 ►], [Measurement Method ►], [Quick Measurement Method] on the front panel.

[Time Domain Measurement Method]

- **Menu description:** to select the Measurement Method as Time Domain Measurement Method.
- **Key path:** [Measurement Setting], [Menu 1/3 ►], [Measurement Method ►], [Time Domain Measurement Method] on the front panel.

[Limit Test On Off]

- **Menu description:** to turn on or off the limit test. If the Limit Test is ON, each offset will be compared to its high-end and low-end limit values. When the power exceeds limit, the red F near the dBc result indicates Fail.
- **Key path:** [Measurement Setting], [Menu 1/3 ►], [Limit Test ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF
- **Program control commands:**

:CALCulate:ACPower:LIMit:STATe OFF|ON|0|1

:CALCulate:ACPower:LIMit:STATe?

[Low Noise Path On Off]

- **Menu description:** this menu is only available when the H34 option (Low Noise Preamp) is purchased. When the preamp is ON, the Low Noise Path is OFF and this menu is grayed out; when the preamp is OFF, this menu lights on and is switchable.
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [Low Noise Path ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:ACPower:POWer:MW:PATH STD|LNPath

:ACPower:POWer:MW:PATH?

[Preselector Preselecting Bypass]

- **Menu description:** this menu is only available when the H36 option is purchased. It is used for setting whether to bypass the front-end preselector of the signal/spectrum analyzer. In analyzing bandwidth signal, bypass is usually required.
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [Preselector Preselecting Bypass] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

INPut:ACPower:FILTer:YIG[:STATe] OFF|ON|0|1

INPut:ACPower:FILTer:YIG[:STATe]?

[RF Gain ►]

- **Menu description:** to set the Auto ON/OFF of the RF Gain and best allocation algorithm for RF Gain. The soft menus includes [Auto], [Best Dynamic Range] and [Sensitivity Priority].
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [RF Gain] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:ACPower:RF:GAIN:AUTO OFF|ON|0|1

:ACPower:RF:GAIN:AUTO?

:ACPower:RF:GAIN:AUTO:RULes RANGE|SENSITIVITY

:ACPower:RF:GAIN:AUTO:RULes?

[Auto]

- **Menu description:** to set the RF Gain distribution algorithm to Auto. In this case, the RF Gain distribution is
 - "Best Dynamic Range".
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [RF Gain ►], [Auto] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Dynamic Range]

- **Menu description:** to set the RF Gain distribution algorithm to Best Dynamic Range. In this case, the RF Gain is switched to "Auto OFF"
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [RF Gain ►], [Best Dynamic Range] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Sensitivity]

- **Menu description:** to set the RF Gain distribution algorithm to Best Sensitivity. In this case, the RF Gain is switched to "Auto OFF"
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [RF Gain ►], [Best Sensitivity] on the front panel.
- **Status saved:** saved in the instrument status.

[ADC Dither Auto ON OFF]

- **Menu description:** to control opening/closing of ADC dither of the frequency acquisition circuit in the analyzer. Under default mode, the signal/spectrum analyzer will automatically control whether the ADC Dither is ON based on current working condition. When the ADC Dither is under Auto mode, the ON or OFF status depends on the span, resolution bandwidth and sweep type (continuous swept or step sweep); when it is continuous swept, the ADC Dither status will force to switch to Auto and turns off; when it is step sweep, under Auto mode, if the span is 2MHz or below, the ADC Dither is ON; if the span is below 2MHz, the ADC Dither is OFF. Under Auto OFF mode, if the span is above 2MHz, turning on the ADC Dither may affect the measurement results based on selected dither status. You can access the submenu for manual control.

- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [ADC Dither Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**

[:SENSe]:ACPower:ADC:DITHer[:STATe] OFF|ON|HIGH

[:SENSe]:ACPower:ADC:DITHer[:STATe]?

[:SENSe]:ACPower:ADC:DITHer:AUTO[:STATe] OFF|ON|0|1

[:SENSe]:ACPower:ADC:DITHer:AUTO[:STATe]?

[Measurement Reset]

- **Menu description:** to reset the measurement parameters to the factory preset status or user saved parameter status
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [Measurement Reset] on the front panel.
- **Factory preset:** factory reset.
- **Program control commands:**

:CONFigure:ACPower

5. 2. 5. 18. Measurement Control

Pop up the menu related to measurement control, including [Measurement Continuous ON OFF], [Restart Measurement] and [Pause/Resume].

[Measurement Continuous ON OFF]

- **Menu description:** to set continuous measurement OFF or ON. When [Measurement Continuous On/Off] is pressed, Continuous On will be triggered and continuous sweep will be the default measurement control method; when Continuous Off is selected, single measurement will be triggered. Press [Sweep Continuous OFF] to restart sweep when the next trigger signal arrives.
- **Key path:** [Measurement Control], [Measurement Continuous ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Continuous On.
- **Program control commands:**

:INITiate:CONTInuous OFF|ON|0|1

:INITiate:CONTInuous?

- **Examples:**

:INIT:CONT OFF

[Restart Measurement]

- **Menu description:** to stop current measurement and restart measurement for the signal/spectrum analyzer.
- **Key path:** [Measurement Control], [Restart Measurement] on the front panel
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:REST

[Pause/Resume]

- **Menu description:** when the signal/spectrum analyzer is in operation, this menu is used for pausing current measurement; when in Paused status, this menu is used for continuing measurement.
- **Key path:** [Measurement Control], [Pause/Resume] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:PAUS

:INITiate:RES

5. 2. 6. Power Statistic

5. 2. 6. 1. Frequency

The [Frequency] key on the front panel is used to set parameters related to the signal/spectrum analyzer frequency, including [Center Frequency], [Frequency Step Auto ON/OFF], [Frequency Offset]. See the [Frequency] menu of the sweep analysis function for more details.

[Center Freq]

See the [Center Frequency] under [Frequency] of the sweep analysis function for more details.

[Frequency Step Auto ON OFF]

See the [Frequency Step Auto ON/OFF] under [Frequency] of the sweep analysis function for more details.

[Frequency deviation]

See the [Frequency Offset] under [Frequency] of the sweep analysis function for more details.

5. 2. 6. 2. Amplitude/Y Axis

Pop up menus for setting Amplitude/Y Axis parameter, including [Attenuator ►], [Preamplifier ON/OFF].

[Attenuator ►]

See [Attenuator ►] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Preamplifier ON OFF]

See [Preamplifier ON/OFF] under [Amplitude/Y Axis] of the sweep analysis function for more details.

5. 2. 6. 3. Span/X Axis

Press the [Span/X Axis] key on the front panel to enable the X Axis scale setting function. Press the [Span/X Axis] key to pop up [Scale/Division].

[Scale/Division]

- **Menu description:** to set the scale value to which each division of X Axis corresponds. Use number keys, stepping keys or knob to set the scale value.
- **Key path:** [Measurement Setting] on the front panel.

- **Status saved:** saved in the instrument status.
- **Factory preset:** 2.0 dB.
- **Setting range:** 0.1dB - 20dB
- **Default unit:** dB.
- **Program control commands:**

:DISPlay:PSStatistic:VIEW:WINDow:TRACe:X[:SCALe]:PDIVision <rel_ampI>

:DISPlay:PSStatistic:VIEW:WINDow:TRACe:X[:SCALe]:PDIVision?

5. 2. 6. 4. Bandwidth

Pop up the soft menu for setting the measurement bandwidth, [Measure Bandwidth].

[Measure Bandwidth]

- **Menu description:** to change the Measure Bandwidth for power statistic function, ranging from 100 Hz to 40 MHz. Use number keys, stepping keys and knot to change the Measure Bandwidth.
- **Key path:** [Bandwidth] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.0MHz
- **Setting range:** Min.:100Hz, Max.: 40MHz.
- **Default unit:** Hz
- **Program control commands:**

:PSStatistic:BANDwidth <bandwidth>

:PSStatistic:BANDwidth?

- **Examples:**

:PSStatistic:BANDwidth 2MHz

5. 2. 6. 5. Auto Setting

Pop up the soft menu related to auto setting including [Couple All], [Mechanical Attenuator Auto ON OFF], [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF], [VBW/RBW Auto ON OFF], [Span/RBW Auto ON OFF], [Sweep Time Auto ON OFF] and [Frequency Step Auto ON OFF].

[Couple All]

- **Menu description:** to set the Mechanical Attenuator and Frequency Step as Auto Couple.
- **Key path:** [Auto Setting], [Couple All] on the front panel.
- **Status saved:** not saved in instrument status.
- **Factory preset:** Couple All.
- **Program control commands:**

:COUPle ALL

- **Examples:**

:COUP ALL

5. 2. 6. 6. Trace

Press [Trace] key on the front panel to pop up corresponding soft menu, including [Save Reference Traces], [Reference Trace ON OFF], [Gaussian Curve ON OFF].

[Save Reference Trace]

- **Menu description:** to save the current measured trace as the Reference Trace.
- **Key path:** [Trace], [Save Reference Trace] on the front panel.
- **Program control commands:**

:CALCulate:PSTatistic:STORe:REFerence

[Reference Trace On Off]

- **Menu description:** to turn on or off display of Reference Trace.
- **Key path:** [Trace], [Reference Trace On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF
- **Program control commands:**

:DISPlay:PSTatistic:RTRace[:STATe] OFF|ON|0|1

:DISPlay:PSTatistic:RTRace[:STATe]?

Gaussian Curve On Off]

- **Menu description:** to turn on or off display of the Gaussian Curve.
- **Key path:** [Trace], [Gaussian Curve On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** ON
- **Program control commands:**

:DISPlay:PSTatistic:GAUSSian[:STATe] OFF|ON|0|1

:DISPlay:PSTatistic:GAUSSian[:STATe]?

5. 2. 6. 7. Sweep

This key has no soft menu.

5. 2. 6. 8. Single

- **Menu description:** the [Continuous Off] key on the front panel has no corresponding soft menu. This function is mainly used for manual trigger of one sweep. Singular

In remote control programming and system establishment, this function combined with *WAI can effectively synchronize the measurement process and enable the trace data obtained after the *WAI finishes directly correspond to the measurement process one by one.

- **Program control commands:**

:INITiate:PSTatistic

5. 2. 6. 9. Continuous

The [Continuous] key on the front panel has no corresponding soft menu. This function is mainly used for changing the Measurement Continuous OFF to Measurement Continuous ON; if the current state is Measurement Continuous ON, the instrument performs no operation.

- Program control commands:

:INITiate:CONTInuous ON

5. 2. 6. 10. Trigger

See [Trigger] menu of the sweep analysis function for more details.

5. 2. 6. 11. Display

Pop up the soft menu related to display, including [Display Line ON OFF], [Display Configuration ►].

[Display Line On Off]

See [Display Line ON/OFF] under [Display] of the sweep analysis function for more details.

[Display Configuration ►]

It is used for configurations of interface language, status area display on interface. The soft menus include [Select Language Chinese English], [Graticule Display ON OFF], Status Area Display ON OFF], [Frequency Information Display ON OFF]. See [Display Configuration ►] under [Display] of the sweep analysis function for more details.

5. 2. 6. 12. Input Output

See the [Input Output] menu of the sweep analysis function for more details.

5. 2. 6. 13. Marker

Pop up the soft menu related to markers, including [Marker Select ►], [Normal Markers], [Delta Marker], [Fixed Marker], [Marker OFF], [Marker Attribute ►], [Marker Couple ON OFF], and [All Markers OFF].

[Marker Select ► Marker 1]

- **Command description:** to select among 12 different markers of the analyzer. When one marker is selected, the menu will indicate the current marker and the type and the attribute of the selected marker can be set. Select and trigger another marker and place it at the center of the current trace.
- **Key path:** [Marker], [Marker Select ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Marker 1.

[Normal Marker]

- **Menu description:** to set the selected marker as the Normal Marker.
- **Key path:** [Marker], [Normal Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:PStatistic:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE POSition

:CALCulate:PStatistic:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Delta Marker]

- **Menu description:** to set the selected marker as the Delta Marker. Display the probability difference and amplitude difference between two markers at the marker display area at the top right corner of the screen. If there exists a single marker, a [Delta Marker] operation will generate a reference marker in the active marker position. Move the active marker through the knob, stepping keys or number keys. The display amplitude difference unit is dB and probability difference unit is %.
- **Key path:** [Marker], [Delta Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:PStatistic:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE DELTa

:CALCulate:PStatistic:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Fixed Marker]

- **Menu description:** to set the selected marker as the Fixed Marker. The X Axis and Y Axis positions of the fixed marker are fixed. The Fixed Marker can be used as reference marker.
- **Key path:** [Marker], [Fixed Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:PStatistic:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE FIXed

:CALCulate:PStatistic:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker OFF]

- **Menu description:** to turn off the selected marker.
- **Key path:** [Marker], [Marker Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:PStatistic:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE OFF

:CALCulate:PStatistic:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker Attribute ►]

Pop up the menu related to the attribute setting of currently selected marker, including [Reference Marker ►], [Marker Trace ►].

[Reference Marker ►]

- **Menu description:** to select reference marker for current marker. It can be any one from 11 markers except the currently selected marker.
- **Key path:** [Marker], [Marker Attribute ►], [Reference Marker ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:PSTatistic:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence <integer>

:CALCulate:PSTatistic:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence?

[All Markers OFF]

- **Menu description:** to turn off all current markers which are ON and related soft keys, e.g. [Noise Marker].
- **Key path:** [Marker], [Menu 1/2 ►], [All Markers OFF] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:PSTatistic:MARKer:AOFF

5. 2. 6. 14. Marker->

This key has no soft menu.

5. 2. 6. 15. Marker Function

This key has no soft menu.

5. 2. 6. 16. Peak

This key has no soft menu.

5. 2. 6. 17. Measurement Setting

Pop up the soft menu related to measurement setting, including [Measurement Count], [Measurement Cycle], [Measurement Count], [Low Noise Path ON OFF], [Preselector Preselecting Bypass], [RF Gain ►], [ADC Dither Auto ON OFF], [Measurement Reset].

[Measurement Count]

- **Menu description:** to set the accumulated counts of sampling points of the data. Use number keys, stepping keys or knob to set the Measurement Count.
- **Key path:** [Measurement Setting], [Measurement Method Count] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100kpt
- **Setting range:** 1000 - 8.389E+6
- **Default unit:** pt
- **Program control commands:**

[:SENSe]:PSTatistic:COUNts <integer> [:SENSe]:PSTatistic:COUNts?

[Measurement Cycle]

- **Menu description:** to set the number of measurement cycles corresponding to the accumulated point count. This value is dependent on settings of the Measure Bandwidth, Measurement Time and Measurement Count. Use number keys, stepping keys or knob to set the Measurement Cycle.
- **Key path:** [Measurement Setting], [Measurement Cycle] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 80

- **Setting range:** dependent on settings of the Measure Bandwidth, Measurement Time and Measurement Count.
- **Default unit:** none
- **Program control commands:**

[:SENSe]:PSTatistic:SWEep:CYCLes <integer> [:SENSe]:PSTatistic:SWEep:CYCLes?

[Measuring time]

- **Menu description:** to specify the time for measurements. The minimum value is 1us and the maximum value depends on Measure Bandwidth setting. Use number keys, stepping keys or knob to set the Measuring Time.
- **Key path:** [Measurement Setting], [Measurement Time] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.0ms
- **Setting range:** 1us - 60s
- **Default unit:** s
- **Program control commands:**

[:SENSe]:PSTatistic:SWEep:TIME <time> [:SENSe]:PSTatistic:SWEep:TIME?

[Low Noise Path On Off]

- **Menu description:** this menu is only available when the H34 option (Low Noise Preamp) is purchased. When the preamplifier is ON, the Low Noise Path is OFF and this menu is grayed out; when the preamplifier is OFF, this menu lights on and is switchable.
- **Key path:** [Measurement Setting], [Menu 1/2], [Low Noise Path ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:PSTatistic:POWer:MW:PATH STD|LNPath

:PSTatistic:POWer:MW:PATH?

[Preselector Preselecting Bypass]

- **Menu description:** this menu is only available when the H36 option is purchased. It is used for setting whether to bypass the front-end preselector of the signal/spectrum analyzer. In analyzing bandwidth signal, bypass is usually required.
- **Key path:** [Measurement Setting], [Menu 1/2], [Preselector Preselecting Bypass] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

INPut:PSTatistic:FILTer:YIG[:STATe] OFF|ON|0|1 INPut:PSTatistic:FILTer:YIG[:STATe]?

[RF Gain ▶]

- **Menu description:** to set the Auto ON/OFF of the RF Gain and best allocation algorithm for RF Gain. The soft menus includes [Auto], [Best Dynamic Range] and [Best Sensitivity].
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain] on the front panel.
- **Status saved:** saved in the instrument status.

- **Program control commands:**

:PSTatistic:RF:GAIN:AUTO OFF|ON|0|1

:PSTatistic:RF:GAIN:AUTO?

:PSTatistic:RF:GAIN:AUTO:RULes RANGE|SENSITIVITY

:PSTatistic:RF:GAIN:AUTO:RULes?

[Auto]

- **Menu description:** to set the RF Gain distribution algorithm to Auto. In this case, the RF Gain distribution is "Best Dynamic Range".
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Auto] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Dynamic Range]

- **Menu description:** to set the RF Gain distribution algorithm to Best Dynamic Range. In this case, the RF Gain is switched to "Auto OFF"
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Best Dynamic Range] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Sensitivity]

- **Menu description:** to set the RF Gain distribution algorithm to Best Sensitivity. In this case, the RF Gain is switched to "Auto OFF"
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Best Sensitivity] on the front panel.
- **Status saved:** saved in the instrument status.

[ADC Dither Auto ON OFF]

- **Menu description:** to control opening/closing of ADC dither of the frequency acquisition circuit in the analyzer. Under default mode, the signal/spectrum analyzer will automatically control whether the ADC Dither is ON based on current working condition.
- **Key path:** [Measurement Setting], [Menu 1/2], [ADC Dither Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto OFF.
- **Program control commands:**

[:SENSe]:PSTatistic:ADC:DITHer[:STATe] OFF|ON|HIGH

[:SENSe]:PSTatistic:ADC:DITHer[:STATe]?

[:SENSe]:PSTatistic:ADC:DITHer:AUTO[:STATe] OFF|ON|0|1

[:SENSe]:PSTatistic:ADC:DITHer:AUTO[:STATe]?

[Measurement Reset]

- **Menu description:** to reset the measurement parameters to the factory preset status or user saved parameter status
- **Key path:** [Measurement Setting], [Measurement Reset] on the front panel.

- **Factory preset:** factory reset.
- **Program control commands:**

:CONFigure:PSStatistic

5. 2. 6. 18. Measurement Control

Pop up the menu related to measurement control, including [Measurement Continuous ON OFF], [Restart Measurement] and [Pause/Resume].

[Measurement Continuous ON OFF]

- **Menu description:** to set continuous measurement OFF or ON. When [Measurement Continuous On/Off] is pressed, Continuous On will be triggered and continuous sweep will be the default measurement control method; when Continuous Off is selected, single measurement will be triggered. Press [Sweep Continuous OFF] to restart sweep when the next trigger signal arrives.
- **Key path:** [Measurement Control], [Measurement Continuous ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Continuous On.
- **Program control commands:**

:INITiate:CONTinuous OFF|ON|0|1

:INITiate:CONTinuous?

- **Examples:**

:INIT:CONT OFF

[Restart Measurement]

- **Menu description:** to stop current measurement and restart measurement for the signal/spectrum analyzer.
- **Key path:** [Measurement Control], [Restart Measurement] on the front panel
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:REST

[Pause/Resume]

- **Menu description:** when the signal/spectrum analyzer is in operation, this menu is used for pausing current measurement; when in Paused status, this menu is used for continuing measurement.
- **Key path:** [Measurement Control], [Pause/Resume] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:PAUS

:INITiate:RES

5. 2. 7. Burst Power

5. 2. 7. 1. Frequency

The [Frequency] key on the front panel is used to set parameters related to frequency of the signal/spectrum analyzer and its soft menus includes [Center Frequency],

[Frequency Step Auto ON/OFF], [Frequency Offset]. See the [Frequency] menu of the sweep analysis function for more details.

[Center Freq]

See the [Center Frequency] under [Frequency] of the sweep analysis function for more details.

[Frequency Step Auto ON OFF]

See the [Frequency Step Auto ON/OFF] under [Frequency] of the sweep analysis function for more details.

[Frequency deviation]

See the [Frequency Offset] under [Frequency] of the sweep analysis function for more details.

5. 2. 7. 2. Amplitude/Y Axis

Pop up menus related to parameter setting of Amplitude/Y Axis, including [Reference Level], [Attenuator ►], [Preamplifier ON/OFF], [Scale/Division], [Auto Scale], [Menu 1/2 ►], [Y Axis Scale Unit], [Reference Level Offset].

Reference Level

- **Menu description:** to enable the Reference Level function. The reference level can be adjusted with the number keys, step keys or knob. The reference level corresponds to the top of the coordinate top. Measure signal at reference level position to get highest accuracy. The input attenuator of the signal/spectrum analyzer is coupled to the reference level, which can be automatically changed to avoid compression of input signal.
- **Key path:** [Amplitude/Y Axis], [Reference Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0dBm
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Default unit:** set based on Y Axis scale unit.
- **Program control commands:**

```
:DISPlay:TXPower:VIEW:WINDow:TRACe:Y:RLEVel <real>
```

```
:DISPlay:TXPower:VIEW:WINDow:TRACe:Y:RLEVel?
```

- **Examples:**

```
:DISPlay:TXPower:VIEW:WINDow:TRACe:Y:RLEVel20dBm
```

[Attenuator ►]

See [Attenuator ►] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Preamplifier ON OFF]

See [Preamplifier ON/OFF] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Scale/Division]

- **Menu description:** to select the scale/division from 0.1dB/division to 20dB/division. This menu is only valid when the scale type

is logarithm.

- **Key path:** [Amplitude/Y Axis], [Scale/Division] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 10.00 dB.
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Program control commands:**

:DISPlay:TXPower:VIEW:WINDow:TRACe:Y:PDIVision <rel_amp>

:DISPlay:TXPower:VIEW:WINDow:TRACe:Y:PDIVision?

[Auto Scale]

- **Menu description:** the instrument automatically sets parameters like reference level and scale/division based on input signal sizes. When this soft menu key is pressed, the instrument performs one auto scaling. Setting rule for auto scaling: when the [Auto Scale] menu is pressed, firstly obtain the maximum value and the minimum value based on current measurement trace data. Based on the maximum value, place on the 80% graticule of the screen trace Y axis for auto setting of reference level and scale/division.
- **Key path:** [Amplitude/Y Axis], [Auto Scale] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:TXPower:ADJust:LEVel

[Y Axis Scale Unit]

- **Menu description:** to select the Y Axis unit from [dBm], [dBmV], [dBmA], [W], [V], [A], [dB μ V] and [dB μ A]. The instrument will automatically calculate the trace data and marker readout based on the Y axis scale unit.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** dBm

:UNIT:TXPower:POWer DBM|DBMV|DBMA|V|W|A|DBUV|DBUA

:UNIT:TXPower:POWer?

[Reference Level Offset]

- **Menu description:** to introduce offset for all amplitude readout (e.g, reference level and marker amplitude). It will not change the trace position on the screen. This offset unit is dB and is not affected by the scale and unit. Use number keys, stepping keys or knob to input the offset value.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Reference Level Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0 dB.
- **Setting range:** Min.: -1000dB, Max.:1000dB.
- **Program control commands:**

:DISPlay:TXPower:WINDow:TRACe:Y:RLEVel:OFFSet <rel_amp>

:DISPlay:TXPower:WINDow:TRACe:Y:RLEVel:OFFSet?

- **Examples:**

:DISPlay:TXPower:WINDow:TRACe:Y:RLEVel:OFFSet 12

5. 2. 7. 3. Span/X Axis

This key has no soft menu.

5. 2. 7. 4. Bandwidth

Pop up the soft menus for setting resolution bandwidth and video bandwidth, including [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF] and [Filter Bandwidth].

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to change the resolution bandwidth of spectrum analysis, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode.
- **Key path:** [Bandwidth], [Resolution Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

:TXPower:BANDwidth <bandwidth>

:TXPower:BANDwidth?

:TXPower:BANDwidth:AUTO ON|OFF|1|0

:TXPower:BANDwidth:AUTO?

- **Examples:**

:TXPower:BANDwidth 1kHz

:TXPower:BANDwidth:AUTO ON On

[Video bandwidth Auto Manual]

- **Menu description:** to change the video bandwidth within the active function area, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode. **Command description:** to change video bandwidth displayed at the active function zone ranging from 1Hz to 20MHz. When it is above 3MHz, take 4 MHz, 5 MHz, 6 MHz, 8 MHz, 10 MHz and 20 MHz; when it is between 1Hz and 3MHz, change by 10% step. Such value may be changed via number keys, stepping keys or the knob. The mode with a underline is the current mode. When set as Auto Off, press [Frequency Bandwidth Auto ON OFF] to select Auto ON and return to auto mode.
- **Key path:** [Bandwidth], [Video Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.

- **Factory preset:** Auto, same as the Resolution Bandwidth setting.
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

:TXPower:BANDwidth:VIDeo <bandwidth>

:TXPower:BANDwidth:VIDeo?

:TXPower:BANDwidth:VIDeo:AUTO ON|OFF|1|0

:TXPower:BANDwidth:VIDeo:AUTO?

- **Examples:**

:TXPower:BANDwidth:VIDeo 1 kHz

:TXPower:BANDwidth:VIDeo:AUTO ON

[Filter Bandwidth]

- **Menu description:** if Gaussian filter is used for the signal/spectrum analyzer, set the resolution bandwidth as 3dB, 6dB, pulse bandwidth or equivalent noise bandwidth. When this parameter is changed, the resolution bandwidth filter is fixed, and the bandwidth value in the information display zone changes.
- **Key path:** [Bandwidth], [Filter Bandwidth] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 3 dB.
- **Program control commands:**

[:SENSe]:BANDwidth|BWIDth:TYPE DB3|DB6|IMPulse|NOISe

[:SENSe]:BANDwidth|BWIDth:TYPE?

5. 2. 7. 5. Auto Setting

Pop up the soft menu related to auto setting Which includes [Couple All], [Mechanical Attenuator Auto ON OFF], [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF], [Sweep Time Auto ON OFF] and [Frequency Step Auto ON OFF].

[Couple All]

- **Menu description:** to set the resolution bandwidth, video bandwidth, sweep time, mechanical attenuator and frequency step as auto coupling mode. The signal/spectrum analyzer will select most suitable values for those functions based on set frequency and bandwidth (or start frequency and stop frequency). If no ratio is pre- saved, use default ratio.
- **Key path:** [Auto Setting], [Couple All] on the front panel.
- **Status saved:** not saved in instrument status.
- **Factory preset:** Couple All.
- **Program control commands:**

:COUPle ALL

- **Examples:**

:COUP ALL

[Mechanical Attenuator Auto ON OFF]

See [Attenuator ►] under [Amplitude/Y Axis] for more details.

[Resolution Bandwidth Auto ON OFF]

See [Resolution Bandwidth Auto ON/OFF] under [Bandwidth] for more details.

[Video bandwidth Auto ON OFF]

See [Video Bandwidth Auto ON/OFF] under [Bandwidth] for more details.

[Scanning time Auto ON OFF]

See [Sweep Time Auto ON/OFF] under [Sweep] for more details.

[Frequency Step Auto ON OFF]

See [Frequency Step Auto ON/OFF] under [Frequency] for more details.

5. 2. 7. 6. Trace

Press [Trace] key on the front panel to pop up corresponding soft menu. Including [Refresh], [Average], [Max. Hold], [Min. Hold], [Display ON/OFF] [Menu 1/2 ►] and [Detector ►].

[Refresh]

- **Command description:** to set the current trace processing as Refresh, i.e., clear all data of displayed trace and continue the signal trace receipt under sweep status.
- **Key path:** [Trace], [Refresh] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** after all traces are selected, the trace mode is defaulted as Refresh.
- **Program control commands:**

```
:TRACe:TXPower:TYPE WRITe
```

```
:TRACe:TXPower:TYPE?
```

[Averaging]

- **Command description:** to set the current trace processing method as Average, i.e., based on the average count N set in the [Measurement Setting], update trace after averaging the performance index of the measurement trace.
- **Key path:** [Trace], [Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

```
:TRACe:TXPower:TYPE AVERAge
```

```
:TRACe:TXPower:TYPE?
```

[Max. Hold]

- **Menu description:** to set the current trace processing method as maximum hold, i.e., the new trace data will be assigned with

maximum value of previous measured trace data.

- **Key path:** [Trace], [Max. Hold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:TXPower:TYPE |MAXHold

:TRACe:TXPower:TYPE?

[Min. Hold]

- **Menu description:** to set the current trace processing method as minimum hold, i.e., the new trace data will be assigned with minimum value of previous measured trace data.
- **Key path:** [Trace], [Min. Hold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:TXPower:TYPE MINHold

:TRACe:TXPower:TYPE?

[Display ON/OFF ► Refresh Display]

- **Menu description:** to set the display method for the selected trace from [Refresh Display], [Static Display], [Backstage Refresh] and [Display OFF].
- **Key path:** [Trace], [Display ON/OFF ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace display modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:TXPower:DISPlay[:STATe] ON|OFF|0|1

:TRACe:TXPower:DISPlay[:STATe]?

:TRACe:TXPower:UPDate[:STATe] ON|OFF|0|1

:TRACe:TXPower:UPDate[:STATe]?

[Detector ►]

Pop up soft menus related to setting the detector type for the currently selected trace, including [Auto], [Normal], [Positive Peak], [Sample], [Negative Peak], [Average ►], where, the average detector type includes video average, power average and voltage average.

[Auto]

- **Menu description:** to set the detector command for the currently selected trace as Auto. That means, the signal/spectrum analyzer will perform based on the parameter setting of currently selected trace.

- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Auto] on the front panel
- **Status saved:** saved in the instrument status.
- **Factory preset:** the trace detector type is Power Average.
- **Program control commands:**

:TXPower:DETECTOR:AUTO ON|OFF|1|0

:TXPower:DETECTOR:AUTO?

[Normal]

- **Menu description:** to set the detector command for the currently selected trace as Normal. i.e., display the measurement results of positive peak and negative peak at the same time to achieve display effect similar to the analog instrument.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Normal] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:TXPower:DETECTOR:NORMAL

:TXPower:DETECTOR?

[Positive Peak]

- **Menu description:** to set the detector command for the currently selected trace as Positive Peak. i.e., take the maximum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Positive Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:TXPower:DETECTOR:POSITIVE

:TXPower:DETECTOR?

[Sample]

- **Menu description:** to set the detector command for the currently selected trace as Sample. i.e., take the last value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Sample] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:TXPower:DETECTOR:SAMPLE

:TXPower:DETECTOR?

[Negative Peak]

- **Menu description:** to set the detector command for the currently selected trace as Negative Peak. i.e., take the minimum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Negative Peak] on the front panel.

- **Status saved:** saved in the instrument status.

- **Program control commands:**

:TXPower:DETECTOR NEGATIVE

:TXPower:DETECTOR?

[Average ► Video Average]

- **Menu description:** to set the detector command for the currently selected trace as Video Average. Also called Logarithm Power Average Detector, i.e., take the logarithm power average value for all data assigned to each trace point; earlier signal/spectrum analyzer generally displays the measurement trace of logarithm scale, and all filtering and averaging are based on the logarithm power data; the trace is generally called as video signal. After digital IF processing is adopted, to make measurement results same as the earlier signal/spectrum analyzer, the video average detector function is added.

- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Video Average] on the front panel.

- **Status saved:** saved in the instrument status.

- **Program control commands:**

:TXPower:DETECTOR LOG

:TXPower:DETECTOR?

[Average ► Power Average]

- **Menu description:** to set the detector command for the currently selected trace as Power Average. Also called root mean square (RMS) detector. Calculate the root mean square of all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After square these voltage values, take sum and divide the count of sampling data points corresponding to each trace point. Finally, take square root. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those RMS values are trace data.

- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Power Average] on the front panel.

- **Status saved:** saved in the instrument status.

- **Program control commands:**

:TXPower:DETECTOR AVERAGE or

:TXPower:DETECTOR RMS

:TXPower:DETECTOR?

[Average ► Average Voltage]

- **Menu description:** to set the detector command for the currently selected trace as Voltage Average. Also called average (AVG) detector. Take linear average for all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After summing those voltage values, divide the number of sampling data points corresponding to each trace point. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those average values are trace data.

- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Voltage Average] on the front panel.

- **Status saved:** saved in the instrument status.

- **Program control commands:**

:TXPower:DETECTOR SCALAR

:TXPower:DETECTOR?

5. 2. 7. 7. Sweep

Enable sweep-related parameter setup function to pop up corresponding soft menu, including [Sweep Time Auto ON OFF], [Sweep Setting ▶] and [Sweep Points].

- [Scanning time Auto ON OFF]
- **Menu description:** to change the sweep time of signal/spectrum analyzer by number keys, stepping keys or knob. When it is under Auto OFF mode (shaded), it indicates that sweep time can be set manually. When it is under Auto ON status, the sweep time will be automatically coupled based on resolution bandwidth, span and video bandwidth
- **Key path:** [Sweep], [Sweep Time Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep time Auto.
- **Setting range:** Min.: 1ms, Max.: 6000s.
- **Default unit:** s
- **Program control commands:**

:TXPower:SWEep:TIME <time>

:TXPower:SWEep:TIME?

:TXPower:SWEep:TIME:AUTO OFF|ON|0|1

:TXPower:SWEep:TIME:AUTO?

- **Examples:**

:TXP:SWE:TIME 500 ms

:TXP:SWE:TIME:AUTO OFF

[Number of scanning points]

- **Menu description:** to set the trace points.
- **Key path:** [Sweep], [Sweep Points] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1001.
- **Setting range:** 101-30001.
- **Program control commands:**

:TXPower:SWEep:POINts <integer>

:TXPower:SWEep:POINts?

5. 2. 7. 8. Single

- **Menu description:** the [Continuous Off] key on the front panel has no corresponding soft menu. This function is mainly used for manual trigger of a sweep. When the Average is ON, this function performs the sweeps at the count specified by the Average

Count.

In remote control programming and system establishment, this function combined with *WAI can effectively synchronize the sweep process and enable the trace data obtained after the *WAI finishes directly correspond to the sweep process one by one.

- **Program control commands:**

:INITiate:TXPower

5. 2. 7. 9. Continuous

The [Continuous] key on the front panel has no corresponding soft menu. This function is mainly used for changing the Continuous OFF into Continuous ON; if the current sweep is Continuous ON, the instrument performs no operation.

- **Program control commands:**

:INITiate:CONTInuous ON

5. 2. 7. 10. Trigger

See [Trigger] menu of the sweep analysis function for more details.

5. 2. 7. 11. Display

Pop up soft menus related to display, including [Display Line ON OFF], [Bar Graph ON OFF], [Display Configuration ►].

[Display Line ON OFF]

See [Display Line ON/OFF] under [Display] of the sweep analysis function for more details.

[Display Configuration ►]

It is used for configurations of interface language, status area display on interface. The soft menus include [Select Language Chinese English], [Graticule Display ON OFF], Status Area Display ON OFF], [Frequency Information Display ON OFF]. See [Display Configuration ►] under [Display] of the sweep analysis function for more details.

[Bar Graph On Off]

- **Menu description:** to turn on or off Bar Graph Display.
- **Key path:** [Display] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:DISPlay:TXPower:VIEW:WINDow:BGRaph ON|OFF|1|0

:DISPlay:TXPower:VIEW:WINDow:BGRaph?

5. 2. 7. 12. Input Output

See the [Input Output] menu of the sweep analysis function for more details.

5. 2. 7. 13. Marker

Pop up the soft menu related to markers, including [Marker Select ►], [Normal Markers], [Delta Marker], [Fixed Marker], [Marker OFF], [Marker Attribute ►], [Marker Couple ON OFF], and [All Markers OFF].

[Marker Select ► Marker 1]

- **Command description:** to select among 12 different markers of the analyzer. When one marker is selected, the menu will indicate the current marker and the type and the attribute of the selected marker can be set. Select and trigger another marker and place it at the center of the current trace. Users can read amplitude and frequency information (when the frequency span is 0 Hz, time information will be displayed) at the marker display area at the top right corner of the screen.
- **Key path:** [Marker], [Marker Select ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Marker 1.

[Normal Marker]

- **Menu description:** to set the selected marker as the Normal Marker.
- **Key path:** [Marker], [Normal Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE POSition

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Delta Marker]

- **Menu description:** to set the selected marker as the Delta Marker. Display the amplitude difference and frequency difference (or time difference, when span is zero) between two markers at the marker display area at the top right corner of the screen. If there exists a single marker, a [Delta Marker] operation will generate a reference marker in the active marker position. Use the knob, number keys or stepping keys to move the active marker.
- **Key path:** [Marker], [Delta Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE DELTa

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Fixed Marker]

- **Menu description:** to set the selected marker as the Fixed Marker. The X Axis and Y Axis positions of the fixed marker are fixed. The Fixed Marker can be used as reference marker.
- **Key path:** [Marker], [Fixed Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE FIXed

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker OFF]

- **Menu description:** to turn off the selected marker.

- **Key path:** [Marker], [Marker Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE OFF

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker Attribute ►]

Pop up the corresponding menu of currently selected marker attribute setup, including [Reference Marker ►], [X Axis Scale Auto ON/OFF],

[Marker Trace ►] and [Marker Display Line ON/OFF].

[Reference Marker ►]

- **Menu description:** to select reference marker for current marker. It can be any one from 11 markers except the currently selected marker.
- **Key path:** [Marker], [Marker Attribute ►], [Reference Marker ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence <integer>

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence?

[Marker Display Line ►] On Off

- **Menu description:** to set whether the current marker is displayed as a line on the screen, which is easy to observe.
- **Key path:** [Marker], [Marker Attribute ►] and [Marker Display Line On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINES[:STATe] OFF|ON|0|1

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINES[:STATe]?

[Marker Couple On Off]

- **Menu description:** to turn on or off Marker Couple. When it is ON, moving any marker horizontal axis position will cause an equal movement of horizontal axis position of every other marker which is ON. When the marker is moved to less than Start Frequency or larger than Stop Frequency, the marker is limited to the value of the Start Frequency or the Stop Frequency; when the span is zero, the minimum value is limited as 0, and the maximum value is limited as the Sweep Time.
- **Key path:** [Marker], [Menu 1/2 ►], [Marker Couple ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:TXPower:MARKer:COUple[:STATe] ON|OFF|1|0

:CALCulate:TXPower:MARKer:COUple[:STATe]?

[All Markers OFF]

- **Menu description:** to turn off all current markers which are ON and related soft keys, e.g. [Noise Marker].
- **Key path:** [Marker], [Menu 1/2 ►], [All Markers OFF] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:TXPower:MARKer:AOff

5. 2. 7. 14. Marker->

This key has no soft menu.

5. 2. 7. 15. Marker Function

This key has no soft menu.

5. 2. 7. 16. Peak

The [Peak Search] key on the front panel is used for turning on the peak search for traces by the control instrument and turning on marker for display, including [Next Peak], [Next Peak Right], [Next Peak Left].

- **Program control commands:**

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum

[Next Peak]

- **Menu description:** Taking the Amplitude of the point where the current marker is located, search for the next peak of current test trace.
- **Key path:** [Peak Search], [Next Peak] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:NEXT

[Next Peak Right]

- **Menu description:** to search for the peak to the right of the current test trace marker position.
- **Key path:** [Peak Search], [Next Peak Right] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:RIGHT

[Next Peak Left]

- **Menu description:** to search for the peak to the left of the current test trace marker position.
- **Key path:** [Peak Search], [Next Peak Left] on the front panel.

- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:TXPower:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:LEFT

5. 2. 7. 17. Measurement Setting

Pop up the soft menu related to measurement setting including [Average Count ON OFF], [Average State Exponential Repeat], [Average Type ►], [Threshold Level Absolute Relative], [Measurement Method ►], [Burst Width Auto ON OFF], [Low Noise Path ON OFF], [Preselector Preselecting Bypass], [RF Gain ►], [ADC Dither Auto ON OFF] and [Measurement Reset].

[Average frequency On Off]

- **Menu description:** to turn on or off Average. When Average Count is ON, the user can specify the average count required for measurement. The Average Count can be adjusted by number keys, stepping keys or knob.
- **Key path:** [Measurement Setting], [Average Count ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100/OFF
- **Setting range:** 1 - 10000
- **Default unit:** none
- **Program control commands:**

[:SENSe]:TXPower:AVERAge:COUNT <integer>

[:SENSe]:TXPower:AVERAge:COUNT?

[:SENSe]:TXPower:AVERAge[:STATe] ON|OFF|1|0

[:SENSe]:TXPower:AVERAge[:STATe]?

[Average State Exponential Repeat]

- **Menu description:** when Average Count is ON, the user can select Average State required for measurement.

Exponential - Different from Linear Average, in Exponential State, the weight of new data is larger than that of old data. This is good for tracking data change in terms of time. In this case, the selected averaging count determines the weight of the old data on the new data. As the average count increases, the weight of new data gradually decreases. This is good for tracking data change in terms of time. In this case, the selected averaging count determines the weight of the old data on the new data. As the average count increases, the weight of new data gradually decreases.

Repeat - Similarly, it takes exponential averaging. However, when the average count is met, clear all previous results, restart average till the set average count and repeat this process.

- **Key path:** [Measurement Setting], [Average State Exponential Repeat] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Exponential
- **Program control commands:**

[:SENSe]:TXPower:AVERAge:TCONtrol EXPonential|REPeat [:SENSe]:TXPower:AVERAge:TCONtrol?

[Average Type ►]

- **Menu description:** to allow to specify Average Type of data results.
- **Key path:** [Measurement Setting], [Average Mode ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Video Average
- **Program control commands:**

```
[:SENSe]:TXPower:AVERage:TYPE LOG|MAXimum|MINimum|RMS
```

```
[:SENSe]:TXPower:AVERage:TYPE?
```

[Video Average]

- **Menu description:** in calculation, divide the trace data sum by data point number.
- **Key path:** [Measurement Setting], [Average Mode ►], [Video Average] on the front panel.
- **Status saved:** saved in the instrument status.

[Power Average]

- **Menu description:** firstly, change the trace data into power in dB, then average the trace data. This averaging may take a long time.
- **Key path:** [Measurement Setting], [Average Mode ►], [Power Average] on the front panel.
- **Status saved:** saved in the instrument status.

[Threshold Level Absolute Relative]

- **Menu description:** to set the Threshold Level, which is used to calculate the average carrier power that is higher than this threshold. It can be relative power value in dB, or absolute power value in dBm. Use number keys, stepping keys or knob to change the Threshold Level center frequency.
- **Key path:** [Measurement Setting], [Threshold Level Absolute Relative] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -30dB/Relative
- **Setting range:** -100 - 100
- **Default unit:** dB(dBm)
- **Program control commands:**

```
[:SENSe]:TXPower:THReshold <real>
```

```
[:SENSe]:TXPower:THReshold?
```

```
[:SENSe]:TXPower:THReshold:TYPE ABSolute|RELative
```

```
[:SENSe]:TXPower:THReshold:TYPE?
```

[Measurement Method ►]

- **Menu description:** to select the Measurement Method for usage.
- **Key path:** [Measurement Setting], [Measurement Method ►] on the front panel.
- **Status saved:** saved in the instrument status.

- **Factory preset:** Threshold Level method
- **Program control commands:**

```
[:SENSe]:TXPower:METhod THReshold[BWIDth [:SENSe]:TXPower:METhod?
```

[Threshold Level Method]

- **Menu description:** to select the Measurement Method as Threshold Level: select the user-defined threshold level or default level (-30.0dB) as the measurement standard.
- **Key path:** [Measurement Setting], [Measurement Method ►], [Threshold Level Method] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Threshold Level method

[Burst Width Method]

- **Menu description:** to select the Measurement Method as Burst Width Method.
- **Key path:** [Measurement Setting], [Measurement Method ►], [Burst Width Method] on the front panel.
- **Status saved:** saved in the instrument status.

[Burst Width Auto ON OFF]

- **Menu description:** to set the Burst Width parameter as Auto On/Off. Under Auto ON mode, the pulse width is calculated automatically based on the threshold level. For example, if the threshold level is set to 3dB, the pulse width is the interval between 3dB points. Before all results are calculated, after each sweep, the pulse width will update. Since this measurement is only made above the pulse width, the measurement is between 3dB points. Under Auto OFF mode, the user can directly input the pulse width for calculating the pulse power, or the percentage for measured pulse width. In the latter case, the pulse width is only calculated once based on the latest measured pulse width. Otherwise, the pulse width is positioned at the center of each measured pulse.
- **Key path:** [Measurement Setting], [Burst Width Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 10us/Auto
- **Setting range:** 0 - 50s
- **Default unit:** s
- **Program control commands:**

```
[:SENSe]:TXPower:BURSt:WIDTh <time>
```

```
[:SENSe]:TXPower:BURSt:WIDTh?
```

```
[:SENSe]:TXPower:BURSt:AUTO ON|OFF|1|0
```

```
[:SENSe]:TXPower:BURSt:AUTO?
```

[Low Noise Path On Off]

- **Menu description:** this menu is only available when the H34 option (Low Noise Preamp) is purchased. When the preamplifier is ON, the Low Noise Path is OFF and this menu is grayed out; when the preamplifier is OFF, this menu lights on and is switchable.
- **Key path:** [Measurement Setting], [Menu 1/2], [Low Noise Path ON OFF] on the front panel.

- **Status saved:** saved in the instrument status.
- **Program control commands:**

:TXPower:POWer:MW:PATH STD|LNPath

:TXPower:POWer:MW:PATH?

[Preselector Preselecting Bypass]

- **Menu description:** this menu is only available when the H36 option is purchased. It is used for setting whether to bypass the front-end preselector of the signal/spectrum analyzer. In analyzing bandwidth signal, bypass is usually required.
- **Key path:** [Measurement Setting], [Menu 1/2], [Preselector Preselecting Bypass] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

INPut:TXPower:FILTer:YIG[:STATe] OFF|ON|0|1

INPut:TXPower:FILTer:YIG[:STATe]?

[RF Gain ►]

- **Menu description:** to set the Auto ON/OFF of the RF Gain and best allocation algorithm for RF Gain. The soft menus includes [Auto], [Best Dynamic Range] and [Best Sensitivity].
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:TXPower:RF:GAIN:AUTO OFF|ON|0|1

:TXPower:RF:GAIN:AUTO?

:TXPower:RF:GAIN:AUTO:RULes RANGE|SENSITIVITY

:TXPower:RF:GAIN:AUTO:RULes?

[Auto]

- **Menu description:** to set the RF Gain distribution algorithm to Auto. In this case, the RF Gain distribution is "Best Dynamic Range".
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Auto] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Dynamic Range]

- **Menu description:** to set the RF Gain distribution algorithm to Best Dynamic Range. In this case, the RF Gain is switched to "Auto OFF"
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Best Dynamic Range] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Sensitivity]

- **Menu description:** to set the RF Gain distribution algorithm to Best Sensitivity. In this case, the RF Gain is switched to "Auto

OFF"

- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Best Sensitivity] on the front panel.
- **Status saved:** saved in the instrument status.

[ADC Dither Auto ON OFF]

- **Menu description:** to control opening/closing of ADC dither of the frequency acquisition circuit in the analyzer. Under default mode, the signal/spectrum analyzer will automatically control whether the ADC Dither is ON based on current working condition. When the ADC Dither is under Auto mode, the ON or OFF status depends on the span, resolution bandwidth and sweep type (continuous swept or step sweep); when it is continuous swept, the ADC Dither status will force to switch to Auto and turns off; when it is step sweep, under Auto mode, if the span is 2MHz or below, the ADC Dither is ON; if the span is below 2MHz, the ADC Dither is OFF. Under Auto OFF mode, if the span is above 2MHz, turning on the ADC Dither may affect the measurement results based on selected dither status. You can access the submenu for manual control.
- **Key path:** [Measurement Setting], [Menu 1/2], [ADC Dither Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**

```
[:SENSe]:TXPower:ADC:DITHer[:STATe] OFF|ON|HIGH
```

```
[:SENSe]:TXPower:ADC:DITHer[:STATe]? \n
```

```
[:SENSe]:TXPower:ADC:DITHer:AUTO[:STATe] OFF|ON|0|1
```

```
[:SENSe]:TXPower:ADC:DITHer:AUTO[:STATe]?
```

[Measurement Reset]

- **Menu description:** to reset the measurement parameters to the factory preset status or user saved parameter status
- **Key path:** [Measurement Setting], [Measurement Reset] on the front panel.
- **Factory preset:** factory reset.
- **Program control commands:**

```
:CONFigure:TXPower
```

5. 2. 7. 18. Measurement Control

Pop up the menu related to measurement control, including [Measurement Continuous ON OFF], [Restart Measurement] and [Pause/Resume].

[Measurement Continuous ON OFF]

- **Menu description:** to set continuous measurement OFF or ON. When [Measurement Continuous On/Off] is pressed, Continuous On will be triggered and continuous sweep will be the default measurement control method; when Continuous Off is selected, single measurement will be triggered. Press [Sweep Continuous OFF] to restart sweep when the next trigger signal arrives.
- **Key path:** [Measurement Control], [Measurement Continuous ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Continuous On.

- **Program control commands:**

:INITiate:CONTinuous OFF|ON|0|1

:INITiate:CONTinuous?

- **Examples:**

:INIT:CONT OFF

[Restart Measurement]

- **Menu description:** to stop current measurement and restart measurement for the signal/spectrum analyzer.

- **Key path:** [Measurement Control], [Restart Measurement] on the front panel

- **Status saved:** not saved in instrument status.

- **Program control commands:**

:INITiate:REST

[Pause/Resume]

- **Menu description:** when the signal/spectrum analyzer is in operation, this menu is used for pausing current measurement; when in Paused status, this menu is used for continuing measurement.

- **Key path:** [Measurement Control], [Pause/Resume] on the front panel.

- **Status saved:** not saved in instrument status.

- **Program control commands:**

:INITiate:PAUS

:INITiate:RES

5. 2. 8. Harmonic Distortion

5. 2. 8. 1. Frequency

The [Frequency] key on the front panel is used to set parameters related to frequency of the signal/spectrum analyzer. The soft menus includes [Fundamental Frequency], [Frequency Step Auto ON/OFF], [Frequency Offset].

Fundamental Frequency Auto ON OFF]

- **Menu description:** to set the fundamental frequency at auto measurement of harmonic distortion. In Auto On mode, the instrument searches fundamental frequency automatically; in Auto Off mode, users may use number keys, stepping keys or the knob to set.

- **Key path:** [Frequency], [Fundamental Frequency Auto ON/OFF] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** Auto

- **Setting range:** $1.0E^{-7}$ - maximum instrument frequency

- **Default unit:** Hz

- **Program control commands:**

[[:SENSe]:HARMonics:FREQuency:FUNDamental <freq>

[SENSe]:HARMonics:FREQuency:FUNDamental?

[SENSe]:HARMonics:FREQuency:FUNDamental:AUTO OFF|ON|0|1

[SENSe]:HARMonics:FREQuency:FUNDamental:AUTO?

[Frequency Step Auto ON OFF]

See the [Frequency Step Auto ON/OFF] under [Frequency] of the sweep analysis function for more details.

[Frequency deviation]

See the [Frequency Offset] under [Frequency] of the sweep analysis function for more details.

5. 2. 8. 2. Amplitude/Y Axis

Pop up menus related to parameter setting of Amplitude/Y Axis, including [Reference Level], [Attenuator ►], [Preamplifier ON/OFF], [Scale/Division], [Auto Scale], [Menu 1/2 ►], [Y Axis Scale Unit], [Reference Level Offset].

Reference Level

- **Menu description:** to enable the Reference Level function. The reference level can be adjusted with the number keys, step keys or knob. The reference level corresponds to the top of the coordinate top. Measure signal at reference level position to get highest accuracy. The input attenuator of the signal/spectrum analyzer is coupled to the reference level, which can be automatically changed to avoid compression of input signal.
- **Key path:** [Amplitude/Y Axis], [Reference Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0dBm
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Default unit:** set based on Y Axis scale unit.
- **Program control commands:**

:DISPlay:HARMonics:VIEW:WINDow:TRACe:Y:RLEVel <real>

:DISPlay:HARMonics:VIEW:WINDow:TRACe:Y:RLEVel?

- **Examples:**

:DISPlay:HARMonics:VIEW:WINDow:TRACe:Y:RLEVel20dBm

[Attenuator ►]

See [Attenuator ►] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Preamplifier ON OFF]

See [Preamplifier ON/OFF] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Scale/Division]

- **Menu description:** to select the scale/division from 0.1dB/division to 20dB/division. This menu is only valid when the scale type is logarithm.
- **Key path:** [Amplitude/Y Axis], [Scale/Division] on the front panel.

- **Status saved:** saved in the instrument status.
- **Factory preset:** 10.00 dB.
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Program control commands:**

:DISPlay:HARMonics:VIEW:WINDow:TRACe:Y:PDIVision <rel_ampl>

:DISPlay:HARMonics:VIEW:WINDow:TRACe:Y:PDIVision?

[Auto Scale]

- **Menu description:** the instrument automatically sets parameters like reference level and scale/division based on input signal sizes. When this soft menu key is pressed, the instrument performs one auto scaling. Setting rule for auto scaling: when the [Auto Scale] menu is pressed, firstly obtain the maximum value and the minimum value based on current measurement trace data. Based on the maximum value, place on the 80% graticule of the screen trace Y axis for auto setting of reference level and scale/division.
- **Key path:** [Amplitude/Y Axis], [Auto Scale] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:HARMonics:ADJust:LEVel

[Y Axis Scale Unit]

- **Menu description:** to select the Y Axis unit from [dBm], [dBmV], [dBmA], [W], [V], [A], [dBμV] and [dBμA]. The instrument will automatically calculate the trace data and marker readout based on the Y axis scale unit.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** dBm

:UNIT:HARMonics:POWer DBM|DBMV|DBMA|V|W|A|DBUV|DBUA

:UNIT:HARMonics:POWer?

[Reference Level Offset]

- **Menu description:** to introduce offset for all amplitude readout (e.g, reference level and marker amplitude). It will not change the trace position on the screen. This offset unit is dB and is not affected by the scale and unit. Use number keys, stepping keys or knob to input the offset value.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Reference Level Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0 dB.
- **Setting range:** Min.: -1000dB, Max.:1000dB.
- **Program control commands:**

:DISPlay:HARMonics:WINDow:TRACe:Y:RLEVel:OFFSet <rel_ampl>

:DISPlay:HARMonics:WINDow:TRACe:Y:RLEVel:OFFSet?

- **Examples:**

:DISPlay:HARMonics:WINDow:TRACe:Y:RLEVel:OFFSet 12

5. 2. 8. 3. Span/X Axis

This key has no soft menu.

5. 2. 8. 4. Bandwidth

Pop up the soft menu for setting the Resolution Bandwidth, [Resolution Bandwidth Auto ON OFF].

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to change the resolution bandwidth of spectrum analysis, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode.
- **Key path:** [Bandwidth], [Resolution Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

:HARMonics:BANDwidth <bandwidth>

:HARMonics:BANDwidth?

:HARMonics:BANDwidth:AUTO ON|OFF|1|0

:HARMonics:BANDwidth:AUTO?

- **Examples:**

:HARM:BAND 1kHz

:HARM:BAND:AUTO ON On

5. 2. 8. 5. Auto Setting

Pop up the soft menu related to auto setting including [Couple All], [Mechanical Attenuator Auto ON OFF], [Resolution Bandwidth Auto ON OFF], [Sweep Time Auto ON OFF], [Fundamental Frequency Auto ON OFF] and [Frequency Step Auto ON OFF].

[Couple All]

- **Menu description:** to set the resolution bandwidth, sweep time, mechanical attenuator and frequency step as auto coupling mode. The signal/spectrum analyzer will select most suitable values for those functions based on set frequency. If no ratio is pre-saved, use default ratio.
- **Key path:** [Auto Setting], [Couple All] on the front panel.
- **Status saved:** not saved in instrument status.
- **Factory preset:** Couple All.
- **Program control commands:**

:COUPle ALL

- **Examples:**

:COUP ALL

[Mechanical Attenuator Auto ON OFF]

See [Attenuator ▶] under [Amplitude/Y Axis] for more details.

[Resolution Bandwidth Auto ON OFF]

See [Resolution Bandwidth Auto ON/OFF] under [Bandwidth] for more details.

[Scanning time Auto ON OFF]

See [Sweep Time Auto ON/OFF] under [Sweep] for more details.

Fundamental Frequency Auto ON OFF]

See [Fundamental Frequency Auto ON OFF] under [Frequency] for more details.

[Frequency Step Auto ON OFF]

See [Frequency Step Auto ON/OFF] under [Frequency] for more details.

5. 2. 8. 6. Track

Press [Trace] key on the front panel to pop up corresponding soft menu. Including [Refresh], [Average],

[Refresh]

- **Command description:** to set the current trace processing as Refresh, i.e., clear all data of displayed trace and continue the signal trace receipt under sweep status.
- **Key path:** [Trace], [Refresh] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:HARMonics:TYPE WRITe

:TRACe:HARMonics:TYPE?

[Averaging]

- **Command description:** to set the current trace processing method as Average, i.e., based on the average count N set in the [Measurement Setting], update trace after averaging the performance index of the measurement trace.
- **Key path:** [Trace], [Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:HARMonics:TYPE AVERAge

:TRACe:HARMonics:TYPE?

5. 2. 8. 7. Sweep

Enable sweep parameter setting function to pop up setting menu for Sweep Time, [Sweep Time Auto ON OFF]

[Scanning time Auto ON OFF]

- **Menu description:** to change the sweep time of signal/spectrum analyzer by number keys, stepping keys or knob. When it is under Auto OFF mode (shaded), it indicates that sweep time can be set manually. When it is under Auto ON status, the sweep time will be automatically coupled based on resolution bandwidth, span and video bandwidth
- **Key path:** [Sweep], [Sweep Time Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep time Auto.
- **Setting range:** Min.: 1ms, Max.: 6000s.
- **Default unit:** s
- **Program control commands:**

```
:HARMonics:SWEep:TIME <time>
```

```
:HARMonics:SWEep:TIME?
```

```
:HARMonics:SWEep:TIME:AUTO OFF|ON|0|1
```

```
:HARMonics:SWEep:TIME:AUTO?
```

- **Examples:**

```
:HARM:SWE:TIME 500 ms
```

```
:HARM:SWE:TIME:AUTO OFF
```

5. 2. 8. 8. Single

- **Menu description:** the [Continuous Off] key on the front panel has no corresponding soft menu. This function is mainly used for manual trigger of one measurement. When the Average is ON, this function performs measurement at the count specified by the Average Count.

In remote control programming and system establishment, this function combined with *WAI can effectively synchronize the measurement process and enable the trace data obtained after the *WAI finishes directly correspond to the measurement process one by one.

- **Program control commands:**

```
:INITiate:HARMonics
```

5. 2. 8. 9. Continuous

The [Continuous] key on the front panel has no corresponding soft menu. This is mainly used for changing the Measurement Continuous OFF to Measurement Continuous ON; if the current state is Measurement Continuous ON, the instrument performs no operation.

5. 2. 8. 10. Trigger

See [Trigger] menu of the sweep analysis function for more details.

5. 2. 8. 11. Display

Pop up soft menus related to display, including [Display Line ON OFF], [Bar Graph ON OFF], [Display Configuration ►].

[Display Line On Off]

See [Display Line ON/OFF] under [Display] of the sweep analysis function for more details.

[Display Configuration ►]

It is used for configurations of interface language, status area display on interface. The soft menus include [Select Language Chinese English], [Graticule Display ON OFF], [Status Area Display ON OFF], [Frequency Information Display ON OFF]. See [Display Configuration ►] under [Display] of the sweep analysis function for more details.

5. 2. 8. 12. Input Output

See the [Input Output] menu of the sweep analysis function for more details.

5. 2. 8. 13. Marker

This key has no soft menu.

5. 2. 8. 14. Marker->

This key has no soft menu.

5. 2. 8. 15. Marker Function

This key has no soft menu.

5. 2. 8. 16. Peak

This key has no soft menu.

5. 2. 8. 17. Measurement Setting

Pop up the soft menu related to measurement setting Including [Average Count ON OFF], [Average State Exponential Repeat], [Harmonics Number], [Harmonics Table ON OFF], [Configure Harmonics], [Low Noise Path ON OFF], [Preselector Preselecting Bypass], [RF Gain ►], [ADC Dither Auto ON/OFF], [Measurement Reset].

[Average frequency On Off]

- **Menu description:** to turn on or off Average. When Average Count is ON, the user can specify the average count required for measurement. The Average Count can be adjusted by number keys, stepping keys or knob.
- **Key path:** [Measurement Setting], [Average Count ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100/OFF
- **Setting range:** 1 - 10000
- **Default unit:** none
- **Program control commands:**

[:SENSe]:HARMonics:AVERAge:COUNT <integer>

[:SENSe]:HARMonics:AVERAge:COUNT?

[:SENSe]:HARMonics:AVERAge[:STATe] ON|OFF|1|0

[:SENSe]:HARMonics:AVERAge[:STATe]?

[Average State Exponential Repeat]

- **Menu description:** when Average Count is ON, the user can select Average State required for measurement.

Exponential - Different from Linear Average, in Exponential State, the weight of new data is larger than that of old data. This is good for tracking data change in terms of time. In this case, the selected averaging count determines the weight of the old data on the new data. As the average count increases, the weight of new data gradually decreases. This is good for tracking data change in terms of time. In this case, the selected averaging count determines the weight of the old data on the new data. As the average count increases, the weight of new data gradually decreases.

Repeat - Similarly, it takes exponential averaging. However, when the average count is met, clear all previous results, restart average till the set average count and repeat this process.

- **Key path:** [Measurement Setting], [Average State Exponential Repeat] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Exponential
- **Program control commands:**

[::SENSe]:HARMonics:AVERAge:TCONtrol EXPOnential|REPeat

[::SENSe]:HARMonics:AVERAge:TCONtrol?

[Harmonics Number]

- **Menu description:** to set to calculate the total number of harmonics to be measured for harmonic distortion. The minimum value is 2 (fundamental harmonics and second harmonics). The maximum value is 10. Use number keys, stepping keys or knob to change the harmonics number.
- **Key path:** [Measurement Setting] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100/OFF
- **Setting range:** 2 - 10
- **Default unit:** none
- **Program control commands:**

[::SENSe]:HARMonics:NUMBer <integer> [::SENSe]:HARMonics:NUMBer?

[Harmonics Table On Off]

- **Menu description:** to turn on or off Range List. If it is ON, take harmonics measurement based on table. If it is OFF, the first active scope is fundamental harmonic and the self sequence active range is harmonics.
- **Key path:** [Measurement Setting], [Harmonics Table ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF
- **Program control commands:**

[::SENSe]:HARMonics:RTABLE:STATe OFF|ON|0|1

[::SENSe]:HARMonics:RTABLE:STATe?

[Configure Harmonics ▶]

- **Menu description:** to enter the setting interface of the harmonics editing list. If it is OFF, use "----" to indicate that this harmonic

range is void and no measurement is made.

- **Key path:** [Measurement Setting], [Configure Harmonics ►] on the front panel.

[Harmonic On Off]

- **Menu description:** to set the parameter for each harmonics. If it is ON, measure the harmonics. If it is OFF, no measurement is made.
- **Key path:** [Measurement Setting], [Configure Harmonics ►], [Harmonics ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** ON
- **Program control commands:**

```
[:SENSe]:HARMonics:RANGe[:LIST]:STATe OFF|ON|0|1, ...
```

```
[:SENSe]:HARMonics:RANGe[:LIST]:STATe?
```

[Frequency]

- **Menu description:** to set harmonics frequency. Users may use number keys, stepping keys and the knob to adjust it.
- **Key path:** [Measurement Setting], [Configure Harmonics ►], [Frequency] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.0GHz
- **Setting range:** 1 - set the maximum frequency of the instrument
- **Default unit:** Hz
- **Program control commands:**

```
[:SENSe]:HARMonics:RANGe[:LIST]:FREQuency <frequency>,...
```

```
[:SENSe]:HARMonics:RANGe[:LIST]:FREQuency?
```

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to set resolution bandwidth state of the instrument. If the resolution bandwidth is set to Auto ON, the optimal setting is determined by the instrument. When the resolution bandwidth is set as auto off, users may define the bandwidth and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Configure Harmonics ►], [Resolution Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 3MHz/Auto
- **Setting range:** 1Hz - 20MHz
- **Default unit:** Hz
- **Program control commands:**

```
[:SENSe]:HARMonics:RANGe[:LIST]:BANDwidth|BWIDth[:RESolution] <frequency>,...
```

```
[:SENSe]:HARMonics:RANGe[:LIST]:BANDwidth|BWIDth[:RESolution]?
```

```
[:SENSe]:HARMonics:RANGe[:LIST]:BANDwidth|BWIDth[:RESolution]:AUTO ON|OFF|1|0, ...
```

[[:SENSe]:HARMonics:RANGe[:LIST]:BANDwidth|BWIDth[:RESolution]:AUTO?

[Video bandwidth Auto ON OFF]

- **Menu description:** to set video bandwidth state of the instrument. If the video bandwidth is set to Auto ON, the optimal setting is determined by the instrument. When the video bandwidth is set as auto off, users may define the bandwidth and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Configure Harmonics ►], [Video Bandwidth Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 3MHz/Auto
- **Setting range:** 1Hz - 20MHz
- **Default unit:** Hz
- **Program control commands:**

[[:SENSe]:HARMonics:RANGe[:LIST]:BANDwidth|BWIDth:VIDeo <frequency>,...

[[:SENSe]:HARMonics:RANGe[:LIST]:BANDwidth|BWIDth:VIDeo?

[[:SENSe]:HARMonics:RANGe[:LIST]:BANDwidth|BWIDth:VIDeo:AUTO ON|OFF|1|0, ...

[[:SENSe]:HARMonics:RANGe[:LIST]:BANDwidth|BWIDth:VIDeo:AUTO?

[Scanning time Auto ON OFF]

- **Menu description:** to set the Sweep Time of the instrument as Auto ON or OFF and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Configure Harmonics ►], [Sweep Time Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 5ms/Auto
- **Setting range:** 1us - 6000s
- **Default unit:** s
- **Program control commands:**

[[:SENSe]:HARMonics:RANGe[:LIST]:SWEeptime <time>, ...

[[:SENSe]:HARMonics:RANGe[:LIST]:SWEeptime?

[[:SENSe]:HARMonics:RANGe[:LIST]:SWEeptime:AUTO ON|OFF|1|0, ...

[[:SENSe]:HARMonics:RANGe[:LIST]:SWEeptime:AUTO?

[Auto-Fill Range Table]

- **Menu description:** to automatically set the parameters of range table based on current center frequency and span.
- **Key path:** [Measurement Setting], [Configure Harmonics ►], [Auto-Fill Range Table] on the front panel.
- **Program control commands:**

[[:SENSe]:HARMonics:RTABLE:FILL

[Low Noise Path On Off]

- **Menu description:** this menu is only available when the H34 option (Low Noise Preamp) is purchased. When the preamp is ON, the Low Noise Path is OFF and this menu is grayed out; when the preamp is OFF, this menu lights on and is switchable.
- **Key path:** [Measurement Setting], [Menu 1/2], [Low Noise Path ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:HARMonics:POWer:MW:PATH STD|LNPath
```

```
:HARMonics:POWer:MW:PATH?
```

[Preselector Preselecting Bypass]

- **Menu description:** this menu is only available when the H36 option is purchased. It is used for setting whether to bypass the front-end preselector of the signal/spectrum analyzer. In analyzing bandwidth signal, bypass is usually required.
- **Key path:** [Measurement Setting], [Menu 1/2], [Preselector Preselecting Bypass] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
INPut:HARMonics:FILTer:YIG[:STATe] OFF|ON|0|1 INPut:HARMonics:FILTer:YIG[:STATe]?
```

[RF Gain ►]

- **Menu description:** to set the Auto ON/OFF of the RF Gain and best allocation algorithm for RF Gain. The soft menus includes [Auto], [Best Dynamic Range] and [Best Sensitivity].
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:HARMonics:RF:GAIN:AUTO OFF|ON|0|1
```

```
:HARMonics:RF:GAIN:AUTO?
```

```
:HARMonics:RF:GAIN:AUTO:RULEs RANGE|SENSITIVITY
```

```
:HARMonics:RF:GAIN:AUTO:RULEs?
```

[Auto]

- **Menu description:** to set the RF Gain distribution algorithm to Auto. In this case, the RF Gain distribution is "Best Dynamic Range".
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Auto] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Dynamic Range]

- **Menu description:** to set the RF Gain distribution algorithm to Best Dynamic Range. In this case, the RF Gain is switched to "Auto OFF".
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Best Dynamic Range] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Sensitivity]

- **Menu description:** to set the RF Gain distribution algorithm to Best Sensitivity. In this case, the RF Gain is switched to "Auto OFF"
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Best Sensitivity] on the front panel.
- **Status saved:** saved in the instrument status.

[ADC Dither Auto ON OFF]

- **Menu description:** to control opening/closing of ADC dither of the frequency acquisition circuit in the analyzer. Under default mode, the signal/spectrum analyzer will automatically control whether the ADC Dither is ON based on current working condition. When the ADC Dither is under Auto mode, the ON or OFF status depends on the span, resolution bandwidth and sweep type (continuous swept or step sweep); when it is continuous swept, the ADC Dither status will force to switch to Auto and turns off; when it is step sweep, under Auto mode, if the span is 2MHz or below, the ADC Dither is ON; if the span is below 2MHz, the ADC Dither is OFF. Under Auto OFF mode, if the span is above 2MHz, turning on the ADC Dither may affect the measurement results based on selected dither status. You can access the submenu for manual control.
- **Key path:** [Measurement Setting], [Menu 1/2], [ADC Dither Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**

```
[::SENSe]:HARMonics:ADC:DITHer[:STATe] OFF|ON|HIGH
```

```
[::SENSe]:HARMonics:ADC:DITHer[:STATe]?  
n
```

```
[::SENSe]:HARMonics:ADC:DITHer:AUTO[:STATe] OFF|ON|0|1
```

```
[::SENSe]:HARMonics:ADC:DITHer:AUTO[:STATe]?
```

[Measurement Reset]

- **Menu description:** to reset the measurement parameters to the factory preset status or user saved parameter status
- **Key path:** [Measurement Setting], [Menu 1/2 ►], [Measurement Reset] on the front panel.
- **Factory preset:** factory reset.
- **Program control commands:**

```
:CONFigure:HARMonics
```

5. 2. 8. 18. Measurement Control

Pop up the menu related to measurement control, including [Measurement Continuous ON OFF], [Restart Measurement] and [Pause/Resume].

[Measurement Continuous ON OFF]

- **Menu description:** to set continuous measurement OFF or ON. When [Measurement Continuous On/Off] is pressed, Continuous On will be triggered and continuous sweep will be the default measurement control method; when Continuous Off is selected, single measurement will be triggered. Press [Sweep Continuous OFF] to restart sweep when the next trigger signal arrives.
- **Key path:** [Measurement Control], [Measurement Continuous ON OFF] on the front panel.

- **Status saved:** saved in the instrument status.
- **Factory preset:** Continuous On.
- **Program control commands:**

:INITiate:CONTInuous OFF|ON|0|1

:INITiate:CONTInuous?

- **Examples:**

:INIT:CONT OFF

[Restart Measurement]

- **Menu description:** to stop current measurement and restart measurement for the signal/spectrum analyzer.
- **Key path:** [Measurement Control], [Restart Measurement] on the front panel
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:REST

[Pause/Resume]

- **Menu description:** when the signal/spectrum analyzer is in operation, this menu is used for pausing current measurement; when in Paused status, this menu is used for continuing measurement.
- **Key path:** [Measurement Control], [Pause/Resume] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:PAUS

:INITiate:RES

5. 2. 9. Three-order intermodulation (TOI)

5. 2. 9. 1. Frequency

The [Frequency] key on the front panel is used to set parameters related to the signal/spectrum analyzer frequency, including [Center Frequency], [Lower Frequency Auto On/Off], [Upper Frequency Auto On/Off], [Frequency Step Auto ON/OFF], [Frequency Offset]. See the [Frequency] menu of the sweep analysis function for more details.

[Center Freq]

See the [Center Frequency] under [Frequency] of the sweep analysis function for more details.

[Lower base frequency Auto ON OFF]

- **Menu description:** to set the lower frequency of the base frequency for TOI measurement. In Auto On mode, the instrument searches lower frequency automatically; in Auto Off mode, users may use number keys, stepping keys or the knob to set.
- **Key path:** [Frequency], [Lower Base Frequency Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto

- **Setting range:** $-1.0E^{+8}$, set the maximum frequency of the instrument.
- **Default unit:** Hz
- **Program control commands:**

[[:SENSe]:TOI:FREQuency:BASE:LOWer <freq>

[[:SENSe]:TOI:FREQuency:BASE:LOWer <freq>

[[:SENSe]:TOI:FREQuency:BASE:LOWer:AUTO OFF|ON|0|1

[[:SENSe]:TOI:FREQuency:BASE:LOWer:AUTO?

[Upper base frequency Auto ON OFF]

- **Menu description:** to set the upper frequency of the base frequency for TOI measurement. In Auto On mode, the instrument searches upper frequency automatically; in Auto Off mode, users may use number keys, stepping keys or the knob to set.
- **Key path:** [Frequency], [Upper Base Frequency Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto
- **Setting range:** $-1.0E^{+8}$, set the maximum frequency of the instrument.
- **Default unit:** Hz
- **Program control commands:**

[[:SENSe]:TOI:FREQuency:BASE:UPPer <frequency>

[[:SENSe]:TOI:FREQuency:BASE:UPPer?

[[:SENSe]:TOI:FREQuency:BASE:UPPer:AUTO OFF|ON|0|1

[[:SENSe]:TOI:FREQuency:BASE:UPPer:AUTO?

[Frequency Step Auto ON OFF]

See the [Frequency Step Auto ON/OFF] under [Frequency] of the sweep analysis function for more details.

[Frequency deviation]

See the [Frequency Offset] under [Frequency] of the sweep analysis function for more details.

5. 2. 9. 2. Amplitude/Y Axis

Pop up menus related to parameter setting of Amplitude/Y Axis, including [Reference Level], [Attenuator ►], [Preamplifier ON/OFF], [Scale/Division], [Auto Scale], [Menu 1/2 ►], [Y Axis Scale Unit], [Reference Level Offset].

Reference Level

- **Menu description:** to enable the Reference Level function. The reference level can be adjusted with the number keys, step keys or knob. The reference level corresponds to the top of the coordinate top. Measure signal at reference level position to get highest accuracy. The input attenuator of the signal/spectrum analyzer is coupled to the reference level, which can be automatically changed to avoid compression of input signal.
- **Key path:** [Amplitude/Y Axis], [Reference Level] on the front panel.
- **Status saved:** saved in the instrument status.

- **Factory preset:** 0dBm
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Default unit:** set based on Y Axis scale unit.
- **Program control commands:**
:DISPlay:TOI:VIEW:WINDow:TRACe:Y:RLEVel <real>
:DISPlay:TOI:VIEW:WINDow:TRACe:Y:RLEVel?
- **Examples:**
:DISPI:TOI:VIEW:WINDow:TRAC:Y:RLEVel 20dBm

[Attenuator ►]

See [Attenuator ►] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Preamplifier ON OFF]

See [Preamplifier ON/OFF] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Scale/Division]

- **Menu description:** to select the scale/division from 0.1dB/division to 20dB/division. This menu is only valid when the scale type is logarithm.
- **Key path:** [Amplitude/Y Axis], [Scale/Division] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 10.00 dB.
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Program control commands:**
:DISPlay:TOI:VIEW:WINDow:TRACe:Y:PDIVision <rel_amp>
:DISPlay:TOI:VIEW:WINDow:TRACe:Y:PDIVision?

[Auto Scale]

- **Menu description:** the instrument automatically sets parameters like reference level and scale/division based on input signal sizes. When this soft menu key is pressed, the instrument performs one auto scaling. Setting rule for auto scaling: when the [Auto Scale] menu is pressed, firstly obtain the maximum value and the minimum value based on current measurement trace data. Based on the maximum value, place on the 80% graticule of the screen trace Y axis for auto setting of reference level and scale/division.
- **Key path:** [Amplitude/Y Axis], [Auto Scale] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**
:TOI:ADJust:LEVel

[Y Axis Scale Unit]

- **Menu description:** to select the Y Axis unit from [dBm], [dBmV], [dBmA], [W], [V], [A], [dBμV] and [dBμA]. The instrument will

automatically calculate the trace data and marker readout based on the Y axis scale unit.

- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** dBm

:UNIT:TOI:POWer DBM|DBMV|DBMA|V|W|A|DBUV|DBUA

:UNIT:TOI:POWer?

[Reference Level Offset]

- **Menu description:** to introduce offset for all amplitude readout (e.g, reference level and marker amplitude). It will not change the trace position on the screen. This offset unit is dB and is not affected by the scale and unit. Use number keys, stepping keys or knob to input the offset value.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Reference Level Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0 dB.
- **Setting range:** Min.: -1000dB, Max.:1000dB.
- **Program control commands:**

:DISPlay:TOI:WINDow:TRACe:Y:RLEVel:OFFSet <rel_amp>

:DISPlay:TOI:WINDow:TRACe:Y:RLEVel:OFFSet?

- **Examples:**

:DISPI:TOI:WIND:TRAC:Y:RLEVel:OFFSet 12

5. 2. 9. 3. Span/X Axis

Press the [Span/X Axis] on the front panel to enable the span function and set the signal/spectrum analyzer into center frequency/span mode. Press the [Span] key to pop up [Span], [Full Span] and [Previous Span].

[Bandwith]

- **Menu description:** the span can be set by number keys, stepping keys or knob. Use number keys or select \[Zero Span] to set the span as zero.
- **Key path:** [Span/X Axis], [Span] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** maximum frequency limit - start frequency.
- **Setting range:** Min.: 10Hz, Max.: related to the maximum working frequency limit of the instrument.
- **Program control commands:**

:TOI:FREQUency:SPAN <freq>

:TOI:FREQUency:SPAN?

- **Examples:**

:TOI:FREQy:SPAN 10MHz

[Full Span]

- **Menu description:** to set the signal/spectrum analyzer into the center frequency/span mode. Set the span as maximum value.
- **Program control commands:**

:TOI:FREQuency:SPAN:FULL

[Previous Span]

- **Menu description:** to set the signal/spectrum analyzer back to the previous span.
- **Program control commands:**

:TOI:FREQuency:SPAN:PREVious

5. 2. 9. 4. Bandwidth

Pop up the soft menus for setting resolution bandwidth and video bandwidth, including [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF] and [Filter Type].

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to change the resolution bandwidth of spectrum analysis, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode.
- **Key path:** [Bandwidth], [Resolution Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

:TOI:BANDwidth <bandwidth>

:TOI:BANDwidth?

:TOI:BANDwidth:AUTO ON|OFF|1|0

:TOI:BANDwidth:AUTO?

- **Examples:**

:TOI:BAND 1kHz

:TOI:BAND:AUTO ON

[Video bandwidth Auto ON OFF]

- **Menu description:** to change the video bandwidth within the active function area, ranging from 1Hz to 20MHz, which is stepped by 1, 2, 3, 5 and 10. The resolution bandwidth can be changed with the number keys, step keys and knob. The shaded character indicates the currently selected mode. **Command description:** to change video bandwidth displayed at the active function zone ranging from 1Hz to 20MHz. When it is above 3MHz, take 4 MHz, 5 MHz, 6 MHz, 8 MHz, 10 MHz and 20 MHz; when it is between 1Hz and 3MHz, change by 10% step. Such value may be changed via number keys, stepping keys or the knob. The mode with a underline is the current mode. When set as Auto Off, press [Frequency Bandwidth Auto ON OFF] to select Auto ON and return to auto mode.

- **Key path:** [Bandwidth], [Video Bandwidth Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto, same as the Resolution Bandwidth setting.
- **Setting range:** Min.:1Hz, Max.: 20MHz.
- **Default unit:** Hz
- **Program control commands:**

:TOI:BANDwidth:VIDeo <bandwidth>

:TOI:BANDwidth:VIDeo?

:TOI:BANDwidth:VIDeo:AUTO ON|OFF|1|0

:TOI:BANDwidth:VIDeo:AUTO?

- **Examples:**

:TOI:BAND:VID 1 kHz

:TOI:BAND:VID:AUTO ON

[VBW/RBW Auto Manual]

- **Menu description:** to set the ratio between the current video bandwidth and resolution bandwidth with the default value as 1. As the resolution bandwidth changes, the video bandwidth changes to maintain this ratio. The ratio should be displayed on the input area and used for the coupling mode of those two kinds of bandwidth. When a new ratio is selected, change the video bandwidth to meet this new ratio and the resolution bandwidth should remain unchanged.
- **Key path:** [Bandwidth], [VBW/RBW Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** auto with VBW/RBW as 1.
- **Setting range:** Min.:0.0001, Max.: 300000.
- **Program control commands:**

[[:SENSe]:TOI:BANDwidth|BWIDth:VIDeo:RATio <number>

[[:SENSe]:TOI:BANDwidth|BWIDth:VIDeo:RATio?

- **Examples:**

:TOI:BAND:VID:RAT 2

[Span/RBW Auto ON OFF]

- **Menu description:** to set the ratio between the current span and resolution bandwidth and display it in the input area. This ratio is used in coupling mode of the resolution bandwidth.
- **Key path:** [Bandwidth], [Span RBW Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** auto with span/RBW as 106.
- **Setting range:** Min.:2, Max.: 10000.
- **Program control commands:**

[[:SENSe]:TOI:FREQuency:SPAN:BANDwidth[:RESolution]:RATio <integer>

[[:SENSe]:TOI:FREQuency:SPAN:BANDwidth[:RESolution]:RATio?

[[:SENSe]:TOI:FREQuency:SPAN:BANDwidth[:RESolution]:RATio:AUTO OFF|ON|0|1

[[:SENSe]:TOI:FREQuency:SPAN:BANDwidth[:RESolution]:RATio:AUTO?

5. 2. 9. 5. Auto Setting

Pop up the soft menu related to auto setting including [Couple All], [Mechanical Attenuator Auto ON OFF], [Resolution Bandwidth Auto ON OFF], [Video Bandwidth Auto ON OFF], [VBW/RBW Auto ON OFF], [Span/RBW Auto ON OFF], [Sweep Time Auto ON OFF] and [Frequency Step Auto ON OFF].

[Couple All]

- **Menu description:** to set the resolution bandwidth, video bandwidth, sweep time, mechanical attenuator and frequency step as auto coupling mode. The signal/spectrum analyzer will select most suitable values for those functions based on set frequency and bandwidth (or start frequency and stop frequency). If no ratio is pre- saved, use default ratio.
- **Key path:** [Auto Setting], [Couple All] on the front panel.
- **Status saved:** not saved in instrument status.
- **Factory preset:** Couple All.
- **Program control commands:**

:COUPle ALL

- **Examples:**

:COUP ALL

[Mechanical Attenuator Auto ON OFF]

See [Attenuator ►] under [Amplitude/Y Axis] for more details.

[Resolution Bandwidth Auto ON OFF]

See [Resolution Bandwidth Auto ON/OFF] under [Bandwidth] for more details.

[Video bandwidth Auto ON OFF]

See [Video Bandwidth Auto ON/OFF] under [Bandwidth] for more details.

[VBW/RBW Auto Manual]

See [VBW/RBW Auto ON/OFF] under [Bandwidth] for more details.

[Span/RBW Auto Manual]

See [Frequency Span/RBW Auto On/Off] under [Bandwidth] for more details.

[Scanning time Auto ON OFF]

See [Sweep Time Auto ON/OFF] under [Sweep] for more details.

[Lower frequency Auto ON OFF]

See [Lower Frequency Auto ON/OFF] under [Frequency] for more details.

[Upper frequency Auto ON OFF]

See [Upper Frequency Auto ON/OFF] under [Frequency] for more details.

[Frequency Step Auto ON OFF]

See [Frequency Step Auto ON/OFF] under [Frequency] for more details.

5. 2. 9. 6. Trace

Press [Trace] key on the front panel to pop up corresponding soft menu. Including [Refresh], [Average], [Max. Hold], [Min. Hold], [Display ON/OFF] [Menu 1/2 ►] and [Detector ►].

[Refresh]

- **Command description:** to set the current trace processing as Refresh, i.e., clear all data of displayed trace and continue the signal trace receipt under sweep status.
- **Key path:** [Trace], [Refresh] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** after all traces are selected, the trace mode is defaulted as Refresh.
- **Program control commands:**

```
:TRACe:TOI:TYPE WRITe|AVERAge|MAXHold|MINHold
```

```
:TRACe:TOI:TYPE?
```

[Averaging]

- **Command description:** to set the current trace processing method as Average, i.e., based on the average count N set in the [Measurement Setting], update trace after averaging the performance index of the measurement trace.
- **Key path:** [Trace], [Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

```
:TRACe:TOI:TYPE WRITe|AVERAge|MAXHold|MINHold
```

```
:TRACe:TOI:TYPE?
```

[Max. Hold]

- **Menu description:** to set the current trace processing method as maximum hold, i.e., the new trace data will be assigned with maximum value of previous measured trace data.
- **Key path:** [Trace], [Max Hold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

```
:TRACe:TOI:TYPE WRITe|AVERAge|MAXHold
```

```
:TRACe:TOI:TYPE?
```


[Detector ►]

Pop up soft menus related to setting the detector type for the currently selected trace, including [Auto], [Normal], [Positive Peak], [Sample], [Negative Peak], [Average ►], where, the average detector type includes video average, power average and voltage average.

[Auto]

- **Menu description:** to set the detector command for the currently selected trace as Auto. That means, the signal/spectrum analyzer will perform based on the parameter setting of currently selected trace.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Auto] on the front panel
- **Status saved:** saved in the instrument status.
- **Factory preset:** the trace detector type is Power Average.
- **Program control commands:**

```
:TOI:DETECTOR:AUTO ON|OFF|1|0
```

```
:TOI:DETECTOR:AUTO?
```

[Normal]

- **Menu description:** to set the detector command for the currently selected trace as Normal. i.e., display the measurement results of positive peak and negative peak at the same time to achieve display effect similar to the analog instrument.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Normal] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:TOI:DETECTOR:NORMAL|AVERAGE|POSITIVE|SAMPLE|NEGATIVE?
```

```
:TOI:DETECTOR?
```

[Positive Peak]

- **Menu description:** to set the detector command for the currently selected trace as Positive Peak. i.e., take the maximum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Positive Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:TOI:DETECTOR:NORMAL|AVERAGE|POSITIVE|SAMPLE|NEGATIVE?
```

```
:TOI:DETECTOR?
```

[Sample]

- **Menu description:** to set the detector command for the currently selected trace as Sample. i.e., take the last value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Sample] on the front panel.
- **Status saved:** saved in the instrument status.

- **Program control commands:**

:TOI:DETECTOR NORMAl|AVERAge|POSitive|SAMPlE|NEGative?

:TOI:DETECTOR?

[Negative Peak]

- **Menu description:** to set the detector command for the currently selected trace as Negative Peak. i.e., take the minimum value from sampling data assigned to each trace point.

- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Negative Peak] on the front panel.

- **Status saved:** saved in the instrument status.

- **Program control commands:**

:TOI:DETECTOR NORMAl|AVERAge|POSitive|SAMPlE|NEGative?

:TOI:DETECTOR?

[Average ▶ Video Average]

- **Menu description:** to set the detector command for the currently selected trace as Video Average. Also called Logarithm Power Average Detector, i.e., take the logarithm power average value for all data assigned to each trace point; earlier signal/spectrum analyzer generally displays the measurement trace of logarithm scale, and all filtering and averaging are based on the logarithm power data; the trace is generally called as video signal. After digital IF processing is adopted, to make measurement results same as the earlier signal/spectrum analyzer, the video average detector function is added.

- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Average ▶], [Video Average] on the front panel.

- **Status saved:** saved in the instrument status.

- **Program control commands:**

:TOI:DETECTOR NORMAl|AVERAge|POSitive|SAMPlE|NEGative?

:TOI:DETECTOR?

[Average ▶ Power Average]

- **Menu description:** to set the detector command for the currently selected trace as Power Average. Also called root mean square (RMS) detector. Calculate the root mean square of all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After square these voltage values, take sum and divide the count of sampling data points corresponding to each trace point. Finally, take square root. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those RMS values are trace data.

- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Average ▶], [Power Average] on the front panel.

- **Status saved:** saved in the instrument status.

- **Program control commands:**

:TOI:DETECTOR NORMAl|AVERAge|POSitive|SAMPlE|NEGative?

:TOI:DETECTOR?

[Average ▶ Average Voltage]

- **Menu description:** to set the detector command for the currently selected trace as Voltage Average. Also called average (AVG)

detector. Take linear average for all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After summing those voltage values, divide the number of sampling data points corresponding to each trace point. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those average values are trace data.

- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Voltage Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:TOI:DETECTOR NORMAl|AVERAge|POSitive|SAMPlE|NEGative?
```

```
:TOI:DETECTOR?
```

5. 2. 9. 7. Sweep

Enable scan-related parameter setup function to pop up corresponding soft menu, including [Sweep Time Auto On/Off] and [Sweep Points].

[Scanning time Auto ON OFF]

- **Menu description:** to change the sweep time of signal/spectrum analyzer by number keys, stepping keys or knob. When it is under Auto OFF mode (shaded), it indicates that sweep time can be set manually. When it is under Auto ON status, the sweep time will be automatically coupled based on resolution bandwidth, span and video bandwidth
- **Key path:** [Sweep], [Sweep Time Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep time Auto.
- **Setting range:** Min.: 1ms, Max.: 6000s.
- **Default unit:** s
- **Program control commands:**

```
:TOI:SWEEp:TIME <time>
```

```
:TOI:SWEEp:TIME?
```

```
:TOI:SWEEp:TIME:AUTO OFF|ON|0|1
```

```
:TOI:SWEEp:TIME:AUTO?
```

- **Examples:**

```
:TOI:SWE:TIME 500 ms
```

```
:TOI:SWE:TIME:AUTO OFF
```

[Number of scanning points]

- **Menu description:** to set the trace points.
- **Key path:** [Sweep], [Sweep Points] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1001.
- **Setting range:** 101-30001.

- **Program control commands:**

:TOI:SWEEp:POINts <integer>

:TOI:SWEEp:POINts?

5. 2. 9. 8. Single

- **Menu description:** the [Continuous Off] key on the front panel has no corresponding soft menu. This function is mainly used for manual trigger of one measurement. When the Average is ON, this function performs measurement at the count specified by the Average Count.

In remote control programming and system establishment, this function combined with *WAI can effectively synchronize the measurement process and enable the trace data obtained after the *WAI finishes directly correspond to the measurement process one by one.

- **Program control commands:**

:INITiate:TOI

5. 2. 9. 9. Continuous

The [Continuous] key on the front panel has no corresponding soft menu. This is mainly used for changing the Measurement Continuous OFF to Measurement Continuous ON; if the current state is Measurement Continuous ON, the instrument performs no operation.

- **Program control commands:**

:INITiate:CONTInuous ON

5. 2. 9. 10. Trigger

See [Trigger] menu of the sweep analysis function for more details.

5. 2. 9. 11. Display

Pop up soft menus related to display, including [Display Line ON OFF], [Bar Graph ON OFF], [Display Configuration ►].

[Display Line On Off]

See [Display Line ON/OFF] under [Display] of the sweep analysis function for more details.

[Display Configuration ►]

It is used for configurations of interface language, status area display on interface. The soft menus include [Select Language Chinese English], [Graticule Display ON OFF], [Status Area Display ON OFF], [Frequency Information Display ON OFF]. See [Display Configuration ►] under [Display] of the sweep analysis function for more details.

5. 2. 9. 12. Input Output

See the [Input Output] menu of the sweep analysis function for more details.

5. 2. 9. 13. Marker

Pop up the soft menu related to markers, including [Marker Select ►], [Normal Markers], [Delta Marker], [Fixed Marker], [Marker OFF], [Marker Attribute ►], [Marker Couple ON OFF], and [All Markers OFF].

[Marker Select ► Marker 1]

- **Command description:** to select among 12 different markers of the analyzer. When one marker is selected, the menu will

indicate the current marker and the type and the attribute of the selected marker can be set. Select and trigger another marker and place it at the center of the current trace. Users can read amplitude and frequency information (when the frequency span is 0 Hz, time information will be displayed) at the marker display area at the top right corner of the screen.

- **Key path:** [Marker], [Marker Select ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Marker 1.

[Normal Marker]

- **Menu description:** to set the selected marker as the Normal Marker.
- **Key path:** [Marker], [Normal Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE POSition

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Delta Marker]

- **Menu description:** to set the selected marker as the Delta Marker. Display the amplitude difference and frequency difference (or time difference, when span is zero) between two markers at the marker display area at the top right corner of the screen. If there exists a single marker, a [Delta Marker] operation will generate a reference marker in the active marker position. Move the active marker through the knob, stepping keys or number keys. The display amplitude difference unit is dB.
- **Key path:** [Marker], [Delta Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE DELTa

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Fixed Marker]

- **Menu description:** to set the selected marker as the Fixed Marker. The X Axis and Y Axis positions of the fixed marker are fixed. The Fixed Marker can be used as reference marker.
- **Key path:** [Marker], [Fixed Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE FIXed

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker OFF]

- **Menu description:** to turn off the selected marker.
- **Key path:** [Marker], [Marker Off] on the front panel.
- **Status saved:** saved in the instrument status.

- **Program control commands:**

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE OFF

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker Attribute ►]

Pop up the corresponding menu of currently selected marker attribute setup, including [Reference Marker ►], [X Axis Scale Auto ON OFF], [Marker Trace ►] and [Marker Display Line ON OFF].

[Reference Marker ►]

- **Menu description:** to select reference marker for current marker. It can be any one from 11 markers except the currently selected marker.
- **Key path:** [Marker], [Marker Attribute ►], [Reference Marker ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence <integer>

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence?

[Marker Display Line ►] On Off

- **Menu description:** to set whether the current marker is displayed as a line on the screen, which is easy to observe.
- **Key path:** [Marker], [Marker Attribute ►] and [Marker Display Line On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate: TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINes[:STATe] OFF|ON|0|1

:CALCulate: TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINes[:STATe]?

[All Markers OFF]

- **Menu description:** to turn off all current markers which are ON and related soft keys, e.g. [Noise Marker].
- **Key path:** [Marker], [Menu 1/2 ►], [All Markers OFF] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:TOI:MARKer:AOFF

5. 2. 9. 14. Marker->

This key has no soft menu.

5. 2. 9. 15. Marker Function

This key has no soft menu.

5. 2. 9. 16. Peak

The [Peak Search] key on the front panel is used for turning on the peak search for traces by the control instrument and turning on marker for display, including [Next Peak], [Next Peak Right], [Next Peak Left].

Program control commands:

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum

[Next Peak]

- **Menu description:** Taking the Amplitude of the point where the current marker is located, search for the next peak of current test trace.
- **Key path:** [Peak], [Next Peak] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:NEXT

[Next Peak Right]

- **Menu description:** to search for the peak to the right of the current test trace marker position.
- **Key path:** [Peak], [Next Peak Right] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:RIGHT

[Next Peak Left]

- **Menu description:** to search for the peak to the left of the current test trace marker position.
- **Key path:** [Peak], [Next Peak Left] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:TOI:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:LEFT

5. 2. 9. 17. Measurement Setting

Pop up the soft menu related to measurement setting including [Average Count On/Off], [Average State Exponential Repeat], [Zero Span Status ▶], [Low Noise Path On/Off], [Preselector Bypass], [RF Gain ▶], [ADC Dither Auto On/Off] and [Measurement Reset].

[Average frequency On Off]

- **Menu description:** to turn on or off Average. When Average Count is ON, the user can specify the average count required for measurement. The Average Count can be adjusted by number keys, stepping keys or knob.
- **Key path:** [Measurement Setting], [Average Count ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100/OFF
- **Setting range:** 1 - 10000

- **Default unit:** none
- **Program control commands:**

[[:SENSe]:TOI:AVERAge:COUNT <integer>

[[:SENSe]:TOI:AVERAge:COUNT?

[[:SENSe]:TOI:AVERAge[:STATe] ON|OFF|1|0

[[:SENSe]:TOI:AVERAge[:STATe]?

[Average State Exponential Repeat]

- **Menu description:** when Average Count is ON, the user can select Average State required for measurement.

Exponential - Different from Linear Average, in Exponential State, the weight of new data is larger than that of old data. This is good for tracking data change in terms of time. In this case, the selected averaging count determines the weight of the old data on the new data. As the average count increases, the weight of new data gradually decreases. This is good for tracking data change in terms of time. In this case, the selected averaging count determines the weight of the old data on the new data. As the average count increases, the weight of new data gradually decreases.

Repeat - Similarly, it takes exponential averaging. However, when the average count is met, clear all previous results, restart average till the set average count and repeat this process.

- **Key path:** [Measurement Setting], [Average State Exponential Repeat] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Exponential
- **Program control commands:**

[[:SENSe]:TOI:AVERAge:TCONtrol EXPonential|REPeat

[[:SENSe]:TOI:AVERAge:TCONtrol?

[Zero Span State ▶]

- **Menu description:** to select zero span measurement method and set parameters for measurement.
- **Key path:** [Measurement Setting] and [Zero Span State ▶] on the front panel.
- **Program control commands:**

[[:SENSe]:TOI:AVERAge:TCONtrol EXPonential|REPeat

[[:SENSe]:TOI:AVERAge:TCONtrol?

[Zero Span Measurement] On Off]

- **Menu description:** to turn on or off zero span measurement method and set parameters for measurement. Users may specify resolution bandwidth and residence time required for the measurement.
- **Key path:** [Measurement Setting], [Zero Span State ▶] and [Zero Span Measurement On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF
- **Program control commands:**

[[:SENSe]:TOI:ZSPan:STATe ON|OFF|1|0) [[:SENSe]:TOI:ZSPan:STATe?

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to set resolution bandwidth state of the instrument during zero span measurement. If the resolution bandwidth is set to Auto ON, the optimal setting is determined by the instrument. When the resolution bandwidth is set as auto off, users may define the bandwidth and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Zero Span State ►], [Resolution Bandwidth Auto On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 3MHz/Auto
- **Setting range:** 1Hz - 20MHz
- **Default unit:** Hz
- **Program control commands:**

```
[:SENSe]:TOI:ZSPan:BANDwidth|BWIDth <frequency>
```

```
[:SENSe]:TOI:ZSPan:BANDwidth|BWIDth?
```

```
[:SENSe]:TOI:ZSPan:BANDwidth|BWIDth:AUTO OFF|ON|0|1
```

```
[:SENSe]:TOI:ZSPan:BANDwidth|BWIDth:AUTO?
```

[Residence time Auto ON OFF]

- **Menu description:** to set residence time of signals during zero span measurement as auto on/off and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Zero Span State ►] and [Residence Time Auto On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100/OFF
- **Setting range:** 1us - 6000s
- **Default unit:** s
- **Program control commands:**

```
[:SENSe]:TOI:ZSPan:SWEep:TIME <time>
```

```
[:SENSe]:TOI:ZSPan:SWEep:TIME?
```

```
[:SENSe]:TOI:ZSPan:SWEep:TIME:AUTO OFF|ON|0|1
```

```
[:SENSe]:TOI:ZSPan:SWEep:TIME:AUTO?
```

[Low Noise Path On Off]

- **Menu description:** this menu is only available when the H34 option (Low Noise Preamplifier) is purchased. When the preamplifier is ON, the Low Noise Path is OFF and this menu is grayed out; when the preamplifier is OFF, this menu lights on and is switchable.
- **Key path:** [Measurement Setting], [Menu 1/2], [Low Noise Path ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

```
:TOI:POWer:MW:PATH STD|LNPath
```

:TOI:POWer:MW:PATH?

[Preselector Preselecting Bypass]

- **Menu description:** this menu is only available when the H36 option is purchased. It is used for setting whether to bypass the front-end preselector of the signal/spectrum analyzer. In analyzing bandwidth signal, bypass is usually required.
- **Key path:** [Measurement Setting], [Menu 1/2], [Preselector Preselecting Bypass] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

INPut:TOI:FiLTeR:YIG[:STATe] OFF|ON|0|1 INPut:TOI:FiLTeR:YIG[:STATe]?

[RF Gain ►]

- **Menu description:** to set the Auto ON/OFF of the RF Gain and best allocation algorithm for RF Gain. The soft menus includes [Auto], [Best Dynamic Range] and [Best Sensitivity].
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:TOI:RF:GAIN:AUTO OFF|ON|0|1

:TOI:RF:GAIN:AUTO?

:TOI:RF:GAIN:AUTO:RULeS RANGE|SENSITIVITY

:TOI:RF:GAIN:AUTO:RULeS?

[Auto]

- **Menu description:** to set the RF Gain distribution algorithm to Auto. In this case, the RF Gain distribution is "Best Dynamic Range".
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Auto] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Dynamic Range]

- **Menu description:** to set the RF Gain distribution algorithm to Best Dynamic Range. In this case, the RF Gain is switched to "Auto OFF".
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Best Dynamic Range] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Sensitivity]

- **Menu description:** to set the RF Gain distribution algorithm to Best Sensitivity. In this case, the RF Gain is switched to "Auto OFF".
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Best Sensitivity] on the front panel.
- **Status saved:** saved in the instrument status.

[ADC Dither Auto ON OFF]

- **Menu description:** to control opening/closing of ADC dither of the frequency acquisition circuit in the analyzer. Under default mode, the signal/spectrum analyzer will automatically control whether the ADC Dither is ON based on current working condition. When the ADC Dither is under Auto mode, the ON or OFF status depends on the span, resolution bandwidth and sweep type (continuous swept or step sweep); when it is continuous swept, the ADC Dither status will force to switch to Auto and turns off; when it is step sweep, under Auto mode, if the span is 2MHz or below, the ADC Dither is ON; if the span is below 2MHz, the ADC Dither is OFF. Under Auto OFF mode, if the span is above 2MHz, turning on the ADC Dither may affect the measurement results based on selected dither status. You can access the submenu for manual control.
- **Key path:** [Measurement Setting], [Menu 1/2], [ADC Dither Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**
 - [:SENSe]:TOI:ADC:DITHer[:STATe] OFF|ON|HIGH
 - [:SENSe]:TOI:ADC:DITHer[:STATe]?
 - [:SENSe]:TOI:ADC:DITHer:AUTO[:STATe] OFF|ON|0|1
 - [:SENSe]:TOI:ADC:DITHer:AUTO[:STATe]?

[Measurement Reset]

- **Menu description:** to reset the measurement parameters to the factory preset status or user saved parameter status
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Measurement Reset] on the front panel.
- **Factory preset:** factory reset.
- **Program control commands:**

:CONFigure:TOI

5. 2. 9. 18. Measurement Control

Pop up the menu related to measurement control, including [Measurement Continuous ON OFF], [Restart Measurement] and [Pause/Resume].

[Measurement Continuous ON OFF]

- **Menu description:** to set continuous measurement OFF or ON. When [Measurement Continuous On/Off] is pressed, Continuous On will be triggered and continuous sweep will be the default measurement control method; when Continuous Off is selected, single measurement will be triggered. Press [Sweep Continuous OFF] to restart sweep when the next trigger signal arrives.
- **Key path:** [Measurement Control], [Measurement Continuous ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Continuous On.
- **Program control commands:**

:INITiate:CONTInuous OFF|ON|0|1

:INITiate:CONTInuous?

- **Examples:**

:INIT:CONT OFF

[Restart Measurement]

- **Menu description:** to stop current measurement and restart measurement for the signal/spectrum analyzer.
- **Key path:** [Measurement Control], [Restart Measurement] on the front panel
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:REST

[Pause/Resume]

- **Menu description:** when the signal/spectrum analyzer is in operation, this menu is used for pausing current measurement; when in Paused status, this menu is used for continuing measurement.
- **Key path:** [Measurement Control], [Pause/Resume] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:PAUS

:INITiate:RES

5. 2. 10. Spurious emission

5. 2. 10. 1. frequency

This key has no soft menu.

5. 2. 10. 2. Amplitude/Y Axis

Pop up menus related to parameter setting of Amplitude/Y Axis, including [Reference Level], [Attenuator ►], [Preamplifier ON/OFF], [Scale/Division], [Auto Scale], [Menu 1/2 ►], [Y Axis Scale Unit], [Reference Level Offset].

Reference Level

- **Menu description:** to enable the Reference Level function. The reference level can be adjusted with the number keys, step keys or knob. The reference level corresponds to the top of the coordinate top. Measure signal at reference level position to get highest accuracy. The input attenuator of the signal/spectrum analyzer is coupled to the reference level, which can be automatically changed to avoid compression of input signal.
- **Key path:** [Amplitude/Y Axis], [Reference Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0dBm
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Default unit:** set based on Y Axis scale unit.
- **Program control commands:**

:DISPlay:SPURious:VIEW:WINDow:TRACe:Y:RLEVel <real>

:DISPlay:SPURious:VIEW:WINDow:TRACe:Y:RLEVel?

- **Examples:**

:DISP:SPUR:VIEW:WIND:TRAC:Y:RLEV 20dBm

[Attenuator ►]

See [Attenuator ►] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Preamplifier ON OFF]

See [Preamplifier ON/OFF] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Scale/Division]

- **Menu description:** to select the scale/division from 0.1dB/division to 20dB/division. This menu is only valid when the scale type is logarithm.
- **Key path:** [Amplitude/Y Axis], [Scale/Division] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 10.00 dB.
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Program control commands:**

:DISPlay:SPURious:VIEW:WINDow:TRACe:Y:PDIVision <rel_ampl>

:DISPlay:SPURious:VIEW:WINDow:TRACe:Y:PDIVision?

[Y Axis Scale Unit]

- **Menu description:** to select the Y Axis unit from [dBm], [dBmV], [dBmA], [W], [V], [A], [dB μ V] and [dB μ A]. The instrument will automatically calculate the trace data and marker readout based on the Y axis scale unit.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** dBm

:UNIT:SPURious:POWer DBM|DBMV|DBMA|V|W|A|DBUV|DBUA

:UNIT:SPURious:POWer?

[Reference Level Offset]

- **Menu description:** to introduce offset for all amplitude readout (e.g, reference level and marker amplitude). It will not change the trace position on the screen. This offset unit is dB and is not affected by the scale and unit. Use number keys, stepping keys or knob to input the offset value.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Reference Level Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0 dB.
- **Setting range:** Min.: -1000dB, Max.:1000dB.
- **Program control commands:**

:DISPlay:SPURious:WINDow:TRACe:Y:RLEVel:OFFSet <rel_ampl>

:DISPlay:SPURious:WINDow:TRACe:Y:RLEVel:OFFSet?

- **Examples:**

:DISP:SPUR:WIND:TRAC:Y:RLEV:OFFS 12

5. 2. 10. 3. Span/X Axis

This key has no soft menu.

5. 2. 10. 4. Bandwidth

This key has no soft menu.

5. 2. 10. 5. Auto Setting [Couple All]

- **Menu description:** to set the resolution bandwidth, video bandwidth, sweep time, mechanical attenuator and frequency step as auto coupling mode. The signal/spectrum analyzer will select most suitable values for those functions based on set frequency and bandwidth (or start frequency and stop frequency). If no ratio is pre- saved, use default ratio.
- **Key path:** [Auto Setting], [Couple All] on the front panel.
- **Status saved:** not saved in instrument status.
- **Factory preset:** Couple All.
- **Program control commands:**

:COUPle ALL|NONE

- **Examples:**

:COUP ALL

5. 2. 10. 6. Trace

This key has no soft menu.

5. 2. 10. 7. Sweep

Enable sweep-related parameter setup function to pop up [Sweep Setting ►].

[Scanning setting ►]

Pop up the soft menu related to Sweep type, including [Sweep Type Auto ON OFF], [Sweep Type Rules Auto ON OFF] and [FFT Width Auto ON OFF].

[Scanning type ► Auto ON OFF]

- **Menu description:** to set sweep type. is used to determine whether Swept or FFT is adopted for the signal/spectrum analyzer. Also set the FFT step bandwidth for FFT sweep. The soft menus include [Auto], [Swept] and [FFT]. When under Auto ON mode, the signal/spectrum analyzer will automatically select the sweep type based on sweep type rules.
- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep type: Auto.
- **Program control commands:**

:SPURious:SWEep:TYPE FFT|SWEep

:SPURious:SWEep:TYPE?

:SPURious:SWEep:TYPE:AUTO OFF|ON|0|1

:SPURious:SWEep:TYPE:AUTO?

[Sweep Type Rules Auto ON OFF]

- **Menu description:** to set rules for auto sweep type. While the sweep type rules include "Best Dynamic Range" and " Best Speed".
 - "Best Dynamic Range" rules: when RBW is or larger than 1kHz, the sweep type is Swept; when RBW is less than 1kHz, the sweep type is FFT.
 - "Best Speed" rules: when RBW is or larger than 30kHz, the sweep type is Swept; when RBW is less than 30kHz, the sweep type is FFT.
- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Rules Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** the sweep type rules are automatically set as "Best Dynamic Range".
- **Program control commands:**

:SPURious:SWEep:TYPE:AUTO:RULEs SPEEd|DRANge

:SPURious:SWEep:TYPE:AUTO:RULEs?

:SPURious:SWEep:TYPE:AUTO:RULEs:AUTO OFF|ON|0|1

:SPURious:SWEep:TYPE:AUTO:RULEs:AUTO?

[FFT Width Auto ON OFF]

- **Menu description:** to set FFT Width. The FFT width includes [Auto], [<100kHz], [<3MHz], [<13MHz], [<=Max.]. FFT width is only active when the FFT sweep type is selected. Under Auto type, when the signal/spectrum analyzer performs FFT spectrum measurement, the maximum resolution bandwidth is 30kHz. To guarantee best dynamic measurement range, the signal/spectrum analyzer automatically optimizes the FFT width within 100kHz. The larger is the FFT width, the faster is FFT spectrum measurement, but the dynamic range performance will be affected.

Under FFT sweep, the FFT width setup limits the maximum value for center frequency step of each tune. For example, if [<100Hz] is selected, the maximum value for center frequency step of each tune is 100Hz. As the FFT width gets larger, the count of instrument center frequencies get smaller when performing measurement of same frequency scope, and the response measurement gets faster. Therefore, to improve measurement speed, you can manually change the FFT width.

- **Key path:** [Sweep], [Sweep Setting ►], [FFT Width ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** FFT Width is set as Auto.
- **Program control commands:**

:SPURious:SWEep:FFT:WIDTh <real>

:SPURious:SWEep:FFT:WIDTh?

:SPURious:SWEep:FFT:WIDTh:AUTO OFF|ON|0|1

:SPURious:SWEep:FFT:WIDTh:AUTO?

5. 2. 10. 8. Single

- **Menu description:** the [Continuous OFF] key on the front panel has no corresponding soft menu. This function is mainly used for manual trigger of a measurement. When the Average is ON, this function performs the measurements at the count specified by the average count. In remote control programming and system establishment, this function combined with *WAI can effectively synchronize the measurement process and enable the trace data obtained after the *WAI finishes directly correspond to the measurement process one by one.

- **Program control commands:**

:INITiate:SPURious

5. 2. 10. 9. Continuous

The [Continuous] key on the front panel has no corresponding soft menu. This is mainly used for changing the Measurement Continuous OFF to Measurement Continuous ON; if the current state is Measurement Continuous ON, the instrument performs no operation.

- **Program control commands:**

:INITiate:CONTinuous ON

5. 2. 10. 10. Trigger

See [Trigger] menu of the sweep analysis function for more details.

5. 2. 10. 11. Display

Pop up soft menus related to display, including [Display Line ON OFF], [Bar Graph ON OFF], [Display Configuration ▶].

[Display Line On Off]

See [Display Line ON/OFF] under [Display] of the sweep analysis function for more details.

[Display Configuration ▶]

It is used for configurations of interface language, status area display on interface. The soft menus include [Select Language Chinese English], [Graticule Display ON OFF], [Status Area Display ON OFF], [Frequency Information Display ON OFF]. See [Display Configuration ▶] under [Display] of the sweep analysis function for more details.

5. 2. 10. 12. Input Output

See the [Input Output] menu of the sweep analysis function for more details.

5. 2. 10. 13. Marker

Pop up the soft menu related to markers, including [Marker Select ▶], [Normal Markers], [Delta Marker], [Fixed Marker], [Marker OFF], [Marker Attribute ▶], [Marker Couple ON OFF], and [All Markers OFF].

[Marker Select ▶ Marker 1]

- **Command description:** to select among 12 different markers of the analyzer. When one marker is selected, the menu will indicate the current marker and the type and the attribute of the selected marker can be set. Select and trigger another marker and place it at the center of the current trace. Users can read amplitude and frequency information (when the frequency span is 0 Hz, time information will be displayed) at the marker display area at the top right corner of the screen.
- **Key path:** [Marker], [Marker Select ▶] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Marker 1.

[Normal Marker]

- **Menu description:** to set the selected marker as the Normal Marker.
- **Key path:** [Marker], [Normal Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE POSition

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Delta Marker]

- **Menu description:** to set the selected marker as the Delta Marker. Display the amplitude difference and frequency difference (or time difference, when span is zero) between two markers at the marker display area at the top right corner of the screen. If there exists a single marker, a [Delta Marker] operation will generate a reference marker in the active marker position. Move the active marker through the knob, stepping keys or number keys. The display amplitude difference unit is dB.
- **Key path:** [Marker], [Delta Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE DELTa

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Fixed Marker]

- **Menu description:** to set the selected marker as the Fixed Marker. The X Axis and Y Axis positions of the fixed marker are fixed. The Fixed Marker can be used as reference marker.
- **Key path:** [Marker], [Fixed Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE FIXed

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker OFF]

- **Menu description:** to turn off the selected marker.
- **Key path:** [Marker], [Marker Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE OFF

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker Attribute ►]

Pop up the corresponding menu of currently selected marker attribute setup, including [Reference Marker ►], [X Axis Scale Auto

ON OFF], [Marker Trace ►] and [Marker Display Line ON OFF].

[Reference Marker ►]

- **Menu description:** to select reference marker for current marker. It can be any one from 11 markers except the currently selected marker.
- **Key path:** [Marker], [Marker Attribute ►], [Reference Marker ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence <integer>

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:REFerence?

[Marker Display Line ►] On Off]

- **Menu description:** to set whether the current marker is displayed as a line on the screen, which is easy to observe.
- **Key path:** [Marker], [Marker Attribute ►] and [Marker Display Line On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate: SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINES[:STATe] OFF|ON|0|1

:CALCulate: SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:LINES[:STATe]?

[Marker Couple On Off]

- **Menu description:** to turn on or off Marker Couple. When it is ON, moving any marker horizontal axis position will cause an equal movement of horizontal axis position of every other marker which is ON. When the marker is moved to less than Start Frequency or larger than Stop Frequency, the marker is limited to the value of the Start Frequency or the Stop Frequency; when the span is zero, the minimum value is limited as 0, and the maximum value is limited as the Sweep Time.
- **Key path:** [Marker], [Menu 1/2 ►], [Marker Couple ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** OFF.
- **Program control commands:**

:CALCulate:SPURious:MARKer:COUPle[:STATe] ON|OFF|1|0

:CALCulate:SPURious:MARKer:COUPle[:STATe]?

[All Markers OFF]

- **Menu description:** to turn off all current markers which are ON and related soft keys, e.g. [Noise Marker].
- **Key path:** [Marker], [Menu 1/2 ►], [All Markers OFF] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:SPURious:MARKer:AOFF

5. 2. 10. 14. **Maker->**

This key has no soft menu.

5. 2. 10. 15. **Marker Function**

This key has no soft menu.

5. 2. 10. 16. **Peak**

The [Peak Search] key on the front panel is used for turning on the peak search for traces by the control instrument and turning on marker for display, including [Next Peak], [Next Peak Right], [Next Peak Left].

- **Program control commands:**

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum

[Next Peak]

- **Menu description:** Taking the Amplitude of the point where the current marker is located, search for the next peak of current test trace.
- **Key path:** [Peak], [Next Peak] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:NEXT

[Next Peak Right]

- **Menu description:** to search for the peak to the right of the current test trace marker position.
- **Key path:** [Peak], [Next Peak Right] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:RIGHT

[Next Peak Left]

- **Menu description:** to search for the peak to the left of the current test trace marker position.
- **Key path:** [Peak], [Next Peak Left] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MAXimum:LEFT

[Min Search]

- **Menu description:** to turn on the Min Search.
- **Key path:** [Peak Search], [Min Search] on the front panel.
- **Program control commands:**

:CALCulate:SPURious:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MINimum

5. 2. 10. 17. Measurement Setting

Pop up the soft menu related to measurement setting including [Average Count On/Off], [Average State Exponential Repeat], [Zero Span Status ►], [Report Mode], [Low Noise Path On/Off], [Preselector Bypass], [RF Gain ►], [ADC Dither Auto On/Off] and [Measurement Reset].

[Average frequency On Off]

- **Menu description:** to turn on or off Average. When Average Count is ON, the user can specify the average count required for measurement. The Average Count can be adjusted by number keys, stepping keys or knob.
- **Key path:** [Measurement Setting], [Average Count ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100/OFF
- **Setting range:** 1 - 10000
- **Default unit:** none
- **Program control commands:**

```
[:SENSe]:SPURious:AVERage:COUNT <integer>
```

```
[:SENSe]:SPURious:AVERage:COUNT?
```

```
[:SENSe]:SPURious:AVERage[:STATe] ON|OFF|1|0
```

```
[:SENSe]:SPURious:AVERage[:STATe]?
```

[Average State Exponential Repeat]

- **Menu description:** when Average Count is ON, the user can select Average State required for measurement.

Exponential - Different from Linear Average, in Exponential State, the weight of new data is larger than that of old data. This is good for tracking data change in terms of time. In this case, the selected averaging count determines the weight of the old data on the new data. As the average count increases, the weight of new data gradually decreases. This is good for tracking data change in terms of time. In this case, the selected averaging count determines the weight of the old data on the new data. As the average count increases, the weight of new data gradually decreases.

Repeat - Similarly, it takes exponential averaging. However, when the average count is met, clear all previous results, restart average till the set average count and repeat this process.

- **Key path:** [Measurement Setting], [Average State Exponential Repeat] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Exponential
- **Program control commands:**

```
[:SENSe]:SPURious:AVERage:TCONtrol EXPOnential|REPeat
```

```
[:SENSe]:SPURious:AVERage:TCONtrol?
```

[Range List ►]

- **Menu description:** to configure parameters of 20 range lists and switch them to continuous sweep mode. The instrument will set current parameter state of Range 1 (on or off). If certain current range is off, parameters in such range list will be replaced with "----", representing non-active state of the current range.

- **Key path:** [Measurement Setting], [Range List ►] on the front panel.
- **Status saved:** saved in the instrument status.

[Range On Off]

- **Menu description:** to configure parameters of the Range List. When the range is off, it will be used as part of the measurement, otherwise such range will not be measured. The range can be adjusted via number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Range List ►], [Range On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1/OFF
- **Setting range:** 1 - 20
- **Default unit:** none
- **Program control commands:**

[::SENSe]:SPURious[:RANGe][:LIST]:STATe ON|OFF|1|0,...

[::SENSe]:SPURious[:RANGe][:LIST]:STATe?

[Starting frequency]

- **Menu description:** to set start frequency of the current range. Users may use number keys, stepping keys and the knob to set it.
- **Key path:** [Measurement Setting] [Range List ►], [Start Frequency] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.92GHz
- **Setting range:** $-1.0E^{+8}$ - , set the maximum frequency of the instrument.
- **Default unit:** Hz
- **Program control commands:**

[::SENSe]:SPURious[:RANGe][:LIST]:FREQuency:START<freq>,...

[::SENSe]:SPURious[:RANGe][:LIST]:FREQuency:START?

[Freq Stop]

- **Menu description:** to set stop frequency of the current range. Users may use number keys, stepping keys and the knob to set it.
- **Key path:** [Measurement Setting] [Range List ►], [Stop Frequency] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.98GHz
- **Setting range:** $-1.0E^{+8}$ - , set the maximum frequency of the instrument.
- **Default unit:** Hz
- **Program control commands:**

[::SENSe]:SPURious[:RANGe][:LIST]:FREQuency:STOP <freq>,...

[::SENSe]:SPURious[:RANGe][:LIST]:FREQuency:STOP?

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to set resolution bandwidth state of the instrument during zero span measurement. If the resolution bandwidth is set to Auto ON, the optimal setting is determined by the instrument. When the resolution bandwidth is set as auto off, users may define the bandwidth and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Range List ►], [Resolution Bandwidth Auto On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 3MHz/Auto
- **Setting range:** 1Hz - 20MHz
- **Default unit:** Hz
- **Program control commands:**

[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth[:RESolution] <freq>,...

[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth[:RESolution]?

[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth[:RESolution]:AUTO OFF|ON|0|1,...

[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth[:RESolution]:AUTO?

[Video bandwidth Auto ON OFF]

- **Menu description:** to set video bandwidth state of the instrument during zero span measurement. If the video bandwidth is set to Auto ON, the optimal setting is determined by the instrument. When the video bandwidth is set as auto off, users may define the bandwidth and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Range List ►], [Video Bandwidth Auto On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 3MHz/Auto
- **Setting range:** 1Hz - 20MHz
- **Default unit:** Hz
- **Program control commands:**

[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:VIDeo <freq>,...

[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:VIDeo?

[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:VIDeo:AUTO OFF|ON|0|1,...

[Filter Type ►]

- **Menu description:** to set filter type of resolution bandwidth measurement.
- **Key path:** [Measurement Setting], [Range List ►], [Filter Type ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Gaussian
- **Program control commands:**

[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:SHAPE|Gaussian|FLATtop,...

[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:SHAPE?

[Gaussian]

- **Menu description:** to select the Bandwidth Filter Type as Gaussian.
- **Key path:** [Measurement Setting], [Range List ►], [Filter Type ►], [Gaussian] on the front panel.

[Top Flat]

- **Menu description:** to select the Bandwidth Filter Type as Top Flat.
- **Key path:** [Measurement Setting], [Range List ►], [Filter Type ►], [Top Flat] on the front panel.

[Absolute Start Limit]

- **Menu description:** to set limit start value and the same stop value. Spurious information above the limit value will be recorded in the result report based on currently set peak offset and peak threshold. If measured spurious amplitude is above the start limit value, such amplitude will be added with a red F in the end. Users may use number keys, stepping keys or the knob to set the limit.
- **Key path:** [Measurement Setting], [Range List ►], [Menu 1/3 ►], [Absolute Start Limit] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -50dBm
- **Setting range:** -200dBm - 50dBm
- **Default unit:** dBm.
- **Program control commands:**

:CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer]:DATA[:START] <ampl>,...

:CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer]:DATA[:START]?

[Absolute Stop Limit Auto ON OFF]

- **Menu description:** to set limit stop value. Spurious information above the limit value will be recorded in the result report based on currently set peak offset and peak threshold. If measured spurious amplitude is above the start limit value, such amplitude will be added with a red F in the end. Under auto mode, the instrument will automatically couple a value same with the set start value; while under auto off mode, users may use number keys, stepping keys or the knob to set the limit.
- **Key path:** [Measurement Setting], [Range List ►], [Menu 1/3 ►], [Absolute Stop Limit] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -50dBm
- **Setting range:** -200dBm - 50dBm
- **Default unit:** dBm.
- **Program control commands:**

:CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer]:DATA:STOP <ampl>,...

:CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer]:DATA:STOP?

:CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer]:DATA:STOP:AUTO OFF|ON|0|1,...

:CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer]:DATA:STOP:AUTO?

[Peak Definition]

- **Menu description:** to set the minimum amplitude change of the signal at peak point. For example, if the peak excursion is 6 dB, it means that points more than 6 dB higher or lower than the peak threshold will be considered as peak points. Users may use number keys, stepping keys or the knob to set.
- **Key path:** [Measurement Setting], [Range List ▶], [Menu 1/3 ▶], [Peak Excursion] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 6 dB.
- **Setting range:** 0.0dB - 100.0dB
- **Default unit:** dB.
- **Program control commands:**

```
[::SENSe]:SPURious[:RANGe][:LIST]:PEAK:EXCursion <rel_ampl>,...
```

```
[::SENSe]:SPURious[:RANGe][:LIST]:PEAK:EXCursion?
```

[Peak Threshold]

- **Menu description:** to set the minimum amplitude value of the signal at peak point. For example, if the peak threshold is -90 dBm, only points meeting the peak excursion and with an amplitude more than -90 dBm will be considered as peak points. Users may use number keys, stepping keys or the knob to set.
- **Key path:** [Measurement Setting], [Range List ▶], [Menu 1/3 ▶], [Peak Threshold] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 6 dB.
- **Setting range:** -200.0 dBm - reference level
- **Default unit:** dBm.
- **Program control commands:**

```
[::SENSe]:SPURious[:RANGe][:LIST]:PEAK:THReshold <real>,...
```

```
[::SENSe]:SPURious[:RANGe][:LIST]:PEAK:THReshold?
```

[Attenuation Auto Manual]

- **Menu description:** to adjust the input attenuator via number keys, stepping keys or the knob. The decrement ranges from 0 - 70 dB and increases and decreases at a rate of 10 dB (or 2 dB if set as 2 dB). Users may use number keys, stepping keys or the knob to set.
- **Key path:** [Measurement Setting], [Range List ▶], [Menu 1/3 ▶], [Attenuator Auto On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 10 dB/auto
- **Setting range:** 0dB - 70dB
- **Default unit:** dB.
- **Program control commands:**

```
[::SENSe]:SPURious[:RANGe][:LIST]:ATTenuation <rel_ampl>,...
```


[SENSe]:SPURious[:RANGe][:LIST]:ATTenuation?

[SENSe]:SPURious[:RANGe][:LIST]:ATTenuation:AUTO OFF|ON|0|1,...

[SENSe]:SPURious[:RANGe][:LIST]:ATTenuation:AUTO?

[Detector]

- **Menu description:** to set detector mode, including standard, positive and negative peak, sample, average modes.
- **Key path:** [Measurement Setting], [Range List ▶], [Menu 1/3 ▶], [Menu 2/3 ▶], [Detector] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** positive peak mode
- **Program control commands:**

[SENSe]:SPURious[:RANGe][:LIST]:DETEctor[:FUNCTion] AVERAge|NEGative|NORMal|POSitive|SAMPLE|RMS,...

[SENSe]:SPURious[:RANGe][:LIST]:DETEctor[:FUNCTion]?

[Scanning time Auto ON OFF]

- **Menu description:** to set the Sweep Time of current sweep block as Auto ON or OFF and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Range List ▶], [Menu 1/3 ▶], [Menu 2/3 ▶], [Sweep Time] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 5ms/Auto
- **Setting range:** 1 ms - 6000 s
- **Default unit:** s
- **Program control commands:**

[SENSe]:SPURious[:RANGe][:LIST]:SWEep:TIME <time>,...

[SENSe]:SPURious[:RANGe][:LIST]:SWEep:TIME?

[SENSe]:SPURious[:RANGe][:LIST]:SWEep:TIME:AUTO OFF|ON|0|1,...

[SENSe]:SPURious[:RANGe][:LIST]:SWEep:TIME:AUTO?

[Number of scanning points] Auto ON OFF]

- **Menu description:** to set points of one measurement and sweep of current sweep block as Auto ON or OFF and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Range List ▶], [Menu 1/3 ▶], [Menu 2/3 ▶], [Sweep Points] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1001/auto
- **Setting range:** 101 - 30001
- **Default unit:** none
- **Program control commands:**

[SENSe]:SPURious[:RANGe][:LIST]:SWEep:POINts <integer>,...

[:SENSe]:SPURious[:RANGe][:LIST]:SWEp:POINts?

[:SENSe]:SPURious[:RANGe][:LIST]:SWEp:POINts:AUTO OFF|ON|0|1,...

[:SENSe]:SPURious[:RANGe][:LIST]:SWEp:POINts:AUTO?

[Select Spurious]

- **Menu description:** to view spurious signals searched. When selected spurious is changed, the instrument state is set as the parameter state within the range of relevant spurious signal. Number keys, stepping keys or the knob can be used to adjust it.
- **Key path:** [Measurement Setting], [Select Spurious] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1
- **Setting range:** 1 - 200
- **Default unit:** none
- **Program control commands:**

[:SENSe]:SPURious:SPUR <integer> [:SENSe]:SPURious:SPUR?

[Report Mode ►]

- **Command description:** to select the display mode of spurious information in measured data report, including display all and display spurious information beyond the set limit.
- **Key path:** [Measurement Setting], [Report Mode ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** display all
- **Program control commands:**

[:SENSe]:SPURious:REPT:MODE ALL|LIMTest

[:SENSe]:SPURious:REPT:MODE?

[Display All]

- **Menu description:** to select the display mode of spurious information of measured data report as display all.
- **Key path:** [Measurement Setting], [Report Mode ►], [Display All Spurious] on the front panel.

[Display Spurious Beyond Limit]

- **Menu description:** to select the display mode of spurious information of measured data report as display spurious information beyond the set limit.
- **Key path:** [Measurement Setting], [Report Mode ►], [Display Out-of-limit Spurious] on the front panel.

[Low Noise Path On Off]

- **Menu description:** this menu is only available when the H34 option (Low Noise Preamp) is purchased. When the preamplifier is ON, the Low Noise Path is OFF and this menu is grayed out; when the preamplifier is OFF, this menu lights on and is switchable.
- **Key path:** [Measurement Setting], [Menu 1/2], [Low Noise Path ON OFF] on the front panel.

- **Status saved:** saved in the instrument status.
- **Program control commands:**

:SPURious:POWer:MW:PATH STD|LNPath

:SPURious:POWer:MW:PATH?

[Preselector Preselecting Bypass]

- **Menu description:** this menu is only available when the H36 option is purchased. It is used for setting whether to bypass the front-end preselector of the signal/spectrum analyzer. In analyzing bandwidth signal, bypass is usually required.
- **Key path:** [Measurement Setting], [Menu 1/2], [Preselector Preselecting Bypass] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

INPut:SPURious:FILTer:YIG[:STATe] OFF|ON|0|1

INPut:SPURious:FILTer:YIG[:STATe]?

[RF Gain ►]

- **Menu description:** to set the Auto ON/OFF of the RF Gain and best allocation algorithm for RF Gain. The soft menus includes [Auto], [Best Dynamic Range] and [Best Sensitivity].
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:SPURious:RF:GAIN:AUTO OFF|ON|0|1

:SPURious:RF:GAIN:AUTO?

:SPURious:RF:GAIN:AUTO:RULes RANGE|SENSITIVITY

:SPURious:RF:GAIN:AUTO:RULes?

[Auto]

- **Menu description:** to set the RF Gain distribution algorithm to Auto. In this case, the RF Gain distribution is "Best Dynamic Range".
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Auto] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Dynamic Range]

- **Menu description:** to set the RF Gain distribution algorithm to Best Dynamic Range. In this case, the RF Gain is switched to "Auto OFF".
- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Best Dynamic Range] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Sensitivity]

- **Menu description:** to set the RF Gain distribution algorithm to Best Sensitivity. In this case, the RF Gain is switched to "Auto

OFF"

- **Key path:** [Measurement Setting], [Menu 1/2], [RF Gain ►], [Best Sensitivity] on the front panel.
- **Status saved:** saved in the instrument status.

[ADC Dither Auto ON OFF]

- **Menu description:** to control opening/closing of ADC dither of the frequency acquisition circuit in the analyzer. Under default mode, the signal/spectrum analyzer will automatically control whether the ADC Dither is ON based on current working condition. When the ADC Dither is under Auto mode, the ON or OFF status depends on the span, resolution bandwidth and sweep type (continuous swept or step sweep); when it is continuous swept, the ADC Dither status will force to switch to Auto and turns off; when it is step sweep, under Auto mode, if the span is 2MHz or below, the ADC Dither is ON; if the span is below 2MHz, the ADC Dither is OFF. Under Auto OFF mode, if the span is above 2MHz, turning on the ADC Dither may affect the measurement results based on selected dither status. You can access the submenu for manual control.
- **Key path:** [Measurement Setting], [Menu 1/2], [ADC Dither Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto
- **Program control commands:**

```
[::SENSe]:SPURious:ADC:DITHer[:STATe]
```

```
[::SENSe]:SPURious:ADC:DITHer[:STATe]?
```

```
[::SENSe]:SPURious:ADC:DITHer:AUTO[:STATe] OFF|ON|0|1
```

```
[::SENSe]:SPURious:ADC:DITHer:AUTO[:STATe]?
```

[Measurement Reset]

- **Menu description:** to reset the measurement parameters to the factory preset status or user saved parameter status
- **Key path:** [Measurement Setting], [Menu 1/2 ►], [Measurement Reset] on the front panel.
- **Factory preset:** factory reset.
- **Program control commands:**

```
:CONFigure:SPURious
```

5. 2. 10. 18. Measurement Control

Pop up the menu related to measurement control, including [Measurement Continuous ON OFF], [Restart Measurement] and [Pause/Resume].

[Measurement Continuous ON OFF]

- **Menu description:** to set continuous measurement OFF or ON. When [Measurement Continuous On/Off] is pressed, Continuous On will be triggered and continuous sweep will be the default measurement control method; when Continuous Off is selected, single measurement will be triggered. Press [Sweep Continuous OFF] to restart sweep when the next trigger signal arrives.
- **Key path:** [Measurement Control], [Measurement Continuous ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Continuous On.

- **Program control commands:**

:INITiate:CONTinuous OFF|ON|0|1

:INITiate:CONTinuous?

- **Examples:**

:INIT:CONT OFF

[Restart Measurement]

- **Menu description:** to stop current measurement and restart measurement for the signal/spectrum analyzer.

- **Key path:** [Measurement Control], [Restart Measurement] on the front panel

- **Status saved:** not saved in instrument status.

- **Program control commands:**

:INITiate:REST

[Pause/Resume]

- **Menu description:** when the signal/spectrum analyzer is in operation, this menu is used for pausing current measurement; when in Paused status, this menu is used for continuing measurement.

- **Key path:** [Measurement Control], [Pause/Resume] on the front panel.

- **Status saved:** not saved in instrument status.

- **Program control commands:**

:INITiate:PAUS

:INITiate:RES

5. 2. 11. Spectral emission mask

5. 2. 11. 1. frequency

The [Frequency] key on the front panel is used to set parameters related to the signal/spectrum analyzer frequency, including [Center Frequency], [Frequency Step Auto ON/OFF], [Frequency Offset]. See the [Frequency] menu of the sweep analysis function for more details.

[Center Freq]

See the [Center Frequency] under [Frequency] of the sweep analysis function for more details.

[Frequency Step Auto ON OFF]

See the [Frequency Step Auto ON/OFF] under [Frequency] of the sweep analysis function for more details.

[Frequency deviation]

See the [Frequency Offset] under [Frequency] of the sweep analysis function for more details.

5. 2. 11. 2. Amplitude/Y Axis

Pop up menus related to parameter setting of Amplitude/Y Axis, including [Reference Level], [Attenuator ►], [Preamplifier ON/OFF], [Scale/Division], [Auto Scale], [Menu 1/2 ►], [Y Axis Scale Unit], [Reference Level Offset].

Reference Level

- **Menu description:** to enable the Reference Level function. The reference level can be adjusted with the number keys, step keys or knob. The reference level corresponds to the top of the coordinate top. Measure signal at reference level position to get highest accuracy. The input attenuator of the signal/spectrum analyzer is coupled to the reference level, which can be automatically changed to avoid compression of input signal.
- **Key path:** [Amplitude/Y Axis], [Reference Level] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0dBm
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Default unit:** set based on Y Axis scale unit.
- **Program control commands:**

:DISPlay:SEMask:VIEW:WINDow:TRACe:Y:RLEVel <real>

:DISPlay:SEMask:VIEW:WINDow:TRACe:Y:RLEVel?

- **Examples:**

:DISP:SEM:VIEW:WIND:TRAC:Y:RLEV 20dBm

[Attenuator ►]

See [Attenuator ►] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Preamplifier ON OFF]

See [Preamplifier ON/OFF] under [Amplitude/Y Axis] of the sweep analysis function for more details.

[Scale/Division]

- **Menu description:** to select the scale/division from 0.1dB/division to 20dB/division. This menu is only valid when the scale type is logarithm.
- **Key path:** [Amplitude/Y Axis], [Scale/Division] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 10.00 dB.
- **Setting range:** Min.: -170dBm, Max.: 30dBm.
- **Program control commands:**

:DISPlay:SEMask:VIEW:WINDow:TRACe:Y:PDIVision <rel_amp>

:DISPlay:SEMask:VIEW:WINDow:TRACe:Y:PDIVision?

[Auto Scale]

- **Menu description:** the instrument automatically sets parameters like reference level and scale/division based on input signal sizes. When this soft menu key is pressed, the instrument performs one auto scaling. Setting rule for auto scaling: when the [Auto Scale] menu is pressed, firstly obtain the maximum value and the minimum value based on current measurement trace data. Based on the maximum value, place on the 80% graticule of the screen trace Y axis for auto setting of reference level and scale/division.

- **Key path:** [Amplitude/Y Axis], [Auto Scale] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:SEMAsk:ADJust:LEVel

[Y Axis Scale Unit]

- **Menu description:** to select the Y Axis unit from [dBm], [dBmV], [dBmA], [W], [V], [A], [dBμV] and [dBμA]. The instrument will automatically calculate the trace data and marker readout based on the Y axis scale unit.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Y Axis Scale Unit ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** dBm

:UNIT:SEMAsk:POWer DBM|DBMV|DBMA|V|W|A|DBUV|DBUA

:UNIT:SEMAsk:POWer?

[Reference Level Offset]

- **Menu description:** to introduce offset for all amplitude readout (e.g, reference level and marker amplitude). It will not change the trace position on the screen. This offset unit is dB and is not affected by the scale and unit. Use number keys, stepping keys or knob to input the offset value.
- **Key path:** [Amplitude/Y Axis], [Menu 1/2 ►], [Reference Level Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0 dB.
- **Setting range:** Min.: -1000dB, Max.:1000dB.
- **Program control commands:**

:DISPlay:SEMAsk:WINDow:TRACe:Y:RLEVel:OFFSet <rel_ampI>

:DISPlay:SEMAsk:WINDow:TRACe:Y:RLEVel:OFFSet?

- **Examples:**

:DISP:SEM:WIND:TRAC:Y:RLEV:OFFS 12

5. 2. 11. 3. Span/X Axis

This key has no soft menu.

5. 2. 11. 4. Bandwidth

Pop up the [Filter Type] menu for selecting filter type.

[Filter Type]

- **Menu description:** comprising [Gaussian] and [Flat Top]. In general, the signal/spectrum analyzer uses Gaussian filter, i.e., use filter approximate to the Gaussian shape to complete filtering of resolution bandwidth. If the flat top filter is used, the signal/spectrum analyzer adopts filter approximate to the rectangular shape to complete filtering of resolution bandwidth. The response time of flat top filter is about 3 times of that of the Gaussian filter. The sweep speed of the flat top filter is smaller than that of the Gaussian filter. The flat top filter has better selectivity than the Gaussian filter and therefore is more capable of

distinguishing two signals with unequal amplitude.

- **Key path:** [Bandwidth], [Filter Type] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Gaussian
- **Program control commands:**

:SEMAsk:BANDwidth:SHAPE GAUSSian|FLATtop

:SEMAsk:BANDwidth:SHAPE?

5. 2. 11. 5. Auto Setting [Couple All]

- **Menu description:** to set the resolution bandwidth, video bandwidth, sweep time, mechanical attenuator and frequency step as auto coupling mode. The signal/spectrum analyzer will select most suitable values for those functions based on set frequency and bandwidth (or start frequency and stop frequency). If no ratio is pre- saved, use default ratio.
- **Key path:** [Auto Setting], [Couple All] on the front panel.
- **Status saved:** not saved in instrument status.
- **Factory preset:** Couple All.
- **Program control commands:**

:COUPlE ALL

- **Examples:**

:COUP ALL

5. 2. 11. 6. Trace

Press [Trace] key on the front panel to pop up corresponding soft menu. Including [Refresh], [Average], [Display ON/OFF] [Menu 1/2 ►] and [Detector ►].

[Refresh]

- **Command description:** to set the current trace processing as Refresh, i.e., clear all data of displayed trace and continue the signal trace receipt under sweep status.
- **Key path:** [Trace], [Refresh] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** after all traces are selected, the trace mode is defaulted as Refresh.
- **Program control commands:**

:TRACe:SEMAsk:TYPE WRITe

:TRACe:SEMAsk:TYPE?

[Averaging]

- **Command description:** to set the current trace processing method as Average, i.e., based on the average count N set in the [Measurement Setting], update trace after averaging the performance index of the measurement trace.
- **Key path:** [Trace], [Average] on the front panel.
- **Status saved:** saved in the instrument status.

- **Factory preset:** all trace modes are defaulted as Refresh.
- **Program control commands:**

:TRACe:SEMask:TYPE AVERAge

:TRACe:SEMask:TYPE?

[Detector ▶]

Pop up soft menus related to setting the detector type for the currently selected trace, including [Auto], [Normal], [Positive Peak], [Sample], [Negative Peak], [Average ▶], where, the average detector type includes video average, power average and voltage average.

[Auto]

- **Menu description:** to set the detector command for the currently selected trace as Auto. That means, the signal/spectrum analyzer will perform based on the parameter setting of currently selected trace.
- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Auto] on the front panel
- **Status saved:** saved in the instrument status.
- **Factory preset:** the trace detector type is Power Average.
- **Program control commands:**

:SEMask:DETEctor:AUTO ON|OFF|1|0

:SEMask:DETEctor:AUTO?

[Normal]

- **Menu description:** to set the detector command for the currently selected trace as Normal. i.e., display the measurement results of positive peak and negative peak at the same time to achieve display effect similar to the analog instrument.
- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Normal] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:SEMask:DETEctor NORMal

:SEMask:DETEctor?

[Positive Peak]

- **Menu description:** to set the detector command for the currently selected trace as Positive Peak. i.e., take the maximum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Positive Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:SEMask:DETEctor POSitive

:SEMask:DETEctor?

[Sample]

- **Menu description:** to set the detector command for the currently selected trace as Sample. i.e., take the last value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Sample] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:SEMask:DETECTOR SAMPLE

:SEMask:DETECTOR?

[Negative Peak]

- **Menu description:** to set the detector command for the currently selected trace as Negative Peak. i.e., take the minimum value from sampling data assigned to each trace point.
- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Negative Peak] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:SEMask:DETECTOR NEGATIVE

:SEMask:DETECTOR?

[Average ▶ Video Average]

- **Menu description:** to set the detector command for the currently selected trace as Video Average. Also called Logarithm Power Average Detector, i.e., take the logarithm power average value for all data assigned to each trace point; earlier signal/spectrum analyzer generally displays the measurement trace of logarithm scale, and all filtering and averaging are based on the logarithm power data; the trace is generally called as video signal. After digital IF processing is adopted, to make measurement results same as the earlier signal/spectrum analyzer, the video average detector function is added.
- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Average ▶], [Video Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:SEMask:DETECTOR LOG

:SEMask:DETECTOR?

[Average ▶ Power Average]

- **Menu description:** to set the detector command for the currently selected trace as Power Average. Also called root mean square (RMS) detector. Calculate the root mean square of all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After square these voltage values, take sum and divide the count of sampling data points corresponding to each trace point. Finally, take square root. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those RMS values are trace data.
- **Key path:** [Trace], [Menu 1/2 ▶], [Detector ▶], [Average ▶], [Power Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:SEMask:DETECTOR AVERAGE or

:SEMask:DETECTOR RMS

:SEMask:DETECTOR?

[Average ► Average Voltage]

- **Menu description:** to set the detector command for the currently selected trace as Voltage Average. Also called average (AVG) detector. Take linear average for all sampling data assigned to each trace point; the S3503 signal/spectrum analyzer envelopes the detector for the RF input signal and obtains linear voltage. After summing those voltage values, divide the number of sampling data points corresponding to each trace point. When the scale is logarithm, take 20 times of logarithm transformation for these RMS values (with 10 as base) and obtain the trace data. When the scale type is linear, those average values are trace data.
- **Key path:** [Trace], [Menu 1/2 ►], [Detector ►], [Average ►], [Voltage Average] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:SEMask:DETECTOR SCALAR

:SEMask:DETECTOR?

5. 2. 11. 7. Sweep

Enable sweep-related parameter setup function to pop up [Sweep Setting ►].

[Scanning setting ►]

Pop up the soft menu related to Sweep type, including [Sweep Type Auto ON OFF], [Sweep Type Rules Auto ON OFF] and [FFT Width Auto ON OFF].

[Scanning type ► Auto ON OFF]

- **Menu description:** to set sweep type. is used to determine whether Swept or FFT is adopted for the signal/spectrum analyzer. Also set the FFT step bandwidth for FFT sweep. The soft menus include [Auto], [Swept] and [FFT]. When under Auto ON mode, the signal/spectrum analyzer will automatically select the sweep type based on sweep type rules.
- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** sweep type: Auto.
- **Program control commands:**

:SEMask:SWEEP:TYPE FFT|SWEEP

:SEMask:SWEEP:TYPE?

:SEMask:SWEEP:TYPE:AUTO OFF|ON|0|1

:SEMask:SWEEP:TYPE:AUTO?

[Sweep Type Rules Auto ON OFF]

- **Menu description:** to set rules for auto sweep type. While the sweep type rules include "Best Dynamic Range" and "Best Speed".

- "Best Dynamic Range" rules: when RBW is or larger than 1kHz, the sweep type is Swept; when RBW is less than 1kHz, the sweep type is FFT.
- "Best Speed" rules: when RBW is or larger than 30kHz, the sweep type is Swept; when RBW is less than 30kHz, the sweep type is FFT.
- **Key path:** [Sweep], [Sweep Setting ►], [Sweep Type Rules Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** the sweep type rules are automatically set as "Best Dynamic Range".
- **Program control commands:**
 :SEMask:SWEEp:TYPE:AUTO:RULEs SPEEd|DRANge
 :SEMask:SWEEp:TYPE:AUTO:RULEs?
 :SEMask:SWEEp:TYPE:AUTO:RULEs:AUTO OFF|ON|0|1
 :SEMask:SWEEp:TYPE:AUTO:RULEs:AUTO?

[FFT Width Auto ON OFF]

- **Menu description:** to set FFT Width. The FFT width includes [Auto], [<100kHz], [<3MHz], [<13MHz], [<=Max.]. FFT width is only active when the FFT sweep type is selected. Under Auto type, when the signal/spectrum analyzer performs FFT spectrum measurement, the maximum resolution bandwidth is 30kHz. To guarantee best dynamic measurement range, the signal/spectrum analyzer automatically optimizes the FFT width within 100kHz. The larger is the FFT width, the faster is FFT spectrum measurement, but the dynamic range performance will be affected.

Under FFT sweep, the FFT width setup limits the maximum value for center frequency step of each tune. For example, if [<100Hz] is selected, the maximum value for center frequency step of each tune is 100Hz. As the FFT width gets larger, the count of instrument center frequencies get smaller when performing measurement of same frequency scope, and the response measurement gets faster. Therefore, to improve measurement speed, you can manually change the FFT width.

- **Key path:** [Sweep], [Sweep Setting ►], [FFT Width ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** FFT Width is set as Auto.
- **Program control commands:**
 :SEMask:SWEEp:FFT:WIDTh <real>
 :SEMask:SWEEp:FFT:WIDTh?
 :SEMask:SWEEp:FFT:WIDTh:AUTO OFF|ON|0|1
 :SEMask:SWEEp:FFT:WIDTh:AUTO?

5. 2. 11. 8. Single

- **Menu description:** the [Continuous OFF] key on the front panel has no corresponding soft menu. This function is mainly used for manual trigger of a measurement. When the Average is ON, this function performs the measurements at the count specified by the average count.

In remote control programming and system establishment, this function combined with *WAI can effectively synchronize the measurement process and enable the trace data obtained after the *WAI finishes directly correspond to the measurement process one by one.

- **Program control commands:**

:INITiate:SEMAsk

5. 2. 11. 9. Continuous

The [Continuous] key on the front panel has no corresponding soft menu. This is mainly used for changing the Measurement Continuous OFF to Measurement Continuous ON; if the current state is Measurement Continuous ON, the instrument performs no operation.

- **Program control commands:**

:INITiate:CONTInuous ON

5. 2. 11. 10. Trigger

See [Trigger] menu of the sweep analysis function for more details.

5. 2. 11. 11. Display

Pop up the soft menu related to display, including [Display Line On/Off], [Report Display ►] and [Display Configuration ►].

[Display Line On Off]

See [Display Line ON/OFF] under [Display] of the sweep analysis function for more details.

[Display Configuration ►]

It is used for configurations of interface language, status area display on interface. The soft menus include [Select Language Chinese English], [Graticule Display ON OFF], [Status Area Display ON OFF], [Frequency Information Display ON OFF]. See [Display Configuration ►] under [Display] of the sweep analysis function for more details.

[Report Display ►]

- **Menu description:** to select content information displayed at the data report window.

The absolute power & frequency-data report is displayed with the absolute power and frequency corresponding to the offset. The relative power & frequency-data report is displayed with the relative power and frequency corresponding to the offset. The integral power-data report is displayed with the integral power corresponding to the offset.

- **Key path:** [Display], [Report Display ►] on the front panel.

- **Status saved:** saved in the instrument status.

- **Factory preset:** integral power.

- **Program control commands:**

:DISPlay:SEMAsk:VIEW[:SElect] APFReq|RPFReq|IPOWER

:DISPlay:SEMAsk:VIEW[:SElect]?

5. 2. 11. 12. Input Output

See the [Input Output] menu of the sweep analysis function for more details.

5. 2. 11. 13. Marker

Pop up the soft menu related to markers, including [Marker Select ►], [Normal Marker], [Delta Marker], [Fixed Marker], [Marker OFF], [All Markers OFF].

[Marker Select ► Marker 1]

- **Command description:** to select among 12 different markers of the analyzer. When one marker is selected, the menu will indicate the current marker and the type and the attribute of the selected marker can be set. Select and trigger another marker and place it at the center of the current trace. Users can read amplitude and frequency information (when the frequency span is 0 Hz, time information will be displayed) at the marker display area at the top right corner of the screen.
- **Key path:** [Marker], [Marker Select ►] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Marker 1.

[Normal Marker]

- **Menu description:** to set the selected marker as the Normal Marker.
- **Key path:** [Marker], [Normal Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:SEMask:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE POSition

:CALCulate:SEMask:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Delta Marker]

- **Menu description:** to set the selected marker as the Delta Marker. Display the amplitude difference and frequency difference (or time difference, when span is zero) between two markers at the marker display area at the top right corner of the screen. If there exists a single marker, a [Delta Marker] operation will generate a reference marker in the active marker position. Move the active marker through the knob, stepping keys or number keys. The display amplitude difference unit is dB.
- **Key path:** [Marker], [Delta Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:SEMask:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE DELTa

:CALCulate:SEMask:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Fixed Marker]

- **Menu description:** to set the selected marker as the Fixed Marker. The X Axis and Y Axis positions of the fixed marker are fixed. The Fixed Marker can be used as reference marker.
- **Key path:** [Marker], [Fixed Marker] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:SEMask:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE FIXEd

:CALCulate:SEMask:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[Marker OFF]

- **Menu description:** to turn off the selected marker.
- **Key path:** [Marker], [Marker Off] on the front panel.

- **Status saved:** saved in the instrument status.
- **Program control commands:**

:CALCulate:SEMask:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE OFF

:CALCulate:SEMask:MARKer[1|2|3|4|5|6|7|8|9|10|11|12]:MODE?

[All Markers OFF]

- **Menu description:** to turn off all current markers which are ON and related soft keys, e.g. [Noise Marker].
- **Key path:** [Marker], [Menu 1/2 ►], [All Markers OFF] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:CALCulate:SEMask:MARKer:AOFF

5. 2. 11. 14. Maker->

This key has no soft menu.

5. 2. 11. 15. Marker Function

This key has no soft menu.

5. 2. 11. 16. Peak

This key has no soft menu.

5. 2. 11. 17. Measurement Setting

Pop up the soft menu related to measurement setting Including [Average Count ON/OFF], [Average State Exponential Repeat], [Reference Channel ►], [Offset/Limit ►], [Reference Type ►], [Measurement Method ►], [Phase Noise Optimization], [Low Noise Path ON/OFF], [Preselector Preselecting Bypass], [RF Gain ►], [ADC Dither Auto ON/OFF] and [Measurement Reset].

[Average frequency On Off]

- **Menu description:** to turn on or off Average. When Average Count is ON, the user can specify the average count required for measurement. The Average Count can be adjusted by number keys, stepping keys or knob.
- **Key path:** [Measurement Setting], [Average Count ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 100/OFF
- **Setting range:** 1 - 10000
- **Default unit:** none
- **Program control commands:**

[:SENSe]:SEMask:AVERage:COUNT <integer>

[:SENSe]:SEMask:AVERage:COUNT?

[:SENSe]:SEMask:AVERage[:STATe] ON|OFF|1|0

[:SENSe]:SEMask:AVERage[:STATe]?

[Reference Channel ►]

- **Menu description:** to set parameters of reference channel
- **Key path:** [Measurement Setting] [Reference Channel] on the front panel.
- **Status saved:** saved in the instrument status.

[Integration Bandwidth]

- **Menu description:** to designate the bandwidth integration range for calculating power within the channel. The integration bandwidth is displayed in the trace window and indicated with a pair of vertical lines connected with arrows. Such commands may be adjusted via number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting] [Reference Channel], [Integration Bandwidth] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 3.84MHz
- **Setting range:** 1kHz - 50MHz
- **Default unit:** Hz
- **Program control commands:**

[::SENSe]:SEMask:BANDwidth:INTegration <bandwidth> [::SENSe]:SEMask:BANDwidth:INTegration?

[Channel Frequency Span]

- **Menu description:** to designate frequency span range of the main channel. Such commands may be adjusted via number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting] [Reference Channel], [Channel Frequency Span] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 5.0MHz
- **Setting range:** 10 Hz - maximum instrument frequency span
- **Default unit:** Hz
- Program control commands:

[::SENSe]:SEMask:FREQuency:SPAN <freq>

[::SENSe]:SEMask:FREQuency:SPAN?

[Scanning time Auto ON OFF]

- **Menu description:** to set the Sweep Time of the main channel as Auto ON or OFF and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting] [Reference Channel ►], [Sweep Time] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.0ms/Auto
- **Setting range:** 1 ms - 6000 s
- **Default unit:** s

- **Program control commands:**

[[:SENSe]:SEMAsk:SWEEp:TIME <time>

[[:SENSe]:SEMAsk:SWEEp:TIME?

[[:SENSe]:SEMAsk:SWEEp:TIME:AUTO OFF|0|ON|1

[[:SENSe]:SEMAsk:SWEEp:TIME:AUTO?

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to set resolution bandwidth of the instrument when measuring the main channel. If the resolution bandwidth is set to Auto ON, the optimal setting is determined by the instrument. When the resolution bandwidth is set as auto off, users may define the bandwidth and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Reference Channel ►], [Resolution Bandwidth Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 270kHz/Auto
- **Setting range:** 1Hz - 20MHz
- **Default unit:** Hz
- **Program control commands:**

[[:SENSe]:SEMAsk:BANDwidth[:RESolution] <bandwidth>

[[:SENSe]:SEMAsk:BANDwidth[:RESolution]?

[[:SENSe]:SEMAsk:BANDwidth[:RESolution]:AUTO OFF|ON|1|0

[[:SENSe]:SEMAsk:BANDwidth[:RESolution]:AUTO?

[Video bandwidth Auto ON OFF]

- **Menu description:** to set video bandwidth of the instrument when measuring the main channel. If the video bandwidth is set to Auto ON, the optimal setting is determined by the instrument. When the video bandwidth is set as auto off, users may define the bandwidth and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Reference Channel ►], [Video Bandwidth Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 3MHz/Auto
- **Setting range:** 1Hz - 20MHz
- **Default unit:** Hz
- **Program control commands:**

[[:SENSe]:SEMAsk:BANDwidth:VIDeo <bandwidth>

[[:SENSe]:SEMAsk:BANDwidth:VIDeo?

[[:SENSe]:SEMAsk:BANDwidth:VIDeo:AUTO OFF|ON|1|0

[[:SENSe]:SEMAsk:BANDwidth:VIDeo:AUTO?

[VBW/RBW Auto ON OFF]

- **Menu description:** to set ratio of BW/RBW when measuring the main channel. When it is set as auto off, users may define the

ratio to be set and adjust it with number keys, stepping keys or the knob.

- **Key path:** [Measurement Setting], [Reference Channel ►], [VBW/RBW Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.0/Auto
- **Setting range:** 0.0001 - 300000
- **Default unit:** none
- **Program control commands:**

```
[:SENSe]:SEMask:BANDwidth:VIDeo:RATio <real>
```

```
[:SENSe]:SEMask:BANDwidth:VIDeo:RATio?
```

```
[:SENSe]:SEMask:BANDwidth:VIDeo:RATio:AUTO OFF|ON|1|0
```

```
[:SENSe]:SEMask:BANDwidth:VIDeo:RATio:AUTO?
```

[Offset Limit ►]

- **Menu description:** to set parameters of offset and limit.
- **Key path:** [Measurement Setting], [Offset Limit ►] on the front panel.

[Offset]

- **Menu description:** to select the offset to be set.
- **Key path:** [Measurement Setting], [Offset Limit ►], [Offset] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** A

[Starting frequency On Off]

- **Menu description:** to set start frequency limit of each offset (the points closest to the carrier). If it is set as off, no measurement will be made for such offset. Users may use number keys, stepping keys and the knob to adjust it.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Start Frequency On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 2.515 MHz/on.
- **Setting range:** 0 Hz - stop frequency - 10 Hz
- **Default unit:** Hz
- **Program control commands:**

```
[:SENSe]:SEMask:OFFSet:LIST:FREQuency:STARt <freq>,...
```

```
[:SENSe]:SEMask:OFFSet:LIST:FREQuency:STARt?
```

```
[:SENSe]:SEMask:OFFSet:LIST:STATe ON|OFF|1|0,...
```

```
[:SENSe]:SEMask:OFFSet:LIST:STATe?
```

[Freq Stop]

- **Menu description:** to set stop frequency limit of each offset (the points farthest from the carrier). Users may use number keys, stepping keys and the knob to adjust it.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Stop Frequency] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 2.715MHz
- **Setting range:** start frequency + 10 Hz - 500 MHz
- **Default unit:** Hz
- **Program control commands:**

```
[:SENSe]:SEMask:OFFSet:LIST:FREQuency:STOP <freq>,...
```

```
[:SENSe]:SEMask:OFFSet:LIST:FREQuency:STOP?
```

[Scanning time Auto ON OFF]

- **Menu description:** to set offset Sweep Time as Auto ON or OFF and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Sweep Time Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 5.0 ms/Auto Off.
- **Setting range:** 1 ms - 6000 s
- **Default unit:** s
- **Program control commands:**

```
[:SENSe]:SEMask:OFFSet:LIST:SWEep:TIME <time>,...
```

```
[:SENSe]:SEMask:OFFSet:LIST:SWEep:TIME?
```

```
[:SENSe]:SEMask:OFFSet:LIST:SWEep:TIME:AUTO ON|OFF|1|0,...
```

```
[:SENSe]:SEMask:OFFSet:LIST:SWEep:TIME:AUTO?
```

[Resolution Bandwidth Auto ON OFF]

- **Menu description:** to set resolution bandwidth of the instrument during offset measurement. If the resolution bandwidth is set to Auto ON, the optimal setting is determined by the instrument. When the resolution bandwidth is set as auto off, users may define the bandwidth and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Menu 1/3 ►], [Resolution Bandwidth Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 30 kHz/Auto Off.
- **Setting range:** 1Hz - 20MHz
- **Default unit:** Hz
- **Program control commands:**

```
[:SENSe]:SEMask:OFFSet:LIST:BANDwidth[:RESolution] <bandwidth>,...
```

```
[:SENSe]:SEMask:OFFSet:LIST:BANDwidth[:RESolution]?
```

```
[:SENSe]:SEMask:OFFSet:LIST:BANDwidth[:RESolution]:AUTO OFF|ON|1|0,...
```

[[:SENSe]:SEMAsk:OFFSet:LIST:BANDwidth[:RESolution]:AUTO?

[Video bandwidth Auto ON OFF]

- **Menu description:** to set video bandwidth of the instrument when measuring the main channel. If the video bandwidth is set to Auto ON, the optimal setting is determined by the instrument. When the video bandwidth is set as auto off, users may define the bandwidth and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Menu 1/3 ►], [Video Bandwidth Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 30 kHz/Auto Off.
- **Setting range:** 1Hz - 20MHz
- **Default unit:** Hz

[[:SENSe]:SEMAsk:OFFSet:LIST:BANDwidth:VIDeo <freq>,...

[[:SENSe]:SEMAsk:OFFSet:LIST:BANDwidth:VIDeo?

[[:SENSe]:SEMAsk:OFFSet:LIST:BANDwidth:VIDeo:AUTO OFF|ON|0|1,...

[[:SENSe]:SEMAsk:OFFSet:LIST:BANDwidth:VIDeo:AUTO?

[VBW/RBW Auto ON OFF]

- **Menu description:** to set the ratio of BW/RBW during offset measurement. When it is set as auto off, users may define the ratio to be set and adjust it with number keys, stepping keys or the knob.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Menu 1/3 ►], [VBW/RBW Auto ON/OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 1.0/Auto
- **Setting range:** 0.0001 - 300000
- **Default unit:** none
- **Program control commands:**

[[:SENSe]:SEMAsk:OFFSet:LIST:BANDwidth:VIDeo:RATio <real>,...

[[:SENSe]:SEMAsk:OFFSet:LIST:BANDwidth:VIDeo:RATio?

[[:SENSe]:SEMAsk:OFFSet:LIST:BANDwidth:VIDeo:RATio:AUTO OFF|ON|0|1,...

[[:SENSe]:SEMAsk:OFFSet:LIST:BANDwidth:VIDeo:RATio:AUTO?

[Absolute Start Limit]

- **Menu description:** to set absolute limit start value of the current offset and the same stop value. Users may use number keys, stepping keys or the knob to set the limit.
- **Key path:** [Measurement Setting], [Offset/Limit ►], [Menu 1/3 ►], [Menu 2/3 ►], [Absolute Start Limit] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -14dBm
- **Setting range:** -200dBm - 50dBm

- **Default unit:** dBm.
- **Program control commands:**

```
[[:SENSe]:SEMAsk:OFFSet:LIST:STARt:ABSolute <real>,...
```

```
[[:SENSe]:SEMAsk:OFFSet:LIST:STARt:ABSolute?
```

[Absolute Stop Limit Auto ON OFF]

- **Menu description:** to set absolute limit stop value of the current offset. Under auto mode, the instrument will automatically couple a value same with the set start value; while under auto off mode, users may use number keys, stepping keys or the knob to set the limit.
- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Menu 1/3 ▶], [Menu 2/3 ▶], [Absolute Stop Limit Auto On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -14dBm
- **Setting range:** -200dBm - 50dBm
- **Default unit:** dBm.
- **Program control commands:**

```
[[:SENSe]:SEMAsk:OFFSet:LIST:STOP:ABSolute <real>,...
```

```
[[:SENSe]:SEMAsk:OFFSet:LIST:STOP:ABSolute?
```

```
[[:SENSe]:SEMAsk:OFFSet:LIST:STOP:ABSolute:COUPlE ON|OFF|1|0,...
```

```
[[:SENSe]:SEMAsk:OFFSet:LIST:STOP:ABSolute:COUPlE?
```

[Relative Start Limit]

- **Menu description:** to set relative limit start value of the current offset and the same stop limit. Users may use number keys, stepping keys or the knob to set the limit.
- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Menu 1/3 ▶], [Menu 2/3 ▶], [Relative Start Limit] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** -30 dB.
- **Setting range:** -200.0dB -50dB
- **Default unit:** dB.
- **Program control commands:**

```
[[:SENSe]:SEMAsk:OFFSet:LIST:STARt:RCARrier <rel_amp>,...
```

```
[[:SENSe]:SEMAsk:OFFSet:LIST:STARt:RCARrier?
```

[Relative stop limit] Auto ON OFF]

- **Menu description:** to set relative limit stop value of the current offset. Under auto mode, the instrument will automatically couple a value same with the set start value; while under auto off mode, users may use number keys, stepping keys or the knob to set the limit.
- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Menu 1/3 ▶], [Menu 2/3 ▶], [Relative Stop Limit Auto On/Off] on the

front panel.

- **Status saved:** saved in the instrument status.
- **Factory preset:** -30 dB.
- **Setting range:** -200.0dB -50dB
- **Default unit:** dB.
- **Program control commands:**

[[:SENSe]:SEMask:OFFSet:LIST:STOP:RCARrier <rel_amp>,...

[[:SENSe]:SEMask:OFFSet:LIST:STOP:RCARrier?

[[:SENSe]:SEMask:OFFSet:LIST:STOP:RCARrier:COUPlE ON|OFF|1|0,...

[[:SENSe]:SEMask:OFFSet:LIST:STOP:RCARrier:COUPlE?

[Limit Template ▶]

- **Menu description:** to set limit test mark of the current offset, including four following mask tests:
 - Absolute: to serve as absolute limit line. When measured absolute result exceeds the absolute limit value, the test failed.
 - Relative: to serve as relative limit line. and measured relative result exceeds the relative limit value, the test failed.
 - Absolute and relative: to serve both as the absolute and relative limit lines. When measured absolute results exceeds the absolute limit value, and measured relative result exceeds the relative limit value, the test fails.
 - Absolute or relative: to serve as the absolute or the relative limit lines. When measured absolute results exceeds the absolute limit value, or measured relative result exceeds the relative limit value, the test failed.
- **Key path:** [Measurement Setting], [Offset/Limit ▶], [Menu 1/3 ▶], [Menu 2/3 ▶], [Limit Template ▶] on the front panel.
- **Save:** saved in the instrument status.
- **Factory preset:** Absolute

[[:SENSe]:SEMask:OFFSet:LIST:TESTABSolute|AND|OR|RELative,...

[[:SENSe]:SEMask:OFFSet:LIST:TEST?

[Reference Type ▶]

- **Menu description:** to set measurement reference type, total power reference, power spectral density reference and frequency spectrum peak reference.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Reference Type ▶] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** total power reference

[Total Power Reference]

- **Menu description:** to use carrier power as reference for calculating relative power value of the offset when selecting total power reference.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Reference Type ▶], [Total Power Reference] on the front panel.

[Spectral Density Reference]

- **Menu description:** to use carrier power spectral density as reference for calculating relative power value of the offset when selecting power spectral density reference.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Reference Type ▶], [Spectral Density Reference] on the front panel.

Frequency Spectrum Peak Reference

- **Menu description:** to use frequency spectrum peak power as reference for calculating relative power value of the offset when selecting frequency spectrum peak reference.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Reference Type ▶], [Frequency Spectrum Peak Reference] on the front panel.

[Total Power Reference] Auto ON OFF

- **Menu description:** to set a reference value corresponding to the reference type of the menu when selecting total power reference as measurement type. Under auto mode, the reference value will be the power spectral density of the current main channel; while under auto off mode, users may use number keys, stepping keys or the knob to set the reference value.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Reference Type ▶], [Total Power Reference Auto On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0dBm
- **Setting range:** -200dBm - 200dBm
- **Default unit:** dBm.
- **Program control commands:**

```
[::SENSe]:SEMask:CARRier[:POWER] <real>
```

```
[::SENSe]:SEMask:CARRier[:POWER]?
```

```
[::SENSe]:SEMask:CARRier:AUTO[:STATe] OFF|ON|1|0
```

```
[::SENSe]:SEMask:CARRier:AUTO[:STATe]?
```

[Spectral Density Reference Auto ON OFF]

- **Menu description:** to set a reference value corresponding to the reference type of the menu when selecting spectral density reference as measurement type. Under auto mode, the reference value will be the power spectral density of the current main channel; while under auto off mode, users may use number keys, stepping keys or the knob to set the reference value.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Reference Type ▶], [Spectral Density Reference Auto On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0 dBm/Hz.
- **Setting range:** -200 dBm/Hz - 200 dBm/Hz
- **Default unit:** dBm/Hz
- **Program control commands:**

```
[::SENSe]:SEMask:CARRier:CPSD <real>
```

[[:SENSe]:SEMAsk:CARRier:CPsD?

Frequency Spectrum Peak Reference Auto ON OFF]

- **Menu description:** to set a reference value corresponding to the reference type of the menu when selecting frequency spectrum peak reference as measurement type. Under auto mode, the reference value will be the frequency spectrum peak power of the current main channel; while under auto off mode, users may use number keys, stepping keys or the knob to set the reference value.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Reference Type ▶], [Frequency Spectrum Peak Reference Auto On/Off] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** 0dBm
- **Setting range:** -200dBm - 200dBm
- **Default unit:** dBm.
- **Program control commands:**

[[:SENSe]:SEMAsk:CARRier:PEAK[:POWer] <real>

[[:SENSe]:SEMAsk:CARRier:PEAK[:POWer]?

[Measurement Method ▶]

- **Menu description:** to select the calculation method for measurement.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Measurement Method ▶] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Bandwidth Integration.
- **Program control commands:**

[[:SENSe]:SEMAsk:FILTer[:RRC][:STATe] OFF|ON|0|1

[[:SENSe]:SEMAsk:FILTer[:RRC][:STATe]?

[Bandwidth Integration]

- **Menu description:** to select the calculation method as Bandwidth Integration method.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Measurement Method ▶], [Bandwidth Integration] on the front panel.

[RRC Weighting]

- **Menu description:** to select the calculation method as RRC Weighting.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Measurement Method ▶], [RRC Weighting] on the front panel.

[Filter Factor a]

- **Menu description:** to set the Filter Factor when using RRC method. The influence factor of RRC Filter will be considered in calculating the measurement result. Use number keys, stepping keys or knob to change the Filter Factor a.
- **Key path:** [Measurement Setting], [Menu 1/2 ▶], [Filter Factor a] on the front panel.
- **Status saved:** saved in the instrument status.

- **Factory preset:** 0.22
- **Setting range:** 0.01 - 1.0
- **Default unit:** none
- **Program control commands:**

[:SENSe]:SEMAsk:FILTer[:RRC]:ALPHa <real> [:SENSe]:SEMAsk:FILTer[:RRC]:ALPHa?

[Low Noise Path On Off]

- **Menu description:** this menu is only available when the H34 option (Low Noise Preamplifier) is purchased. When the preamplifier is ON, the Low Noise Path is OFF and this menu is grayed out; when the preamplifier is OFF, this menu lights on and is switchable.
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [Low Noise Path ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:SEMAsk:POWer:MW:PATH STD|LNPath

:SEMAsk:POWer:MW:PATH?

[Preselector Preselecting Bypass]

- **Menu description:** this menu is only available when the H36 option is purchased. It is used for setting whether to bypass the front-end preselector of the signal/spectrum analyzer. In analyzing bandwidth signal, bypass is usually required.
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [Preselector Preselecting Bypass] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

INPut:SEMAsk:FILTer:YIG[:STATe] OFF|ON|0|1 INPut:SEMAsk:FILTer:YIG[:STATe]?

[RF Gain ►]

- **Menu description:** to set the Auto ON/OFF of the RF Gain and best allocation algorithm for RF Gain. The soft menus includes [Auto], [Best Dynamic Range] and [Best Sensitivity].
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [RF Gain] on the front panel.
- **Status saved:** saved in the instrument status.
- **Program control commands:**

:SEMAsk:RF:GAIN:AUTO OFF|ON|0|1

:SEMAsk:RF:GAIN:AUTO?

:SEMAsk:RF:GAIN:AUTO:RULEs RANGE|SENSITIVITY

:SEMAsk:RF:GAIN:AUTO:RULEs?

[Best Dynamic Range]

- **Menu description:** to set the RF Gain distribution algorithm to Best Dynamic Range. In this case, the RF Gain is switched to "Auto OFF"

- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [RF Gain ►], [Best Dynamic Range] on the front panel.
- **Status saved:** saved in the instrument status.

[Best Sensitivity]

- **Menu description:** to set the RF Gain distribution algorithm to Best Sensitivity. In this case, the RF Gain is switched to "Auto OFF"
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [RF Gain ►], [Best Sensitivity] on the front panel.
- **Status saved:** saved in the instrument status.

[ADC Dither Auto ON OFF]

- **Menu description:** to control opening/closing of ADC dither of the frequency acquisition circuit in the analyzer. Under default mode, the signal/spectrum analyzer will automatically control whether the ADC Dither is ON based on current working condition. When the ADC Dither is under Auto mode, the ON or OFF status depends on the span, resolution bandwidth and sweep type (continuous swept or step sweep); when it is continuous swept, the ADC Dither status will force to switch to Auto and turns off; when it is step sweep, under Auto mode, if the span is 2MHz or below, the ADC Dither is ON; if the span is below 2MHz, the ADC Dither is OFF. Under Auto OFF mode, if the span is above 2MHz, turning on the ADC Dither may affect the measurement results based on selected dither status. You can access the submenu for manual control.
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [ADC Dither Auto ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Auto.
- **Program control commands:**

```
[:SENSe]:SEMask:ADC:DITHer[:STATe] OFF|ON|HIGH
```

```
[:SENSe]:SEMask:ADC:DITHer[:STATe]?n
```

```
[:SENSe]:SEMask:ADC:DITHer:AUTO[:STATe] OFF|ON|0|1
```

```
[:SENSe]:SEMask:ADC:DITHer:AUTO[:STATe]?
```

[Measurement Reset]

- **Menu description:** to reset the measurement parameters to the factory preset status or user saved parameter status
- **Key path:** [Measurement Setting], [Menu 1/3], [Menu 2/3], [Measurement Reset] on the front panel.
- **Factory preset:** factory reset.
- **Program control commands:**

```
:CONFigure:SEMask
```

5. 2. 11. 18. 5.2.11.18 Measurement Control

Pop up the menu related to measurement control, including [Measurement Continuous ON OFF], [Restart Measurement] and [Pause/Resume].

[Measurement Continuous ON OFF]

- **Menu description:** to set continuous measurement OFF or ON. When [Measurement Continuous On/Off] is pressed, Continuous On will be triggered and continuous sweep will be the default measurement control method; when Continuous Off is selected, single measurement will be triggered. Press [Sweep Continuous OFF] to restart sweep when the next trigger signal

arrives.

- **Key path:** [Measurement Control], [Measurement Continuous ON OFF] on the front panel.
- **Status saved:** saved in the instrument status.
- **Factory preset:** Continuous On.
- **Program control commands:**

:INITiate:CONTinuous OFF|ON|0|1

:INITiate:CONTinuous?

- **Examples:**

:INIT:CONT OFF

[Restart Measurement]

- **Menu description:** to stop current measurement and restart measurement for the signal/spectrum analyzer.
- **Key path:** [Measurement Control], [Restart Measurement] on the front panel
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:REST

[Pause/Resume]

- **Menu description:** when the signal/spectrum analyzer is in operation, this menu is used for pausing current measurement; when in Paused status, this menu is used for continuing measurement.
- **Key path:** [Measurement Control], [Pause/Resume] on the front panel.
- **Status saved:** not saved in instrument status.
- **Program control commands:**

:INITiate:PAUS

:INITiate:RES

6. Remote control

In this chapter, basic information of operating S3503 series signal/spectrum analyzer via remote control is introduced to help users remotely operate the analyzer. Specific contents include:

- Basis of remote control
- Remote control port and configuration
- Basic VISA interface programming method
- I/O library

6. 1. Basis of Remote Control

- Program Control Interface
- Messages
- SCPI Commands
- Command Sequence and Synchronization
- Status Report System
- Programming Precautions

6. 1. 1. Remote Control Interface

S3503 series signal/spectrum analyzer is compatible only to two remote control interfaces: LAN and GPIB. As shown in the following table:

Remote Control Interface	VISA address character string (note 1)	Instructions
LAN (Local Area Network)	Original socket protocol: TCPIP::host_address::port::SOCKET	Remote control can be realized by the connecting the instrument through the network port on the rear panel of the instrument. For details, refer to: 6.1.2.1 LAN Interface
GPIB (IEC/IEEE Bus Interface)	GPIB::primary address[:INSTR]	Remote control can be realized by the connecting the instrument through the port on the rear panel of the instrument. Comply with the bus interface standards of IEC 625.1/IEEE418. For details, refer to: 2.1.2.2 GPIB Interface.

Table 6.1 Types and VISA Addressing Character Strings of Remote Control Interfaces

Note 1: VISA stands for Virtual Instrumentation Software Architecture, which is a standard software interface function library. Users may use the library to control the instrument via such interfaces as GPIB, RS232, LAN and USB. Users should firstly install VISA library on the control computer and use it to remotely control the instrument. See the User Manual of the VISA library to be installed for more details.

- LAN Interface
- GPIB interface

6. 1. 1. 1. LAN Interface

The signal/spectrum analyzer may use RJ45 communication cables (shielded or unshielded Class 5 TP) to connect to 10Mbps/100Mbps/1000Mbps Ethernet for remote control via the control computer inside LAN. In order to control the instrument

remotely inside LAN, the analyzer has been installed with the interface adapter and TCP/IP protocol and configured with corresponding TCP protocol-based web service.

The network interface adapter installed in the analyzer has three operating modes, including:

- 10Mbps Ethernet (IEEE802.3);
- 100Mbps Ethernet (IEEE802.3u);
- 1000Mbps Ethernet (IEEE802.3ab).

The interface adapter will automatically seek appropriate network speed for matching based on link condition. The cable for connecting the analyzer usually has a length no more than 100 m. Visit <http://www.ieee.org> for more information of Ethernet.

LAN interfaces are introduced below.

1) IP address

Ensure that the physical connection is smooth for remote control of the signal/spectrum analyzer by LAN. Through the "Local IP" menu of the signal/spectrum analyzer, set the address to the subnet where the controlling computer is located. Example: If the IP address of the master control computer is 192.168.12.0, the IP address of the signal/spectrum analyzer should be set as 192.168.12.XXX, in which, XXX is a value between 1 and 255.

Only the IP address is required to establish the network connector. The VISA addressing character string is as follows:

TCPIP::host address::port::SOCKET Where:

- TCPIP refers to the applied network protocol.
- "Host address" refers to the IP address or host name of the instrument, used to identify and control the instrument to be controlled.
- "port" refers to the socket port number and the port of the S3503 signal/spectrum analyzer is 5000;
- SOCKET refers to the original network socket resource class. Example:

Use the following string for original socket connection:

"TCPIP::192.1.2.3::5000::SOCKET" can be used for establishing the original socket connection.



Identification of multiple instrument in remote control system

If multiple instruments are connected in the network, distinguish them with the separate IP address and associated resource string. The respective VISA resource string is used by the master control computer to identify the instrument.

2) Socket communication

TCP/IP protocol can be networked with the signal generator using LAN socket. Socket is a basic approach used in computer network programming, which enables network communication among applications employing different hardware and operating systems. In this method, the signal/spectrum analyzer is connected to the computer through the port for two-way communication.

Socket is a kind of software specially programmed and has defined the information necessary for network communication such as IP address and device port number and integrated some basic operations of network programming. Socket can be used as long as the packaged libraries are installed in the OS. Berkeley Socket Library applied in UNIX and Winsock Library applied in Windows constitute the two common socket libraries.

The socket of the signal/spectrum analyzer is compatible with the Berkeley socket and Winsock through the application program interface (API). Besides, it is also compatible with other standard socket API. The command will be sent by the socket program to

control the signal/spectrum analyzer through SCPI commands. The signal/spectrum analyzer has a fixed socket port number of 5000.

6. 1. 1. 2. GPIB Interface

As the only bus dedicated to instrument control, GPIB is still widely applied in automatic test systems. The S3503 signal/spectrum analyzer integrated GPIB interface on the rear panel. In order to realize remote control, the master control computer should be configured with the GPIB bus card, drive program and VISA library in advance. During communication, the controlled instrument is addressed by the master control computer according to the GPIB bus address and users may change such GPIB address to prevent communication failure caused by address conflict in the entire system.

Refer to ANSI/IEEE 488.1-1987 and ANSI/IEEE 488.2-1992 for details of descriptions of GPIB and relevant interfaces. For details, visit the IEEE website <http://www.ieee.org>.

Pay attention to the following when connecting the GPIB interface:

- Only 15 pieces of equipment are allowed at most in the test system connected with GPIB bus;
- The total length of the transmission cable must not exceed 20m or twice of the number of instruments in the system.
- Generally, the maximum length of the transmission cable between devices must not exceed 2m.
- For parallel connection of instruments, use "or" connecting lines.
- Connect the terminal of the IEC bus cable to the instrument or controlling computer.

6. 1. 2. Message

Messages transmitted through the data lines are divided into the following two types.

1) Interface message

Interface messages are unique to GPIB bus and only instruments with GPIB bus function are able to respond to such messages. When the master control computer sends interface messages to the instrument, the attention line should be lowered at first before interface messages can be transmitted to the instrument via the data line.

2) Instrument message

For the structure and grammar of instrument messages, refer to "5.1.4 SCPI Commands". According to the transmission direction, instrument messages can be divided into the command and instrument response. Unless otherwise specified, the same method should be applied for use of instrument messages with the remote control interface.

a) Command:

The command (programming message) is a kind of message transmitted by the master control computer to the instrument, used for remote control of the instrument function and query of the status information. Commands are divided into the following two types:

- According to the influence on the instrument:
 - Setting command: change the instrument setting status, such as resetting, frequency setting, etc.
 - Query command: inquire and return data, such as instrument identification or parameter query. The query command ends with a suffix question mark.
- According to the definition in the standard:
 - General command: the function and grammar are defined in the IEEE488.2 standard, and this kind of command is suitable for all kinds of instruments, and if possible, used for standard status register management, resetting, automatic testing, etc.
 - Instrument control command: a kind of instrument characteristic command, used to realize the instrument functions. Example: frequency setting. The grammar should comply with the SCPI specifications.

b) Instrument response:

The instrument response (response message and service request) is a kind of query result message transmitted by the instrument to the computer. This kind of message includes the measurement result, instrument status, etc.

6. 1. 3. SCPI Command

- [SCPI Command Introduction](#)
- [SCPI Command Description](#)

6. 1. 3. 1. SCPI Command Introduction

SCPI (Standard Commands for Programmable Instruments) is a command set, which is established based on the IEEE488.2 Standard and suitable for all instrument. It mainly aims to apply the same programmed commands for the same functions to realize the universality of programmed commands.

The SCPI command is composed of the command head and one or more parameter(s), which are separated by spaces. The command head includes one or more key field(s). The command with the suffix question mark is the query command. The command can be divided into general command and special command of different grammatical structures. The SCPI command has the following features:

- 1) Programmed commands are applicable to the test function, but not for instrument description.
- 2) Programmed commands can help to reduce the repetition of similar test functions and ensure the program compatibility.
- 3) Programmed messages are defined in the layer which is not related to the hardware of the physical layer in communication.
- 4) Programmed messages are not related to the programming method and language. The SCPI test program is easy to transplant.
- 5) Programmed commands are scalable to adapt to measurement control of various scales.
- 6) The extensibility of SCPI enables it to be "live" standard. For more SCPI details, refer to:
 - IEEE Standard 488.1-1987, IEEE Standard Digital Interface for Programmable Instrumentation. New York, NY, 1998.
 - IEEE Standard 488.2-1987, IEEE Standard Codes, Formats, Protocols and Comment Commands for Use with ANSI/IEEE Std488.1-1987. New York, NY, 1998.
 - Standard Commands for Programmable Instruments(SCPI) VERSION 1999.0. For details of the remote command set, classification and specifications of S3503 series signal/spectrum analyzer, refer to:
- 7) Appendix B SCPI Command Index of this Manual.
- 8) "3 Remote Control Commands" of the Remote Control Manual.
- 9) Appendix A SCPI Command Tree of Section 6.1 of the Remote Control Manual.
- 10) Appendix B Table of Subsystem-based ASCPI Classification" of Section 6.2 of the Remote Control Manual.
- 11) Appendix C Table of menu-based ASCPI Classification" of Section 6.3 of the Remote Control Manual.

6. 1. 3. 2. SCPI Command Specifications

- [General Terms](#)
- [Command Types](#)
- [Grammar of Special Instrument Commands](#)
- [Command Tree](#)
- [Command Parameters and Responses](#)
- [Command Value System](#)
- [Command Line Structure](#)

1) General terms

The following terms are applicable to this section. In order to better understand the contents, you should know the exact definitions of such terms.

a) Controller

Any computer used to communicate with SCPI devices. The PC, minicomputer or card in a card cage can be used as the controller. Also, some intelligent devices can be used as controller.

b) Equipment

Any device supporting SCPI. Most devices are electronic measurement or excitation devices and establish communicate using GPIB interface.

c) Remote control messages

A combination of one or more properly formatted SCPI commands. Programming messages instruct a device how to measure and output signals.

d) Response messages

A combination of data in specified SCPI formats. Response messages are always transmitted from a device to a controller or monitor. Response messages inform the controller of the internal status or measured values of a device.

e) Commands

Any command compliant with SCPI standard. Messages control the combination of device commands. Generally, the commands consist of keyword, parameter and punctuation.

f) Event commands

Some commands are events and cannot be queried. Generally, there is no front panel key corresponding to the event command. The event command is used to trigger an event at the specific time.

g) Query

A special type of command. For query of control equipment, return to the response message conforming to the controller grammar requirements. Query string always end with a question mark.

2) Command type

The SCPI command is divided into two types: general command and special instrument command. Common commands are used to manage macros, status registers, synchronization and data storage, and are defined by IEEE 488.2. It can be easily identified with the star mark in front of the command. For example, *IDN? , *OPC and *RST are common commands. The general command is not the special instrument command and can be explained in the same method, regardless of the current path setting.

The special instrument command is easy to identify with the colon (:). The colon is used at the beginning of a command statement and between keywords, as in FREQuency[:CW?]. Based on the internal functional modules of the instrument, special instrument commands are divided into corresponding subsystem command subsets. For example, the power subsystem (:POWer) includes relevant power commands, and the status subsystem (:STATus) includes the status control register commands.

3) Grammar of special instrument command

Table 6.2 Special Characters of Command Grammar

Symbol	Meaning	Examples
	The vertical line between the keyword and parameter means a variety of options.	[[:SOURce]:AM: SOURce EXTernal INTErnal EXTernal and INTErnal are optional.

[]	The square brackets means that the included keywords or parameters are optional in the command. Even if the included keywords or parameters are ignored, the command will be executed.	[:SOURce]:AM[:DEPT]h]:EXPon ential? SOURce and DEPT are optional.
< >	The part in the angle brackets must not be used according to the literal meaning in the command. The angle brackets mean the necessary part.	[:SOURce]:FREQ:STOP<val><unit> In this command, <val> and <unit> must be replaced with the actual frequency and unit. Example: ":FREQ:STOP 3.5GHz"
{ }	The braces mean that the parameter is optional.	[:SOURce]:LIST:POWer <val>{,<val>} Example: "LIST:POWer 5"

Table 6.3 Command Grammar

Character, Keyword and Grammar	Examples
Upper-case lettering indicates the minimum set of characters required to execute the command.	[:SOURce]:FREQuency[:CW]?, FREQ is the short part of the command.
The lowercase character part of the command is optional. This flexible format is known as "flexible listening". For more information, refer to the "Command Parameter and Response" section.	:FREQuency :FREQ, :FREQuency or :FREQUENCY, is correct.
If a colon is applied between two command mnemonics, the current path in the command tree will be moved to next layer. Refer to "Command Tree" for more information on command paths.	:TRIGger:OUTPut:POLarity? TRIGger is the keyword of the top layer of the command.
Adjacent parameters in the command should be separated with commas. The parameters have no influence on the path layer and do not belong to the command path part.	[:SOURce]:LIST:DWELl <val>{,<val>}
The semicolon is used to separate two adjacent commands, with no influence on the current command path.	:FREQ 2.5GHZ; :POW 10DBM
The blank character, such as <space> or <tab>, is generally ignored when not used between or in keywords. are generally ignored as long as they do not occur within or between keywords. However, you must use the blank character to separate the command and parameter, with no influence on the current path.	:FREQ uency or :POWer :LEVel6.2 is not allowed. Allowed ":LEVel" and "6.2" must be separated with the space. E.g. ":POWer:LEVel 6.2"

A typical command is made up of keywords prefixed with colons (:). The keywords are followed by parameters. The following is an example syntax statement:

```
[:SOURce]:POWer[:LEVel] MAXimum|MINimum
```

In the above example, ":POWer" is followed by [:LEVel], with no space. "MINimum|MAXimum" behind [:LEVel] is the parameter part. A space is used between the command and parameter. For the other parts of the grammar expression, see Table 6.2 and 6.3.

4) Command tree

Special instrument commands are used in most of remote control programs. To analyze this kind of command, the SCPI structure should be similar to the file system, known as the command tree.

The top command is the root command, referred to as the "root". Follow the specific path of the tree structure to next layer in command analysis. Example: :POWer:ALC:SOURce? Where, ":POWer" refers to AA, ":ALC" refers to BB, and ":SOURce" refers to

GG. The whole command path is (:AA:BB:GG).

The command interpreter, a module of the instrument software, is dedicated to analysis of each received SCPI command. It is used to divide the command into separate command elements according to a series of rules to distinguish command tree paths. The current command should be kept unchanged after analysis, so as to analyze the subsequent command more rapidly and efficiently as the same command keyword may be used in various paths. The current command path should be set as the root after the instrument is started or reset (*RST).

5) Command parameter and response

Table 6.4 SCPI Command Parameters and Response Types

Parameter type	Response Data Types
Numeric	Real or integer
Extended Numeric	Integer
Discrete	Discrete
Boolean	Numeric Boolean
String	String
Block	Block with definite length
	Block of uncertain length
Non-decimal Numeric	Hexadecimal system
	Octal system
	Binary system

SCPI defines different data formats for use in program and response messages. It does this to accommodate the principle of forgiving listening and precise talking. Refer to IEEE488.2 for more information. Forgiving listening means the command and parameter formats are flexible. For example, the signal/spectrum analyzer is set with a frequency offset status command: FREQUENCY:OFFSet:STATe ON|OFF|1|0. The following command formats are to turn on the frequency offset mode:

:FREQUENCY:OFFSet:STATe ON, :FREQUENCY:OFFSet:STATe 1,

:FREQ:OFFS:STAT ON, :FREQ:OFFS:STAT 1.

Various parameter types correspond to one or more response data type(s). The numeric type of the parameter will change into the data type in query. Response data are accurate, strictly referred to as "accurate telling".

For example, if you query the power status (:POWER:ALC:STATe?) when it is on, the response is always 1, regardless of whether you previously sent :POWER:ALC:STATe1 or :POWER:ALC:STATe ON.

a) Numerical parameter

Special instrument commands and general commands can be expressed as numeric parameters. All kinds of common decimal counting can be applied for reception of numeric parameters, including the plus or minus, decimal and scientific counting methods. If one device can only receive the specific numeric type, such as the integer, the received numeric parameter will be automatically rounded.

The following are examples of numeric parameters:

0	no decimal point required
100	fractional digits optional
1.23	leading signs allowed

4.56e<space>3	space allowed after the E in exponential
-7.89E-01	use either E or e in exponential
+256	leading + allowed
5	digits left of decimal point optional

b) Extended numeric parameters

The numeric parameter is extended to specify the physical quantity in the majority of measurements related to special instrument commands. Extended numeric parameters accept all numeric parameter values and other special values as well. The extended numeric parameters include the MAXimum and MINimum. Other special values, such as UP and DOWN, are received depending on the analysis capability of the instrument. All effective parameters are listed in the SCPI command table.

Note: The extended numeric parameters are not applicable to general commands or STATus subsystem commands. The following are examples of extended numeric parameters:

101	Numeric parameter
1.2GHz	GHz can be used for exponential (E009)
200MHz	MHz can be used for exponential (E006)
-100mV	negative 100 millivolts
10DEG	10 degree
MAXimum	sets parameter to largest possible value
MINimum	sets parameter to smallest possible value
UP	a stepper up
DOWN	a stepper down

c) Discrete parameters

Discrete parameters are used to identify a limited number of parameters to be set. Discrete parameters use mnemonics to represent each valid setting. Similar to the programmed command mnemonics, discrete parameter mnemonics are divided into long type, short type and uppercase/lowercase mixed type.

Discrete parameters and commands are used together in the following examples.

:TRIGger[:SEQuence]:SOURce BUS|IMMediate|EXTernal

BUS	GPIB,LAN,RS-232 triggering
IMMediate	immediate trigger
EXTernal	external triggering

d) Boolean parameters

The Boolean parameter represents one true or false binary condition, and only four possible values can be applied. The following are examples of boolean parameters:

ON	boolean true
OFF	boolean false
1	boolean true
0	boolean false

e) String parameters

For the character string type, the ASCII character string is allowed to be transmitted as the parameter. Single and double quotes are used as delimiters.

The following are examples of string parameters:

[:SOURce]:POWer[:LEVel] MAXimum|MINimum

f) Real response data

Most test data are real data that represent decimal numbers in either fixed decimal or scientific notation. Most high-level programming languages support such two formats.

The following are examples of real response data:

1.23E+0
 -1.0E+2
 +1.0E+2 0.5E+0
 0.23
 -100.0
 +100.0
 0.5

g) Integer response data

Integer response data are decimal representations of integer values including signs. For status register query, integer response data will be returned in most cases.

The following are examples of integer response data:

0	Signs are optional
+100	leading + allowed
-100	leading - allowed
256	never any decimal point

h) Discrete response data

Discrete response data are similar to discrete parameters. The main difference is that discrete response data only returns the short form of a particular mnemonic in all upper case letters.

Example of discrete response data:

INTernal	power leveled internally
EXTernal	power leveled externally
MMHead	power leveled by millimeter wave source module

i) Numeric Boolean response data

Boolean response data returns a binary numeric value of 1 or 0.

j) String response data

String response data are similar to string parameters. The main difference is that the double quotation marks instead of single quotation marks must be used as the separator of the string response data. Double quotation marks are allowed to be embedded in the string response data, with no character.

6) System of numeric value of command

The command value can be entered in the binary, decimal, hexadecimal or octal format. An appropriate identifier should be applied in front of the value in the binary, hexadecimal or octal format. The identifier is not required in the decimal format (default). The entered value with no identifier will be saved in the decimal format. The following list shows the identifiers for the formats that require them:

- #B means that the figure is a binary value;
- #H means that the figure is a hexadecimal value;

- #Q means that the figure is an octal value.

The following are examples of SCPI command values and identifiers for the decimal value 45:

#B101101

#H2D

#Q55

In the following example, the hexadecimal value 00A is used to set the RF output power as 10dBm (or equivalent to the value in the selected unit, such as DBUV or DBUVEMF).

:POW #H000A

In the non-decimal format, the measurement unit such as DBM or mV is not used together with the value.

7) Command line structure

One command line may include multiple SCPI commands. The following methods can be applied to end the current command line:

- Enter;
- Enter key and EOI;
- EOI and the last byte.

Commands in the command line are separated by semicolons. Commands of different subsystems begin with the colon. For example:

MMEM:COPY "Test1", "MeasurementXY";:HCOP:ITEM ALL

This command line includes two commands, the first of which is the MMEM subsystem command and the second of which is the HCOP subsystem command. If adjacent commands belong to the same subsystem and the command paths are subject to partial overlapping, the commands can be abbreviated. For example:

HCOP:ITEM ALL;:HCOP:IMM

This command line includes two commands which belong to the same level of the HCOP subsystem. The second command is started at the level lower than the HCOP command, and the colon at the beginning of the command can be omitted. The command line can be abbreviated as follows:

HCOP:ITEM ALL;IMM

6. 1. 4. Command Sequence and Synchronization

IEEE488.2 defines the difference of the overlapping command and continuous command.

- The continuous command refers to the command sequence to be executed continuously. Generally, the speed of command execution is high.
- The overlapping command refers to the command which is not executed automatically before execution of next command. The processing time of the overlapping command is generally long. The program is allowed to process other events synchronously.

Even if one command line includes multiple setting commands, commands may not be executed according to the reception sequence. In order to execute each command according to a certain sequence, all the commands must be transmitted as a separate command line.

Example: command line including setting and query commands.

If one command line includes query commands, query results are unpredictable. The returned value will be fixed if the following command is entered:

:FREQ:STAR 1GHZ;SPAN 100;:FREQ:STAR?

Returned value: 1000000000 (1GHz)

The returned value will not be fixed if the following command is entered:

```
:FREQ:STAR 1GHz;STAR?;SPAN 1000000
```

The returned result may be the current starting frequency of the instrument before command sending, as the commands will be executed one by one by the host program after command messages are received. The returned result may be 1GHz in the case of execution after the commands are received by the host program.



Setting commands and query commands are sent separately.

- General rules: setting commands and query commands should be sent in different program messages in order to ensure that the returned results of query commands are correct.

6. 1. 4. 1. Prevention of Overlapping Execution of Commands

In order to prevent overlapping execution of commands, multiple threads or commands can be applied, including *OPC, *OPC? or *WAI. The three commands cannot be executed until the hardware is set. The computer may be forced to wait for a certain period to synchronize certain events in the programming process. The above methods are described below.

- **Use multiple threads in the control program.**

Multiple threads are used to complete waiting commands and synchronize the user interface and program, that is, the command "*OPC?" is executed in each single thread, with no blockage of GUI or program threads.

- **The use of three commands in synchronous execution is shown in the following table.**

Table 6.5 Command Grammar

Method	Execution Action	Programming Method
*OPC	After command execution, set the operation completion bit in the ESR register.	Set ESE BIT0; Set SRE BIT5; send the overlapping command and *OPC; Wait for the service request signal (SRQ). The service request signal means that the overlapping command has been executed.
*OPC?	Stop executing the current command and return to 1. Only when the operation completion bit in the ESR register is set, the command will be returned, indicating that the previous command has been processed.	End the current command processing before executing other commands. Directly send the command after processing of the current command.
*WAI	Before executing *WAI, wait for sending of all commands. Then process the uncompleted commands.	End the current command processing before executing other commands. Directly send the command after processing of the current command.

6. 1. 5. Status Report System

The status report system is used to save all operation status information and error information of the current instrument. The operation status information and error information are respectively saved in the status register and error queue and can be inquired through the programmed interface.

- [Structure of status register organization](#)

- Application of status report system

6. 1. 5. 1. Structure of Status Register Organization

Register categories are as follows:

1) STB, SRE

The top register of the status report system is composed of the status byte (STB) and associated shielding register, i.e. service request enabling register (SRE). STB is used to collect the information of registers of the lower layers and save the general working conditions of the instrument.

2) ESR and SCPI status register

STB is used to receive the following register information:

- Relevant values of event status registers and event status enabling (ESE) shielding registers.
- SCPI status registers, such as STATus:OPERation and STATus:QUEStionable registers (defined by the SCPI standard), including specific operations of the instrument. All the SCPI status registers have the same internal structure (refer to "2.1.5.2 Structure of SCPI Status Register" of the program control manual).

3) IST, PPE

The separate bit of SRQ and IST sign ("IndividualStatus") is composed of the combination of all statuses of the instrument. The STB data bit for the IST sign depends on the associated Parallel Poll Enable (PPE) Register.

4) Output buffer zone

The output buffer zone is used to save messages returned by the instrument to the controller. It does not belong to the status report system, but is decisive to the MAV bit of STB.

For details of the above registers, refer to "2.1.6 Status Report System" of the program control manual. Please refer to Fig. 6.1 for the hierarchical structure of the status register.



SRE and ESE

The Service Request Enable (SRE) register is used as the enabling part of STB. Similarly, ESE can be used as the enabling part of ESR.

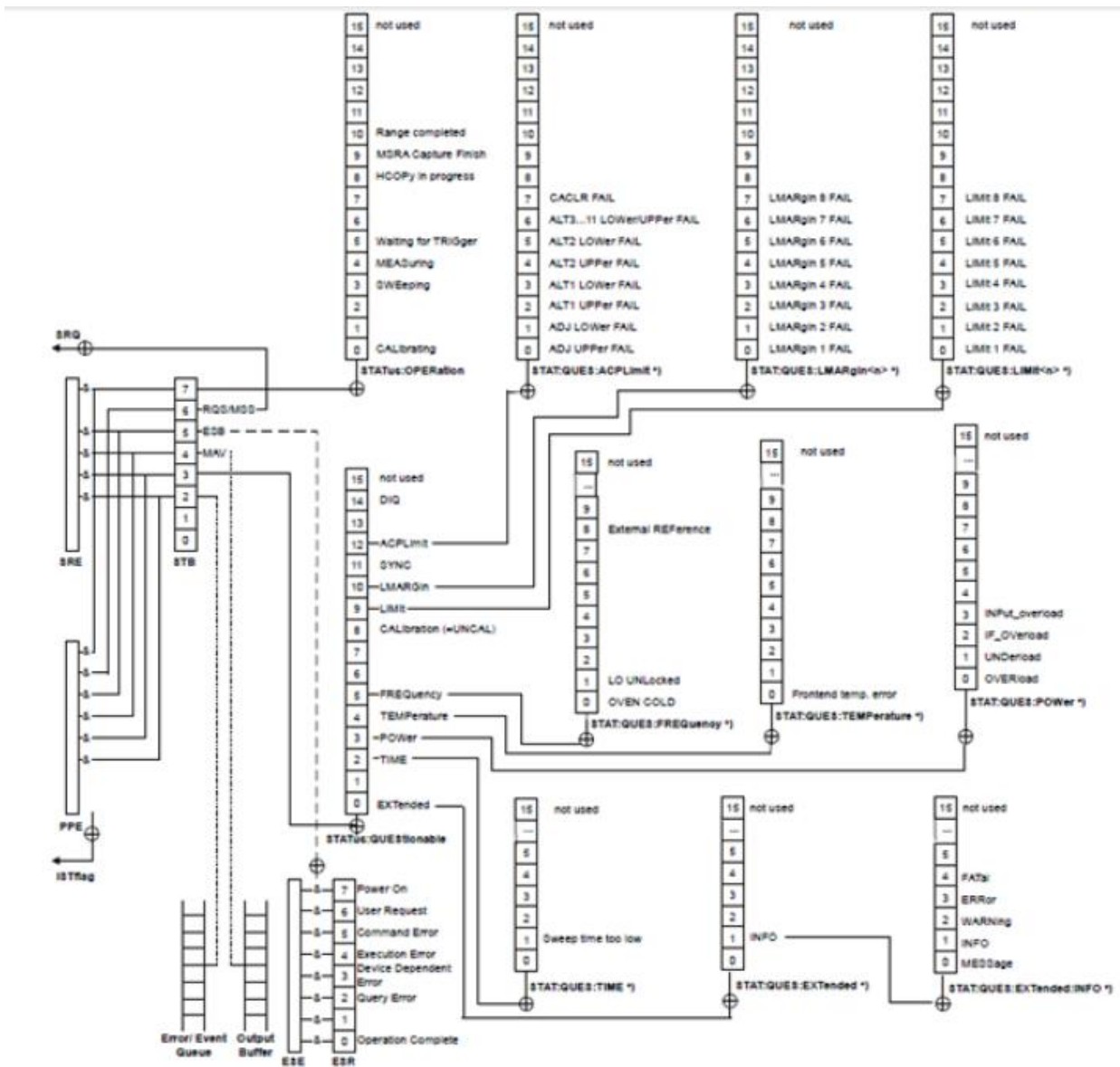


Fig. 6.1 Hierarchical Structure of Status Register

6. 1. 5. 2. Application of Status Report System

The status report system is used to monitor the status of one or more instrument(s) in the test system. In order to properly realize the functions of the status report system, the controller in the test system must receive and evaluate the information of all instruments. Standard methods to be applied include:

- 1) Service request (SRQ) sent by the instrument.
- 2) Series query sent by the controlled to all instruments in the bus system, aiming to find the sender and causes of service request.
- 3) Parallel query of all instruments.
- 4) Query of specific instrument statuses with programmed commands.

For specific operations, refer to "2.1.5 Application Status Report System" of the programming manual.

6. 1. 6. Programming Precautions

- 1) Initialize the instrument status before changing the setting.

For instrument setting of remote control, initialize the instrument status (sending "**RST", etc.) and then set the required status.

2) Command sequence

Generally, the setting command and query command should be transmitted separately. Otherwise, the returned value of the query command will change according to the current instrument operation sequence.

3) Fault response

The service request must be sent by the instrument. The controller of the test system should be programmed to guide the instrument to actively send the service request if required, so as to enable the corresponding service interruption program.

4) Error queue

The error queue instead of the status register should be inquired once the service request is processed by the controller program, so as to find more accurate causes. The queue should be always inquired in the controller program test phase to obtain the commands sent by the controller to the instrument.

6. 2. Programmed Port and Configuration of Instrument

- LAN
- GPIB

6. 2. 1. LAN

The programmed LAN (Local Area Network) system is configured with SICL-LAN to control S3503 signal/spectrum analyzer.



Use of USB master control port connector of the front panel:

The Type-A connector of the front panel is a USB master control port connector. In the S3503 signal/spectrum analyzer, this port is connected to the flash disc with USB1.1 interface to update the software in the instrument. It can also be connected to the USB keyboard and mouse to control the signal/spectrum analyzer. However, this port cannot be used for remotely control the instrument. It must not be used for program control of the instrument.

However, this port cannot be used for remotely control the instrument.

-
- On connection
 - Interface Configuration

6. 2. 1. 1. Establish Connection

Connect the S3503 series signal/spectrum analyzer and external controller (computer) to LAN through cables. Pay special attention to the possibility of conflict caused by IP address setting and confirm with the network administrator before setting to prevent any conflict.

6. 2. 1. 2. Interface Configuration

Ensure that the physical connection is smooth for remote control of the signal/spectrum analyzer by LAN. As the DHCP, domain name access and WAN are not supported, the network programming of the signal/spectrum analyzer is relatively simple. Users only need to press [System], [Interface Configuration ►], [Network Configuration ►] and set the "IP address", "Subnet mask" and "Default gateway" to be within the subnet with the master controller as shown in the menu of Fig. 6.2.

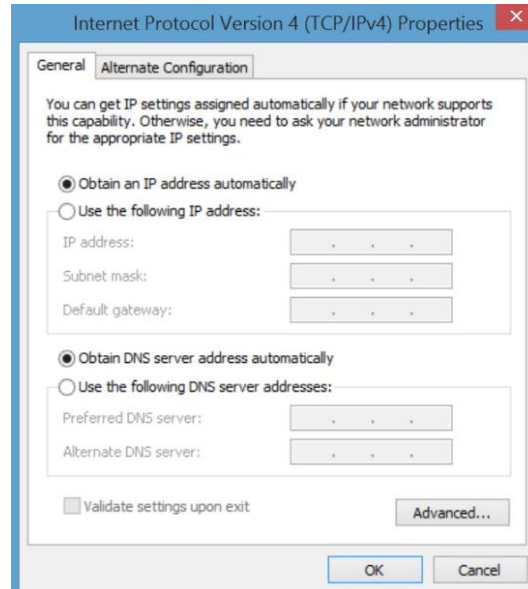


Fig. 6.2 LAN Interface Setting

Attention

Ensure that the signal/spectrum analyzer is in proper physical connection via 10Base-T LAN or 100Base-T LAN cable.

The signal/spectrum analyzer only supports the establishment of one LAN control system and static IP address setting, and does not support DHCP or access to the host through the DNS and domain name server. Therefore, it is not required to modify the subnet mask. The subnet mask of the instrument should be set as the fixed value 253.353.355.0.

6. 2. 2. GPIB

- On connection
- Interface Configuration

6. 2. 2. 1. Establish Connection

Connect the S3503 series signal/spectrum analyzer and external controller (computer) to LAN through GPIB cables.

6. 2. 2. 2. Interface Configuration

To set the GPIB interface, press [System] [Interface Configuration ►] [GPIB address] to enter the interface shown in Fig. 6.3; modify the GPIB address in the [Local GPIB address] input box through the number keys of the front panel.

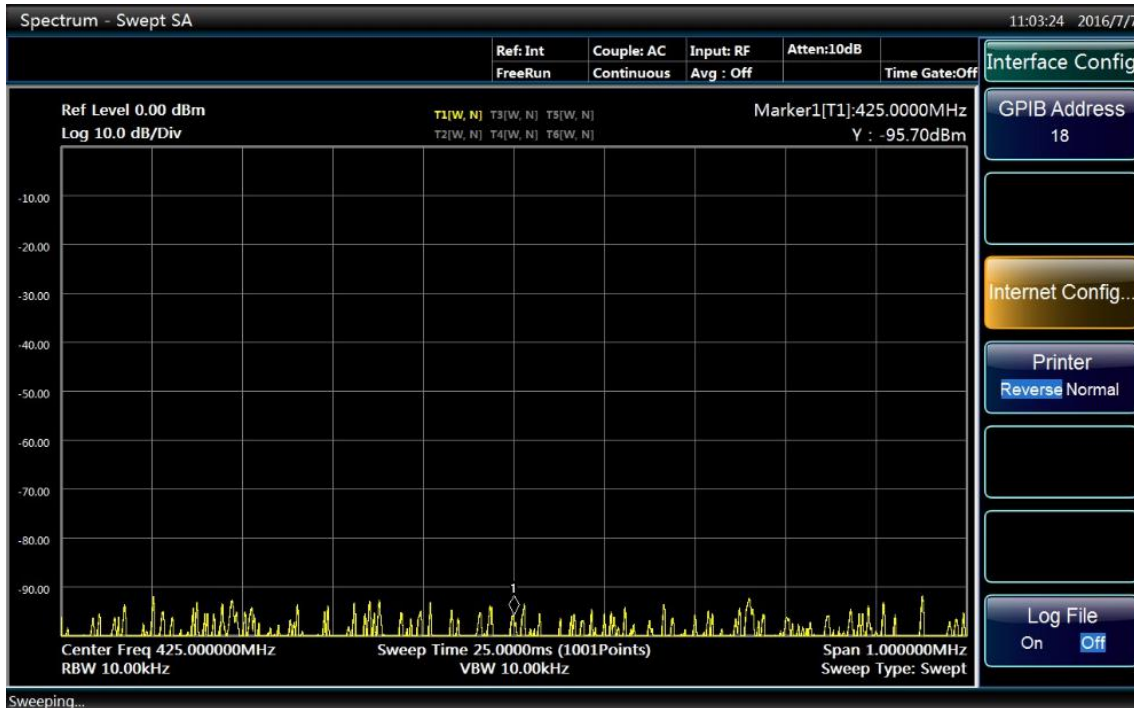


Fig. 6.3 GPIB Interface Setting

6. 3. Basic Programming Method of VISA Interface

The following example shows the basic method of instrument programming with the VISA library. Take the C++ language as the example.

- Install VISA Library
- Initialize Controller
- Initialize Instrument
- Sending of setting command602
- Reading of measurement instrument state
- Reading of frequency marker
- Command synchronization

6. 3. 1. Install VISA library

The VISA library must be installed at first for remote control. The VISA library includes the transmission functions of the bottom VXI, GPIB, LAN and USB interface to facilitate direct calling. This signal/spectrum analyzer is compatible with the programming interfaces of GPIB, LAN and RS-232. Combination of such interfaces with the VISA library helps to remotely control the signal/spectrum analyzer.

6. 3. 2. Initialization of Controller

```
/******/
```

The following example shows how to establish the communication connection between the VISA library and instrument (with the specified descriptor).

```
// initialize the controller: open the default resource manager and return the instrument handle to the analyzer.
```

```
/******/
```

void InitController()

```
{
ViStatus status;
status = viOpenDefaultRM(&defaultRM);
status = viOpen(defaultRM, analyzerString, VI_NULL, VI_NULL, &analyzer);
}
```

6. 3. 3. 6.3.3 Instrument Initialization

```
/*-----*/
```

The following example shows the initialization of the default instrument state and clearing of the status register.

```
/*-----*/
```

void InitDevice()

```
{
ViStatus status; long retCnt;
status = viWrite(analyzer, "**CLS", 4, &retCnt); //reset status register
status = viWrite(analyzer, "**RST", 4, &retCnt); //Reset instrument
status = viWrite(analyzer, ":INST:SEL SA", 12, &retCnt); //Set instrument operating mode (with commands of the signal/spectrum analyzer as an example)
}
```

6. 3. 4. Sending of Setting Command

```
/*-----*/
```

The following example shows how to set the center frequency of S3503 signal/spectrum analyzers.

```
/*-----*/
```

void SimpleSettings()

```
{
ViStatus status; long retCnt;
// set the center frequency as 128MHz.
status = viWrite(analyzer, ":FREQUENCY:CENTER 128MHz", 22, &retCnt);
}
```

6. 3. 5. Reading of Measurement Instrument Status

```
/*-----*/
```

The following example shows how to read the setting status of the instrument.

```
/*-----*/
```

void ReadSettings()

```
{
ViStatus status; long retCnt;
char rd_Buf_CW[VI_READ_BUFLen]; // #define VI_READ_BUFLen 40
```

```
//Query center frequency
```

```
status = viWrite(analyzer, ":FREQ:CENT?", 10, &retCnt); status = viRead(analyzer, rd_Buf_CW, 20, &retCnt);
```

```
// printing of commissioning information sprintf("Cw is %s", rd_Buf_CW);
```

```
}
```

6. 3. 6. Reading of frequency marker (signal/spectrum analyzers)

```
/******
```

The following example shows how to read the frequency scale information.

```
/******
```

```
void ReadMarker ()
```

```
{
```

```
ViStatus status; long retCnt;
```

```
char rd_Buf_Marker[VI_READ_BUFLEN]; // #define VI_READ_BUFLEN 20
```

```
// opening of frequency marker 1 and query of frequency marker peak (frequency and amplitude) status = viWrite(analyzer, ":CALC:MARKER:MAX", 25, &retCnt);
```

```
status = viWrite(analyzer, ":CALC:MARK:Y?", 15, &retCnt);
```

```
// printing of commissioning information sprintf("Marker is %s", rd_Buf_Marker);
```

```
}
```

6. 3. 7. Command Synchronization

```
/******
```

The method of command synchronization is introduced below, taking the scanning process as an example.

```
/******
```

```
void SweepSync()
```

```
{
```

```
ViStatus status; long retCnt; ViEventType etype; ViEvent event; int stat;
```

```
char OpcOk [2];
```

```
/******
```

```
/* Command INITiate[:IMMediate] start single scanning ( closed in continuous scanningINIT:CONT OFF)*/
```

```
/* Execute next command of command buffer zone after single scanning */
```

```
/******/ status = viWrite(analyzer, ":INIT:CONT OFF", 13, &retCnt);
```

```
// Method 1 of waiting for ending of scanning: use *WAI status = viWrite(analyzer, ":INIT", 18, &retCnt);
```

```
status = viWrite(analyzer, "*WAI", 18, &retCnt);
```

```
// Method 2 of waiting for ending of scanning: use *OPC? status = viWrite(analyzer, ":INIT", 20, &retCnt);
```

```
status = viWrite(analyzer, "*OPC?", 18, &retCnt);
```

```
status = viRead(analyzer, OpcOk, 2, &retCnt); //Wait for*OPC and return to "1"
```

```
// Method 3 of waiting for ending of scanning: use *OPC
```

```
//To use GPIB service request, set "Disable Auto Serial Poll" is "yes" status = viWrite(analyzer, "**SRE 32", 7,
&retCnt);
status = viWrite(analyzer, "**ESE 1", 6, &retCnt); // enable service request ESR
// set event enabling bit to complete operation
status = viEnableEvent(analyzer, VI_EVENT_SERVICE_REQ, VI_QUEUE, VI_NULL);
// enable SRQ event
status = viWrite(analyzer, ":INIT ", 18, &retCnt); status = viWrite(analyzer, "**OPC?", 18, &retCnt);
// start scanning synchronously with OPC
status = viWaitOnEvent(analyzer, VI_EVENT_SERVICE_REQ, 10000, &etype,
&event)
// wait for service request
status = viReadSTB(analyzer, &stat);
status = viClose(event); // close event handle
// prohibit SRQ event
status = viDisableEvent(analyzer, VI_EVENT_SERVICE_REQ, VI_QUEUE);
// main program continues.....
}
```

6. 4. I/O Library

- [Overview of I/O Library](#)
- [Installation and Configuration of I/O Library](#)

6. 4. 1. Overview of I/O Library

The I/O library is a library of pre-written software programs for the instrument, known as the instrument drive program, i.e. instrument driver. It is an intermediate software layer between the computer and instrument hardware equipment. It is composed of the function library, utility program, tool kit, etc., and is a set of software code modules. This set corresponds to a series of planned operations, such as instrument configuration, reading, writing, triggering, etc. It is installed the computer and used as a connecting bridge and link between the computer and instrument. With the easy-to-program high-level modular library, the user does not need to the complex special low-level programming protocol for the specific instrument. It is key to use the instrument driver to rapidly develop the test measurement application.

From the functional perspective, one general instrument driver is composed of five parts: functional body, interactive developer interface, program developer interface, subprogram interface and I/O interface, as shown in Fig. 6.4.

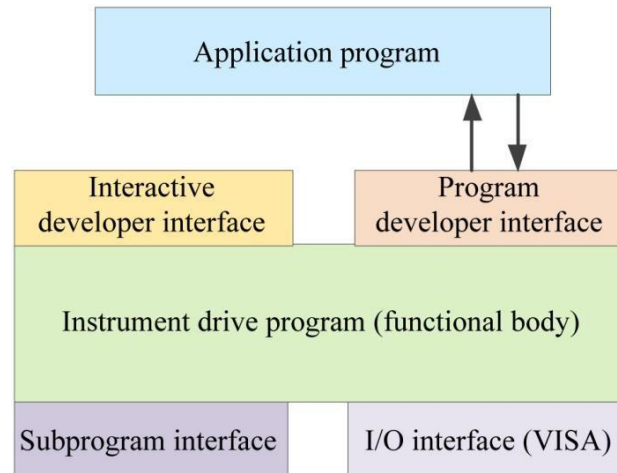


Fig. 6.4 Instrument Driver Structure Model

Details are as follows:

- 1) **Functional body.** This is the main functional part of the instrument driver and can be understood as the framework program of the instrument driver.
- 2) **Interactive developer interface** To facilitate use, the graphical interactive developer interface is generally set in the application environment supporting instrument driver development. For example, the function panel of Labwindows/CVI is a kind of interactive development interface. Each parameter of the instrument driver function in the function panel is expressed in the graphical control form.
- 3) **Programming developer interface** This is a software interface for the application program to call the instrument driver function, such as the dynamic link library file of instrument driver.dll in the Windows system.
- 4) **I/O interface** It is used for actual communication between the instrument driver and instrument. It is allowed to use the special bus I/O software, such as GPIB and RS-232, or the general standard I/O software (VISA/I/O) to be used over multiple buses.
- 5) **Subprogram interface** It is a software interface for the instrument driver to visit other supporting libraries, such as the data library, FFT function, etc. It will be used when other software modules, operating systems, program code libraries and analysis function libraries are called by the instrument driver after completion of tasks.

6. 4. 2. I/O Library Installation and Configuration

With applications in the test field, the I/O library has experienced various development phases from the traditional instrument to virtual instrument. In order to ensure the instrument interchangeability in the automatic test system and the reusability of the test program, the instrument drive program has also experienced various development phases. At present, the popular universal driver is an IVI (Interchangeable Virtual Instruments) instrument driver. Based on the IVI specification, the new instrument programming interface, inserted drive program and VPP architecture on VISA are defined, so that the test application program is fully independent of the instrument hardware. In addition, the unique functions of instrument simulation, range detection and status caching are added to improve the system operating efficiency and truly realize the instrument interchangeability.

IVI drives are divided into two types: IVI-C and IVI-COM. The IVI-COM drive is based on the Microsoft component object model (COM) technology and of COM API form. The IVI-C drive is based on the ANSI C technology and of C API form. The two types of drivers are designed in accordance with the instrument categories defined in the IVI specifications. The application development environments are the same, including Visual Studio, Visual Basic, Agilent VEE, LabVIEW, CVI/LabWindows, etc.

In order to meet user requirements in different development environments, two types of drivers are needed at present. The IVI drive of the signal/spectrum analyzer is developed with Nimbus Driver Studio, and the IVI-COM and IVI-C drive and program installation package is generated directly. For specific installation configuration, refer to the accompanying data of the control card and I/O library.

The installed IVI driver is divided into the IVI inherent function group and instrument function group (basic function group and extended

function group). For specific functional classification, functions and attribute details, refer to the help file of the driver.

! Prompt

Port configuration and I/O library installation:

Before controlling the signal/spectrum analyzer with a computer, check whether the necessary port and I/O library are properly installed and configured.

7. Fault Diagnosis and Repair

This chapter will introduce how to find out problems and receive the after-sale service. Indicate error messages of the signal/spectrum analyzer. In case of any problem in operation of the S3503 series signal/spectrum analyzer you purchased or when you need to purchase relevant components or accessories, please contact us as we provide complete after-sales services.

In general, the trouble is caused by failure of hardware/software or users' misuse. Please contact us immediately in case of any trouble. For the signal/spectrum analyzer within the warranty period, we will implement free repair according to the commitments in the warranty; otherwise, we will charge the costs.

- [Operating principle](#)
- [Fault diagnosis and troubleshooting](#)
- [Error information](#)
- [Repair](#)

7. 1. Operating principles

To help users better understand functions of the S3503 series signal/spectrum analyzer and solve problems occurred during operation, basic operating principles and hardware schematic diagram of the signal/spectrum analyzer will be introduced in this section.

- [Operating principles and hardware functional block diagram](#)

7. 1. 1. Operating principles and hardware functional block diagram

Controlled by a microprocessor and operated based on Windows 7 operating system, the instrument is a triple- conversion superheterodyne sweep type signal/spectrum analyzer. It consists of microwave receiver module, RF processor module, synthetic LO module, data collection & processing module, DSP processing module, control display module and power module. The functional block diagram of the instrument is as shown in Fig. 7.1.

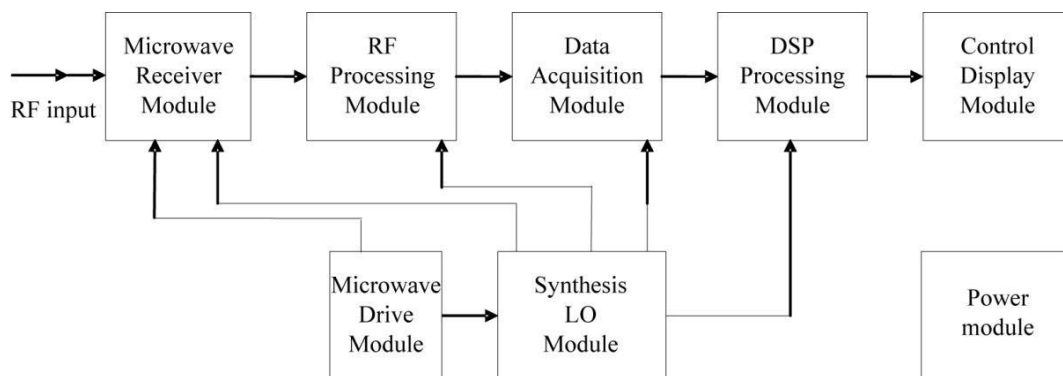


Fig. 7.1 Functional block diagram of S3503 series signal/spectrum analyzer

The block diagram of frequency conversion of the microwave and millimeter wave circuit is as shown in Fig. 7.2.

The 3GHz signal of zero wave band enters the low-band frequency converter module from the input terminal via the 14 dB switch DC block programmable step attenuator, the 58 dB programmable step attenuator and the duplexer, mixes with the signal from the first LO (YIG oscillator) to obtain 5.225 GHz IF signal. Such IF signal goes to the second frequency converter in the low-band frequency converter module via the 5.225 GHz band-pass filter and mixes with the 4.8 GHz beat frequency to get 425 MHz second IF signal. When the frequency is less than 1.1 GHz and the frequency span is less than 5 MHz, the instrument automatically enters phase noise optimization mode where the input signal mixes with the two divided-frequency signal (2.825 - 4.525 GHz) from the first LO (YIG oscillator) to obtain 2.825 GHz IF signal. Such IF signal goes to the second frequency converter in the low- band frequency converter module via the 5.225 GHz band-pass filter and mixes with the 2.4 GHz beat frequency to get 425 MHz second IF signal. The high band is divided into five bands: first, second, third, fourth and fifth bands.

The 40 GHz signal enters the LO mixing module via the 14 dB switch DC block programmable step attenuator, the 58 dB programmable step attenuator, the duplexer, the millimeter-wave coaxial switch (optional preselector bypass), millimeter-wave YTF, millimeter-wave low-noise amplifier (or without YTF in wideband mode) and preselector bypass YTF to mix with the signal from the first LO in the built-in millimeter-wave mixer for fundamental wave frequency mixing in order to obtain second IF signal.

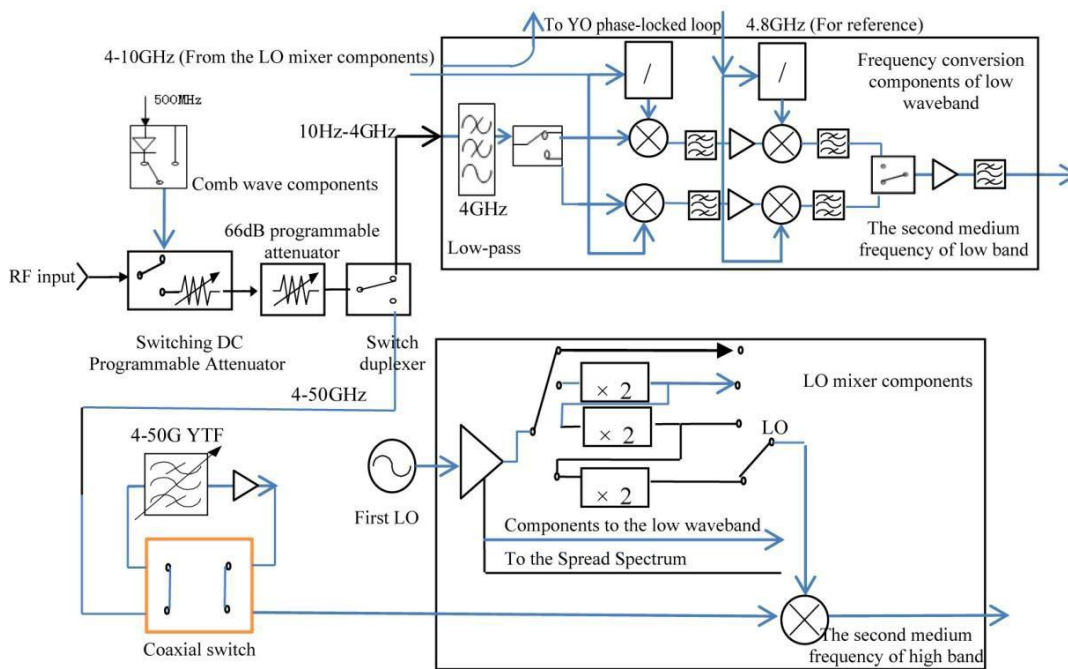


Fig. 7.2 Block diagram of frequency conversion of the microwave and millimeter wave circuit

The RF processor module combines low-band, high-band and external-mixing input signals from the switch selector into one signal for flatness compensation. The resulting 425 MHz signal is divided by a power divider into two, one for wideband IF output (375 MHz IF in wideband analysis mode) and the other for mixing with 500 MHz signal from the third LO to output 75 MHz IF signal.

The synthetic LO module mainly consists of 4 loops, including the reference loop, the sample loop, YTO loop and fractional loop. In single loop mode, the LO signal of 3 - 10 GHz enters the fractional loop module via the divide- by-2 divider to get a fixed IF of 50 MHz. Such fixed IF signal mixes with the 50 MHz signal from the reference loop for phase discrimination. The resulting error signal is sent to YTO drive coil for YTO frequency adjustment until the sample IF output is equal to 50 MHz. In four-loop mode, the LO signal of 4 - 9 GHz enters the sampler and the sample loop provides a signal of 618 - 905 MHz as the sample LO. The sample IF output of 30 - 64 MHz mixes with the 20-way frequency output from the fractional loop for phase discrimination. The resulting error signal is sent to YTO drive coil for YTO frequency adjustment until the sample IF output is equal to the fractional loop output. Phase lock synthesis greatly improves LO frequency stability and the microstep (mHz) from the fractional loop enables LO stepping by 1 (mHz) to increase the frequency resolution to 1 Hz.

The IF collection and processing module contains four circuit boards for narrowband collection, wideband collection, base band collection and DSP processing respectively. The narrowband collecting board quantifies 75 MHz IF signal with bandwidth of 40 MHz at a rate of 100 MHz. FPGA on the board is capable of digital down conversion, IQ data separation and saving and transmits the data to

DSP processing board or the host. The wideband collecting board quantifies 425 MHz IF signal with bandwidth of 200 MHz at a rate of 500 MHz. FPGA on the board is capable of digital down conversion, IQ data separation and saving and transmits the data to DSP processing board or the host.

The DSP processor module is mainly used for spectral analysis in sweep detection mode and wideband record and playback in wideband record mode. In sweep detection mode, the DSP processing board sends the data preprocessed by the narrowband or wideband collecting board to three DSPs for spectral analysis and transmits the processing result to the host for display processing; in wideband record and playback mode, the DSP processing board sends the data of the narrowband or wideband collecting board to the recorder for saving or return the data in the recorder back to the host for display processing.

The master controller controls internal operations of the signal/spectrum analyzer and receives various requests from the keyboard on the front panel or the outer computer via the I/O port, while the control program in the flash memory card determines operations to be performed by the master controller. The master controller sends relevant control signals to such microwave components as YTO, YTF, programmable step attenuator and RF switch via the microwave drive board.

7. 2. Fault Diagnosis and Troubleshooting

Generally, problems in the instrument are caused by hardware/software failure or improper use. In case of any problem, please check and save error message, analyze possible causes, and perform preliminary troubleshooting with reference to the methods indicated in "7.2.1 Basic procedure of fault diagnose" and "7.2.2 Common faults and solutions". You can also contact our customer service center and provide the collected error information. We will assist you to solve the problem as soon as possible. For more details, refer to the contact information in the Manual or visit the website www.ei41.com to obtain the contact information of the nearest technical support center.



Fault diagnosis and guidance

This section aims to guide simple judgment and disposal of faults of the S3503 series signal/spectrum analyzer. If necessary, you need to provide accurate feedbacks to the manufacturer for us to solve problems as soon as possible.

7. 2. 1. Basic procedure of fault diagnose

In case of any problem in the instrument, firstly check as follows:

- Check whether the power socket is connected to the power supply.
- Is the instrument turned on? Check whether the green LED beside the power switch is ON. Pay attention to the internal fan noise and check whether the cooling fan of the analyzer works.
- If any, check whether the other instruments, cables and connectors used together with the instrument are connected properly and work normally.
- If the communication of the instrument through LAN fails, check the yellow LED beside the LAN interface of the rear panel. If this indicator does not flash, check the LAN cable and connection.
- If the operating system cannot be fully loaded or run or the application program of the instrument is not successfully started, the hard disc may be damaged. If the system recovery is run for a long time in the start-up process, refer to the "Windows 7 system restoration" in "2.2.2.2 System maintenance".
- If the problem occurs again, check all measurement steps. Check whether all settings are correct.
- If the analyzer does not work normally, press [Reset] to go back to a known status of the analyzer.
- Check whether the measurement and results comply with the requirements of the performance indicators and features of the

analyzer. Refer to the relevant performance indicators in "8 Technical indicators and test methods" of the user manual of the analyzer.

- The analyzer should be calibrated to meet above indicators. Select Auto Calibration (Of) (press [System], [Calibration], [Auto Calibration On/Off]) or calibrate manually.
- Does the instrument display messages? Please refer to "7.3 Error messages" of the Manual for information of error messages.

7. 2. 2. Common faults and solutions

Common faults and solutions are classified by the following types of functions.

- Startup problems
- Instrument setup problems
- No signal display
- Abnormal signal frequency reading
- Abnormal signal amplitude reading
- Instrument network connection failure

7. 2. 2. 1. Startup problems

Problems occurred during startup of the S3503 series signal/spectrum analyzer may be caused by failures of the power, processor hardware, instrument setup, etc. In this section, faults during startup and possible causes will be analyzed according to the energizing and starting procedure of the analyzer. It takes about 3 min for the instrument to start and such time varies based on hardware configuration, installation options and the number of measurement applications.

1) Yellow standby indicator is not ON

Plug in the instrument outlet and turn on the switch on the rear panel to observe the power indicator at the bottom left corner of the front panel to turn yellow. If the yellow standby indicator is not on, firstly check whether the power switch on the rear panel is turned on and then whether the voltage and frequency of the power meet the operating power parameters requirement of the analyzer. See "3.1.1.3 Power ON/OFF" of the Manual. If power parameters meet the requirement, it is possible that the instrument power is at fault. Please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

2) Abnormal green start lamp

Press the power button at the bottom right of the front panel to turn on the instrument. At such time, the power indicator of the instrument will change from yellow to green. If the indicator has not turned green, it is possible that the instrument power is at fault. If the power indicator flashes in yellow and green alternatively, it is possibly caused by abnormal internal load of the instrument rather than the power failure. Please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

3) Abnormal fan operation

After energizing and starting up, all fans should start working. If none of them is working, it is possible that the power is at fault; if some fan does not work, then such fan has developed a fault. Please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

4) Black screen

A black screen can be caused by many a reason. If causes for three above failures are removed, follow the steps below:

- a) Connect from the monitor interface on the rear panel properly to a CRT display device, turn on its power and wait for 30 s. If the CRT displays normally, it is possible that the BIOS configuration parameters of the instrument have been altered. Users need to turn off the instrument, connect the standard keyboard of the PS/2 interface, turn on the analyzer again, long press "F2" to enter

the BIOS setup interface, select Load Setup Defaults under Exit tab, call and save factory configuration of display control, exit and reboot the instrument. If nothing is displayed, LED components may be at fault. Please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

- b) If nothing is displayed after CRT is connected, it is possible that the hardware fails. Please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

5) BIOS detection crash

If the analyzer stays at processor information display interface after energizing, it is caused by BIOS detection crash. Follow the steps below:

- a) Check if the standard keyboard is connected and BIOS detection is suspended; if not, proceed to the next step.
- b) Turn off the instrument, connect the standard keyboard of the PS/2 interface, turn on the instrument, long press "F2" to enter the BIOS setup interface, select Load Setup Defaults under Exit tab, call and save factory configuration of display control and reboot the instrument. If the problem remains, please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

6) Unable to find system disk

If the analyzer displays "unable to find system disk" after energizing, turn off the power at the back, wait for 1 - 2 min, turn on the instrument and press the power button on the front panel to see whether the system disk can be found properly. If not, connect the PS/2 keyboard to check whether the IDE is available. If not, the instrument hardware fails. Please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

7) Abnormal windows startup

After processor information is displayed, an operating system menu will be shown with a timer, including Windows 7 startup and system recovery tools. It is default to start Windows 7 system. If system recovery is required, use the up/down arrow on the standard keyboard to choose "OneKey Ghost V2011.07.01" before the timer hits 0 and click Enter.

In case of blue screen, startup crash, auto reboot during Windows system startup, check according to the following steps:

- a) Firstly confirm that no external USB storage is connected to the instrument.
- b) Reboot the analyzer and if the instrument can be used properly and no such failures occur frequently, then it is the occasional abnormal startup of the Windows system. Otherwise, proceed to the next step.
- c) Turn off the instrument and connect the standard keyboard of the PS/2 interface. Turn on the instrument again, long press "F2" to enter the BIOS setup interface, select Load Setup Defaults under Exit tab, call and save factory configuration of display control and reboot the instrument. If the failure is removed, it means the problem is caused by alternation of BIOS options. If the problem remains, proceed to the next step.
- d) Turn off the instrument and connect the standard keyboard of the PS/2 interface. Turn on the instrument again, select System Recovery option in the operating system menu (before starting system recovery, users need to follow instructions in the Manual and contact the manufacturer), follow system prompts to recover the system. Refer to "3.1.2.5 System backup recovery" in the Manual for detailed procedure.
- e) If it is unable to recover the system, it is possible that the hardware of the instrument fails. Please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

7. 2. 2. 2. Instrument setup problems

When the signal/spectrum analyzer enters the test interface and successfully completed all starting calibrations, the instrument will

enter normal sweep test status and continuously refreshed traces can be seen on the screen. However, if some parameters are not properly set, users may not be able to see traces or signals expected to be shown. IF trace refreshing or signal display fails, please firstly check the following settings.

1) No trace refreshing or abnormal refreshing

In case of no trace refreshing or abnormal refreshing on the interface, please follow the step below:

- a) Check if the instrument is set as auto trigger mode and continuous sweep mode. If the settings are correct, but there is still no refreshing, proceed to the next step.
- b) Open the marker and check if its reading changes. If the reading has changed, it may be caused by settings. For example, the trace will be shown below the screen by setting the instrument as linear mode or setting the reference level too high and thus is invisible. In this case, the instrument can be changed to log mode or the reference level can be lowered before observing the trace. If the marker reading remains unchanged, it indicates the error in sending back the trace. Please reboot the instrument. If the problem still remains, please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

2) No signal display

If no wave band has any signal display, please follow the steps: press [Input/Output], [Input Port RF Calibration] to check whether RF signal is selected. If not, check the RF signal. If there is still no signal display, it is possible that the instrument hardware circuit fails. Please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

7. 2. 2. 3. Abnormal signal frequency reading

If the signal is found jittering on the screen or the frequency reading is out of its error range during signal measurement, firstly check whether the frequency of the input signal of the instrument is stable. If the signal is stable, then check whether the instrument reference is correctly set and choose external or internal reference based on different test scenarios by pressing [Input/Output] and [Frequency Reference External/Internal]. If the frequency reading is still not accurate by this time, it is possible that internal LO of the instrument loses the lock. Please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

LO lock loss is usually classified into the following types: loss of lock when frequency span ≤ 180 kHz; loss of lock when 180 kHz $<$ frequency span ≤ 2 MHz; loss of lock when 2 MHz $<$ frequency span ≤ 20 MHz; loss of lock when frequency span > 20 MHz; loss of lock under certain frequency points.

7. 2. 2. 4. Abnormal signal amplitude reading

Abnormal amplitude includes abnormal low-band reading with normal high-band reading; abnormal high-band reading with normal low-band reading; abnormal amplitude reading of signals of all wave bands; huge in difference of amplitude reading between signals with different attenuator settings. If the signal amplitude reading is inaccurate, run all IF calibrations in the instrument. If the reading remains inaccurate, it is possible that the instrument internal circuit fails. In this case, follow the steps below:

- a) Press [Input/Output], [Input Port RF Calibration], [Calibration Interface], [500MHz] to turn on the 500 MHz calibration signal of the instrument. Set the instrument center frequency as 500 MHz and frequency span as 1 MHz and turn on Peak Search to measure the level of the 500 MHz calibration signal. If the instrument operates normally, the amplitude of the calibration signal should fall in the range of -20 dBm ± 2 dB. If such amplitude is not correct, it means that low-band (below 4 GHz) reading of the instrument is abnormal.
- b) Press [Input/Output], [Input Port RF Calibration], [Calibration Interface], [4.8GHz] to turn on the 4.8 GHz calibration signal of the instrument. Set the instrument center frequency as 4.8GHz and frequency span as 1 MHz and turn on Peak Search to measure the level of the 4.8GHz calibration signal. If the instrument operates normally, the amplitude of the calibration signal should fall in the range of -20 dBm ± 2 dB. If such amplitude is not correct, it means that high-band (above 4 GHz) reading of the instrument is abnormal.

The above two steps are used to determine abnormal reading in partial or entire wave band. Please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.



Attention

Even if the calibration signal (500 MHz or 4.8 GHz) amplitude is normal, other frequency bands on the same wave band may have abnormal signal amplitude reading.

The amplitude test with internal calibration signal is only a quick way of path detection.

7. 2. 2. 5. Instrument network connection failure

- 1) Firstly check that whether the network has web-surfing capability.
- 2) Ensure that proper IP settings have been obtained from the system administrator.
- 3) Check whether the cable connecting to the network interface of the instrument is intact.

Check whether the incoming network cable is connected to the LAN interface on the rear panel of the analyzer and whether the yellow indicator flashes at the interface. If the network connection still fails, please contact our customer service center according to relevant information in the Manual and provide the error messages. We will help you solve the problem as quickly as possible.

7. 3. Error Information

The signal/spectrum analyzer records errors occurred during measurement in two ways: error message queue displayed in the operation interface of the front panel and SCPI (under remote control) error message queue. Such two queues are stored separately for management.

- [Error message file](#)
- [Description of error information](#)

7. 3. 1. Error message files

The file of "errormessage.pdf" stored in the random disc records a complete list of error messages. Such error list consists of error No. and error description. If several error messages have the same error No., they will be sorted in alphabetical order.

7. 3. 2. Description of Error Information

- [Local error message](#)
- [Remote error message](#)

7. 3. 2. 1. Local Error Information

- [Viewing of Error Information](#)
- [Description of error information](#)

1) Viewing of Error Information

By interface operation:

Error messages prompted at the bottom right corner of the signal/spectrum analyzer during operation indicates software operation or hardware problems. Types of problems can be more or less determined based on error codes and measures can be taken for troubleshooting accordingly.

Only one error message will be display at a time in the error display area of the signal/spectrum analyzer. As the problems may occur

at the same time, the following operations can help to view all the error prompt information:

Step 1: press [System] > [Error List] to pop up the error list window.

Step 2: prompt information will be displayed in the window;

Step 3: browse the error information with the mouse and close the dialog window;

Step 4: click [Clear error list] to clear historical error information.

2) Error message

If any error is detected during measurement of the analyzer, the warning or error message will be displayed at the right corner of the status indicator field (error code + error abbreviation) as shown in Fig. 7.4:



Fig. 7.4 Error message displayed in the status indicator field

See Schedule 3 Local Error Message Table of Appendix D: Error Message Index for more details of description of local error messages.

7. 3. 2. 2. Program Error Information

- [Format and description of error messages](#)
- [Type of error messages](#)

1) Error information formats

In the remote control mode, error messages are recorded in the error/event queue in the status report system and can be inquired with "SYSTem:ERRor?" command with the format as follows:

"<error code>, "<error message in error queue>; <detailed description of error message>"

- **Example:**
- "-110, "Out-of-limit data; input parameter beyond lower bound."
- Program error information is divided into two types:
- Negative error codes defined in the SCPI standard, not detailed here;
- See Schedule 4 Remote Error Message Table of Appendix D: Error Message Zoom Table for positive-value error codes with instrument characteristics and more details of description of local error messages.
- Error message type
- Error event corresponds to only one type of error message. Error messages are classified into the following types (8257):
- System error (0 to -49): control platform, OS, file system, etc.
- Processing error (50 to -99): control platform, OS, file system, etc.
- LO RF (100 to -199): lock detect, status detect, etc.
- Wideband IF (200 to -299): bandwidth, gain, attenuation, compensation, etc.
- Narrowband IF (300 to -499): bandwidth, gain, attenuation, compensation, etc.
- Video & sample (500 to -599): Adc, dsp, platform interface, etc.
- Communication interface (600 to -699): network, gpib, print, etc.
- Measurement error (700 to -799): TBD.

8. Specifications and test methods

In this chapter, specifications and major test methods of the S3503 series signal/spectrum analyzer is described.

- Statement
- Product features
- Technical indicators
- Supplementary information
- Performance characteristics test

8. 1. Statement

Unless otherwise stated, tests of all specifications should be conducted under the temperature of $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and half an hour after startup. Supplementary information of the instrument aims to help users to get better understanding of its performance and is not related to any technical indicator. Key terms:

Specifications (spec): unless otherwise indicated, calibrated instrument should be left under the working temperature range of 0 - 40 °C for at least two hours and preheated for another 30 min to ensure its performance (measurement error included). If not otherwise noted, data in this Manual all refers to technical indicators.

Typical value (typ): indicates the typical performance 80% instruments can reach. This is not guaranteed data and does not include uncertainties in measurement process. It is only effective under room temperature (about 25°C).

Nominal value: indicates expected average performance or designed performance characteristics, such as 50 Ω connector. It is not guaranteed data and is obtained under room temperature.

Measured value (meas): indicates the performance characteristics obtained in design stage and used to compare with the expected performance, such as change of amplitude shift along with time. This is not guaranteed data and is obtained under room temperature.

8. 2. Product features

Table 8.1 Product features

Temp. Range	Working hour: 0 - +50°C Storage time: -40 - +70°C
Altitude	4,600 m
Electromagnetic compatibility	Compliant with the following requirements of Section 3.9.2 in GJB 3947A-2009:
	a) CE102 10 kHz - 10 MHz power line conducted emission;
	b) CS101 25 Hz - 50 kHz power line conducted susceptibility;
	c) CS114 10 kHz - 400 MHz wire bundle injection conducted susceptibility;
	d) RE102 10 kHz - 18 GHz electric field radiation emission;
e) RS103 10 kHz - 1 GHz electric field radiation susceptibility.	
Security	Compliant with the safety certification requirements of Section 3.10 in GJB 3947A-2009:
	a) Resistance between the power input terminal and the enclosure of the instrument (power switch is on) should be no less than 100 MΩ under standard atmospheric pressure for test and no less than 2 MΩ in humid environment. b) When a AC voltage of 1,500 V is applied between the power input terminal and the enclosure, the instrument should be free

	from breakdown, flashover or flicker.	
	c) During operation, the leakage current between the enclosure and the ground should be no more than 3.5 mA.	
Power Requirements	Voltage and frequency (Nominal value)	220 V, 50/60 Hz; The allowable steady state voltage range is 0% of the nominal value, and the allowable steady state frequency range is $\pm 5\%$ of the nominal value.
	Power consumption	Maximum power consumption: 400 W Maximum standby: 20 W
Display screen	1280 x 800, XGA 10.1"	
Data storage	160G solid state disk Compatible with memory devices up to USB 2.0 standard	
Weight	Net weight: less than 25 kg; Packed transportation weight: 34 kg nominal value	
Dimension	W x H x D (mm) = 426 x 177 x 460 (not including the handle, the footing, the foot pad and the side belt) with allowable tolerance of ± 10 mm.	
	W x H x D (mm) = 510 x 190 x 534 (including the handle, the footing, the foot pad and the side belt) with allowable tolerance of ± 10 mm.	
Warranty	The S3503 signal/spectrum analyzer has a standard warranty period of 18 months.	
Reliability	MTBF (θ) ≥ 5000 h	
Calibration period	The recommended calibration period is one year by professional calibration bodies.	

8. 3. Technical index

The table of specification is given based on function classification: description/characteristic value.

- Frequency and time
- Amplitude accuracy and range
- Dynamic range

8. 3. 1. Frequency and time

1) Frequency range

Model	Frequency range (DC coupling)	Frequency range (AC coupling)
S3503A	3Hz~4GHz	10MHz~4GHz
S3503B	3Hz~9GHz	10MHz~9GHz
S3503C	3Hz~13.2GHz	10MHz~13.2GHz
S3503D	3Hz~18GHz	10MHz~18GHz
S3503E	3Hz~26.5GHz	10MHz~26.5GHz
S3503F	3Hz~40GHz	10MHz~40GHz
S3503G	3Hz~45GHz	10MHz~45GHz
S3503H	3Hz~50GHz	10MHz~50GHz
S3503L	3Hz~67GHz	/

2) Band division (nominal value)

N value (LO harmonic times)	Band No.	Frequency range
-----------------------------	----------	-----------------

1	Band 0	3Hz~4.1GHz
1	Band 1	3.9GHz~9GHz
2	Band 2	8.7GHz~18.3GHz
4	Band 3	17.7GHz~27GHz
4	Band 4	26.6GHz~40.4GHz
8	Band 5	39.6GHz~50GHz
1	Band 6	49.5GHz - 54.6GHz
2	Band 7	54.3GHz - 63.9GHz
4	Band 8	63.3GHz - 67GHz

3) Frequency reference

Frequency accuracy:	\pm (time elapsed since the last calibration date \times aging rate + temperature stability + calibration accuracy)
Aging rate:	$\pm 1 \times 10^{-7}$ /year
Temperature stability:	$\pm 1.5 \times 10^{-8}$ (20°C - 30°C), $\pm 5 \times 10^{-8}$ (full temperature range)
To obtain the initial calibration accuracy:	$\pm 4 \times 10^{-8}$

Note: The default time elapsed since the last calibration date is one year.

4) Residual frequency modulation

$\leq 0.25 \text{ Hz} \times N$ (10 Hz refers to the resolution bandwidth and the video bandwidth respectively and specific value of N depends on harmonic times of frequency band division)

5) Frequency readout accuracy:

\pm (frequency reading \times frequency reference accuracy + 0.10% \times frequency span + 5% \times resolution bandwidth + 2 Hz + 0.5 \times horizontal resolution¹)

6) Marker frequency count

Accuracy: \pm (marker frequency \times frequency reference accuracy + 0.100 Hz)
 Counter resolution: 0.001Hz

7) Frequency span

Range: 0 Hz, 10 Hz - the maximum frequency range of the instrument
 Resolution: 2Hz
 Accuracy: \pm (0.1% \times frequency span + horizontal resolution¹)

8) Sweep time and trigger

Range:	1 μ s - 6,000 s, frequency span = 0 Hz 1 ms - 6,000 s, frequency span \geq 10 Hz
Accuracy:	$\pm 0.01\%$, frequency span = 0 Hz
Trigger mode:	Free, video, power, external level (front panel), external level (rear panel), burst RF, timer
Trigger delay:	0 - + 500 ms
Trigger delay resolution:	0.1 μ s

9) Range of sweep points

101 - 30001

10) Resolution bandwidth

Bandwidth range:	1 Hz - 3 MHz (step by 1, 2, 3 and 5) , 4, 5, 6, 8, 10, 20 MHz
Bandwidth accuracy (3.01 dB):	± 5% (nominal value) 1 Hz - 2 MHz (step by 1, 2, 3 and 5) ± 15% (nominal value) 3, 4, 5, 6, 8, 10 MHz ± 20% (nominal value) 20 MHz
Selectivity (-60 dB/-3 dB):	5:1 (nominal value)

11) Maximum analysis bandwidth (nominal value)

10MHz	Standard
40MHz	Optional S3503-H38A
200MHz	Optional S3503-H38B
550MHz	Optional S3503-H38C

12) Video bandwidth (nominal value)

Range: 1 Hz - 3 MHz (step by 1, 2, 3 and 5) , 4, 5, 6, 8, 10, 20 MHz

8. 3. 2. Amplitude accuracy and range

1) Amplitude range

Measuring range:	Display average noise level (DANL) to the maximum safety input level
Input attenuator range:	0 - 70 dB, stepping by 2 dB

2) Maximum safety input level

Total average power: + 30 dBm (1 W)

3) Display range

Scale type:	Logarithm/linear
Logarithm scale	0.1 - 20 dB/division with resolution of 0.01 dB
Scale unit:	dBm, dBmV, dBμV, dBmA, dBμA, V, W, A

4) Frequency response (10 dB input attenuation, 20°C - 30°C)

Without pre- amplifier (S3503)	Pre-amplifier Off	Pre-amplifier On	Frequency range
±0.70dB	±1.20dB	±1.50dB	3Hz~20MHz
±0.50dB	±1.00dB	±1.50dB	20MHz~2GHz
±0.70dB	±1.20dB	±1.50dB	2GHz~3.6GHz
±1.00dB	±1.50dB	±1.80dB	3.6GHz~4GHz
±1.50dB	±2.00dB	±2.50dB	4GHz~9GHz
±2.00dB	±2.50dB	±3.00dB	9GHz~18GHz

±2.50dB	±3.00dB	±3.50dB	18GHz~26.5GHz
±3.00dB	±3.50dB	±4.00dB	26.5GHz~40GHz
±3.00dB	±3.50dB	±4.00dB	40GHz~50GHz
±4.00dB	/	/	50GHz~67GHz

5) Total resolute amplitude accuracy ((10 dB input attenuation, 20 - 30°C, 1 Hz ≤ RBW ≤ 1 MHz; input signal -10 - -50 dBm; all settings are automatically coupled with random reference level and random scale)

Technical index	Frequency range
±0.24dB	500 MHz (calibration frequency)
± 0.24 dB + frequency response	Above any frequency

6) Input voltage standing-wave ratio (VSWR) (10 dB input attenuation)

Technical index	Frequency range
< 1.40	50MHz~4GHz
< 1.50	4GHz~9GHz
< 1.80	9GHz~18GHz
< 1.70	18GHz~26.5GHz
< 1.80	26.5GHz~40GHz
< 1.90	40GHz~50GHz
< 3.00	50GHz~67GHz

7) Resolution bandwidth switching error (with 300 kHz RBW as reference)

Technical index	RBW range
±0.30dB	1 Hz - 2 MHz (step by 1, 2, 3 and 5)
±0.30dB	3, 4, 5, 6, 8, 10 MHz

8) Reference level (RF gain coupling mode: best sensitivity)

Range:	Logarithm scale: -170 - + 30 dBm, stepping by 0.01 dB.
Linear scale:	707 pV - 7.07 V, 0.11% (0.01dB) resolution
Switching error:	0.20dB

9) Display scale fidelity

±0.20dB Between -10 dBm - -80 dBm input mixer level

10) Trace detector mode

Normal, positive peak, negative peak, sample, video average, power average, voltage average

8. 3. 3. Dynamic range

1) 1 dB gain compression

Input mixer level (S3503)	Frequency range
≥-3dBm	20MHz~40MHz

≥+1dBm	40MHz~200MHz
≥+3dBm	200MHz~4GHz
≥-1dBm	4GHz~9GHz
≥+1dBm	9GHz~50GHz
≥-1dBm	50GHz~67GHz

2) Display average noise level (input port connected to 50 Ω load; noise maker on; on dB input attenuation; RF gain coupling mode as best sensitivity; 20 - 30 °C)

Without pre- amplifier (S3503A/B/C/D/E/F/G/H)	Without pre- amplifier (S3503L)	Pre-amplifier Off	Pre-amplifier On	Frequency range
≤-153dBm	≤-153dBm	≤-150dBm	≤-162dBm	10MHz~1GHz
≤-151dBm	≤-151dBm	≤-148dBm	≤-162dBm	1GHz~2GHz
≤-150dBm	≤-148dBm	≤-147dBm	≤-160dBm	2GHz~3GHz
≤-148dBm	≤-147dBm	≤-145dBm	≤-156dBm	3GHz~3.6GHz
≤-145dBm	≤-143dBm	≤-141dBm	≤-155dBm	3.6GHz~4GHz
≤-148dBm	≤-144dBm	≤-142dBm	≤-155dBm	4GHz~4.4GHz
≤-150dBm	≤-145dBm	≤-143dBm	≤-155dBm	4.4GHz~9GHz
≤-148dBm	≤-145dBm	≤-140dBm	≤-154dBm	9GHz~18GHz
≤-143dBm	≤-141dBm	≤-134dBm	≤-154dBm	18GHz~26.5GHz
≤-138dBm	≤-135dBm	≤-126dBm	≤-150dBm	26.5GHz~40GHz
≤-133dBm	≤-131dBm	≤-121dBm	≤-145dBm	40GHz~50GHz
/	≤-131dBm	/	/	50GHz~67GHz

3) Residual response (input port connected to 50 Ω load; 0 dB input attenuation)

Technical index

≤-100dBm

Frequency range

200kHz~9GHz

4) Image response (-10 dBm mixer level)

Response	Tuning frequency	Excitation frequency
≤ -80 dBc	10MHz~1.1GHz	f + 150 MHz
≤ -76 dBc	1.1Hz~4.0GHz	f - 150MHz
≤ -80 dBc	4GHz~26.5GHz	f - 150MHz
≤ -80 dBc	26.5GHz~40GHz	f + 150 MHz
≤ -76 dBc	40GHz~50GHz	f - 150MHz
≤-76dBc	50GHz~67GHz	f - 150MHz
≤ -80 dBc	10MHz~1.1GHz	f - 850MHz

≤ -80 dBc	10MHz~18GHz	f + 850MHz
≤ -70 dBc	18GHz~26.5GHz	f + 850MHz
≤ -70 dBc	26.5GHz~40GHz	f - 850MHz
≤ -60 dBc	40GHz~50GHz	f + 850MHz
≤ -47 dBc	50GHz~67GHz	f + 850MHz
≤ -80 dBc	10MHz~1.1GHz	f + 3950MHz
≤ -80 dBc	1.1GHz~4GHz	f + 10450MHz

5) Second harmonic distortion (SHI)

SHI	Distortion products	Mixer level	Input frequency range
+42dBm	-57 dBc	-15dBm	10MHz~0.55GHz
+44dBm	-59 dBc	-15dBm	0.55GHz~2GHz
+57dBm	-72 dBc	-15dBm	2GHz~4.5GHz
+55dBm	-70dBc	-15dBm	4.5GHz~9GHz
+50dBm	-65 dBc	-15dBm	9GHz~25GHz
+50dBm	-65 dBc	-15dBm	25GHz~33.5GHz

6) Three-order intermodulation distortion (TOI) (test two input mixer signals with frequency interval of 50 kHz and 20°C - 30°C)

TOI (S3503)	Frequency range
$\geq +13$ dBm	10MHz~200MHz
$\geq +13$ dBm	200MHz~4GHz
$\geq +11$ dBm	4GHz~9GHz
$\geq +13$ dBm	9GHz~18GHz
$\geq +13$ dBm	18GHz~50GHz
$\geq +11$ dBm	50GHz~67GHz

7) Phase noise (carrier 1 GHz, 20°C - 30°C)

Technical index (S3503)	Frequency offset
≤ -96 dBc/Hz	100Hz
≤ -115 dBc/Hz	1kHz
≤ -125 dBc/Hz	10kHz
≤ -125 dBc/Hz	100kHz

1: Horizontal resolution = frequency / (sweep points - 1), default sweep points for S3503 is 1001.

8. 4. Additional information

8. 4. 1. Front panel interfaces

Table 8.2 Front panel interfaces

RF Input Interface	S3503A	N type (female)
	S3503B	N type (female)

	S3503C	N type (female)
	S3503D	N type (female)
	S3503E	3.5mm(male)
	S3503F	2.4mm (male)
	S3503G	2.4mm (male)
	S3503H	2.4mm (male)
	S3503L	1.85mm (male)
First LO output interface (optional)	10 GHz - 40 GHz, 50 Ω impedance, 2.4 mm female adapter	
IF input interface (optional)	425 MHz, 50 Ω impedance, 3.5 mm female adapter	
Sync sweep output	BNC female adapter	
USB2.0 interface	It is to connect mouse/keyboard, to externally upgrade system software and back up data, etc.	
Trigger input	BNC female adapter	

8. 4. 2. Rear panel interfaces

Table 8.3 Rear panel interfaces

RF Input Interface (Options)	S3503A/-S	N type (female)
	S3503B/-S	N type (female)
	S3503C/-S	N type (female)
	S3503D/-S	N type (female)
	S3503E/-S	3.5 mm (male)
	S3503F	2.4mm (male)
	S3503G	2.4mm (male)
	S3503H	2.4mm (male)
	S3503L	1.85mm (male)
Keyboard interface	Standard Ps/2 interface for external connection of standard computer keyboard.	
Video interface	VGA interface (15-core D-SUB adapter) for external connection of display interface	
LAN interface	Standard RJ-45 1000Base-T for software upgrading and remote control	
GP-IB interface	IEEE-488 bus connector with 24-pin plug (GP-IB code: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, C0) for remote control	
USB2.0 interface	It is to connect mouse/keyboard, to externally upgrade system software and back up data, etc.	
Sync sweep output	BNC female adapter	
Narrowband output I (optional)	50 Ω impedance, SMA female adapter	

Narrowband output Q (optional)	50 Ω impedance, SMA female adapter
Wideband output I (optional)	50 Ω impedance, SMA female adapter
Wideband output Q (optional)	50 Ω impedance, SMA female adapter
Wideband output-I (optional)	50 Ω impedance, SMA female adapter
Wideband output-Q (optional)	50 Ω impedance, SMA female adapter
10MHz reference input	50 Ω impedance, BNC female adapter, amplitude range: -5 dBm - +10 dBm
10MHz reference output	50 Ω impedance, BNC female adapter, amplitude range \geq 0 dBm
Trigger input	BNC female adapter
Trigger Output 1	BNC female adapter
Trigger Output 2	BNC female adapter

8. 5. Performance characteristics test

- Recommended test method
- Record sheet of performance characteristics of signal/spectrum analyzer
- Auxiliary form of performance characteristics of S3503 signal/spectrum analyzer
- Instruments recommended for performance characteristics

8. 5. 1. Recommended test method

8. 5. 1. 1. Frequency and time

8.5.1.1.1 Frequency Range

1. Test items

Frequency range refers to the range from the highest to the lowest frequency signal to be correctly measured by the signal/spectrum analyzer. Capability of the S3503 signal/spectrum analyzer to measure frequency according to relevant requirements is tested with signals from the signal generator with high frequency stability within the nominal upper and lower measurement frequency limits.

2. Test equipment

Synthesized signal generator (E8257D/S1103 is recommended)

Frequency standard

a) Test steps

- 1) Connect the frequency standard output to the 10 MHz input of the signal generator according to Fig. 8.1 to provide reference frequency for the synthesized signal generator with the external frequency standard and connect the low frequency output of the synthesized signal generator to the input interface of the S3503 signal/spectrum analyzer (if no frequency standard is available, optional signal generator with frequency of high stability can be used).
- 2) Connect the low frequency output of the synthesized signal generator to the RF input of the S3503 signal/spectrum analyzer as indicated by solid lines in Fig. 1.

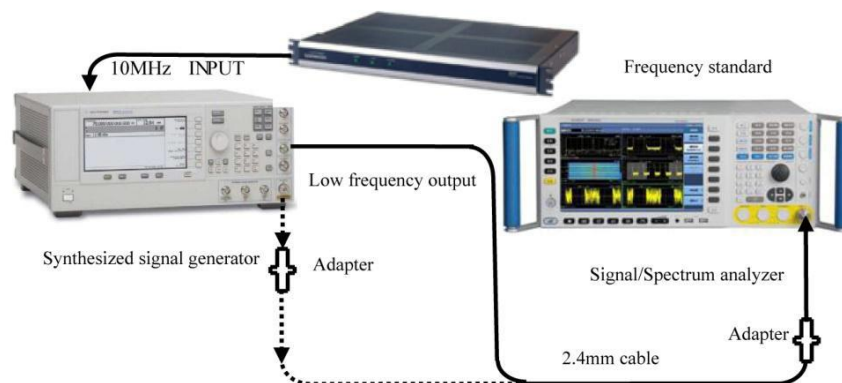


Fig. 8.1 Schematic diagram of frequency range test

- 3) Set the synthesized signal generator as follows: turn on AM modulation, set AM modulation amplitude as 80% and modulation rate as 3 Hz; turn on low frequency output amplitude and set it as 100 mVp.
- 4) Reset the analyzer and set as frequency analysis mode; set input/output coupling mode as DC, center frequency as the nominal lower frequency limit of 3 Hz, frequency span of 10 Hz; press Peak after completion of each test; when the marker correctly indicates the peak signal, there is no obvious dither in the marker amplitude value and the signal is clear distinguishable, record the center frequency as the lower measurement value. Records made at any other time will not meet relevant requirements (if the signal peak is at the zero frequency, zero frequency auto adjustment is required).
- 5) Change the connections in the test to connect the RF output of the synthesized signal generator to the RF input of the S3503 signal/spectrum analyzer as indicated by dotted lines in Fig. 1.
- 6) Set the output frequency of the synthesized signal generator as the nominal upper frequency limit of the analyzer to be tested, output power as -10 dBm, RF output on/off as on and modulation function as off.
- 7) Set the analyzer center frequency as the nominal upper frequency limit and frequency span as 20 kHz; press Peak Search and when the marker correctly indicates the peak signal, there is no obvious dither in the marker amplitude value and the signal is clear distinguishable, record the center frequency as the upper measurement value of the frequency range. Records made at any other time will not meet relevant requirements.
- 8) Record measurement results in the Record Sheet of Performance Characteristics of S3503 Series Signal/Spectrum Analyzer (hereinafter referred to as the "S3503 Record Sheet").
- 9) Set S3503 input/output coupling mode as AC, repeat step 3 - 8, where the frequency lower limit test signal comes from the RF output of the signal generator.

b) Test records and data processing

- 10) Record measurement results in the S3503 Record Sheet.

8.5.1.1.2 Band division

a) Test items

Band division of S3503 depends on the combination of LO working scope (3 GHz - 10 GHz) and octave with reference to the principles of band division of ITU under IEE.

S3503 band division is ensured at the stage of design and manufacturing of the instrument.

b) Test procedure

- 1) Reset S3503 and set the center frequency as 1 GHz and the frequency span as zero.
- 2) Use the frequency diagnosis function in the analyzer system to display current first LO frequency LO1 as 7.65 GHz. According to design regulations, N value of band 0 is 1, that of band 1 is 1, therefore, in band 0 and band 1, IF1 is 5.225 GHz, LO2 is 4.8 GHz, IF2 is 425 MHz, LO3 is 500 MHz and IF3 is 75 MHz. Band 0 and 1 meet the frequency conversion formulae 1 - 3.

$$IF1=N * LO1-RF..... (1)$$

$$IF2= IF1-LO2 (2)$$

$$IF3=LO3-IF2 (3)$$

- 3) Each band has a frequency point according to band division (not in the band cross-covered region). Since N value of band 2 is 1, that of band 3 and 4 is 5, and that of band 5 is 8, IF2 is 425 MHz, LO3 is 500 MHz and IF3 is 75 MHz. Band 2, 3 and 5 meet the frequency conversion formulae 3 and 4; band 4 meets the frequency conversion formulae of 3 and 5.

$$IF2=N * LO1-RF.....(4)$$

$$IF2=RF-N * LO1.....(5)$$

c) Test records and data processing

- 4) If all LO frequencies meet the frequency conversion formulae, "compliant" should be noted in the S3503 Record Sheet, otherwise it should be considered as noncompliant.

8.5.1.1.3 Frequency reference

a) Test items:

Frequency reference is the basis of measurement by the spectrum analyzer. The frequency reference has a high requirements for frequency accuracy and stability and uses complicated test equipment of the aging rate and the temperature stability, featuring long test time and inapplicability in the production site test. During acceptance and identification of the signal analyzer and production inspection, the main test target is the reference frequency accuracy. The design nominal value of the frequency reference components can be used to obtain the initial calibration accuracy. The aging rate and the temperature stability can be obtained by sending sampled frequency reference components from production batches of each year to be tested by the measurement body with the surveyor's certificate. See "Regulation for Verification of Quartz Crystal Oscillator in Electronic Measuring Instruments (JJG180-2002)" or equivalent methods for more details of test methods.

b) Test equipment

Synthesized signal generator (E8257D/S1103 is recommended) Frequency standard

c) Test steps

- 1) Connect the frequency standard output to the 10 MHz input of the signal generator according to Fig. 8.1 to provide reference frequency for the synthesized signal generator with the external frequency standard/ Connect the low frequency output of the synthesized signal generator to the input interface of the S3503 signal/spectrum analyzer (if no frequency standard is available, optional signal generator with frequency of high stability can be used).
- 2) The S3503 analyzer to be tested, the synthesized generator and the frequency standard are preheated for predetermined time.
- 3) Set the output frequency of the synthesized signal generator as the upper frequency limit of the analyzer to be tested and the output power as -10 dBm.
- 4) Reset S3503, set the frequency span as 100 kHz, press Peak Search and turn on Delta Count.
- 5) Record marker count measurement results in B1 of the Auxiliary Form of Performance Characteristics of S3503 Series Signal/Spectrum Analyzer (hereinafter referred to as the "S3503 Auxiliary Form").

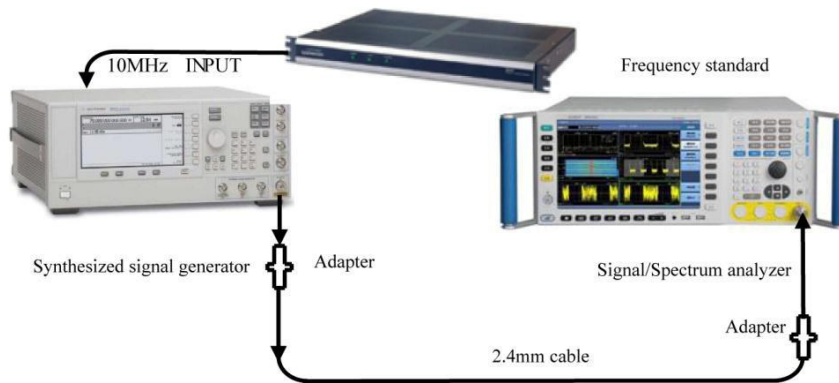


Fig. 8.2 Schematic diagram of frequency reference test

d) Test records and data processing

6) Calculate the frequency reference accuracy with formula (6).

$$S = \frac{f - f_0}{f_0} \dots\dots\dots (6)$$

Where f refers to the S3503 marker count measurement value (Hz);

f0 refers to the nominal frequency value of the synthesized signal generator (Hz).

7) Record the frequency reference accuracy calculation results in the S3503 Record Sheet. The aging rate, the temperature stability and the standard accuracy will be obtained via measurement standards from batch spot checks.

8.5.1.1.4 Residual frequency modulation

a) Test items:

The residual frequency modulation refers to the short-term frequency instability inherent to the signal/spectrum analyzer. Any LO instability is transferred to the IF via frequency mixing process. The testing method for the residual frequency modulation is to place a stable signal to the input interface of the analyzer, set the analyzer as zero frequency and detect the amplitude offset of the signal at the 10 Hz resolution frequency sideband. The frequency offset (also known as the residual frequency modulation) can be obtained by multiplying the amplitude offset with the slope of the 10 Hz filter slop.

b) Test equipment

Synthesized signal generator (E8257D/S1103 is recommended)

c) Test steps

- 1) Connect the test equipment as shown in Figure 8.3.
- 2) Set the synthesized signal generator frequency as 1 GHz and the amplitude as 0 dBm.
- 3) Reset S3503 and set as follows:

Center frequency as 1 GHz Bandwidth=1MHz

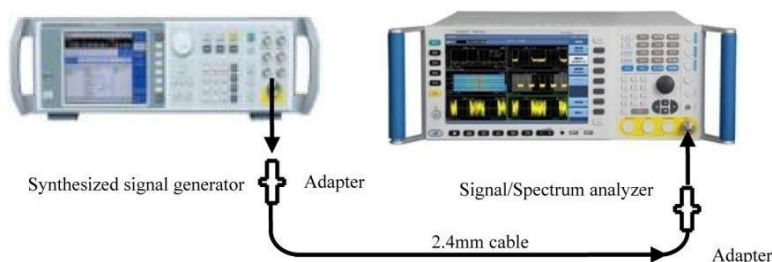


Fig. 8.3 Schematic diagram of residual frequency modulation

- 4) Gradually reduce the frequency span to 100 Hz and press Peak Search to move the signal to the center frequency.
- 5) Set S3503 amplitude scale as 2 dB/division and adjust the output amplitude of the signal generator to place the signal peak at the reference level.
- 6) Execute Peak Search to adjust the peak to the center and execute Delta Marker.
- 7) Turn the analyzer knob anticlockwise until the delta marker amplitude reading is closest to -5 dB. Execute Delta Marker.
- 8) Turn the knob anticlockwise until the delta marker amplitude reading is closest to -10 dB.
- 9) Record current frequency difference Δf and the amplitude different ΔL of the delta marker, calculate the demodulation sensitivity S according to the formula (7) and record the result in the S3503 Auxiliary Form.

$$S = \frac{\Delta f}{\Delta L} \dots\dots\dots (7)$$

- 10) Execute Peak Delta and Delta Marker. Turn the knob anticlockwise until the delta marker amplitude reading is closest to -10 dB. When the marker points step by 1 Hz at such time, select the marker point closest to -10 dB, execute marker-to-center and set the frequency span as 0.
- 11) Set the analyzer sweep time as 1 s, execute Single Sweep, press Peak Search, execute Delta Marker and turn the knob to move the marker to the lowest. Record the absolute value of the delta marker amplitude (amplitude offset) ΔA in B2 of the S3503 Auxiliary Form.
- 12) Change the output frequency of the signal generator and the center frequency of the S3503 analyzer and repeat step 2 - 11.

d) Test records and data processing

- 13) Calculate the residual frequency modulation RFM according to the formula (8) and record it in the S3503 Auxiliary Form.

$$R_{FM} = \Delta A \times S \dots\dots\dots (8)$$

- 14) Determine errors in results of all test items in B2 of the S3503 Auxiliary Form. If all test data falls within the range of error, "compliant" should be noted in the S3503 Record Sheet, otherwise it should be considered as noncompliant.

8.5.1.1.5 Frequency readout accuracy

a) Test items

The frequency readout accuracy is used to reflect the closeness between the frequency measurement indicated value and the actual value. During sweeping of the analyzer, the frequency measurement indicated value is affected by the reference frequency, the sweep width, the frequency bandwidth and the LO residual frequency modulation. An input signal of a given frequency can be used to test the marker of the analyzer in order to read out the accuracy.

b) Test equipment

Synthesized signal generator (E8257D/S1103 is recommended)

c) Test steps

- 1) Connect the test equipment according to Fig. 2 with the signal output interface of the signal generator connected to the signal input interface of the analyzer.
- 2) Reset the signal generator and set the output frequency as 1.5 GHz, the power level as -10 dBm and the RF output as on.
- 3) Reset S3503 and set the center frequency as 1.5 GHz and the frequency span as relevant value indicated in the S3503 Record Sheet.

- 4) Execute Marker until relevant marker value changes to the center frequency set value and then execute Delta Marker.
- 5) Execute Peak Search and record the frequency difference of the peak marker readout as measurement result in relevant test item of the S3503 Record Sheet.
- 6) Set the analyzer frequency span according to the frequency span value in the S3503 Record Sheet and repeat step 5.
- 7) Close all markers and repeat step 2 - 6 for all combinations of frequency and frequency span in relevant test items in the S3503 Record Sheet.

8.5.1.1.6 Marker count

a) Test items

A signal generator output of a given frequency is used as the standard and the error between the analyzer marker count value and the signal generator output as the marker count accuracy.

b) Test equipment

Synthesized signal generator (E8257D/S1103 is recommended)

c) Test steps

- 1) Connect the test equipment according to Fig. 8.4 with the 10MHz output interface of the analyzer connected to the 10MHz input interface of the synthesized signal generator and the RF output of the synthesized signal generator connected to the signal input interface of the analyzer.
- 2) Reset S3503, set the frequency span as 1 MHz, turn on Marker Count and set the gate time as 5 s.
- 3) Check the resolution of the analyzer marker count and record as 0.001 Hz if the test data display meet the requirement of 0.001 Hz. otherwise consider it as non-compliant.
- 4) Set the output frequency of the synthesized signal generator and the center frequency of the analyzer as f_0 according to relevant test items in the S3503 Auxiliary Form.
- 5) Execute Peak Search and record the marker count frequency value f_s in relevant test item of the S3503 Auxiliary Form.
- 6) Repeat Step 4 to 5 for all frequency points in relevant test items of the S3503 Auxiliary Form.

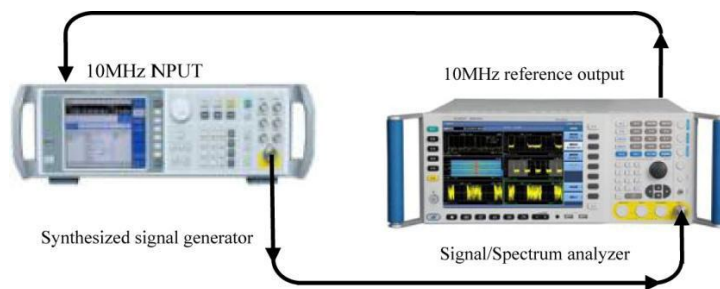


Fig. 8.4 Schematic diagram of marker count test

d) Test records and data processing

- 7) Calculate the marker count accuracy Δf according to the formula (9) and record it in B3 of the S3503 Auxiliary Form.

$$\Delta f = f_s - f_0 \dots\dots\dots (9)$$

- 8) Determine values in results of all test items in B3 of the S3503 Auxiliary Form. If all results fall within the range of error, records in the S3503 Record Sheet meet relevant requirements, otherwise not.

8.5.1.1.7 Frequency span accuracy

a) Test items

Set frequency difference of two synthesized signal generator as $0.8 \times \text{SPAN}$ signal of the signal analyzer and the center frequency of the signal analyzer as the median of output frequencies of these two signal generators. Use the Marker function measure frequency difference of such two signals. Calculate and record the percentage error between the measured marker difference and the frequency span. Use the same frequency as reference for two signal generators and the signal analyzer.

Note: It is allowed to use only one signal generator for test. Firstly, set the center frequency and the frequency span of the signal analyzer; set the signal generator with the frequency value of #1 signal generator; set delta marker for the signal analyzer and set it as the frequency value of #2 signal generator; search for the peak and record current marker difference frequency value as the measurement value.

b) Test equipment

E8257D or S1103 is recommended for synthesized signal generator #1.

E8257D or S1103 power divider is recommended for synthesized signal generator #2.

c) Test steps

- 1) Connect the instrument as shown in Fig. 8.5, reset the S3503 analyzer and set it with the frequency reference provided by two synthesized signal generators.

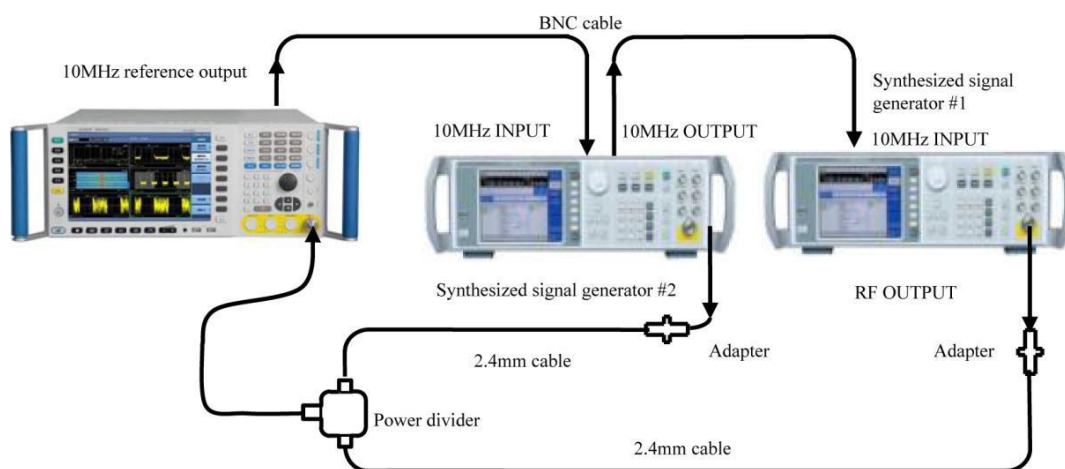


Fig. 8.5 Schematic diagram of frequency span accuracy test

- 2) Set the output power of synthesized signal generator #1 as 0 dBm and the frequency output as on.
- 3) Set the power of synthesized signal generator #2 as -10 dBm and the frequency output as on.
- 4) Set the S3503 analyzer according to the relations of frequency span and center frequency listed in B4 of the S3503 Auxiliary Form.
- 5) Set the synthesized signal generators according to the frequencies of synthesized signal generators #1 and #2 listed B4 of in the S3503 Auxiliary Form.
- 6) Execute Single Sweep and wait; execute Peak Search and Delta Marker and then Next Peak Search.
- 7) Record the delta marker frequency value Δf displayed in the S3503 analyzer.
- 8) Repeat Step 5 to 8 for all frequency span set values and frequencies of the signal generators in relevant test items in B4 of the S3503 Auxiliary Form.

d) Test records and data processing

- 9) Calculate the frequency span accuracy δSPAN according to the formula (10) and record it in the S3503 Auxiliary Form.

$$\delta_{SPAN} = \left(\frac{\Delta f - 0.8 * SPAN}{0.8 * SPAN} \right) \dots\dots\dots (10)$$

Where Δf refers to the delta marker frequency value Δf displayed in the S3503 analyzer (Hz);

SPAN refers to set frequency span value of the S3503 analyzer (Hz).

- 10) Determine values in results of all test items in B4 of the S3503 Auxiliary Form. If all results fall within the range of error, the absolute maximum error in the result from step 9 should be recorded in the S3503 Record Sheet. Otherwise, the record will be considered not compliant with relevant requirements.

8.5.1.1.8 Sweep time and trigger

a) Test items

The amplitude modulation signals are demodulated into periodic amplitude change signals when the signal/spectrum analyzer is in the zero bandwidth state. When the modulation rate of the modulation signals reasonably correspond to the sweep time of the signal/spectrum analyzer, demodulation signals will be uniformly distributed on the screen. Calculate the peak value of demodulation signals to obtain the actual sweep time and then compare it with the designated time to obtain the sweep time accuracy. The sweep time accuracy is guaranteed in the design. In order to reduce the test time, the typical sweep time will be tested for verification.

The Trigger function of the analyzer is also guaranteed by the design.

Note: The synthesized signal generator and the function generator can be replaced with the synthesized signal generator with built-in AM option.

b) Test equipment

E8257D is recommended for the synthesized signal generator.

Function generator

c) Test steps

- 1) Connect the test equipment as shown in Fig.8 4, reset S3503, and connect the output of the signal generator to the input of the tested S3503, and the 10MHz output interface of S3503 to the 10MHz INPUT port of the synthesized signal generator.
- 2) Set the output frequency of the signal generator as 1GHz, the output amplitude as -5dBm, the modulation mode as "Internal AM", the modulation depth as 80% and the modulation wave as the triangular wave output.
- 3) Set the S3503 analyzer center frequency as 1 GHz, the frequency span as 100 MHz, the minimum settable sweep time as 1 ms and the maximum settable sweep time as 6,000 s. If above settings meet records in the S3503 Record Sheet, they will be considered as compliant, otherwise not.
- 4) Set the S3503 analyzer frequency span as 0 Hz and the range of sweep time as 1 μ s to 6,000 s.
- 5) If above settings meet records in the S3503 Record Sheet, they will be considered as compliant, otherwise not.
- 6) Set the S3503 analyzer with linear scale, positive peak detection mode and the resolution bandwidth as 3 MHz.
- 7) Set the sweep time of S3503 and the AM frequency of the signal generator according to the test items listed in the S3503 Auxiliary Form.
- 8) Execute Single Sweep, read the time difference ΔT between the 2nd and 10th peak value from the left with the delta marker and record it in B5 of the S3503 Auxiliary Form.
- 9) Set different sweep time according to requirements in B5 of the S3503 Auxiliary Form and repeat step 6 to 7.
- 10) The S3503 analyzer has seven trigger modes, including free, video, power, external level (front panel), external level (rear panel), burst RF and timer. When set as free trigger, the spectrum trace can be refreshed normally.
- 11) Set the output frequency of the signal generator as 2 GHz, the output power as -20 dBm, the pulse modulation output width as 1

ms and the pulse period as 2 ms; connect the RF output interface to the RF input interface of the S3503 analyzer; set the S3503 analyzer frequency as 2 GHz and the trigger mode as video trigger; reduce the trigger level. If the signal spectrum trace can be refreshed, then the S3503 video trigger mode meets relevant technical requirements, otherwise not.

- 12) Set the output frequency of the signal generator as 2 GHz, the output power as -20 dBm, the pulse modulation output width as 0.1 ms and the pulse period as 0.2 ms; connect the RF output interface to the RF input interface of the S3503 analyzer; set the signal generator as low frequency output, the output frequency as 1 kHz and the output voltage as 1 V; connect the lower frequency output interface to the trigger input interface of the S3503; set the S3503 analyzer frequency as 2 GHz and the trigger mode as external trigger; reduce the trigger level. If the signal spectrum trace can be refreshed, then the S3503 external trigger mode meets relevant technical requirements, otherwise not.
- 13) Trigger delay of 0 - +500 ms and trigger delay resolution of 0.1 μs are guaranteed by the design.
- 14) If steps 9 to 12 are completed, then the trigger mode of the S3503 analyzer meets relevant technical requirements and "Compliant" should be noted in relevant items in the S3503 Record Sheet. Otherwise, it will be considered as noncompliant.

d) Test records and data processing

- 15) Calculate the sweep time accuracy δ with the formula (11).

$$\delta = \left(\frac{\Delta T - 0.8 \times T}{0.8 \times T} \right) \times 100\% \dots\dots\dots (11)$$

Where, ΔT refers to the time difference between the second peak and the tenth peak;

T refers to the set sweep time of S3503 analyzer.

- 16) Determine values in results of all test items in B5 of the S3503 Auxiliary Form. If all results fall within the range of error, the absolute maximum error in the result from step 9 should be recorded in the S3503 Record Sheet. Otherwise, the record will be considered not compliant with relevant requirements.

8.5.1.1.9 Range of sweep points

a) Test items

Sweep points are used to set the number of trace data that is required to be captured by the signal/spectrum analyzer during one measurement. If the sweep points are added, the span corresponding to each trace datum is narrower, the measured results are more stable and the frequency readout accuracy is higher.

Sweep points are guaranteed during design and production by the manufacturer of the analyzer and can be checked via the sweep points setting.

b) Test procedure

- 1) Reset the S3503 analyzer, enter the sweep menu and set the sweep points from 101 to 300001.
- 2) Determine measurement values according to the requirements in Section 3.12.1.9. If all results fall within the range of error, "compliant" should be noted in the S3503 Record Sheet, otherwise it should be considered as noncompliant.

8.5.1.1.10 Resolution bandwidth

a) Test items

The frequency resolution refers to the capacity of the signal/spectrum analyzer to distinguish the smallest constant amplitude signal.

The signal generator produces standard sine waves. The change of the signal generator frequency can be considered as equivalent to the change of the IF filter frequency; the measurement of the amplitude response of signals of different frequencies in fixed frequency points of the signal analyzer can be considered as equivalent to the measurement of the shape of IF filter (including 3 dB bandwidth and rectangle coefficient).

b) Test equipment

E8257D/S1103 is recommended as the synthesized signal generator. c) Test procedure

- 1) Connect the instrument as shown in Fig. 4. The S3503 analyzer provides the frequency reference for the synthesized signal generator.
- 2) Set the synthesized signal generator as follows: frequency as 500 MHz, power as -2 dBm, power step as 1 dBm and IF output on.
- 3) Reset the S3503 analyzer, complete all calibrations, turn on NdB bandwidth measurement function and change N value to 3.01.
- 4) Set the center frequency of S3503 as 500 MHz, the frequency span as 20 MHz, the amplitude scale as 1 dB, the resolution bandwidth as 10 MHz and VBW/RBW as 0.1.
- 5) Adjust the output amplitude of the synthesized signal generator to display the signal peak 2 - 3 divisions below the reference level (2 dB - 3 dB).
- 6) Execute Continuous Measurement On, Peak Search and Marker to Center to move the signal peak to the center of the screen.
- 7) Execute Continuous Measurement Off, record current 3 dB bandwidth marker difference reading Δf -3 dB in the column "3 dB bandwidth measurement value" in B6 of the S3503 Auxiliary Form.
- 8) Set the S3503 analyzer according to the resolution bandwidth listed in B6 of the S3503 Auxiliary Form, set the frequency span as approximately 2 times of the resolution bandwidth and repeat step 6 - 7.
- 9) Reset the S3503 analyzer, set its center frequency as 500 MHz, the frequency span as 100 MHz, the reference level as 0 dBm, the amplitude scale as 10 dB, the resolution bandwidth as 10 MHz, VBW/RBW as 0.1 and the sweep type as sweep frequency and then execute Peak Search.
- 10) Adjust the output power of the synthesized signal generator until the S3503 signal peak amplitude reading is closest to 0 dBm. Turn on NdB bandwidth measurement function and change N value to 60.
- 11) Execute Continuous Measurement On, Peak Search and Marker to Center to move the signal peak to the center of the screen.
- 12) Execute Continuous Measurement Off, record current 60 dB bandwidth marker difference reading Δf -60 dB in the column "60 dB bandwidth measurement value" in B6 of the S3503 Auxiliary Form.
- 13) Set the S3503 analyzer according to the resolution bandwidth listed in B6 of the S3503 Auxiliary Form, set the frequency span as approximately 5 - 10 times of the resolution bandwidth and repeat step 11 - 12.

c) Test records and data processing

- 1) Calculate the resolution bandwidth accuracy δ according to the formula (12) and record it in the S3503 Record Sheet.

$$\delta = \left(\frac{\Delta f_{-3dB} - RBW}{RBW} \right) \times 100\% \dots\dots\dots (12)$$

Where Δf -3dB refers to 3 dB bandwidth measurement value of the S3503 analyzer (Hz);

RBW refers to the nominal value of the S3503 analyzer resolution bandwidth (Hz).

- 2) Calculate the resolution bandwidth selectivity S according to the formula (13) and record it in the S3503 Record Sheet.

$$S = \frac{\Delta f_{-60dB}}{\Delta f_{-3dB}} \dots\dots\dots (13)$$

Where Δf -60dB refers to 60 dB bandwidth measurement value of the S3503 analyzer (Hz);

Δf -3dB refers to 3 dB bandwidth measurement value of the S3503 analyzer (Hz).

8.5.1.1.11 Maximum analysis bandwidth

a) Test items

The nominal value of maximum analysis bandwidth of the S3503 analyzer is 10 MHz, option H38A is 40 MHz and option H38B is 200 MHz. Set the S3503 analyzer as IQ analysis mode for two synthesized signal generators of stable frequency to provide constant amplitude signals for the S3503 analyzer at the same time; change frequencies of two signals within the demodulation bandwidth successively until amplitude difference of all signals does not exceed 3 dB, which means the maximum analysis bandwidth is met.

b) Testing block diagram and testing instrument and equipment

E8257D/S1103 is recommended for synthesized signal generator #1.

E8257D/S1103 is recommended as the synthesized signal generator#2. c) Test procedure

1) Connect the tested instrument as shown in Fig. 8.6 and reset the S3503 analyzer.

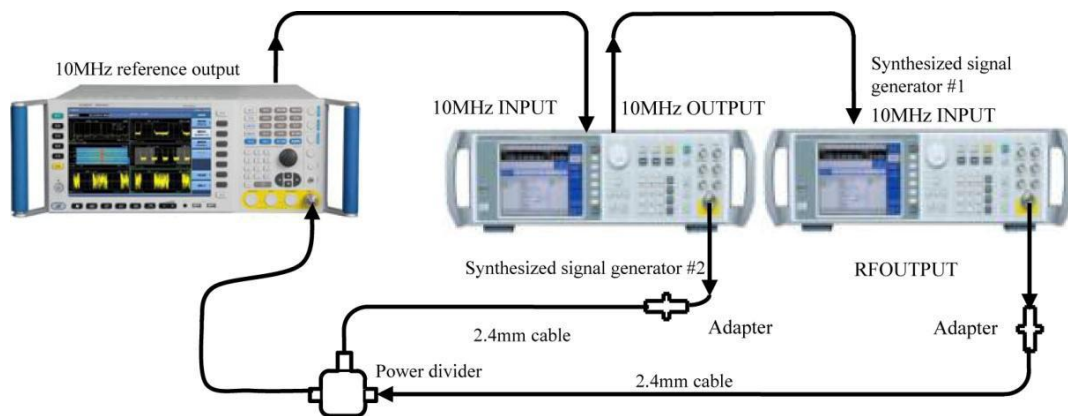


Fig. 8.6 Schematic diagram of maximum analysis bandwidth test

- 2) Set the S3503 analyzer as IQ analysis mode and the frequency domain window as current window. Set the center frequency as 1 GHz and the analysis bandwidth as 10 MHz.
- 3) Set the frequency of synthesized signal generator#1 as 1 GHz and the amplitude as -10 dBm; execute Delta Marker and turn off the output of signal generator #1. Set the frequency of synthesized signal generator#2as 1 GHz and the amplitude as -10 dBm; adjust the output of signal generator#2 to ensure the delta marker reading is closest to 0 dB.
- 4) Gradually reduce the frequency of signal generator #2 and execute Peak Search. If the marker amplitude reading is less than -3 dB, note the current output frequency of the signal generator as left limit value, otherwise record the frequency value at the left-most graticule of the S3503 analyzer screen and record the result in the fL column in the S3503 Auxiliary Form.
- 5) Turn off the output of signal generator #2 and turn on the output of signal generator#1.
- 6) Turn on and gradually increase the frequency of signal generator #1 and execute Peak Search. If the marker amplitude reading is less than -3 dB, note the current output frequency of the signal generator as right limit value, otherwise record the frequency value at the right-most graticule of the S3503 analyzer screen and record the result in the fR column in the S3503 Auxiliary Form.
- 7) If bandwidth option H38A or H38B is available, repeat step 2 - 6 based on the set value of relevant analysis bandwidth in B7 of the S3503 Auxiliary Form.

c) Test records and data processing

8) Calculate the maximum analysis bandwidth measurement value BWMAX according to the formula (14) and record the result in the S3503 Record Sheet. Otherwise, the record will be considered not compliant with relevant requirements.

$$BW_{MAX} = f_R - f_L \dots\dots\dots (14)$$

Where, f_R refers to the right limit value (MHz);

f_L refers to the left limit value (MHz).

8.5.1.1.12 Video bandwidth

a) Test items

The video bandwidth refers to the bandwidth of the tunable low-pass filter in the video circuit behind the detector of the signal/spectrum analyzer. The video filter is the low-pass filter located behind the detector for defining the bandwidth of the video amplifier. It can smooth the noise and is used to average or smooth traces. Besides, it can easily detect weak signals in noises. Change of the video bandwidth does not affect the frequency resolution of the S3503 analyzer, but too narrow video bandwidth may lead to increase in the sweep time. The video bandwidth is guaranteed during design and production by the manufacturer of the analyzer and can be checked via the video bandwidth setting.

b) Test procedure

- 1) Reset the S3503 analyzer, enter the bandwidth menu and set the video bandwidth from 1 Hz to 3 MHz (stepping by 10%) or as 4, 5, 6, 8 and 10 MHz.
- 2) Determine measurement values according to the requirements in Section 3.12.1.12. If all results fall within the required range, "compliant" should be noted in the S3503 Record Sheet, otherwise it should be considered as noncompliant.

8.5.1.2. Tests of amplitude accuracy and range

8.5.1.2.1 Amplitude range

a) Test items

It is used to check the range of amplitude from the maximum signal to the minimum signal of the S3503 analyzer. The maximum signal of the S3503 analyzer has the highest level.

For the safety input level, the minimum signal is the display average noise level.

b) Test procedure

- 1) The maximum signal L_{MAX} (maximum safety input level) is tested based on Section 4.6.12.2.2.
- 2) The minimum signal L_{DANL} (display average noise level) is tested based on Section 4.6.12.3.2.
- 3) Calculate the amplitude measurement range according to the formula (15) with the measured display average noise level of each band of the signal/spectrum analyzer. If requirements in 1) and 2) are met, the amplitude range will be noted as "compliant", otherwise it will be considered as noncompliant.

$$L_{range} = L_{MAX} - L_{DANL} \dots\dots\dots (15)$$

- 4) Reset the S3503 analyzer and select internal 500 MHz input interface. Set the center frequency as 500 MHz, the frequency span as 1 kHz, the resolution bandwidth as 100 Hz, the input attenuator as 10 dB and the reference level as -15 dBm.
- 5) Execute Peak Search and Delta Marker.
- 6) Set the input attenuator as 0, 2, 4, 6, 8, 20, 30, 40, 50, 60 and 70 respectively. If the instrument can properly indicate the decrement, note "compliant" in the S3503 Record Sheet, otherwise as "noncompliant".

8.5.1.2.2 Maximum safety input level

a) Test items

The maximum safety input level refers to the maximum level allowed at the input interface of the signal/spectrum analyzer that will not damaged the instrument.

Damages of the signal/spectrum analyzer can be checked and the maximum safety input level can be determined whether to meet relevant requirements by producing a signal consistent to the maximum safety input level and inputting it into the signal/spectrum analyzer.

Since the test has high risk, several frequency points can be selected to test according to the following procedure if the purchase has such need.

b) Test equipment

Synthesized signal generator (E8257D/S1103 is recommended) SAV38701D is recommended for the high power amplifier. U2000B is recommended for the USB power meter.

c) Test steps

- 1) Set the signal output of the signal generator as off, the frequency as 33GHz, amplitude as -50 dB and power step as 0.1 dB.
- 2) Reset S3503 and set its center frequency as 3 GHz, the frequency span as 2 MHz and the reference level as +30 dBm.
- 3) Connect the test equipment according to solid lines of Fig. 8.7 with the output cable of the high power amplifier connected to the USB power meter sensor rather than the signal/spectrum analyzer.
- 4) Turn on the signal generator RF output, press Amplitude Setting key and use the knob to change the amplitude and gradually increase the signal power to increase the test power value of the power meter to $+30 \pm 0.1$ dBm. At such time, the output cable interface power of the high power amplifier is +30 dBm.
- 5) Turn off the output of the signal generator and the power of the high power amplifier and connect the output cable of the high power amplifier to the input of the signal/spectrum analyzer.
- 6) Turn on the RF output of the signal generator and the power of the high power amplifier, keep the power on for 5 min and then set the output power of the signal generator as 65 dB.
- 7) Set Peak Search and Delta Marker of the signal/spectrum analyzer.
- 8) Change the decrement stepping of the attenuator of the signal/spectrum analyzer to 2 dB until all attenuation levels are set. There should be no obvious transition at such time.

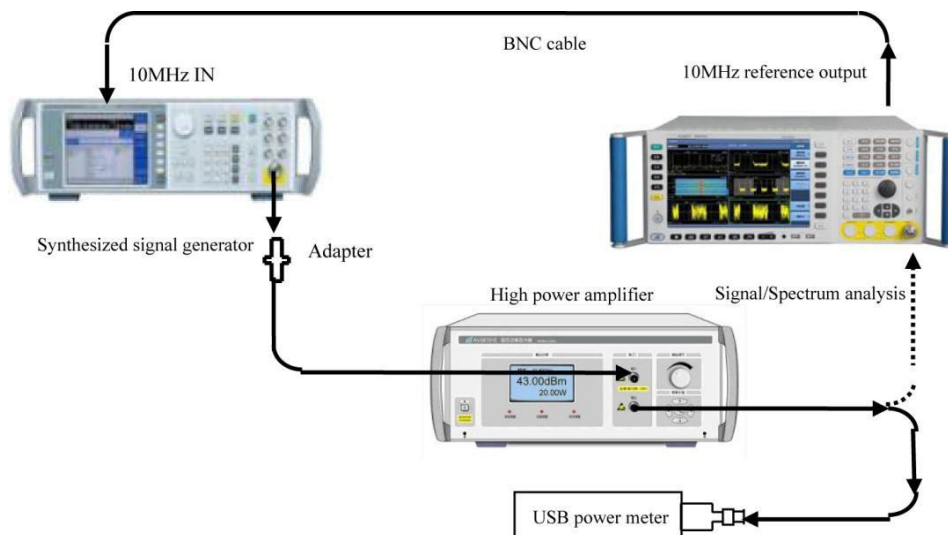


Fig. 8.7 Schematic diagram of maximum safety input level test

d) Records and data processing

- 9) If steps 1 - 8 can be properly completed, it means the maximum safety input level of +30 dBm meets relevant requirements and +30 dBm should be noted in the S3503 Record Sheet. If not, the relevant test item should be noted as noncompliant.

8.5.1.2.3 Frequency response

a) Test items

The frequency response refers to the change of the amplitude along with that of the frequency within the specified frequency range, namely the dependency between the amplitude and the frequency. The change of the amplitude along with that of the frequency within the specified frequency range is investigated by inputting a sine wave signal with known frequency and power (defined with the power meter) from the signal generator.

Note: The alternative comparison method may be used for testing. Firstly, use the signal/spectrum analyzer to test and record the output signal amplitude of the signal generator and then use the power meter to test the output power of the signal generator with such amplitude unchanged; correspond the test data with the output frequency of the signal generator to obtain the difference between the marker reading of the S3503 and the measurement value of the power meter, which is the frequency response.

b) Testing block diagram and testing instrument and equipment

Synthesized signal generator (E8257D/S1103 is recommended) E4418B is recommended for the power meter. SAV71712A/N8487A is recommended for the power sensor. 11667C is recommended for the power divider.

c) Test steps

Frequency response: (50MHz~4GHz)

- 1) Connect the tested instrument as shown in Fig. 8.8.
- 2) Set the output frequency of the synthesized signal generator as 50 MHz, the frequency step as 200 MHz and the amplitude as -4 dBm.
- 3) Reset and set the S3503 analyzer:
 - Center frequency: 50MHz
 - Bandwidth=0Hz
 - Resolution bandwidth: 300kHz
 - Video bandwidth: 30kHz Frequency step 200 MHz
 - Set as Off when the pre-amplifier option is provided.
- 4) Set the power meter frequency as 50 MHz.
- 5) Record the S3503 marker reading L2 and the power meter reading L1 in the S3503 Auxiliary Form.
- 6) Execute Frequency Step Up for the synthesized signal generator and the S3503 analyzer.
- 7) Repeat the power meter frequency as the frequency value to be tested next in B8 of the S3503 Auxiliary Form and repeat step 5 to 6 for each frequency point in the S3503 Auxiliary Form.

Frequency response: (4GHz~9GHz)

- 8) Set the output frequency of the synthesized signal generator as 4.05 GHz and the center frequency of the S3503 analyzer as 4.05 GHz.
- 9) Set the power meter frequency as 4.05GHz.
- 10) Record the S3503 marker reading L2 and the power meter reading L1 in the S3503 Auxiliary Form.
- 11) Execute Frequency Step Up for the synthesized signal generator and the S3503 analyzer.
- 12) Repeat the power meter frequency as the frequency value to be tested next in B8 of the S3503 Auxiliary Form and repeat step 10 to 11 for each frequency point in the S3503 Auxiliary Form.

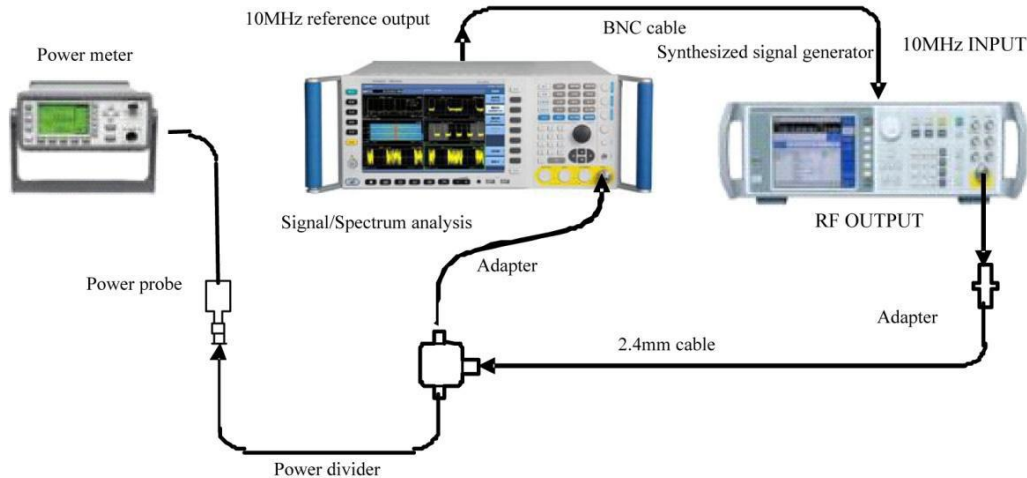


Fig. 8.8 Schematic diagram of frequency response test (50 MHz - 50 GHz)

Frequency response: (9GHz~18GHz)

- 13) Set the output frequency of the synthesized signal generator as 9.05 GHz. Set the center frequency of the S3503 analyzer as 9.05 GHz and the frequency step as 500 MHz.
- 14) Set the power meter frequency as 9.05GHz.
- 15) Record the S3503 marker reading L2 and the power meter reading L1 in the S3503 Auxiliary Form.
- 16) Execute Frequency Step Up for the synthesized signal generator and the S3503 analyzer.
- 17) Repeat the power meter frequency as the frequency value to be tested next in B8 of the S3503 Auxiliary Form and repeat step 15 to 16 for each frequency point in the S3503 Auxiliary Form.

Frequency response: (18GHz~26.5GHz)

- 18) Set the output frequency of the synthesized signal generator as 18.05GHz and the center frequency of the S3503 analyzer as 18.05GHz.
- 19) Set the power meter frequency as 18.05GHz.
- 20) Record the S3503 marker reading L2 and the power meter reading L1 in the S3503 Auxiliary Form.
- 21) Execute Frequency Step Up for the synthesized signal generator and the S3503 analyzer.
- 22) Repeat the power meter frequency as the frequency value to be tested next in B8 of the S3503 Auxiliary Form and repeat step 20 to 21 for each frequency point in the S3503 Auxiliary Form.

Frequency response: (26.5GHz~40GHz)

- 23) Set the output frequency of the synthesized signal generator as 26.55GHz and the center frequency of the S3503 analyzer as 26.55GHz.
- 24) Set the power meter frequency as 26.55GHz.
- 25) Record the S3503 marker reading L2 and the power meter reading L1 in the S3503 Auxiliary Form.
- 26) Execute Frequency Step Up for the synthesized signal generator and the S3503 analyzer.
- 27) Repeat the power meter frequency as the frequency value to be tested next in B8 of the S3503 Auxiliary Form and repeat step 25 to 26 for each frequency point in the S3503 Auxiliary Form.

Frequency response: (40GHz~50GHz)

- 28) Set the output frequency of the synthesized signal generator as 40.05GHz and the center frequency of the S3503 analyzer as

40.05GHz.

- 29) Set the power meter frequency as 40.05GHz.
- 30) Record the S3503 marker reading L2 and the power meter reading L1 in the S3503 Auxiliary Form.
- 31) Execute Frequency Step Up for the synthesized signal generator and the S3503 analyzer.
- 32) Repeat the power meter frequency as the frequency value to be tested next in B8 of the S3503 Auxiliary Form and repeat step 30 to 31 for each frequency point in the S3503 Auxiliary Form.

Frequency response: (3Hz~50MHz)

- 33) Set the S3503 analyzer as follows:

Center frequency as 50MHz

Bandwidth=100Hz

Resolution bandwidth10 Hz

MarkerAll Markers Off

- 34) Connect the test instrument as shown in Fig. 8.9 and then connect two output interfaces of the power divider to 50 Ω load and the signal/spectrum analyzer respectively.

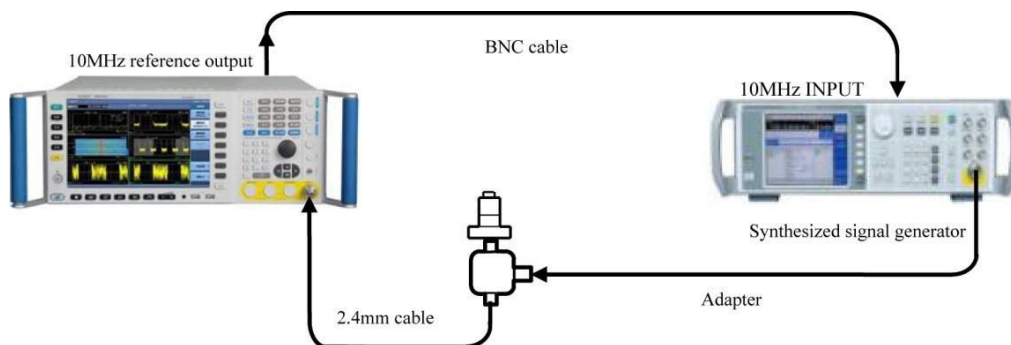


Fig. 8.9 Schematic diagram of frequency response test (3Hz - 50MHz)

- 35) Set Peak Search for the S3503 analyzer and adjust the amplitude of the synthesized signal generator until the S3503 amplitude reading is closest to the marker reading recorded in step 5.
- 36) Set Delta Marker for the S3503 analyzer.
- 37) Set the center frequency of the S3503 analyzer and the frequency of the synthesized signal generator as the frequencies listed in the form and record the delta marker reading at each frequency point in the "relative 50 MHz amplitude error" column in B8 of the S3503 Auxiliary Form.
- 38) Repeat step 37 for each frequency point in the form.
- 39) Record the 50 MHz amplitude error of the first point in "amplitude error (band 0, 50 MHz - 4 GHz)" in B8 of the S3503 Auxiliary Form in "50 MHz amplitude error" under "amplitude error (band 0, 0 MHz)".

Frequency response (pre-amplifier on)

- 40) Follow step 1 - 39 when the pre-amplifier option is provided and set the amplifier in step 3 as on.

d) Test records and data processing

- 41) Reduce "relative 50 MHz amplitude error" by "50 MHz amplitude error" in the table for each frequency point listed in "amplitude error (band 0, 50 MHz - 4 GHz)" in B8 of the S3503 Auxiliary Form and record the result as current frequency point amplitude error in the form.

42) Calculate and record the amplitude error ΔA of relevant frequency point according to the formula (16):

$$\Delta A = L_2 - L_1 \dots\dots\dots (16)$$

Where L_1 refers to the power meter reading (dBm);

L_2 refers to the marker reading of the S3503 analyzer (dBm).

43) Find the positive maximum amplitude error value ΔA_{max} and the negative minimum amplitude error value ΔA_{min} of each band and record them in "frequency response statistical results". The absolute values of such two error values should fall within the frequency response range of the S3503 analyzer, otherwise it will be considered as noncompliant.

44) Calculate the frequency response ΔA_P of each band according to the formula (17) and record it in the S3503 Record Sheet.

$$\Delta A_P = \pm \frac{\Delta A_{max} - \Delta A_{min}}{2} \dots\dots\dots (17)$$

8.5.1.2.4 Display range

a) Test items

The display range defines the display scale type, the logarithm scale and the scale unit of the S3503 analyzer.

b) Test procedure

- 1) Connect the power of the S3503 analyzer and execute factory reset after normal startup.
- 2) Logarithm and linear scale types are displayed under the amplitude menu of the S3503.
- 3) Manually set the requirements of "0.1 - 20 dB/division, resolution 0.01 dB" in logarithm scale mode.
- 4) The S3503 analyzer has 8 scale units, including dBm, dBmV, dB μ V, dBmA, dB μ A, V, W, A.

c) Test records and data processing

5) If steps 1 - 4 can be properly completed, it means the display range meets relevant requirements and "compliant" should be noted in the S3503 Record Sheet, otherwise it should be considered as noncompliant.

8.5.1.2.5 Overall absolute amplitude accuracy

a) Test items

The calibration signal frequency of the S3503 analyzer is 500 MHz and the amplitude is -20 dBm. The internal amplitude calibration of the S3503 analyzer will use them as the benchmark and the change in the calibration signal amplitude will be introduced to the absolute amplitude measurement accuracy error of the S3503 analyzer.

The signal produced from the signal generator with the same frequency and amplitude with the calibration signal is tested respectively by the signal/spectrum analyzer and the power meter and the reading difference between two test results is considered as the absolute amplitude accuracy of the calibration signal.

The absolute amplitude accuracy of the instrument can be obtained by adding the frequency response of each frequency point with the absolute amplitude accuracy of the 500 MHz calibration signal.

b) Testing block diagram and testing instrument and equipment

Synthesized signal generator (E8257D/S1103 is recommended) N1914A is recommended for the power meter. N8487A/SAV71712/R&sZ61 is recommended for the power sensor.

c) Test steps

- 1) Zero and calibrate the power meter. Connect the tested instrument according to solid lines in Fig. 8.10 and connect the output of the signal generator to the power meter. Reset the S3503 analyzer and complete all calibrations without prompted error

messages.

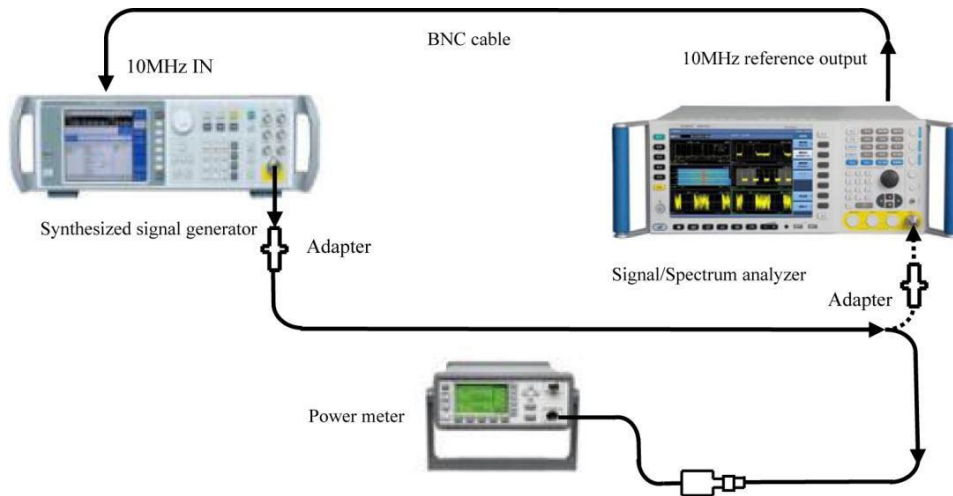


Fig. 8.10 Schematic diagram of overall absolute amplitude accuracy test

- 2) Set the output frequency of the synthesized signal generator as 500 MHz and the amplitude as -20 dBm.
- 3) Set the power meter frequency as 500 MHz and record the power meter reading in the column L1 of the S3503 Auxiliary Form.
- 4) Change the connections in the test according to dotted lines in Fig. 8.10 to connect the cable via the adapter to the S3503 analyzer.
- 5) Set the S3503 analyzer as follows: Center frequency:

500MHz Bandwidth=0Hz

Resolution bandwidth: 300kHz

Video bandwidth: 30kHz

- 6) Execute Peak Search and record the S3503 marker reading L2 in B9 of the S3503 Auxiliary Form.

d) Test records and data processing

- 7) Calculate 500 MHz absolute amplitude accuracy ΔA_{500} of the frequency point according to the formula (18) and record the result in the S3503 Record Sheet:

$$\Delta A_{500} = L_2 - L_1 \dots\dots\dots (18)$$

Where L_1 refers to the power meter reading (dBm);

L_2 refers to the marker reading of the S3503 analyzer (dBm).

- 8) Calculate with the test result indicated in Section 4.6.12.2.3 for each band according to the formula (19) and record the calculation result as the overall absolute amplitude accuracy ΔA_{ALL} in the S3503 Record Sheet:

$$\Delta A_{ALL} = \pm \left(\left| \Delta A_{500} \right| + \left| \Delta A_P \right| \right) \dots\dots\dots (19)$$

Where, ΔA_{500} refers to the 500 MHz absolute amplitude accuracy (dB);

ΔA_P refers to the frequency response data obtained from the test in 4.6.12.2.3 (dB).

8.5.1.2.6 Input voltage standing-wave ratio

a) Test items

Impedance mismatch will lead to production of reflected voltage. The incident voltage and the reflected voltage transmit in two

opposite directions to produce certain interference pattern. The standing-wave ratio is the ratio of the maximum value against the minimum value of the voltage pattern envelop.

The standing-wave test function of the vector network analyzer can be directly used to test the input voltage standing-wave ratio at the input interface of the signal/spectrum analyzer.

b) Testing block diagram and testing instrument and equipment

N5247A is recommended for the network analyzer.

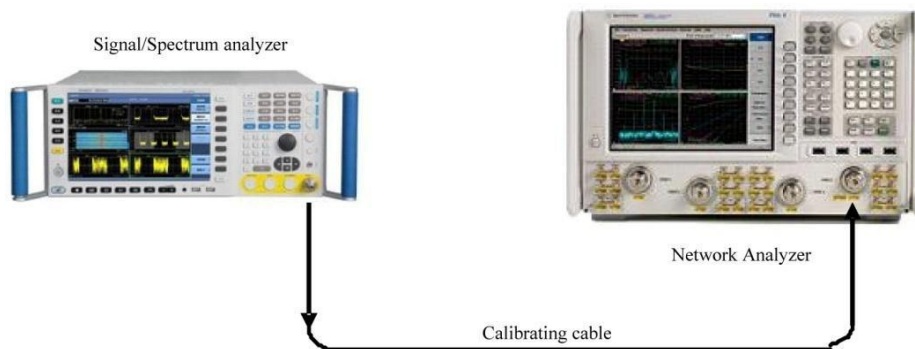


Fig. 8.11 Schematic diagram of input interface voltage standing-wave ratio test

c) Test steps

Fig. 8.11 Schematic diagram of input interface voltage standing-wave ratio test

- 1) Reset the S3503 analyzer and check to confirm the input attenuator is set as 10 dB.
- 2) Set the frequency range and the source output power of the network analyzer properly and select VSWR display mode.
- 3) Select calibration cable for the network analyzer for single-interface measurement and calibration (including open circuit, short circuit and load calibration).
- 4) After calibration, take the calibrated part from the calibration cable and connect the test cable interface to the output interface of the S3503 analyzer as shown in Fig. 8.11.
- 5) Use the marker function to read out the VSWR of corresponding band of the S3503 analyzer in the network analyzer.

d) Test records and data processing

- 6) Record measurement results in the S3503 Record Sheet.

8.5.1.2.7 Resolution bandwidth switching error

a) Test items

The resolution bandwidth is affected by configured parameters during switching, resulting in gain error. Such error has been modified during instrument design, however, certain amplitude error still exists due to calibration methods and environmental change.

The signal peak amplitude offset displayed in the signal/spectrum analyzer will be the resolution bandwidth switching error only by inputting a stable signal and changing the resolution bandwidth of the S3503 analyzer. Since the resolution bandwidth of the signal/spectrum analyzer steps by 10% and has 160 levels, the stepping amount of 1, 2, 3, 5 and 10 will be used to measure typical bandwidths during test.

b) Test procedure

- 1) Reset the S3503 analyzer and complete all calibrations.
- 2) Set the S3503 input as the calibration interface and the calibration source as 500 MHz and set the following parameters:

Center frequency: 500MHz

Bandwidth=500kHz Reference

level-18 dBm

Logarithmic scale dB/division1 dB

Resolution bandwidth: 300kHz

VBW/RBW: 0.1

- 1) Execute Peak Search and Delta Marker.
- 2) Set the S3503 analyzer according to the resolution bandwidth listed in the S3503 Auxiliary Form and set the ratio of the frequency span against the resolution bandwidth as approximately 2 times.
- 3) Execute Peak Search and record the marker difference reading as current resolution bandwidth switching error.
- 4) Repeat Step 4 to 5 for remaining resolution bandwidths in B12 of the S3503 Auxiliary Form.

c) Test records and data processing

- 5) Determine values in all test items in B12 of the S3503 Auxiliary Form and find the positive maximum error value ΔA_{max} and the negative minimum error value ΔA_{min} of each band. Such two values should fall within the resolution bandwidth switching error range of the S3503 analyzer, otherwise it will be considered as noncompliant.
- 6) Calculate the resolution bandwidth switching error ΔA according to the formula (20) and record it in the S3503 Record Sheet.

$$\Delta A = \pm \frac{\Delta A_{max} - \Delta A_{min}}{2} \dots\dots\dots (20)$$

8.5.1.2.8 Reference level

a) Test items

The calibrated vertical scale position on the screen of the signal/spectrum analyzer is used as the reference for amplitude measurement and the reference level usually refers to the top scale line. Switching of the reference level will cause the linkage of gain/attenuation. The reference level switching error is used to assess the error of the switch gain of the S3503 analyzer. By changing the set value of the standard attenuator, the error between the marker reading difference and the calibration value of the standard attenuator caused by switching of the reference level will be the reference level switching error.

b) Test equipment

Synthesized signal generator (E8257D/S1103 is recommended)

84906L is recommended for the standard attenuator. 11713C is recommended for the attenuator drive.

c) Test steps

- 1) Connect the instrument as shown in Fig. 8.12, reset the S3503 analyzer and set it to provide frequency reference for the signal generator. Set the frequency of the signal generator as 30.02 MHz and the output amplitude as -3 dBm.
- 2) Use 11713C to reduce the 84906L standard attenuator to 0 dB attenuation. Record the standard value of the standard attenuator at 30.02 MHz frequency point in the S3503 Auxiliary Form.
- 3) Reset the S3503 analyzer, execute all calibrations, wait until all calibrations are done and set the following parameter:

Center frequency: 30.02MHz

Logarithm scale 1dB/division

Resolution bandwidth: 1kHz

Video bandwidth: 30Hz

RF gain best sensitivity

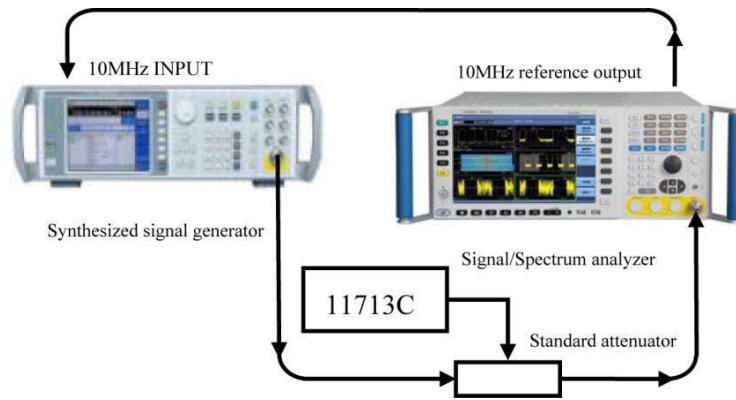


Fig. 8.12 Schematic diagram of reference level switching error

- 4) Execute Peak Search and adjust the output amplitude of the synthesized signal generator to display the signal 2 - 3 divisions below the reference level.
- 5) Execute Delta Marker.
- 6) Use 11713C to reduce the 84906L standard attenuator to 10 dB attenuation.
- 7) Set the reference level of the S3503 analyzer as -10 dBm, execute Continuous Measurement Off and wait for the sweep operation to complete.
- 8) Record the delta marker amplitude reading ΔL of the S3503 analyzer in B11 of the S3503 Auxiliary Form.
- 9) Repeat step 6 - 8 according to the reference level parameter and the set value of the standard attenuator in B11 of the S3503 Auxiliary Form.
- 10) Calculate the relevant reference level switching error ΔA_r according to the formula (21) and record it in the S3503 Record Sheet:

$$\Delta A_{ref} = \Delta L + A_{ATT} \dots\dots\dots (21)$$

Where ΔL refers to the delta marker amplitude reading of the S3503 analyzer (dB);

A_{ATT} Refers to the calibration value of the standard attenuator (dB).

d) Test records and data processing

- 11) Determine values in results of all test items in B11 of the S3503 Auxiliary Form and find the positive maximum error value $\Delta A_{ref \max}$ and the negative minimum error value $\Delta A_{ref \min}$. The absolute values of such two errors should fall within the range of reference level switching error, otherwise, they will be considered as noncompliant.
- 12) Calculate the reference level switching error ΔA according to the formula (22) and record it in the S3503 Record Sheet.

$$\Delta A = \pm \frac{\Delta A_{ref \max} - \Delta A_{ref \min}}{2} \dots\dots\dots (22)$$

8.5.1.2.9 Display scale fidelity

a) Test items

The display scale fidelity is the error between the vertical scale on the screen of the signal/spectrum analyzer and its theoretical value. It is used to assess scale accuracy of the S3503 analyzer.

When testing fidelity with 10 dB/division, the resolution bandwidth of the schematic diagram is 1 kHz and the input signal start amplitude is set as 0 dBm reference level. When the signal amplitude is reduced, the displayed signal amplitude is compared with the reference level. The S3503 analyzer provides 10 MHz frequency reference for the signal generator.

b) Test equipment

Synthesized signal generator (E8257D/S1103 is recommended)

84906L is recommended for the standard attenuator. 11713C is recommended for the attenuator drive.

c) Test steps

- 1) Connect the instrument as shown in Fig. 8.12, reset the S3503 analyzer and set it to provide frequency reference for the signal generator. Set the frequency of the signal generator as 30.02 MHz and the output amplitude as 0 dBm.
- 2) Use 11713C to reduce the 84906L standard attenuator to 0 dB attenuation. Record the standard value of the standard attenuator at 30.02 MHz frequency point in the S3503 Auxiliary Form.
- 3) Reset the S3503 analyzer, execute all calibrations, wait until all calibrations are done and set the following parameter:

Center frequency: 30.02MHz

Bandwidth=10kHz

Resolution bandwidth: 1kHz

Video bandwidth: 30Hz

- 4) Adjust the output amplitude of the synthesized signal generator to display the signal peak at the reference level.
- 5) Execute Peak Search and Delta Marker.
- 6) Use 11713C to reduce the 84906L standard attenuator to 10 dB attenuation.
- 7) Set and execute Continuous Measurement Off and wait for the sweep operation to complete.
- 8) Record the delta marker amplitude reading ΔL of the S3503 analyzer in B12 of the S3503 Auxiliary Form.
- 9) Turn on Average when the reading fluctuation of the delta marker of the signal/spectrum analyzer exceeds relevant requirement.
- 10) Repeat step 6 - 9 according to the set value of the standard attenuator in B12 of the S3503 Auxiliary Form.
- 11) Calculate the relevant display scale error ΔAV according to the formula (23) and record it in the S3503 Record Sheet:

$$\Delta A_V = \Delta L + A_{ATT} \dots\dots\dots (23)$$

Where ΔL refers to the delta marker amplitude reading of the S3503 analyzer (dB);

A_{ATT} Refers to the calibration value of the standard attenuator (dB).

d) Test records and data processing

- 12) Determine values in results of all test items in B12 of the S3503 Auxiliary Form and find the positive maximum error value ΔAV_{max} and the negative minimum error value ΔAV_{min} . The absolute values of such two errors should fall within the range of reference scale fidelity, otherwise, they will be considered as noncompliant.
- 13) Calculate the display fidelity ΔA according to the formula (24) and record it in the S3503 Record Sheet.

$$\Delta A = \pm \frac{\Delta A_{V_{max}} - \Delta A_{V_{min}}}{2} \dots\dots\dots (24)$$

8.5.1.2.10 Trace detector mode

a) Test items

The detector mode refers to a way of displaying signal energy. The S3503 provides 7 detector modes including normal, positive peak, negative peak, sample, video average, power average and voltage average.

b) Test procedure

- 1) Rest the S3503 analyzer and enter the second page of the trace menu to access 5 detector modes, including normal, positive peak, sample, negative peak and average (the average detector mode is classified into three types: video, power and voltage), in which normal mode is the default detector mode.
- 2) Change the detector mode of the S3503 analyzer to change corresponding trace and display it based on the set detector mode.
- c) Test records and data processing**
- 3) If steps 1 - 3 can be properly completed, it means the trace detector mode is normal and meets relevant requirements. In this case, "compliant" should be noted in the S3503 Record Sheet, otherwise it should be considered as noncompliant.

8. 5. 1. 3. Dynamic range test

8.5.1.3.1 dB gain compression

a) Test items

When the input signal level increases, unit circuits of the signal/spectrum analyzer, including the mixer and the amplifier are working close to the saturation point and the input signal component at such time will no longer change linearly with the input signal. Usually, the input level 1 dB lower than the input linear value offset is considered as 1 dB compression point.

Input a low power signal and then a high power signal with frequency interval of 3 MHz into the signal/spectrum analyzer. Change the power of the high power signal until it causes measured value of the low power signal to lower to the closest point to 1dB to obtain the power value of the high power signal, which is also the 1 dB gain compression value.

b) Test equipment

E4418B is recommended for the power meter. E8257D/S1103 is recommended for synthesized signal generator #1. E8257D/S1103 is recommended for synthesized signal generator #2. N8487A/R&sZ61 is recommended for the power sensor. RF directional coupler MMW directional coupler

c) Test steps

Gain compression (10 MHz - 40 MHz)

- 1) The power meter is zeroed and calibrated.
- 2) Reset S3503 and set the center frequency as 30 MHz, the frequency span as 1 kHz, the reference level as -20 dBm, the display scale as 1 dB/division and the attenuator as 0 dB.
- 3) Set the frequency of synthesized signal generator#1 and #2 as 33 MHz and 30 MHz respectively, the power output as -10 dBm and the output of synthesized signal generator#2 as off.
- 4) Connect the instrument according to solid lines in Fig. 8.13 with the output of the RF direction couple connected via the adapter to the power sensor.
- 5) Set the test frequency of the power meter as the output frequency of synthesized signal generator#1. Adjust the output power level of signal generator#1 to change current power meter reading to the mixer level of current test section under 1 dB gain compression and turn off the output of signal generator#1.
- 6) Change the connections in the test according to dotted lines in Fig. 8.13, turn on the output of synthesized signal generator #2 and adjust the power level of synthesized signal generator #2 to display the signal peak 2 - 3 divisions under the S3503 reference level.
- 7) Execute Peak Search and turn on Delta Marker.
- 8) Turn on the output of synthesized signal generator#1. Read out the absolute value of current marker difference amplitude. If such value is lower than 1 dB, it should be recorded in the S3503 Record Sheet. Otherwise, it will be considered as noncompliant.
- 9) Turn off the output of synthesized signal generator#1.

Gain compression (40MHz - 200MHz)

- 10) Connect the instrument according to solid lines in Fig. 8.13. Set the center frequency of the S3503 analyzer as 100 MHz, the frequency of synthesized signal generator#1 as 103 MHz and the frequency of synthesized signal generator#2 as 100 MHz.
- 11) Repeat step 5 - 8.
- 12) Turn off the output of synthesized signal generator#1.

Gain compression (200MHz - 4GHz)

- 13) Connect the instrument according to solid lines in Fig. 8.13. Set the center frequency of the S3503 analyzer as 200 MHz, the frequency of synthesized signal generator#1 as 2.003 GHz and the frequency of synthesized signal generator#2 as 2 GHz.
- 14) Set the power meter frequency as 2GHz.
- 15) Repeat step 5 - 8.
- 16) Turn off the output of synthesized signal generator#1.

Gain compression (4GHz - 9GHz)

- 17) Connect the instrument according to solid lines in Fig. 8.13. Set the center frequency of the S3503 analyzer as 5 GHz, the frequency of synthesized signal generator#1 as 5.003 GHz and the frequency of synthesized signal generator#2 as 5 GHz.
- 18) Use the MMW directional coupler to replace the RF directional coupler.
- 19) Repeat step 5 - 8.
- 20) Turn off the output of synthesized signal generator#1.

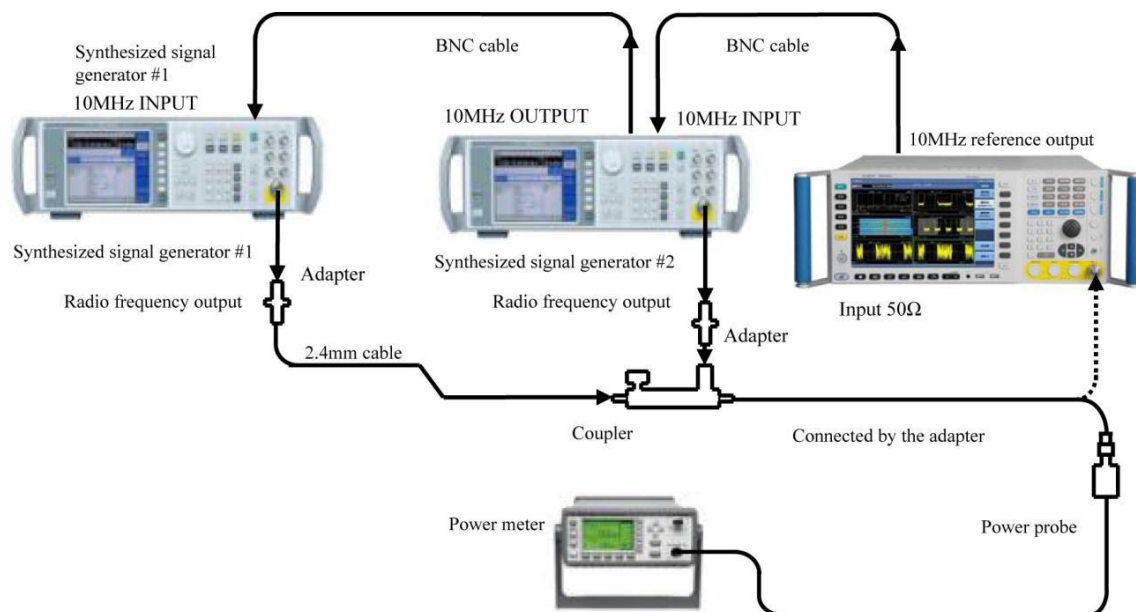


Fig. 8.13 Schematic diagram of 1 dB gain compression test

Gain compression (9GHz - 50GHz)

- 21) Connect the instrument according to solid lines in Fig. 8.13. Set the center frequency of the S3503 analyzer as 15 GHz, the frequency of synthesized signal generator#1 as 15.003 GHz and the frequency of synthesized signal generator#2 as 15 GHz.
- 22) Use the MMW directional coupler to replace the RF directional coupler.
- 23) Repeat step 5 - 8.
- 24) Turn off the output of synthesized signal generator#1.

8.5.1.3.2 Display average noise level

a) Test items

The display average noise level refers to the background noise detected by the signal/spectrum analyzer without any external noise or signal.

The normalized noise level detected without any external noise or signal as well as the minimum attenuation is the measured value of the display average noise level. When the peak test value is the residual response, relevant test frequency points should be avoided.

b) Test equipment

50 Ω loads

c) Test steps

Average noise display (10MHz to 1GHz)

1) Connect the 50 Ω load and the adapter to the input interface of the S3503 analyzer as shown in Fig. 8.14.

2) Reset S3503 and set as follows:

Starting frequency: 10MHz

Ending frequency: 1GHz

Reference level -40 dBm

Average Count 10

Set as Off when the pre-amplifier option is provided.

3) Turn on Trace Average. Set Peak Search for the S3503 analyzer, set the peak value as the center frequency, turn on Noise Marker and set as follows:

Bandwidth=100Hz

Reference level -80 dBm

Attenuator 0 dB

Continuous measurement off

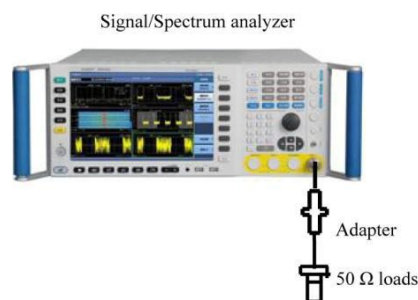


Fig. 8.14 Schematic diagram of display average noise level test

4) Set the RF gain of the S3503 analyzer as Best Sensitivity in the measurement settings.

5) Read the mark amplitude. If this value is less than or equal to the requirement of the S3503 analyzer, record it as the display average noise level within the range from 10 MHz to 1GHz into the corresponding test item of the S3503 Record Sheet. Otherwise, it should be considered as noncompliant.

Average noise display (1GHz to 2GHz)

6) Reset S3503 and set as follows:

Reference level -40 dBm

Starting frequency: 1GHz

Ending frequency: 2GHz

MarkerAll Markers Off

7) Repeat step 3 - 4.

8) 5) Read the mark amplitude. If this value is less than or equal to the requirement of the S3503 analyzer, record it as the display average noise level within the range from 1GHz - 2 GHz into the corresponding test item of the S3503 Record Sheet. Otherwise, it should be considered as noncompliant.

Average noise display (2GHz to 3GHz)

9) Reset S3503 and set as follows:

Reference level -50 dBm

Starting frequency: 2GHz

Ending frequency: 3GHz

MarkerAll Markers Off

10) Repeat step 3 - 4.

11) Read the mark amplitude. If this value is less than or equal to the requirement of the S3503 analyzer, record it as the display average noise level within the range from 1GHz - 2 GHz into the corresponding test item of the S3503 Record Sheet. Otherwise, it should be considered as noncompliant.

Average noise display (3GHz to 4GHz)

12) Reset S3503 and set as follows:

Reference level -50 dBm

Starting frequency: 3GHz

Ending frequency: 4GHz

MarkerAll Markers Off

13) Repeat step 3 - 4.

14) Read the mark amplitude. If this value is less than or equal to the requirement of the S3503 analyzer, record it as the display average noise level within the range from 1GHz - 2 GHz into the corresponding test item of the S3503 Record Sheet. Otherwise, it should be considered as noncompliant.

Average noise display (4GHz to 4.4GHz)

15) Reset S3503 and set as follows:

Reference level -50 dBm

Starting frequency: 4GHz Ending

frequency: 4.4GHz MarkerAll

Markers Off

16) Repeat step 3 - 4.

17) Read the mark amplitude. If this value is less than or equal to the requirement of the S3503 analyzer, record it as the display average noise level within the range from 1GHz - 2 GHz into the corresponding test item of the S3503 Record Sheet. Otherwise,

it should be considered as noncompliant.

Average noise display (4.4GHz to 9GHz)

18) Reset S3503 and set as follows:

Reference level -30 dBm

Starting frequency: 4.4GHz

Ending frequency: 9GHz

MarkerAll Markers Off

19) Repeat step 3 - 4.

20) Read the mark amplitude. If this value is less than or equal to the requirement of the S3503 analyzer, record it as the display average noise level within the range from 18 GHz - 26.5 GHz into the corresponding test item of the S3503 Record Sheet. Otherwise, it should be considered as noncompliant.

Average noise display (9GHz to 18GHz)

21) Reset S3503 and set as follows:

Reference level -30 dBm

Starting frequency: 9GHz

Ending frequency: 18GHz

MarkerAll Markers Off

22) Repeat step 3 - 4.

23) Read the mark amplitude. If this value is less than or equal to the requirement of the S3503 analyzer, record it as the display average noise level within the range from 9GHz - 18GHz into the corresponding test item of the S3503 Record Sheet. Otherwise, it should be considered as noncompliant.

Average noise display (18GHz to 26.5GHz)

24) Reset S3503 and set as follows:

Reference level -30 dBm

Starting frequency: 18GHz

Ending frequency: 26.5GHz

MarkerAll Markers Off

25) Repeat step 3 - 4.

26) Read the mark amplitude. If this value is less than or equal to the indicator value of S3503, record it as the displayed average noise level within the range from 40GHz to 50GHz into the corresponding test item of "S3503 Record Table"; otherwise, the value is unacceptable.

Average noise display (26.5GHz to 40GHz)

27) Reset S3503 and set as follows:

Reference level -30 dBm

Starting frequency: 26.5GHz

Ending frequency: 40GHz

MarkerAll Markers Off

28) Repeat step 3 - 4.

29) Read the mark amplitude. If this value is less than or equal to the indicator value of S3503, record it as the displayed average noise level within the range from 40GHz to 50GHz into the corresponding test item of "S3503 Record Table"; otherwise, the value is unacceptable.

Average noise display (40GHz to 50GHz)

30) Reset S3503 and set as follows:

Reference level -30 dBm

Starting frequency: 40GHz

Ending frequency: 50GHz

MarkerAll Markers Off

31) Repeat step 3 - 4.

32) Read the mark amplitude. If this value is less than or equal to the indicator value of S3503, record it as the displayed average noise level within the range from 40GHz to 50GHz into the corresponding test item of "S3503 Record Table"; otherwise, the value is unacceptable.

Display average noise (pre-amplifier on)

33) Follow step 1 - 32 when the pre-amplifier option is provided and set the amplifier in step 3 as on.

8.5.1.3.3 Residual response

a) Test items

The residual response refers to the discrete response observed on the screen when no input signal enters the signal/spectrum analyzer.

b) Test procedure

1) Connect the instrument as shown in Fig. 8.15. Reset the S3503 analyzer and connect 50 matcher at the signal input 50 interface.

Set the S3503 analyzer as follows:

Center frequency: 15.2MHz

Frequency step 28.5MHz

Bandwidth=30MHz

Reference level -50 dBm

Attenuator 0 dB

Resolution bandwidth: 10kHz

RF gain best sensitivity

2) Turn on the display line and set the noise level at least 5 dB below such display line at -100 dBm. If not, reduce the frequency span and the resolution bandwidth to lower the noise level. If the frequency span is lowered, reduce the frequency step to no more than 95% of the frequency span. If the zero frequency signal leads to a starting signal amplitude higher than -106 dBm, use the knob to adjust the start frequency point to lower the noise level to under -106 dBm.

3) Record the maximum response frequency and the amplitude value of current trace in B13 of the S3503 Auxiliary Form.

- 4) If residual response is suspected, press Single Sweep. The residual response will continue to appear, while the noise peak will disappear. The noise should not be recorded as the residual response.
- 5) Set the frequency step of the S3503 as once, compare the maximum response amplitude of current trace with the maximum value of the previous response after trace refreshing and save the higher value.
- 6) Check the residual response with the frequency up to 9 GHz following step 2 - 5 and record the measured maximum response value at the measurement value of "200 kHz - 9 GHz" in B13 of the S3503 Auxiliary Form.

c) d) Test records and data processing

- 7) Determine measurement values in B13 of the S3503 Auxiliary Form. If the maximum response value is smaller than or equal to the residual response requirement of the S3503 analyzer, it should be recorded in the S3503 Record Sheet, otherwise it should be considered as noncompliant.

8.5.1.3.4 image response

a) Test items

During frequency mixing, if two signals can mix with the LO signal with the same frequency to generate IF signals of the same frequency and if one original signal has a frequency one IF lower than the LO signal and the other original signal has a frequency one IF higher than the LO signal, then such two original signals can be referred to as the image of each other. The input signal of each frequency of the LO signal has an image and the frequency of the original signal and the image differs by two times of IF.

Set the input signal frequency as the center frequency of the S3503 analyzer for reference amplitude measurement, then tune the synthesized signal generator to a frequency that will cause image, multiple or out-of- band response, measure and record the amplitude difference displayed as the image response.

b) Test equipment

Synthesized signal generator (E8257D/S1103 is recommended)

c) Test steps

IF3 image response

- 1) Connect the test equipment as shown in Figure 8.8.
- 2) Set the frequency of the synthesized signal generator as 1 GHz, the power as -4 dBm, the center frequency of the S3503 analyzer as 1 GHz and the test frequency of the power meter as 1 GHz.
- 3) Reset S3503 and set as follows:

Bandwidth=10kHz

Reference level -10 dBm

Attenuator 0 dB

Resolution bandwidth: 100Hz Video bandwidth: 10Hz

- 4) Adjust the power level of the synthesized signal generator until the power meter reading is closest to -10 dBm.
- 5) Execute Peak Search and Delta Marker.
- 6) Set the frequency of the synthesized signal generator and the power meter as the frequencies to enable IF3 image response as listed in the S3503 Record Sheet.
- 7) Adjust the output amplitude of the synthesized signal generator until the power meter reading is closest to -10 dBm.
- 8) Record the delta marker amplitude value in the S3503 Record Sheet.
- 9) Set the S3503 analyzer, the synthesized signal generator and the power meter according to frequencies listed in the S3503

Record Sheet and repeat step 4 - 8.

IF2 image response

- 10) Set the frequency of the synthesized signal generator as 1 GHz, the power as -4 dBm, the center frequency of the S3503 analyzer as 1 GHz and the test frequency of the power meter as 1 GHz.
- 11) Execute Peak Search and Delta Marker.
- 12) Set the frequency of the synthesized signal generator and the power meter as the frequencies to enable IF2 image response as listed in the S3503 Record Sheet.
- 13) Adjust the output amplitude of the synthesized signal generator until the power meter reading is closest to -10 dBm.
- 14) Record the delta marker amplitude value in the S3503 Record Sheet.
- 15) Set the S3503 analyzer, the synthesized signal generator and the power meter according to frequencies listed in the S3503 Record Sheet and repeat step 11 - 14.

IF1 image response

- 16) Set the frequency of the synthesized signal generator as 1 GHz, the power as -4 dBm, the center frequency of the S3503 analyzer as 1 GHz and the test frequency of the power meter as 1 GHz.
- 17) Execute Peak Search and Delta Marker.
- 18) Set the frequency of the synthesized signal generator and the power meter as the frequencies to enable IF1 image response as listed in the S3503 Record Sheet.
- 19) Adjust the output amplitude of the synthesized signal generator until the power meter reading is closest to -10 dBm.
- 20) Record the delta marker amplitude value in the S3503 Record Sheet.
- 21) Set the S3503 analyzer, the synthesized signal generator and the power meter according to frequencies listed in the S3503 Record Sheet and repeat step 17 - 21.

8.5.1.3.5 second harmonic distortion

a) Test items

When a signal is input to nonlinear devices (such as mixer and amplifier), such nonlinear devices will generate subharmonic for such input signal. The unwanted second harmonic component added to the signal is called second harmonic distortion. The value of the second harmonic distortion can be obtained by inputting sine wave signals as pure as possible (by connecting the external filter) into the signal/spectrum analyzer and testing the second harmonic component caused after such signal passes the signal/spectrum analyzer.

b) Testing block diagram and testing instrument and equipment

Synthesized signal generator (E8257D/S1103 is recommended)

500 MHz low-pass filter: 1

1.6GHz low-pass filter: 1

4GHz low-pass filter: 1

26.5GHz low-pass filter: 1

c) Test steps

Second harmonic distortion (10 MHz - 0.85 GHz)

- 1) Connect the 500 MHz low-pass filter and the BNC cable to the instrument as shown in Fig. 8.15. Reset the S3503 analyzer to provide frequency reference for the synthesized signal generator.

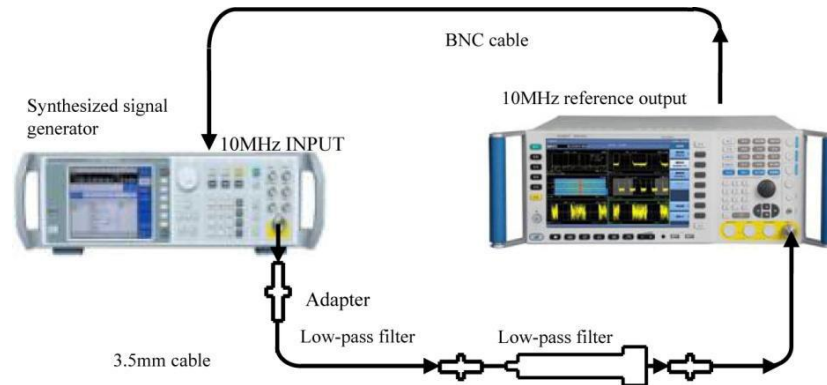


Fig. 8.15 Schematic diagram of second harmonic distortion test

- 2) Set the frequency of the synthesized signal generator as 500 MHz, the amplitude as -15 dBm and the RF output as on.
- 3) Reset S3503 and set as follows:
Center frequency: 500MHz
Bandwidth=200Hz
Reference level -15 dBm Attenuator0 dB
- 4) Set Peak Search, adjust the power level of the synthesized signal generator until the S3503 analyzer reading is closest to -15 dBm.
- 5) Set the S3503 analyzer as Single Sweep and wait for the sweep operation to complete. Set Peak Search, Marker Step, Delta Marker and Frequency Step Once. Set the S3503 analyzer as Single Sweep.
- 6) Execute Peak Search after a new sweep is completed. Record the delta marker reading as in the S3503 Record Sheet as the second harmonic distortion product of current test band.

Second harmonic distortion (0.85GHz - 2GHz)

- 7) Connect the instrument as shown in Fig. 8.15 and use 1.6 GHz low-pass filter.
- 8) Set the synthesized signal generator frequency as 1.6GHz and the amplitude as -15 dBm.
- 9) Set the S3503 analyzer as follows:
Center frequency: 1.6GHz
MarkerAll Markers Off
- 10) Repeat step 4 - 6.

Second harmonic distortion (2GHz - 4.5GHz)

- 11) Connect the instrument as shown in Fig. 8.15 and use 4GHz low-pass filter.
- 12) Set the synthesized signal generator frequency as 4GHz and the amplitude as -15 dBm.
- 13) Set the S3503 analyzer as follows:
Center frequency: 4GHz
MarkerAll Markers Off
- 14) Repeat step 4 - 6.

Second harmonic distortion (4.5 GHz - 9 GHz)

- 15) Connect the instrument as shown in Fig. 8.15 and use 9GHz low-pass filter.

16) Set the synthesized signal generator frequency as 8GHz and the amplitude as -15 dBm.

17) Set the S3503 analyzer as follows:

Center frequency: 8GHz

MarkerAll Markers Off

18) Repeat step 4 - 6.

Second harmonic distortion (9GHz - 25GHz)

19) Connect the instrument as shown in Fig. 8.15 and use 26.5GHz low-pass filter.

20) Set the synthesized signal generator frequency as 20GHz and the amplitude as -15 dBm.

21) Set the S3503 analyzer as follows:

Center frequency: 20GHz

MarkerAll Markers Off

22) Repeat step 4 - 6.

8.5.1.3.6 Three-order intermodulation distortion

a) Test items

TOI distortion refers to the unwanted frequency component generated via interactions of two or more input signal spectrum components caused by device nonlinearity.

It is produced by inputting at the same time two sine wave signals with frequency interval of 50 kHz and same power generated by two signal generators into the signal/spectrum analyzer. The Marker function of the signal/spectrum analyzer can be used directly to measure the TOI distortion product.

b) Testing block diagram and testing instrument and equipment

E4418B is recommended for the power meter.

SAV71712A/N8487A is recommended for the power sensor.

E8257D/S1103 is recommended for synthesized signal generator #1.

E8257D/S1103 is recommended for synthesized signal generator #2.

CTP-3060 is recommended for the isolator.

XTP-1218A is recommended for the isolator.

SAV70603 is recommended for the MMW directional coupler.

RF directional coupler

50 MHz low-pass filter

1.6GHz low-pass filter

c) Test steps

TOI distortion (10 MHz - 200 MHz)

1) Set the power meter frequency as 50 MHz after zeroing and calibration.

2) Connect the instrument according to solid lines in Fig. 8.16.

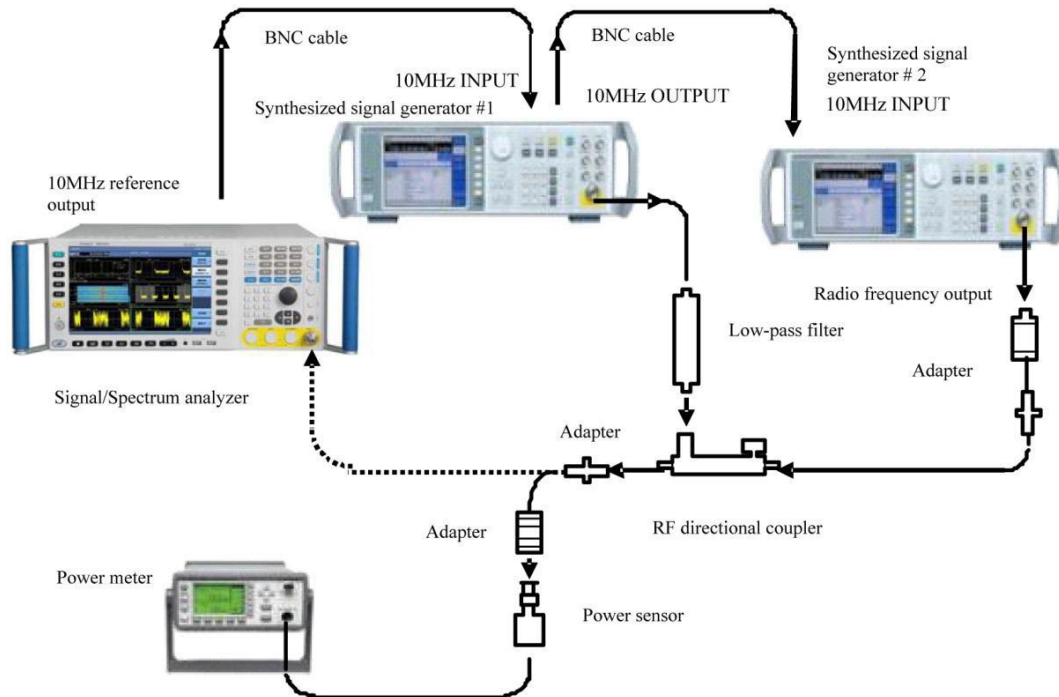


Fig. 8.16 Schematic diagram of TOI distortion test (10 MHz - 4 GHz)

- 3) Set the frequency of synthesized signal generator#1 as 50 MHz, the amplitude as +5 dBm and the amplitude step as 0.05 dB.
- 4) Reset synthesized signal generator#2 and set its frequency as 50.05 MHz, its power as -110 dBm and the RF output as off.
- 5) Reset S3503 and set as follows:
Center frequency: 50MHz
Frequency step: 50kHz
Bandwidth 200Hz
Reference level -10 dBm
Attenuator 0 dB
- 6) Adjust the output amplitude of synthesized signal generator#1 until the power meter reading is closest to -10 dBm.
- 7) Remove the power sensor from the RF directional coupler. Connect the RF directional coupler via the adapter directly to the input of the S3503 analyzer.
- 8) Set the S3503 analyzer as Peak Search and Marker Reference. Wait for the sweep operation to complete. Execute Delta Marker and Frequency Step Once.
- 9) Turn on the RF output of synthesized signal generator #2 and set the power as -10 dBm.
- 10) Set the S3503 analyzer as Peak Search.
- 11) Adjust the power level of synthesized signal generator#1 until the delta marker reading of the S3503 analyzer is closest to 0 dBm.
- 12) Set the S3503 analyzer as Delta Marker and the center frequency as step down twice. Wait for the sweep operation to complete. Set Video Average as 5 times and execute Single Sweep. Wait until Video Average 5 is displayed in the grid. Execute Peak Search and record obtained delta marker reading of the S3503 as the TOI distortion lower product in B14 of the S3503 Auxiliary Form.
- 13) Set the center frequency of the S3503 analyzer as step up for three times. Execute Peak Search after setting Single Sweep. The obtained delta marker reading of the S3503 is the TOI distortion upper product. in B14 of the S3503 Auxiliary Form.

TOI distortion (200MHz - 4GHz)

- 14) Set the frequency of synthesized signal generator#1 as 1.5 GHz, the power as+5 dBm and the RF output as on.
- 15) Set the frequency of synthesized signal generator#2 as 1.50005 GHz, the signal power as -110 dBm and the RF output as off.
- 16) Set the power meter frequency as 1.5GHz.
- 17) Reset the S3503 analyzer and set the center frequency as 1.5 GHz.
- 18) Repeat step 6 - 14.

TOI distortion (4GHz - 9GHz)

- 19) Connect the instrument as shown in Fig. 8.17 and use the MMW directional coupler to replace the RF directional coupler in Fig. 16.
- 20) Set the frequency of synthesized signal generator#1 as 5GHz, the power as+5 dBm and the RF output as on.
- 21) Set the frequency of synthesized signal generator#2 as 5.00005GHz, the signal power as -110 dBm and the RF output as off.
- 22) Set the power meter frequency as 5GHz.
- 23) Reset the S3503 analyzer and set the center frequency as 5 GHz.
- 24) Repeat step 6 - 14.

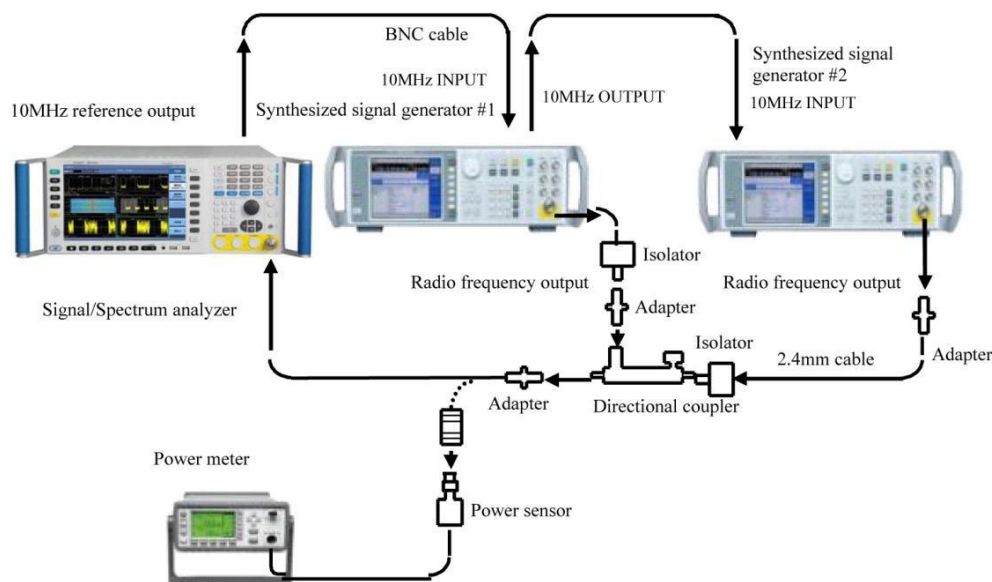


Fig. 8.17 Schematic diagram of TOI distortion test (4GHz - 50GHz)

TOI distortion (9GHz - 18GHz)

- 25) Set the frequency of synthesized signal generator#1 as 15GHz, the power as+5 dBm and the RF output as on.
- 26) Set the frequency of synthesized signal generator#2 as 15.00005GHz, the signal power as -110 dBm and the RF output as off.
- 27) Set the power meter frequency as 15GHz.
- 28) Reset the S3503 analyzer and set the center frequency as 15GHz.
- 29) Repeat step 6 - 13.

TOI distortion (18GHz - 50GHz)

- 30) Set the frequency of synthesized signal generator#1 as 35GHz, the power as+5 dBm and the RF output as on.

- 31) Set the frequency of synthesized signal generator#2 as 35.00005GHz, the signal power as -110 dBm and the RF output as off.
- 32) Set the power meter frequency as 35GHz.
- 33) Reset the S3503 analyzer and set the center frequency as 35GHz.
- 34) Repeat step 6 - 13.

d) Test records and data processing

- 35) Select the maximum value in the lower and upper TOI distortion products of the same frequency as the TOI distortion product ΔA of the mixer level at L (0 - 10 dBm). Calculate the TOI intercept point according to the formula (25) and record the result in the S3503 Record Sheet if it meets relevant requirement. Otherwise, the result will be considered as noncompliant.

$$TOI = L_0 - \frac{\Delta A}{2} \dots\dots\dots (25)$$

8.5.1.3.7 Phase noise

a) Test items

The phase noise is used to reflect the short-term stability of LO signal frequency of the signal/spectrum analyzer.

The reference sine signal of 1 GHz and 0 dBm can be measured at 100 Hz, 1 kHz, 10 kHz and 100 kHz offset carrier. The noise level at each frequency offset of the reference sine signal should be at least 6 dB higher than that of the signal/spectrum analyzer. If there is spurious response at set frequency offset during test, such spurious response should be eliminated and measurement should be made near relevant frequency offset.

b) Test equipment

E8257D is recommended for the synthesized signal generator.

c) Test steps

- 1) Connect the test instrument as shown in Fig. 8.18 and connect the signal output interface of the synthesized signal generator to the signal input interface of the S3503 analyzer.

Set the signal generator as follows:

Frequency 1 GHz

Amplitude 0 dBm

- 2) Reset the S3503 analyzer and set the center frequency as 1 GHz and the frequency span as 100 kHz.
- 3) Reduce the frequency span of the S3503 analyzer to display the signal in the center of the screen and finally lower it to 200 Hz.
- 4) Adjust the amplitude of the synthesized signal generator to display the signal peak at the reference level.
- 5) Set the S3503 analyzer as Peak Search, turn on Noise Marker and Delta Marker functions and execute Video Average for 10 times and Single Sweep.
- 6) After single measurement, read the amplitude difference of the noise marker at 100 Hz and -100 Hz frequency offsets as the noise level at +100 Hz and -100 Hz frequency offset respectively and record them in the S3503 Record Sheet.

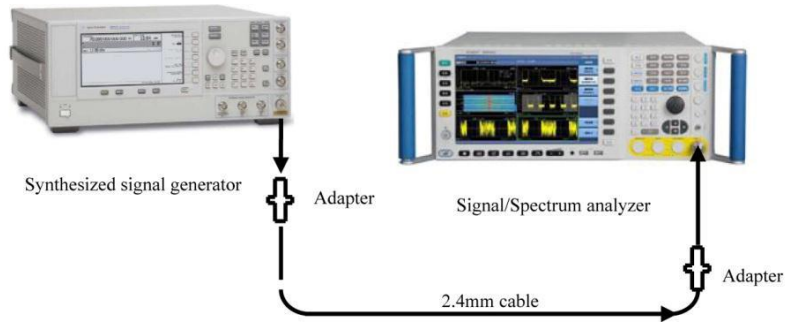


Fig. 8.18 Schematic diagram of phase noise test

- 7) Set the S3503 analyzer as Continuous Sweep.
- 8) Set the frequency span of the S3503 analyzer as 2 kHz, 20 kHz and 200 kHz, repeat step 5 - 7 and test the noise level at ± 1 kHz, ± 10 kHz and ± 100 kHz frequency offset.

8. 5. 2. Record sheet of performance characteristics of signal/spectrum analyzer

Inspection Records of S3503 Signal/Spectrum Analyzer

Instrument No.:

Tester:

Test conditions:

Testing date:

No.	Inspection item	Unit	Standard	Inspection result
1	Appearance		The instrument is clean and neat; the panel signs are clear; keys are easy to use; each connector is convenient and properly in place.	
2	Function	/	Spectrum Analysis	
			Power Kit Measurement	
			IQ Analysis	
			Analog Modulation Measurement (option)	
			Phase Noise Test (option)	
			Audio analysis (option)	
			Pulse Signal Analysis (option)	
			Transient Signal Analysis (option)	
			External Frequency Extension (option)	
			Calibration	
			Self-test	
3	Frequency range	/	DC coupling: 3 Hz to the upper limit of the frequency range of relevant model	
			AC coupling: 10 MHz to the upper limit of the frequency range of relevant model	
4	Frequency reference	/	Frequency accuracy: \pm (temperature stability + calibration accuracy)	
5	Residual frequency modulation (N refers to LO harmonic times)	Hz	3Hz ~1.1GHz (N=0.5) : 0.125Hz	
			3Hz ~4.0GHz (N=1) : 0.25Hz	
			4GHz~9GHz (N=1) : 0.25Hz	
			9GHz~18GHz (N=2) : 0.5Hz	
			18GHz~26.5GHz (N=4) : 1Hz	

			26.5GHz~40GHz (N=4) : 1Hz	
			40GHz~50GHz (N=8) : 2Hz	
6	Frequency reading accuracy	kHz	1.5 GHz (frequency span 200kHz): $\pm 0.62\text{kHz}$	
		kHz	1.5 GHz (frequency span 5MHz): $\pm 10.08\text{kHz}$	
		kHz	1.5 GHz (frequency span 50MHz): $\pm 98.73\text{kHz}$	
		kHz	1.5GHz (frequency span: 200MHz): $\pm 390.23\text{kHz}$	
		MHz	1.5GHz (frequency span: 500MHz): $\pm 900.23\text{kHz}$	
		kHz	1.5GHz (frequency span: 1GHz): $\pm 1.65\text{MHz}$	
		kHz	3.0GHz (frequency span 200kHz): $\pm 0.86\text{kHz}$	
		kHz	3.0GHz (frequency span 5MHz): $\pm 10.32\text{kHz}$	
		kHz	3.0GHz (frequency span 50MHz): $\pm 98.97\text{kHz}$	
		kHz	3.0GHz (frequency span: 200MHz): $\pm 390.47\text{kHz}$	
		kHz	3.0GHz (bandwidth: 500MHz): $\pm 900.47\text{kHz}$	
		MHz	3.0GHz (frequency span: 1GHz): $\pm 1.65\text{MHz}$	
		kHz	5.0GHz (frequency span: 200kHz): $\pm 1.17\text{kHz}$	
		kHz	5.0GHz (frequency span: 5MHz): $\pm 10.63\text{kHz}$	
		kHz	5.0GHz (frequency span: 50MHz): $\pm 99.28\text{kHz}$	
		kHz	5.0GHz (frequency span: 200MHz): $\pm 390.78\text{kHz}$	
		kHz	5.0GHz (frequency span: 500MHz): $\pm 900.78\text{kHz}$	
		MHz	5.0GHz (frequency span: 1GHz): $\pm 1.65\text{MHz}$	
		kHz	15GHz (frequency span: 200kHz): $\pm 2.72\text{kHz}$	
		kHz	15GHz (frequency span: 5MHz): $\pm 12.18\text{kHz}$	
		kHz	15GHz (frequency span: 50MHz): $\pm 100.83\text{kHz}$	
		kHz	15GHz (frequency span: 200MHz): $\pm 392.33\text{kHz}$	
		kHz	15GHz (frequency span: 500MHz): $\pm 902.33\text{kHz}$	
		MHz	15GHz (frequency span: 1GHz): $\pm 1.65\text{MHz}$	
		kHz	25GHz (frequency span: 200kHz): $\pm 4.27\text{kHz}$	
		kHz	25GHz (frequency span: 5MHz): $\pm 13.73\text{kHz}$	
		kHz	25GHz (frequency span: 50MHz): $\pm 102.38\text{kHz}$	
		kHz	25GHz (frequency span: 200MHz): $\pm 393.88\text{kHz}$	
		kHz	25GHz (frequency span: 500MHz): $\pm 903.88\text{kHz}$	

		MHz	25GHz (frequency span: 1GHz): $\pm 1.65\text{MHz}$	
		kHz	35GHz (frequency span: 200kHz): $\pm 5.82\text{kHz}$	
		kHz	35GHz (frequency span: 5MHz): $\pm 15.28\text{kHz}$	
		kHz	35GHz (frequency span: 50MHz): $\pm 103.93\text{kHz}$	
		kHz	35GHz (frequency span: 200MHz): $\pm 395.43\text{kHz}$	
		kHz	35GHz (frequency span: 500MHz): $\pm 905.43\text{kHz}$	
		MHz	35GHz (frequency span: 1GHz): $\pm 1.66\text{MHz}$	
		kHz	45GHz (frequency span: 200kHz): $\pm 7.37\text{kHz}$	
		kHz	45GHz (frequency span: 5MHz): $\pm 16.83\text{kHz}$	
		kHz	45GHz (frequency span: 50MHz): $\pm 105.78\text{kHz}$	
		kHz	45GHz (frequency span: 200MHz): $\pm 396.98\text{kHz}$	
		kHz	45GHz (frequency span: 500MHz): $\pm 906.98\text{kHz}$	
		MHz	45GHz (frequency span: 1GHz): $\pm 1.66\text{MHz}$	
		7	Marker Count	Hz
1.7GHz $\pm 0.1\text{Hz}$				
4GHz $\pm 0.1\text{Hz}$				
9GHz $\pm 0.1\text{Hz}$				
13.2GHz $\pm 0.1\text{Hz}$				
18GHz $\pm 0.1\text{Hz}$				
26.5GHz $\pm 0.1\text{Hz}$				
40GHz $\pm 0.1\text{Hz}$				
45GHz $\pm 0.1\text{Hz}$				
50GHz $\pm 0.1\text{Hz}$				
8	Frequency span accuracy	/	Center frequency: 300.000004 MHz Frequency span: 10 Hz: $\pm 0.2\%$	
			Center frequency: 300.000004 MHz Frequency span: 100 Hz: $\pm 0.2\%$	
			Center frequency: 300.0004MHz Frequency span: 1kHz: $\pm 0.2\%$	
			Center frequency: 300.004MHz Frequency span: 10kHz: $\pm 0.2\%$	
			Center frequency: 300.04MHz Frequency span: 100kHz: $\pm 0.2\%$	
			Center frequency: 300.4MHz Frequency span: 1MHz: $\pm 0.2\%$	
			Center frequency: 304MHz Frequency span: 10MHz: $\pm 0.2\%$	

			Center frequency: 340MHz Frequency span: 100MHz: $\pm 0.2\%$	
			Center frequency: 700MHz Frequency span: 1GHz: $\pm 0.2\%$	
			Center frequency: 2000MHz Frequency span: 4GHz: $\pm 0.2\%$	
			Center frequency: 4500MHz Frequency span: 9GHz: $\pm 0.2\%$	
			Center frequency: 6600MHz Frequency span: 13.2GHz: $\pm 0.2\%$	
			Center frequency: 9000MHz Frequency span: 18GHz: $\pm 0.2\%$	
			Center frequency: 13250MHz Frequency span: 26.5GHz: $\pm 0.2\%$	
			Center frequency: 20000MHz Frequency span: 40GHz: $\pm 0.2\%$	
			Center frequency: 22500MHz Frequency span: 45GHz: $\pm 0.2\%$	
			Center frequency: 25000MHz Frequency span: 50GHz: $\pm 0.2\%$	
9	Resolution bandwidth	Accuracy /	10 MHz: $\pm 15\%$	
			8MHz: $\pm 15\%$	
			6MHz: $\pm 15\%$	
			5MHz: $\pm 15\%$	
			4MHz: $\pm 15\%$	
			3MHz: $\pm 15\%$	
			2MHz: $\pm 5\%$	
			1MHz: $\pm 5\%$	
			500kHz: $\pm 5\%$	
			300kHz: $\pm 5\%$	
			200kHz: $\pm 5\%$	
			100kHz: $\pm 5\%$	
			50kHz: $\pm 5\%$	
			30kHz: $\pm 5\%$	
			20kHz: $\pm 5\%$	
			10kHz: $\pm 5\%$	
			5kHz: $\pm 5\%$	
			3kHz: $\pm 5\%$	
			2kHz: $\pm 5\%$	
			1kHz: $\pm 5\%$	
500Hz: $\pm 5\%$				

			300Hz: ±5%	
			200Hz: ±5%	
			100Hz: ±5%	
			50Hz: ±5%	
			30Hz: ±5%	
			20Hz: ±5%	
			10Hz: ±5%	
			5Hz: ±5%	
			3Hz: ±5%	
			2Hz: ±5%	
			1Hz: ±5%	
			Selectivity	10 MHz: 5: 1
		8MHz: 5: 1		
		6MHz: 5: 1		
		5MHz: 5: 1		
		4MHz: 5: 1		
		3MHz: 5: 1		
		2MHz: 5: 1		
		1MHz: 5: 1		
		500kHz: 5: 1		
		300kHz: 5: 1		
		200kHz: 5: 1		
		100kHz: 5: 1		
		50kHz: 5: 1		
		30kHz: 5: 1		
		20kHz: 5: 1		
		10kHz: 5: 1		
5kHz: 5: 1				
3kHz: 5: 1				
2kHz: 5: 1				
1kHz: 5: 1				

			500Hz: 5: 1	
			300Hz: 5: 1	
			200Hz: 5: 1	
			100Hz: 5: 1	
			50Hz: 5: 1	
			30Hz: 5: 1	
			20Hz: 5: 1	
			10Hz: 5:1	
			5Hz: 5:1	
			3Hz: 5:1	
			2Hz: 5:1	
			1Hz: 5:1	
11	Frequency response	dB	3 Hz - 20 MHz: maximum positive response + 0.70	
			3 Hz - 20 MHz: maximum negative response - 0.70	
			20MHz - 2GHz: maximum positive response +0.50	
			20MHz - 2GHz: maximum negative response - 0.50	
			2GHz - 3.6GHz: maximum positive response + 0.70	
			2GHz - 3.6GHz: maximum negative response - 0.70	
			3.6GHz - 4.0GHz: maximum positive response +1.00	
			3.6GHz - 4.0GHz: maximum negative response - 1.00	
			4GHz - 9GHz: maximum positive response +1.50	
			4GHz - 9GHz: maximum negative response - 1.50	
			9GHz - 18GHz: maximum positive response +2.00	
			9GHz - 18GHz: maximum negative response - 2.00	
			18 GHz - 26.5 GHz: maximum positive response + 2.50	
			18 GHz - 26.5 GHz: maximum negative response - 2.50	
			26.5GHz - 40GHz: maximum positive response +3.00	
			26.5GHz - 40GHz: maximum negative response - 3.00	
40GHz - 50GHz: maximum positive response +3.00				
40GHz - 50GHz: maximum negative response - 3.00				
12	Overall absolute	dB	± 0.24 at 500 MHz (calibration frequency)	

		/	Any frequency ± 0.24 dB + frequency response	
13	Resolution bandwidth switching error	dB	10 MHz: ± 0.3 dB	
			8MHz: ± 0.3 dB	
			6MHz: ± 0.3 dB	
			5MHz: ± 0.3 dB	
			4MHz: ± 0.3 dB	
			3MHz: ± 0.3 dB	
			2MHz: ± 0.3 dB	
			1MHz: ± 0.3 dB	
			500kHz: ± 0.3 dB	
			300kHz: ± 0.3 dB	
			200kHz: ± 0.3 dB	
			100kHz: ± 0.3 dB	
			50kHz: ± 0.3 dB	
			30kHz: ± 0.3 dB	
			20kHz: ± 0.3 dB	
			10kHz: ± 0.3 dB	
			5kHz: ± 0.3 dB	
			3kHz: ± 0.3 dB	
			2kHz: ± 0.3 dB	
			1kHz: ± 0.3 dB	
500Hz: ± 0.3 dB				
300Hz: ± 0.3 dB				
200Hz: ± 0.3 dB				
100Hz: ± 0.3 dB				
			50Hz: ± 0.3 dB	
			30Hz: ± 0.3 dB	
			20Hz: ± 0.3 dB	
			10Hz: ± 0.3 dB	
			5Hz: ± 0.3 dB	
			3Hz: ± 0.3 dB	

			2Hz: $\pm 0.3\text{dB}$	
			1Hz: $\pm 0.3\text{dB}$	
14	Reference level switching error	dB	-10dBm: $\pm 0.10\text{dB}$	
		dB	-20dBm: $\pm 0.10\text{dB}$	
		dB	-30dBm: $\pm 0.10\text{dB}$	
		dB	-40dBm: $\pm 0.10\text{dB}$	
		dB	-50dBm: $\pm 0.10\text{dB}$	
		dB	-60dBm: $\pm 0.10\text{dB}$	
		dB	-70dBm: $\pm 0.10\text{dB}$	
		dB	-80dBm: $\pm 0.10\text{dB}$	
15	1dB gain compression	dB	20MHz~40MHz	Mixer level $\geq -3\text{ dBm}$
			40MHz~200MHz	Mixer level $\geq +1\text{ dBm}$
			200MHz~4GHz	Mixer level $\geq +3\text{ dBm}$
			4GHz~9GHz	Mixer level $\geq -1\text{ dBm}$
			9GHz~50GHz	Mixer level $\geq +1\text{ dBm}$
16	Average noise level display	Without pre-amplifier	dBm	10 MHz - 1GHz ≤ -153
				1GHz - 2GHz ≤ -151
				2GHz - 3GHz ≤ -150
				3GHz - 3.6GHz ≤ -148
				3.6GHz - 4GHz ≤ -145
				4GHz - 4.4GHz ≤ -148
				4.4GHz - 9GHz ≤ -150
				9GHz - 18GHz ≤ -148
				18GHz - 26.5GHz ≤ -143
				26.5GHz - 40GHz ≤ -138
		40GHz - 50GHz ≤ -133		
		Pre-amplifier off	dBm	10 MHz - 1GHz ≤ -150
				1GHz - 2GHz ≤ -148
				2GHz - 3GHz ≤ -147
3GHz - 3.6GHz ≤ -145				

				3.6GHz - 4GHz \leq -141	
				4GHz - 4.4GHz \leq -142	
				4.4GHz - 9GHz \leq -143	
				9GHz - 18GHz \leq -140	
				18GHz - 26.5GHz \leq -135	
				26.5GHz - 40GHz \leq -128	
				40GHz - 50GHz \leq -123	
		Pre-amplifier on	dBm	10 MHz - 1GHz \leq -162	
				1GHz - 2GHz \leq -162	
				2GHz - 3GHz \leq -160	
				3GHz - 3.6GHz \leq -156	
				3.6GHz - 4GHz \leq -155	
				4GHz - 4.4GHz \leq -155	
				4.4GHz - 9GHz \leq -155	
				9GHz - 18GHz \leq -154	
				18GHz - 26.5GHz \leq -154	
				26.5GHz - 40GHz \leq -150	
				40GHz - 50GHz \leq -145	
17	Residual response		dBm	200 kHz - 9 GHz \leq -100	
18	Image response	IF3 image response	dBc	1 GHz (input 1.15 GHz) \leq -80 dBc	
				3 GHz (input 2.85 GHz) \leq -76 dBc	
				5GHz (input 4.85GHz) \leq -80 dBc	
				15GHz (input 14.85GHz) \leq -80 dBc	
				25GHz (input 24.85GHz) \leq -80 dBc	
				35GHz (input 35.15GHz) \leq -80 dBc	
				45GHz (input 44.85GHz) \leq -76 dBc	
		IF2 image response	dBc	1 GHz (input 0.15GHz) \leq -80 dBc	
				3 GHz (input 3.85GHz) \leq -80 dBc	
				5GHz (input 5.85GHz) \leq -80 dBc	
				15GHz (input 15.85GHz) \leq -80 dBc	
				25GHz (input 25.85GHz) \leq -70 dBc	

				35GHz (input 34.15GHz) \leq -70 dBc		
				45GHz (input 45.85GHz) \leq -60 dBc		
		IF1 image response	dBc		1 GHz (input 4.95GHz) \leq -80 dBc	
					3GHz (input 13.45GHz) \leq -80 dBc	
19	Second harmonic distortion (dBc)	dBc	Input frequency range	Distortion products		
			10MHz~0.85GHz	< -57 dBc		
			0.85GHz~2GHz	< -59 dBc		
			2GHz~4.5GHz	< -72 dBc		
			4.5GHz~9GHz	< -70dBc		
			9GHz~25GHz	< -65 dBc		
20	Three-order intermodulation (TOI)	dBm	10 MHz - 200 MHz \geq +13 (Test frequency 50 MHz)	Upper product		
				Lower product		
			200MHz - 4GHz \geq +13 (Test frequency 200MHz)	Upper product		
				Lower product		
			4GHz - 9GHz \geq +11 (Test frequency 5GHz)	Upper product		
				Lower product		
			9GHz - 18GHz \geq +13 (Test frequency 15GHz)	Upper product		
				Lower product		
			18GHz - 50GHz \geq +13 (Test frequency 35GHz)	Upper product		
				Lower product		
21	Phase noise	dBc / Hz	Frequency offset - 100 Hz \leq -96			
			Frequency offset +100 Hz \leq -96			
			Frequency offset -1kHz \leq -115			
			Frequency offset +1kHz \leq -115			
			Frequency offset -10kHz \leq -125			
			Frequency offset +10kHz \leq -125			
			Frequency offset - 100 Hz \leq -125			

			Frequency offset +100kHz ≤ -125		
22	Interface	/	RF input interface	S3503A/B/C/D/-S: N type (female)	
				S3503E/-S: 3.5 mm (male)	
				S3503F/G/H: 2.4Mm (anode)	
			Communication	USB interface on the front panel: A type, two	
			interface	USB interface on the rear panel: A type, two	
				VGA interface: 15-core D-SUB cable adapter	
				LAN interface: RJ-45	
				Keyboard interface: PS/2	
				GP-IB interface: IEEE-488 connector	
			Trigger interface	Trigger input on the front panel (BNC female adapter)	
				Trigger input on the rear panel (BNC female adapter)	
				Trigger input 1(BNC female adapter)	
				Trigger input 2(BNC female adapter)	
			Frequency reference interface	10 MHz reference input (BNC female adapter) Output amplitude ≥ 0 dBm	
				10 MHz reference output (BNC female adapter)	
			Sound	Loudspeaker	
				headphone	
			23	Options	/
IF Output					
Reconstructed IF/video signal output					
Wideband reconstructed IF/video signal output					
Audio analysis input					

Synthetic judgment	
Remarks: "√" indicates conformity, and "x" indicates non-conformity; "/" indicates no content in this cell or no such test item for the tested instrument.	

8. 5. 3. Auxiliary form of performance characteristics of S3503 signal/spectrum analyzer

Auxiliary Form of Performance Characteristics of S3503 Signal/Spectrum Analyzer

Instrument No.:

Tester:

Test conditions:

Testing date:

B.1 Frequency reference accuracy

Nominal output frequency value of signal generator	Marker count measurement value of signal/spectrum analyzer	Frequency reference accuracy

B.2 Residual frequency modulation

Band No.	Test frequency (GHz)	Δf	ΔL	S	ΔA	RFM
0	1					
1	5					
2	15					
3	25					
4	35					
5	45					

B.3 Marker count accuracy

Nominal frequency of input signal	S3503 marker count frequency	Theoretical error range	Count accuracy
4GHz			
9GHz			
13.2GHz			
18GHz			
26.5GHz			
40GHz			
45GHz			
50GHz			

B.4 Frequency span accuracy

S3503 center frequency (MHz)	Signal generator frequency #1 (MHz)	Signal generator frequency #2 (MHz)	S3503 frequency span	Marker difference frequency	Frequency span accuracy
300.000004	300	300.000008	10Hz		
300.00004	300	300.00008	100Hz		
300.0004	300	300.0008	1kHz		
300.004	300	300.008	10kHz		
300.04	300	300.08	100kHz		
300.4	300	300.8	1MHz		
304	300	308	10MHz		
340	300	38	100MHz		
700	300	1100	1GHz		
2000	400	3600	4GHz		
4500	900	8100	9GHz		
6600	1320	11880	13.2GHz		
9000	1800	16200	18GHz		
13250	2650	23850	26.5GHz		
20000	4000	36000	40GHz		
22500	4500	40500	45GHz		
25000	5000	45000	50GHz		

B.5 Sweep time accuracy

Sweep time settings	Function generator frequency	Time difference ΔT	Sweep time accuracy
1ms	10kHz		
20ms	500Hz		
100ms	100Hz		
200ms	50Hz		
1s	10Hz		

B.6 Resolution bandwidth

Resolution bandwidth	3 dB bandwidth measurement value	Resolution bandwidth accuracy	60 dB bandwidth measurement value	Resolution bandwidth selectivity
10MHz				
8MHz				
6MHz				
5MHz				
4MHz				
3MHz				
2MHz				
1MHz				
500kHz				
300kHz				
200kHz				
100kHz				
50kHz				
30kHz				
20kHz				
10kHz				
5kHz				
3kHz				
2kHz				
1kHz				
500Hz				
300Hz				
200Hz				

100Hz				
50Hz				
30Hz				
20Hz				
10Hz				
5Hz				
3Hz				
2Hz				
1Hz				

B.7 Maximum analysis bandwidth

Maximum analysis bandwidth set value	Left limit value fL	Right limit value fR	Maximum analysis bandwidth measurement value
10MHz			
40MHz			
200MHz			

B.8 Frequency response Amplitude (band 0, 50 MHz - 4 GHz)

Frequency (MHz)	S3503 marker reading L2 (dBm)	Power meter reading L1 (dBm)	Amplitude error
50			
150			
250			
350			
450			
550			
750			
950			
1150			
1350			
1550			
1750			
1950			
2150			
2350			
2550			

2750			
2950			
3150			
3350			
3550			
3750			
3950			

Amplitude (band 2, 4GHz - 9GHz)

Frequency (GHz)	S3503 marker reading L2 (dBm)	Power meter reading L1 (dBm)	Amplitude error
4.05			
4.25			
4.45			
4.65			
4.85			
5.05			
5.25			
5.45			
5.65			
5.85			
6.05			
6.25			
6.45			
6.65			
6.85			
7.05			
7.25			
7.45			
7.65			
7.85			
8.05			
8.25			
8.45			
8.65			

8.85			
------	--	--	--

Amplitude (band 3, 9GHz - 18GHz)

Frequency (GHz)	S3503 marker reading L2 (dBm)	Power meter reading L1 (dBm)	Amplitude error
9.05			
9.55			
10.05			
10.55			
11.05			
11.55			
12.05			
12.55			
13.05			
13.55			
14.05			
14.55			
15.05			
15.55			
16.05			
16.55			
17.05			
17.55			

Amplitude (band 4, 18GHz - 26.5GHz)

Frequency (GHz)	S3503 marker reading L2 (dBm)	Power meter reading L1 (dBm)	Amplitude error
18.05			
18.55			
19.05			
19.55			
20.05			
20.55			
21.05			
21.55			
22.05			
22.55			

23.05			
23.55			
24.05			
24.55			
25.05			
25.55			
26.05			

Amplitude (band 5, 26.5GHz - 40GHz)

Frequency (GHz)	S3503 marker reading L2 (dBm)	Power meter reading L1 (dBm)	Amplitude error
26.55			
27.05			
27.55			
28.05			
28.55			
29.05			
29.55			
30.05			
30.55			
31.05			
31.55			
32.05			
32.55			
33.05			
33.55			
34.05			
34.55			
35.05			
35.55			
36.05			
36.55			
37.05			
37.55			
38.05			

38.55			
39.05			
39.55			

Amplitude (band 6, 40GHz - 50GHz)

Frequency (GHz)	S3503 marker reading L2 (dBm)	Power meter reading L1 (dBm)	Amplitude error
40.05			
40.55			
41.05			
41.55			
42.05			
42.55			
43.05			
43.55			
44.05			
44.55			
45.05			
45.55			
46.05			
46.55			
47.05			
47.55			
48.05			
48.55			
49.05			
49.55			

Amplitude error (band 0, < 50 MHz)

Frequency	50 MHz amplitude error	Relative 50 MHz amplitude error	Amplitude error
50MHz			
20MHz			
10MHz			
5MHz			
1MHz			
100kHz			

Frequency range	Maximum amplitude error value ΔA_{max}	Minimum amplitude error value ΔA_{min}	Frequency response
3Hz~20MHz			
20MHz~2GHz			
2GHz~3.6GHz			
3.6GHz~4GHz			
4GHz~9GHz			
9GHz~18GHz			
18GHz~26.5GHz			
26.5GHz~40GHz			
40GHz~50GHz			

B.9 Absolute amplitude accuracy

500 MHz absolute amplitude accuracy

Frequency (MHz)	S3503 marker reading (dBm)	Power meter reading (dBm)	Absolute amplitude accuracy
500			

B.10 Resolution bandwidth switching error

Resolution bandwidth	Measured value
10MHz	
8MHz	
6MHz	
5MHz	
4MHz	
3MHz	
2MHz	
1MHz	
500kHz	
300kHz	0 (ref)
200kHz	
100kHz	
50kHz	
30kHz	
20kHz	
10kHz	
5kHz	
3kHz	
2kHz	
1kHz	
500Hz	
300Hz	
200Hz	
100Hz	
50Hz	
30Hz	
20Hz	
10Hz	
5Hz	
3Hz	
2Hz	
1Hz	

Resolution bandwidth switching error	± 0.30 dB 1 Hz - 2 MHz	
	± 0.30 dB 3, 4, 5, 6, 8, 10 MHz	

B.11 Reference level switching error

Reference level	Standard attenuator		Marker difference reading L (dB)	Switching error (dB)
	Set value (dB)	Calibrated value AATT (dB)		
0dBm	0	0dB	0 (ref)	0 dB (ref)
-10dBm	10			
-20dBm	20			
-30dBm	30			
-40dBm	40			
-50dBm	50			
-60dBm	60			
-70dBm	70			

B.12 Scale fidelity

Standard attenuator		Marker difference reading L (dB)	Scale error (dB)
Set value (dB)	Calibrated value AATT (dB)		
0	0dB	0 (ref)	0 dB (ref)
10			
20			
30			
40			
50			
60			
70			
80			

B.13 Residual response

Frequency range	Frequency	Response value
200kHz~9GHz		

B.14 Three-order intermodulation distortion

Test frequency	Upper product of intermodulation distortion	Lower product of intermodulation distortion	TOI
50MHz			
1.5GHz			
7GHz			
15GHz			

8. 5. 4. Instruments recommended for performance characteristics

Table 8.2 Instruments recommended for performance characteristics

No.	Instrument name	Main technical indexes	Recommended cable
1	Synthesized signal generator	Frequency range: 250kHz~50GHz Power output: -100 dBm - +15 dBm Frequency accuracy: $\pm 0.02\%$ Power level capable of being calibrated and saved With internal and external AM modes	E8257D or S1103
2	Function generator	Waveform: sine, triangle, square, etc. Frequency range: 1 μ Hz~80MHz Amplitude range: 1 mV - 10 V	33250A
3	Power meter	Power range: -70 dBm - +20 dBm Calibration source amplitude: 0 dBm	E4418B
4	Power probe	Frequency range: 50MHz~50GHz Power range: -30 dBm - +20 dBm	N8487A or R&sZ61
5	Vector Network Analyzer	Frequency range: 50MHz~50GHz	N5247 or ML2437A
6	spectrum analyzer	Frequency range: 3Hz~4GHz	S3502A
7	Power divider	Frequency range: 50kHz~50GHz Insertion loss: 6 dB Equivalent output VSWR: < 1.22:1	11667C
8	Arbitrary waveform generator	Featuring vertical resolution of 1.25 GS/s and 15 bits, instantaneous analog bandwidth of 500 MHz per channel and spurious free dynamic range of 65 dBc	N8241A
9	Calibration program control step attenuator	Stepping by 10 dB with 90 dB in total; provided with calibration certificate	84906L
10	Attenuator, switch controller	Voltage output: 5, 15 & 24 V, GPIB, USB, LAN (LXI Class C)	11713C
11	RF directional coupler	Frequency range: 300kHz~4GHz Directivity: 35dB VSWR: < 1.45	Self-produced
12	Directional coupler	Frequency range: 2GHz~50GHz coupling factor: 16dB Maximum coupling offset: ± 1 dB Directivity: 14dB Flatness: 0.75 dB Insertion loss: < 1.3 dB	SAV70603
13	Low-pass filter	Cut-off frequency: 1.6GHz Insertion loss: < 0.9 dB Out-of-band rejection: > 65 dB	Self-produced
14	Low-pass filter	Cut-off frequency: 4GHz Insertion loss: < 1 dB Out-of-band rejection: > 65 dB	Self-produced

15	Low-pass filter	Cut-off frequency: 9 GHz Insertion loss: < 1 dB Out-of-band rejection: > 65 dB	Self-produced
16	Low-pass filter	Cut-off frequency: 26.5GHz Insertion loss: < 1 dB Out-of-band rejection: > 65 dB	Self-produced
17	Isolator	Conducting frequency 3 GHz - 6.8 GHz Reverse isolation: 20 dB	CTP-3060
18	Load	Impedance: 50Ω	SMA-50JR
19	Adapter	2.4 (f) - 3.5 (f)	Self-produced
20	Isolator	Conducting frequency 10GHz - 18GHz Reverse isolation: 20 dB	XTP-1218A
21	Low-loss cable	2.4 mm cable (m-m) (two cables are required)	Self-produced
22	Cable	BNC cable (two cables are required)	Self-produced
23	Vernier calipers	0~1000mm	41-A-54
24	Platform scale	TGT-100	0000051
25	Computer	WinXP or Win7	
26	Leakage current withstand voltage tester	Leakage current: 0.5 mA - 20 mA; voltage: 242 V, 3 kV, 5 kV	CJ2673
27	Digital display megger	FLUKE1508	FLUKE1508
28	Variable- frequency power supply	Frequency: 47 Hz - 400 Hz; voltage: 0 - 3,000 V	AFC-1kW

9. Appendix

- [Appendix A Terminology](#)
- [Appendix B SCPI Command Index](#)
- [Appendix C Error Message Index](#)

Appendix A Terminology

LO

short for local oscillator. the IF signal obtained by mixing the LO frequency in the signal/spectrum analyzer and the frequency of the received signal.

LO feedthrough

LO feedthrough is the obvious defect of the superheterodyne signal/spectrum analyzer. When the LO frequency is the same with (or very close to) the IF frequency, the LO signal appears in the measurement via the IF filter. Such LO frequency corresponds to 0 Hz (DC) input frequency and can be used as 0 Hz frequency marker. Therefore, LO feedthrough can also be called as DC response. For IF filters with limited bandwidth, LO feedthrough extends from 0 Hz to about $BWRES/2$ and its shape is similar to the filter curve of IF filters.

Waveform factor

It is the ratio of 60 dB (or 40 dB) bandwidth against 3 dB bandwidth of the filter, known also as the rectangle coefficient, indicating steepness and selectivity of the filter. The waveform factor affects the capability of the signal/spectrum analyzer to distinguish signals of unequal amplitude.

Spurious response

Spurious signal unwanted on the screen of the signal/spectrum analyzer. The spurious response is divided into spurious response and residual response, in which spurious response is the abnormal response caused on the screen of the signal/spectrum analyzer along with the input signal and can be divided into harmonic, image frequency, multiple and out-of-band response. The spurious response can also be divided into harmonic response and non-harmonic response, in which non-harmonic response should be intermodulation or residual response. Detailed description is as follows:

- a) Harmonic distortion: When the input signal amplitude increases to enable the mixer to work in nonlinear state, the harmonic component of such input signal will be produced in the mixer, which is called harmonic distortion.
- b) Image and multiple response

During frequency mixing, if two signals can mix with the LO signal with the same frequency to generate IF signals of the same frequency and if one original signal has a frequency one IF lower than the LO signal and the other original signal has a frequency one IF higher than the LO signal, then such two original signals can be referred to as the image of each other. The input signal of each frequency of the LO signal has an image and the frequency of the original signal and the image differs by two times of IF.

The multiple response refers to double or multiple response caused on the screen by one input signal of single frequency, which means the signal responds to two or more LO frequencies. The LO frequency capable of generating the multiple response has an interval of two times of IF. The multiple response can only occur when overlapping is selected as mixing mode and the LO sweeps a range wide enough to mix the input signal in more than one mixing mode. Difference signal/spectrum analyzers have different principle structures and cause the image and multiple response at different frequencies.

- c) Residual response

The residual response refers to the discrete response observed on the screen when no input signal enters the signal/spectrum

analyzer.

Measuring Unit

Measurement units commonly used in the signal/spectrum analyzer are as shown in Schedule 1:

Schedule 1 Measuring Units

Measured parameters	Unit Name	Abbr.
Frequency	Hz	Hz
Power Level	dBm	dBm
Power ratio	Decibel	dB
Voltage	Volt (V)	V
Time	Second	s
Impedance (resistance)	Ohm (Ω)	

Menu

Press hard keys or soft keys on the front panel to trigger relevant functions according to the functional information of the signal/spectrum analyzer prompted on the right of the display area on the screen.

Reference level

The calibrated vertical scale position on the screen of the signal/spectrum analyzer is used as the reference for amplitude measurement and the top scale line is usually selected for the reference level.

Measuring range

The power ratio (dB) of the maximum signal (usually the maximum safety input level) and the minimum signal (display average noise level) measured at the input interface of the signal/spectrum analyzer. Such ratio is usually far larger the dynamic range to be realized in single measurement.

Delta Marker

One marker method, in which one is the fixed reference marker and the other is the active marker that can be placed at any position of the displayed trace. The displayed data can be the relative amplitude difference and the frequency difference (or time difference) between the active marker and the fixed reference marker.

Impact bandwidth

If the actual area formed by voltage response curve of the filter in the signal/spectrum analyzer is made equivalent to the voltage response curve of an ideal rectangular filter with the same area and the height of such two curves are made equal, then the width of such rectangular filter is called equivalent impact bandwidth. It is different from the signal bandwidth or the noise bandwidth. In signal/spectrum analyzer, the impact width is about 1.5 times of 3 dB bandwidth.

Bandwidth selectivity

Otherwise known as rectangle coefficient, the bandwidth selectivity is an index for assessing the capacity of the signal/spectrum analyzer to distinguish signals of unequal amplitude. It is usually defined as the ratio of the 60 dB bandwidth and the 3 dB bandwidth of the filter and it indicates steepness of the filter edge.

Dynamic range

The maximum power ratio of two or more signals at the input interface of the signal/spectrum analyzer measured with a given accuracy (unit: dB). It indicates the capability to measure the amplitude difference of two or more signals. The dynamic range is divided into multi-signal dynamic range, single-signal dynamic range, instantaneous dynamic range and safety dynamic range. It is different from the concept of display range or measurement range. Influence factors of the dynamic range include display average noise level, internal distortion, noise sideband, input attenuator, logarithmic amplifier, detector and AD converter.

The best dynamic range for two-order and three-order undistorted measurement can be calculated according to the following formula.

$$MDR_2 = \frac{1}{2} \times (SHI - DANL)$$

$$MDR_3 = \frac{2}{3} \times (TOI - DANL)$$

Where:

MDR2: best dynamic range of two-order undistorted measurement SHI: two-order distortion intercept point

DANL: display average noise level

MDR3: best dynamic range of two-order undistorted measurement

TOI: three-order distortion intercept point

Logarithm scale display

The vertical scale on the screen is displayed in logarithm mode. The amplitude units of dBm, dBmV, dBμV, W and V can be used in logarithm mode.

Spurious response

Spurious signal unwanted on the screen of the signal/spectrum analyzer. The spurious response is divided into spurious response and residual response, in which spurious response is the abnormal response caused on the screen of the signal/spectrum analyzer along with the input signal and can be divided into harmonic, image frequency, multiple and out-of-band response. The spurious response can also be divided into harmonic response and non-harmonic response, in which non-harmonic response should be intermodulation or residual response. Detailed description is as follows:

a) Harmonic distortion

When the input signal amplitude increases to enable the mixer to work in nonlinear state, the harmonic component of such input signal will be produced in the mixer, which is called harmonic distortion.

b) Image and multiple response

During frequency mixing, if two signals can mix with the LO signal with the same frequency to generate IF signals of the same frequency and if one original signal has a frequency one IF lower than the LO signal and the other original signal has a frequency one IF higher than the LO signal, then such two original signals can be referred to as the image of each other. The input signal of each frequency of the LO signal has an image and the frequency of the original signal and the image differs by two times of IF.

The multiple response refers to double or multiple response caused on the screen by one input signal of single frequency, which means the signal responds to two or more LO frequencies. The LO frequency capable of generating the multiple response has an interval of two times of IF. The multiple response can only occur when overlapping is selected as mixing mode and the LO sweeps a range wide enough to mix the input signal in more than one mixing mode. Difference signal/spectrum analyzers have different principle structures and cause the image and multiple response at different frequencies.

c) Residual response

The residual response refers to the discrete response observed on the screen when no input signal enters the signal/spectrum analyzer.

[FFT]

short for fast fourier transform. It is used for specific mathematical analysis of time domain signals to provide frequency domain analysis result.

Resolution

Resolution indicates the capacity of the signal/spectrum analyzer to clearly distinguish two input signals. It is affected by IF filter bandwidth, rectangle coefficient, LO residual frequency modulation, phase noise and sweep time. Most signal/spectrum analyzers use LC filter, crystal filter, active power filter and digital filter to enable different resolution bandwidths.

Amplitude accuracy:

A parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurement. Influence factors of amplitude measurement accuracy include frequency response, display fidelity, input attenuator switching error, IF gain, scale factor and resolution bandwidth.

Negative peak value detection

It is a display detection method for signal energy. Each displayed point corresponds to multiple detection sampling data points of video signals in any part of the frequency span or the time interval indicated by such point. The method to extract the minimum value among such data points is the negative peak value detection.

Track

Traces comprise of a succession of data points containing frequency (time) and amplitude information. Such succession of data points is usually considered as an a set. Trace 1, 2 and 3 are commonly used in the signal/spectrum analyzer.

Intermodulation

When two or more signals are loaded at the input interfaces of active devices (such as mixer or amplifier) at the same time, multiple sum frequency or difference frequency of signal themselves will produce intermodulation products in addition to signal harmonics due to nonlinearity of such active devices. For the signal/spectrum analyzer, such intermodulation products are interference signal and their level should be as low as possible. The relation between the intermodulation product level and the input signal level: if the amplitude of two sine input signals changes by Δ dB, relevant intermodulation product level will change by $n \cdot \Delta$ dB, in which n refers to the order of the intermodulation product, which means the sum of the term of each frequency. For example, if the frequency is $2 \cdot f_1 + 1 \cdot f_2$, the order will be $2 + 1 = 3$. The point of intersection where the signal amplitude is equal to the intermodulation product amplitude is usually called the intercept point. Actually such point does not exist because when the input signal increases to a certain degree, there will be compression imposed on the output of active devices. The intercept point can be defined with the input or output level. Therefore, the nominal intercept point is divided into input and output intercept point and the default intercept point is the input intercept point. The intercept point is usually expressed with dBm. The greater the value of the intercept point, the better the linearity of the signal/spectrum analyzer, which is the precondition of obtaining larger dynamic range. In most cases, two-order and three-order products among such intermodulation products have great impact on measurements. The two-order intercept point is often defined as IP2 or SOI (second order intercept) and the three-order intercept point defined as IP3 or TOI (third order intercept). The value of the front input attenuator of the signal/spectrum analyzer (usually 0 dB) should be designated when calibrating the intercept point since the intercept point value will increase along with the increase in the decrement of the attenuator.

Linearity of the active devices changes with the increase in the current and the power. The larger the current provided by the amplifier, or the larger the LO power of the mixer, the better the linearity. Therefore, low power consumption of the signal/spectrum analyzer often indicates poor linearity. However, what should be noted is that this is contradictory to the noise requirement. The input attenuator of the signal/spectrum analyzer can control intermodulation products and has high IP3 under high noise factor. Therefore, IP3 and the noise factor should be analyzed and compared in the equivalent operation mode. IP3 is an index for measuring the linearity of the signal/spectrum analyzer and reflects the size of intermodulation distortion when the signal/spectrum analyzer is affected by strong

signal interference.

Activity function area

It is the area on the screen for the signal/spectrum analyzer to display active functions and their status. Active functions are those triggered by the last-pressed key or the last remote control command by the signal/spectrum analyzer.

Detection mode

It is a way of processing before analog information is digitalized and saved in the memory and serves mainly as a method of display detection for signal energy. It includes normal, positive peak, negative peak, sample, and average modes.

Speed factor

It refers to the numeric unit represented by each grid on vertical axis scale of the screen.

Zero Span

The sweep LO of the signal/spectrum analyzer is kept fixed to certain frequency, which means there is no LO sweep operation (span = 0). When the span is set as zero, the signal/spectrum analyzer becomes a fixed-tuned receiver whose bandwidth is the resolution bandwidth.

Drift

The LO frequency changes when the sweep voltage changes, resulting in the signal position changing slowly on the screen. In case of drift, readjustment may be required, but the frequency resolution will not be compromised.

Frequency response

The frequency response refers to the change of the amplitude along with that of the frequency within the specified frequency range, namely the dependency between the amplitude and the frequency. The frequency response is divided into absolute and relative frequency response. The absolute frequency response refers to the amplitude offset of other frequency points when the signal amplitude of certain frequency point has been taken as the reference within a given frequency range. Also known as the frequency response flatness, the relative frequency response indicates the difference between the maximum signal amplitude and the minimum amplitude or $\pm 1/2$ of such difference within certain band or the entire frequency range.

Marker

It refers to the visible indicating cursor placed at any point of the screen trace and can use numbers to display absolute values of frequency and amplitude on traces on markers. Active markers refer to those on the traces that are capable of being directly moved via control keys or remote control commands on the front panel.

Bandwidth

The difference between the start frequency and the stop frequency of the signal/spectrum analyzer. The frequency span setting defines the scale of the horizontal axis of the screen of the signal/spectrum analyzer.

Frequency range

When the specified performance conditions are met, the signal/spectrum analyzer can measure the range between the lowest frequency and the highest frequency. The frequency range and relevant band division should be specified in the product specifications.

Frequency accuracy

The degree of closeness between the measured frequency display value and the actual value. It is divided into absolute and relative accuracy, in which the absolute accuracy refers to the actual size of read-out frequency error and the relative accuracy refers to the ratio of the read-out frequency error against the ideal frequency value.

Frequency stability

It refers to the extent of the signal frequency remaining unchanged in short term or long term. The short-term frequency stability can be expressed with residual frequency modulation or phase noise. The long-term frequency stability can be expressed with aging rate.

Signal/spectrum analyzer

The instrument used to effectively display each single spectrum component (sine wave) composing the time-domain signal. Whether to retain phase information depends on the type of analyzer and relevant design principles.

Flatness

It corresponds to the variation in display amplitude of the measurement frequency range of the signal/spectrum analyzer and indicates the corresponding relation between the signal amplitude variation and the frequency.

Sampling detection

It is a display detection method for signal energy. The value displayed for each point refers to the instantaneous value at certain time of the video signal at the frequency interval or time interval represented by such point.

Scanning time

The time it takes for LO tuning to pass the selected frequency interval. The sweep time directly affects the time used to complete one test, excluding the dead time after previous sweep completes and the next sweep begins. When the span is zero, the horizontal axis only calibrates the time. When the span is not zero, the horizontal axis calibrates both the frequency and the time. The sweep time often changes with the span, the resolution bandwidth and the video bandwidth.

RF attenuator

The step attenuator between the input connector and the first mixer of the signal/spectrum analyzer. The RF attenuator is used to adjust the signal level of the first mixer.

Residual frequency modulation

The inherent short-term frequency instability of the LO signal when there is no frequency modulation input. It generally refers to the peak or its value with frequency dither in specified time interval within the test bandwidth. The residual frequency modulation causes spectral line jitter, reduces actual resolution and affects frequency readout accuracy of the signal/spectrum analyzer.

Video

The signal input from the detector of the signal/spectrum analyzer. Its frequency ranges from 0 Hz to far beyond the frequency of the widest resolution bandwidth provided by the signal/spectrum analyzer and video filter setting defines the final bandwidth of the video path.

Video bandwidth

The bandwidth of the tunable low-pass filter in the video circuit of the signal/spectrum analyzer. The video filter is the low-pass filter located behind the detector for defining the bandwidth of the video amplifier. It can smooth the noise and is used to average or smooth traces. Besides, it can easily detect weak signals in noises. Change of the video bandwidth does not affect the frequency resolution of the signal/spectrum analyzer, but too narrow video bandwidth may lead to increase in the sweep time.

Video amplifier

The DC coupling amplifier located behind the detector of the signal/spectrum analyzer.

Video filter and video average

Since what the signal/spectrum analyzer displays is the measured signal plus its internal noise, video filter or video average is required for the displayed signals in order to reduce the impact of such noise of the small signals to be measured.

The video filter refers to the low-pass filter behind the envelop filter. When the video bandwidth is equal to or smaller than the resolution bandwidth, the video circuit is unable to adequately respond to the fast fluctuations of the detector output and the displayed trace is smoothed. The degree of such average or smoothing is associated with the video bandwidth and the resolution bandwidth.

The video average is done point by point during several sweep operations. At each point, new measured data and previous data are averaged together and average values of several measurements will be centrally displayed. The video average function is only used in the signal/spectrum analyzers with digital display and the average values depend on the sweep times selected by users. In average algorithm, one weighting coefficient ($1/n$, n refers to current sweep times) is used as the amplitude value of the given point of current sweep and another weighting coefficient $[(n-1) / n]$ is used for previously saved average value. Such two values will then be combined as current average value. After the specified sweeps are completed, the weighting coefficients remain unchanged and dynamic average will be displayed.

In most measurement cases, the video filter is basically the same with the video average. However, they differ in that the video filter is a kind of real-time average function. When a signal drifting with the time is measured, their difference becomes significant, leading to totally different measurement results. When the video filter is used, each sweep may result in different average value; while the video average uses results of several sweeps to obtain adequately averaged value. Therefore, the result got via the video average is very close to the actual average value.

Input amplitude range

The power ratio (dB) of the maximum signal (usually the maximum safety input level) and the minimum signal (display average noise level) measured at the input interface of the signal/spectrum analyzer. Such ratio is always far larger the dynamic range to be realized in single measurement.

Input impedance

The terminal impedance presented by the signal/spectrum analyzer with respect to the signal source. The impedance of the RF and microwave analyzer is usually 50 Ω . The standard impedance of some systems (such as cable television) is 75 Ω . The degree of mismatch between the nominal impedance and the actual impedance is expressed with VSWR.

Refresh mode

It is used to clear screen traces and sweep will restarted when the trigger condition is met. When the trigger condition is met, new input signal data will be displayed.

Display range

The difference between the maximum signal and the minimum signal observed on the screen at the same time. For the signal/spectrum analyzer with 10 amplitude scale intervals, its display range is scale coefficient * 10.

Average noise level display

When reducing peak-to-peak fluctuation of noise by decreasing resolution bandwidth with minimum resolution bandwidth and input attenuation, the level observed on the screen of the signal/spectrum analyzer is the display average noise level expressed in dBm. The display average noise level of the signal/spectrum analyzer is equivalent to its sensitivity.

Linear display

The vertical scale on the screen is displayed in direct proportion to the input signal voltage. The graticule at the bottom of the screen stands for 0 V and the top graticule stands for the reference level (depending on some non-zero value of specific signal/spectrum analyzer). For most signal/spectrum analyzers, the scale factor equals to the product derived by dividing the reference level with the number of divisions. In linear display mode, the amplitude units of dBm, dBmV, dBμV, W and V can be used for the signal/spectrum analyzer.

Relative amplitude accuracy

Error of amplitude measurement The amplitude of one signal is compared with that of the other without considering the absolute amplitude of either signal. Influence factors of amplitude accuracy include frequency response, display fidelity, change in input decrement, IF gain, scale factor and resolution bandwidth.

Preselector

The low-pass filter with tunable center frequency before the input mixer of the signal/spectrum analyzer. It is used to eliminate multiple and image responses of the superheterodyne signal/spectrum analyzer and improve its dynamic range. The preselector generally uses bands over 4 GHz.

Sensitivity

The capability of the signal/spectrum analyzer to measure signals with lowest level. The sensitivity is divided into input signal level sensitivity, which produces input signal level about two times of average noise, and equivalent input noise sensitivity, which the average level converted with externally generated noise to the input interface. The best sensitivity can be obtained under the narrowest resolution bandwidth and the minimum input attenuation and with adequate video filter. Influence factors of the sensitivity include input attenuator, pre-amplifier, insertion loss of front-end devices, bandwidth of IF filter and noise sideband. The video filter is unable to improve sensitivity, but it can enhance resolution capability and measurement repeatability under low signal-to-noise ratio. The best sensitivity may conflict with other measurement requirements. For example, when the resolution bandwidth is decreased, the sweep time increases; when attenuation is set as 0 dB, the VSWR increases and the measurement accuracy decreases; when pre-amplifier is increased, the dynamic range of the signal/spectrum analyzer is affected. Relation between the sensitivity and the resolution bandwidth is as follows:

$$Pd_{Bm} = -174 \text{ dBm} + F_{dB} + 10 \text{ Log}B$$

Where:

Pd_{Bm} : sensitivity of the signal/spectrum analyzer F_{dB} : noise factor of the signal/spectrum analyzer

B : 3 dB bandwidth of the signal/spectrum analyzer (Hz)

Noise Marker

A marker whose value indicates the noise level within 1 Hz equivalent noise bandwidth. When the noise maker is selected, sample detector mode will be initiated and trace line points (the number of such points depends on the analyzer) surrounding the marker will be averaged; obtained average value will normalize the power within 1 Hz equivalent noise bandwidth.

Phase noise (noise sideband)

The oscillator of the signal/spectrum analyzer is used to convert input signals of different frequencies to IF. The phase noise refers to the relative value (dBc/Hz) of the noise power and the carrier power within 1 Hz equivalent noise bandwidth at certain frequency offset of the relative carrier. It indicates the level of short-term frequency stability of the oscillator, which is caused by phase or frequency change. It is displayed among signals of the oscillator as a bell-shaped noise characteristic. It affects the capability of the instrument to measure phase noise of the tested signal as well as the sensitivity and the dynamic range of the instrument.

Harmonic mixing

LO harmonic "generated" in the mixer is used in mixing to extend the tuning measurement range of the signal/spectrum analyzer.

Gain compression.

When the input signal level increases, unit circuits of the signal/spectrum analyzer, including mixer and the amplifier are working close to the saturation point. At such time, the input signal component will no longer change linearly with the input signal and the displayed signal level is low due to gain compression. Usually, the input level 1 dB (0.5 dB) lower than the output linear value offset is used to indicate 1 dB (0.5 dB) compression point.

Normal detection

It is a display detection method for signal energy. Each displayed point corresponds to multiple detection sampling data points of video signals in any part of the frequency span or the time interval indicated by such point. The minimum value and the maximum value among such data points are extracted and connected with a vertical line during trace display. Such mode helps direct analysis of noise signal fluctuation range and increase in the sweep time will widen the displayed noise bandwidth.

Negative peak value detection

It is a display detection method for signal energy. Each displayed point corresponds to multiple detection sampling data points of video signals in any part of the frequency span or the time interval indicated by such point. The method to extract the maximum value among such data points is the positive peak value detection.

IF gain/attenuation

IF gain/attenuation is used to adjust the vertical position of the signal on the screen without affecting the IF controller for the signal level on the mixer. When the IF gain/attenuation is changed, the reference level changes accordingly.

Appendix B SCPI Command Index

Schedule B SCPI Command Index

Command	Function
*CLS	Generic commands
*ESE	Generic commands
*ESE?	Generic commands
*ESR?	Generic commands
*IDN?	Generic commands
*OPC	Generic commands
*OPC?	Generic commands
*RST	Generic commands
*SRE	Generic commands
*SRE?	Generic commands
*STB?	Generic commands
*TST?	Generic commands
*TRG	Generic commands
*WAI	Generic commands
:ABORt	Cancel (only for remote control)
:CALCulate:BWIDth BANDwidth:NDB <rel_amp>	ndB setting
:CALCulate:BWIDth BANDwidth:NDB?	ndB setting query
:CALCulate:BWIDth BANDwidth[:STATe] OFF ON 0 1	ndB measurement switch
:CALCulate:BWIDth BANDwidth[:STATe]?	ndB measurement switch query
:CALCulate:BWIDth BANDwidth:RESult?	ndB result query
:CALCulate:MARKer:TRCKing[:STATe] OFF ON 0 1	Set signal track
:CALCulate:MARKer:TRCKing[:STATe]?	Query signal track
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:MAXimum	Peak search
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:MAXimum:NEX T	Next Peak
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:MAXimum:RIG Ht	Next Peak Right
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:MAXimum:NEX T	Next Peak Left
:CALCulate:MARKer:PEAK:EXCursion <rel_amp>	Set peak definition
:CALCulate:MARKer:PEAK:EXCursion?	Query peak definition

Command	Function
:CALCulate:MARKer:PEAK:EXCursion:STATe OFF ON 0 1	Set peak definition switch
:CALCulate:MARKer:PEAK:EXCursion:STATe?	Query peak definition switch
:CALCulate:MARKer:PEAK:THReshold <ampl>	Set peak threshold
:CALCulate:MARKer:PEAK:THReshold?	Query peak threshold
:CALCulate:MARKer:PEAK:THReshold:STATe OFF ON 0 1	Set peak threshold switch
:CALCulate:MARKer:PEAK:THReshold:STATe?	Query peak threshold switch
:CALCulate:MARKer:PEAK:TABLE:STATe OFF ON 0 1	Set peak list switch
:CALCulate:MARKer:PEAK:TABLE:STATe?	Query peak list switch
:CALCulate:MARKer:PEAK:SORT FREQuency AMPLitude	Set peak sequence
:CALCulate:MARKer:PEAK:SORT?	Query peak sequence
:CALCulate:MARKer:PEAK:TABLE:READout ALL GTDLine LTDLine	Set peak read-out
:CALCulate:MARKer:PEAK:TABLE:READout?	Query peak read-out
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:CPSearch[:STATe] ON OFF 1 0	Set peak track on/off
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:CPSearch[:STATe]?	Query peak track on/off
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:PTPeak	Peak-to-peak search
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:MINimum	[Min Search]
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:MODE POSition DELTA FIXed OFF	Set marker mode
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:MODE?	Query marker mode
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:X <freq>	Set marker position on X axis
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:X <freq>	Query marker position on X axis
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:X:POSition <real>	Set marker X point
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:X:POSition?	Query marker X point
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:Y <real>	Set marker position on Y axis
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:Y?	Query marker position on Y axis
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:REFerence<integer>	Set marker reference
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:REFerence?	Query marker reference
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:X:READout FREQuency TIME ITIME PERiod	Marker X axis scale attribute
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:X:READout?	Query marker X axis scale attribute
:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:X:READout:AUTO ON OFF 1 0	Marker X axis scale attribute

Command	Function
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:X:READout:AUTO?	Query marker X axis scale attribute
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:TRACe1[2 3 4 5 6]	Set marker trace
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:TRACe?	Query marker trace
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:LINes[:STATe] OFF ON 0 1	Set marker line display on/off
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:LINes[:STATe]?	Set marker line display on/off
:CALCulate:MARKer:TABLe[:STATe] OFF ON 0 1	Set marker report window on/off
:CALCulate:MARKer:TABLe[:STATe]?	Query marker report window on/off
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FCOunt[:STATe] OFF ON 0 1	Set marker count on/off
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FCOunt[:STATe]?	Query marker count on/off
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FCOunt:X?	Query marker count
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FCOunt:GATetim e <time>	Set marker count gate time
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FCOunt:GATetim e?	Query marker count gate time
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FCOunt:GATetim e?	Set marker count gate time auto on/off
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FCOunt:GATetim e:AUTO?	Query marker count gate time auto on/off
:CALCulate:MARKer:COUPle[:STATe] OFF ON 0 1	Set marker couple
:CALCulate:MARKer:COUPle[:STATe]?	Query marker couple
:CALCulate:MARKer:AOFF	Set all markers off
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FUNCTioN? NOISe BPOWer BDENsity OFF	Set marker function
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FUNCTioN?	Query marker function
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FUNCTioN:BAND: SPAN <freq>	Set bandwidth adjustment span
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FUNCTioN:BAND: SPAN?	Query bandwidth adjustment span
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FUNCTioN:BAND: LEFT <freq>	Set bandwidth adjustment start frequency
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FUNCTioN:BAND: LEFT?	Query bandwidth adjustment start frequency
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FUNCTioN:BAND: RIGHT <freq>	Set bandwidth adjustment stop frequency
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12]:FUNCTioN:BAND: RIGHT?	Query bandwidth adjustment stop frequency
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12][:SET]:CENTer	Marker -> Center
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12][:SET]:STEP	Marker -> Frequency Step

Command	Function
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12 [:SET]:START	Marker -> Start
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12 [:SET]:STOP	Marker -> Stop
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12 [:SET]:DELTA:SPAN	Marker Delta -> Span
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12 [:SET]:DELTA:CENTer	Delta Marker -> Center
:CALCulate:MARKer[1][2 3 4 5 6 7 8 9 10 11 12 [:SET]:RLEVel	Marker -> Reference
:CALCulate:MATH:MODE <LInear LOGarithmic POWER>	Set trace operation method
:CONFigure?	Measurement function query
:CONFigure:SANalyzer	Set as spectrum measurement
:CONFigure:SANalyzer:NDEFault	Enter spectrum measurement as default
:COUple ALL NONE	Set couple all
:DEMod AM FM PM OFF	Set audio demodulation type
:DEMod?	Query audio demodulation type
:DEMod:TIME <time>	Set audio demodulation time
:DEMod:TIME?	Query audio demodulation time
:DISPlay:WINDow[1]:ANNotation[:ALL] OFF ON 0 1	Set status area display on/off
:DISPlay:WINDow[1]:ANNotation[:ALL]?	Query status area display on/off
:DISPlay:ANNotation:FREQuency OFF ON 0 1	Set frequency information display on/off
:DISPlay:ANNotation:FREQuency?	Query frequency information display on/off
:DISPlay:WINDow[1]:TRACe:GRATICule:GRID[:STATe] OFF ON 0 1	Set grid line on/off
:DISPlay:WINDow[1]:TRACe:GRATICule:GRID[:STATe]?	Query grid line on/off
:DISPlay:WINDow[1]:TRACe:Y[:SCALE]:PDIVision <rel_amp>	Set scale/division
:DISPlay:WINDow[1]:TRACe:Y[:SCALE]:PDIVision?	Query scale/division
:DISPlay:WINDow[1]:TRACe:Y[:SCALE]:RLEVel <real>	Set reference level
:DISPlay:WINDow[1]:TRACe:Y[:SCALE]:RLEVel?	Query reference level
:DISPlay:WINDow[1]:TRACe:Y[:SCALE]:RLEVel:OFFSet <rel_power>	Set reference level offset
:DISPlay:WINDow[1]:TRACe:Y[:SCALE]:RLEVel:OFFSet?	Query reference level offset
:DISPlay:WINDow[1]:TRACe:Y[:SCALE]:SPACing LInear LOGarithmic	Set scale type
:DISPlay:WINDow[1]:TRACe:Y[:SCALE]:SPACing?	Query scale type
:DISPlay:WINDow[1]:TRACe:Y:DLIne <amp>	Set display line

Command	Function
:DISPlay:WINDow[1]:TRACe:Y:DLINe?	Query display line
:DISPlay:WINDow[1]:TRACe:Y:DLINe:STATe OFF ON 0 1	Set display line on/off
:DISPlay:WINDow[1]:TRACe:Y:DLINe:STATe?	Query display line on/off
:FETCh:SANalyzer[n]?	
:FORMat:TRACe[:DATA]ASCii INTeger32 REAL32 REAL64	Set trace data type (only for remote control)
:FORMat:TRACe[:DATA]?	Query trace data type (only for remote control)
:FORMat:BORDER NORMAl SWAPped	Set data byte sequence (only for remote control)
:FORMat:BORDER?	Query data byte sequence (only for remote control)
:INITiate:CONTInuous OFF ON 0 1	Set continuous on/off
:INITiate:CONTInuous?	Query continuous on/off
:INITiate:SANalyzer	Spectrum Analysis Initialize
:INITiate[:IMMediate]	Refresh now
:INITiate:PAUS	Measurement pause
:INITiate:RES	Restart measurement
:INITiate:REStart	Restart Measurement
:INPut:COUPling AC DC	Set coupling method
:INPut:COUPling?	Query coupling method
INPut:FILTer:YIG[:STATe] OFF ON 0 1	Set preselector bypass on/off
INPut:FILTer:YIG[:STATe]?	Query preselector bypass on/off
:MEASure:SANalyzer[n]?	Make spectrum measurement as default
:MMEMory:STORe:TRACe:DATA TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6 ALL<filename >	Set trace data store
:MMEMory:LOAD:TRACe:DATA TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6<filename>	Trace call
:MMEMory:LOAD:CORRection 1 2 3 4 5 6, <filename>	Call amplitude correction
:MMEMory:STORe:CORRection 1 2 3 4 5 6, <filename>	Save amplitude correction
:OUTPut:AUX SIF AIF OFF	Set HIF and IF output on/off
:OUTPut:AUX?	Query HI-IF and IF Output On/Off
:OUTPut:AUX:AIF <value>	Set IF output frequency
:OUTPut:AUX:AIF?	Query IF output frequency

Command	Function
:OUTPut:AUX:LOGVideo OFF ON 0 1	Set Logarithmic Detector Output On/Off
:OUTPut:AUX:LOGVideo?	Query Logarithmic Detector Output On/Off
:OUTPut:AUX:SIF <value>	Set HIF output frequency
:OUTPut:AUX:SIF?	Query HIF output frequency
:READ:SANalyzer[n]?	
[:SENSe]:ADC:DITHer[:STATe] OFF ON HIGH	Set ADC on/off
[:SENSe]:ADC:DITHer[:STATe]?	Query ADC on/off
[:SENSe]:ADC:DITHer:AUTO[:STATe] OFF ON 0 1	Set ADC auto on/off
[:SENSe]:ADC:DITHer:AUTO[:STATe]?	Query ADC auto on/off
[:SENSe] :ADJust:LEVel	Set amplitude auto scaling
[:SENSe]:AVERAge:COUNt <integer>	Set up average frequency.
[:SENSe]:AVERAge:COUNt?	Query average count
[:SENSe]:AVERAge:CLEAr	Clear current average count
[:SENSe]:AVERAge:TYPE:AUTO OFF ON 0 1	Average type auto on/off
[:SENSe]:AVERAge:TYPE:AUTO?	Query average type auto on/off
[:SENSe]:AVERAge:TYPE RMS LOG SCALAr	Set average type
[:SENSe]:AVERAge:TYPE?	Query average type
[:SENSe]:BANDwidth BWIDth[:RESolution] <freq>	Set resolution bandwidth
[:SENSe]:BANDwidth BWIDth[:RESolution]?	Query resolution bandwidth
[:SENSe]:BANDwidth BWIDth[:RESolution]:AUTO OFF ON 0 1	Set resolution bandwidth auto on/off
[:SENSe]:BANDwidth BWIDth[:RESolution]:AUTO?	Query resolution bandwidth auto on/off
[:SENSe]:BANDwidth BWIDth:VIDeo <freq>	Set video bandwidth
[:SENSe]:BANDwidth BWIDth:VIDeo?	Query video bandwidth
[:SENSe]:BANDwidth BWIDth:VIDeo:AUTO OFF ON 0 1	Set video bandwidth auto on/off
[:SENSe]:BANDwidth BWIDth:VIDeo:AUTO?	Query video bandwidth auto on/off
[:SENSe]:BANDwidth BWIDth:VIDeo:RATio <real>	Set VBW/RBW
[:SENSe]:BANDwidth BWIDth:VIDeo:RATio?	Query VBW/RBW
[:SENSe]:BANDwidth BWIDth:VIDeo:RATio:AUTO OFF ON 0 1	Set VBW/RBW on/off
[:SENSe]:BANDwidth BWIDth:VIDeo:RATio:AUTO?	Query VBW/RBW

Command	Function
[:SENSe]:BANDwidth BWIDth:SHAPE GAUSSian FLATop	Set filter type
[:SENSe]:BANDwidth BWIDth:SHAPE?	Query filter type
[:SENSe]:BANDwidth BWIDth:TYPE DB3 DB6 IMPulse NOISe	Set filter bandwidth
[:SENSe]:BANDwidth BWIDth:TYPE?	Query filter bandwidth
[:SENSe]:CORRection:CSET[1] 2 3 4 5 6[:STATe] ON OFF 1 0	Set current amplitude correction on/off
[:SENSe]:CORRection:CSET[1] 2 3 4 5 6[:STATe]?	Query current amplitude correction on/off
[:SENSe]:CORRection:CSET[1] 2 3 4 5 6:DELeTe	Delete current amplitude correction
[:SENSe]:CORRection:CSET:ALL[:STATe] ON OFF 1 0	Apply all corrections on/off
[:SENSe]:CORRection:CSET:ALL[:STATe]?	Query all corrections application on/off
[:SENSe]:CORRection:CSET:ALL:DELeTe	Delete All Corrections
[:SENSe]:DEMod:STATe:MODE INTER CONT	Set audio demodulation method
[:SENSe]:DEMod:STATe:MODE?	Query audio demodulation method
[:SENSe]:DETEctor:TRACe[1] 2 3 4 5 6? AVERAge NEGAtive NORMAl POSitive SAMPle QPEak EAverage RAverage	Set trace detector mode
[:SENSe]:DETEctor:TRACe[1] 2 3 4 5 6?	Query trace detector mode setting
[:SENSe]:DETEctor[:FUNction] NORMAl AVERAge POSitive SAMPle NEGAtive QPEak EAverage EPOSitive MPOSitive RMS	Set trace detector mode (applicable for all traces)
[:SENSe]:DETEctor[:FUNction]?	Query trace detector mode setting (applicable for all traces)
[:SENSe]:DETEctor:TRACe[1] 2 3 4 5 6:AUTO ON OFF 1 0	Set detector mode auto on/off
[:SENSe]:DETEctor:TRACe[1] 2 3 4 5 6:AUTO?	Query detector mode auto on/off
[:SENSe]:DETEctor:AUTO ON OFF 1 0	Set detector mode auto on/off (for all traces)
[:SENSe]:DETEctor:AUTO?	Query detector mode auto on/off (for all traces)
[:SENSe]:FEED RF AREFereNce	Set input port
[:SENSe]:FEED?	Query input port
[:SENSe]:FEED:AREFereNce REF500 REFCOMB REF4800 OFF	Set calibration port
[:SENSe]:FEED:AREFereNce?	Query calibration port
[:SENSe]:FREQuency:TUNE:IMMediate	Initiate auto tune
[:SENSe]:FREQuency:STARt <freq>	Set the starting frequency

Command	Function
[:SENSe]:FREQUency:START?	Query start frequency
[:SENSe]:FREQUency:STOP <freq>	Set the stop frequency
[:SENSe]:FREQUency:STOP?	Query stop frequency
[:SENSe]:FREQUency:SPAN:BANDwidth[:RESolution]:RATio <integer>	Set Span/RBW
[:SENSe]:FREQUency:SPAN:BANDwidth[:RESolution]:RATio?	Query Span/RBW
[:SENSe]:FREQUency:SPAN:BANDwidth[:RESolution]:RATio:AUTO OFF ON 0 1	Set Span/RBW on/off
[:SENSe]:FREQUency:SPAN:BANDwidth[:RESolution]:RATio:AUTO?	Query Span/RBW
[:SENSe]:FREQUency:SPAN <freq>	Set frequency span
[:SENSe]:FREQUency:SPAN?	Query frequency span
[:SENSe]:FREQUency:SPAN:FULL	Set full frequency span
[:SENSe]:FREQUency:SPAN:PREVIOUS	Query previous frequency span setting
[:SENSe]:FREQUency:SYNThesis[:STATe] OFF ON 0 1	Set phase noise optimization on/off
[:SENSe]:FREQUency:SYNThesis[:STATe]?	Query phase noise optimization on/off
[:SENSe]:FREQUency:SYNThesis:AUTO[:STATe] OFF ON 0 1	Set phase noise optimization auto on/off
[:SENSe]:FREQUency:SYNThesis:AUTO[:STATe]?	Query phase noise optimization auto on/off
[:SENSe]:IF:GAIN:AUTO OFF ON 0 1	Set IF gain auto on/off
[:SENSe]:IF:GAIN:AUTO?	Query IF gain auto on/off
[:SENSe]:IF:GAIN:AUTO:LEVEL 5 0 -5 -10	Set IF auto gain level
[:SENSe]:IF:GAIN:AUTO:LEVEL?	Query IF auto gain level
[:SENSe]:IF:GAIN:SWEPT[:STATe] OFF ON 0 1	Set sweep IF gain on/off
[:SENSe]:IF:GAIN:SWEPT[:STATe]?	Query sweep IF gain on/off
[:SENSe]:IF:GAIN:SWEPT:AUTO[:STATe] OFF ON 0 1	Set sweep IF gain auto on/off
[:SENSe]:IF:GAIN:SWEPT:AUTO[:STATe]?	Query sweep IF gain auto on/off
[:SENSe]:IF:GAIN:FFT[:STATe] LOW HIGH	Set FFT IF gain on/off
[:SENSe]:IF:GAIN:FFT[:STATe]?	Query FFT IF gain on/off
[:SENSe]:IF:GAIN:FFT:AUTO[:STATe] OFF ON 0 1	Set FFT IF gain auto
[:SENSe]:IF:GAIN:FFT:AUTO[:STATe]?	Query FFT IF gain auto
[:SENSe]:POWer[:RF]:MW:PATH STD LNPath	Set low noise path on/off
[:SENSe]:POWer[:RF]:MW:PATH?	Query low noise path on/off

Command	Function
[[:SENSe]:RF:GAIN:AUTO:RULes RANGE	RF gain best dynamic range
[[:SENSe]:RF:GAIN:AUTO:RULes SENSITIVITY	RF gain best sensitivity
[[:SENSe]:RF:GAIN:AUTO:RULes?	Query RF gain distribution rules
[[:SENSe]:RF:GAIN:AUTO[:STATe] OFF ON 0 1	Set RF gain auto on/off
[[:SENSe]:RF:GAIN:AUTO[:STATe]?	Query RF gain auto on/off
[[:SENSe]:SWEep:FFT:WIDTh <real>	Set FFT width
[[:SENSe]:SWEep:FFT:WIDTh?	Query FFT width
[[:SENSe]:SWEep:FFT:WIDTh:AUTO OFF ON 0 1	Set FFT width auto on/off
[[:SENSe]:SWEep:FFT:WIDTh:AUTO?	Query FFT width auto on/off
[[:SENSe]:SWEep:TIME <time>	Set the scanning time
[[:SENSe]:SWEep:TIME?	Query sweep time
[[:SENSe]:SWEep:TIME:AUTO OFF ON 0 1	Set sweep time on/off
[[:SENSe]:SWEep:TIME:AUTO?	Query sweep time
[[:SENSe]:SWEep:TIME:AUTO:RULes NORMAl ACCuracy SRESponse	Set sweep time rules
[[:SENSe]:SWEep:TIME:AUTO:RULes?	Query sweep time rules
[[:SENSe]:SWEep:TYPE FFT SWEep	Set the scanning type
[[:SENSe]:SWEep:TYPE?	Query sweep type
[[:SENSe]:SWEep:TYPE:AUTO OFF ON 0 1	Set sweep type auto on/off
[[:SENSe]:SWEep:TYPE:AUTO?	Query sweep type auto on/off
[[:SENSe]:SWEep:TYPE:AUTO:RULes SPEEd DRANge	Set sweep type rules
[[:SENSe]:SWEep:TYPE:AUTO:RULes?	Query sweep type rules
[[:SENSe]:SWEep:TYPE:AUTO:RULes:AUTO[:STATe] OFF ON 0 1	Set sweep type rules auto on/off
[[:SENSe]:SWEep:TYPE:AUTO:RULes:AUTO[:STATe]?	Query sweep type rules auto on/off
[[:SENSe]:SWEep:POINts <integer>	Set the scanning point number
[[:SENSe]:SWEep:POINts?	Query sweep points
:TRACe:COPIY TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6,TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6	Initiate trace copy
:TRACe:COPIY?	Query trace copy
:TRACe<1 2 3 4 5 6>:DISPlay[:STATe] ON OFF 0 1	Set trace display status on/off

Command	Function
:TRACe<1 2 3 4 5 6>:DISPlay[:STATe]?	Query trace display status on/off
:TRACe:PRESet:ALL	Reset All Traces
:TRACe<1 2 3 4 5 6>:TYPE WRITe AVERAge MAXHold MINHold	Set trace display mode
:TRACe<1 2 3 4 5 6>:TYPE?	Query race display mode
:TRACe#:UPDate[:STATe] ON OFF 0 1	Set trace update state on/off
:TRACe#:UPDate[:STATe]?	Query trace update state on/off
:TRACe[:DATA]? TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6	Query trace data (only for remote control)
:UNIT:POWer DBM DBMv DBMA V W A DBUv DBUA DBUVM DBUAM DBPT D BG	Set Y axis scale unit
:UNIT:POWer?	Query Y axis scale unit
INITiate:PAUSe	Sweep pause
:INITiate:RESume	Sweep resume
[:SENSe]:FREQuency:CENTer <freq>	Set center frequency
[:SENSe]:FREQuency:CENTer?	Query center frequency
[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>	Set frequency step
[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?	Query frequency step
[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF ON 0 1	Set frequency step auto on/off
[:SENSe]:FREQuency:CENTer:STEP:AUTO?	Query frequency step auto on/off
[:SENSe]:FREQuency:OFFSet <freq>	Set frequency offset
[:SENSe]:FREQuency:OFFSet?	Query frequency offset
frequency step auto on/off	Set mechanical attenuation
[:SENSe]:POWer[:RF]:ATTenuation?	Query mechanical attenuation
[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF ON 0 1	Set mechanical attenuation auto on/off
[:SENSe]:POWer[:RF]:ATTenuation:AUTO?	Query mechanical attenuation auto on/off
[:SENSe]:POWer[:RF]:EATTenuation <rel_amp>	Set electronic attenuation
[:SENSe]:POWer[:RF]:EATTenuation?	Query electronic attenuation
[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF ON 0 1	Set electronic attenuator on/off
[:SENSe]:POWer[:RF]:EATTenuation:STATe?	Query electronic attenuator on/off
[:SENSe]:POWer[:RF]:EATTenuation <rel_amp>	Set electronic attenuator
[:SENSe]:POWer[:RF]:EATTenuation?	Query electronic attenuator

Command	Function
[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10dB 2dB	Set mechanical attenuation step
[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?	Query mechanical attenuation step
[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <real>	Set maximum mixer level
[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer]?	Query maximum mixer level
[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF ON 0 1	Set pre-amplifier on/off
[:SENSe]:POWer[:RF]:GAIN[:STATe]?	Query pre-amplifier on/off
[:SENSe]:ROSCillator:SOURce INTernal EXTernal	Set frequency reference internal/external
[:SENSe]:ROSCillator:SOURce?	Query frequency reference internal/external
[:SENSe]:SWEep:EGATe:HOLDoff <time>	Set Trigger Holdoff Time
[:SENSe]:SWEep:EGATe:HOLDoff?	Query Trigger Holdoff Time
[:SENSe]:SWEep:EGATe:HOLDoff:AUTO OFF ON 0 1	Set Trigger Holdoff On/Off
[:SENSe]:SWEep:EGATe:HOLDoff:AUTO?	Query Trigger Holdoff On/Off
:SYSTem:CLOGging ON OFF	Set log text on/off
:SYSTem:CLOGging?	Query log text on/off
:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <integer>	set GPIB address
:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess?	Query the GPIB address.
:TRIGger[:SEQUence]:EXTernal[1] 2:DELay <time>	Set external trigger 1 or external trigger 2 delay
:TRIGger[:SEQUence]:EXTernal[1] 2:DELay?	Query external trigger 1 or external trigger 2 delay
:TRIGger[:SEQUence]:EXTernal[1] 2:DELay:STATe OFF ON 0 1	Set external trigger 1 or external trigger 2 delay
:TRIGger[:SEQUence]:EXTernal[1] 2:DELay:STATe?	Set external trigger 1 or external trigger 2 delay on/off
:TRIGger[:SEQUence]:EXTernal[1] 2:LEVel <level>	Set external trigger 1 or external trigger 2 level
:TRIGger[:SEQUence]:EXTernal[1] 2:LEVel?	Query external trigger 1 or external trigger 2 level
:TRIGger[:SEQUence]:EXTernal[1] 2:SLOPe POSitive NEGative	Set external trigger 1 or external trigger 2 polarity
:TRIGger[:SEQUence]:EXTernal[1] 2:SLOPe?	Query external trigger 1 or external trigger 2 polarity
:TRIGger[:SEQUence]:FRAME:DELay <time>	Set timer trigger delay
:TRIGger[:SEQUence]:FRAME:DELay?	Query timer trigger delay
:TRIGger[:SEQUence]:FRAME:DELay:STATe OFF ON 0 1	Set timer trigger delay on/off
:TRIGger[:SEQUence]:FRAME:DELay:STATe?	Query timer trigger delay on/off

Command	Function
:TRIGger[:SEquence]:FRAME:OFFSet <time>	Set timer trigger offset
:TRIGger[:SEquence]:FRAME:OFFSet?	Query timer trigger offset
:TRIGger[:SEquence]:FRAME:PERiod <time>	Set timer trigger period
:TRIGger[:SEquence]:FRAME:PERiod?	Query timer trigger period
:TRIGger[:SEquence]:FRAME:SYNC EXTeRnal1 EXTeRnal2 RFBurst OFF	Select Sync Source
:TRIGger[:SEquence]:FRAME:SYNC?	Query sync source selection
:TRIGger[:SEquence]:FRAME:SYNC:HOLDoff <time>	Set sync source holdoff
:TRIGger[:SEquence]:FRAME:SYNC:HOLDoff?	Query sync source holdoff
:TRIGger[:SEquence]:LINE:DELay <time>	Set power trigger delay
:TRIGger[:SEquence]:LINE:DELay?	Query power trigger delay
:TRIGger[:SEquence]:LINE:DELay:STATe OFF ON 0 1	Set power trigger delay on/off
:TRIGger[:SEquence]:LINE:DELay:STATe?	Query power trigger delay on/off
:TRIGger[:SEquence]:LINE:SLOPe POSitive NEGative	Set power trigger polarity
:TRIGger[:SEquence]:LINE:SLOPe?	Query power trigger polarity
:TRIGger[:SEquence]:RFBurst:DELay <time>	Set burst signal trigger delay
:TRIGger[:SEquence]:RFBurst:DELay?	Query burst signal trigger delay
:TRIGger[:SEquence]:RFBurst:DELay:STATe OFF ON 0 1	Set burst signal trigger delay on/off
:TRIGger[:SEquence]:RFBurst:DELay:STATe?	Query burst signal trigger delay on/off
:TRIGger[:SEquence]:RFBurst:LEVel:ABSolute <amp;gt;	Set burst signal trigger level
:TRIGger[:SEquence]:RFBurst:LEVel:ABSolute?	Query burst signal trigger level
:TRIGger[:SEquence]:RFBurst:SLOPe POSitive NEGative	Set burst signal trigger polarity
:TRIGger[:SEquence]:RFBurst:SLOPe?	Query burst signal trigger polarity
:TRIGger[:SEquence]:SOURce EXTeRnal1 EXTeRnal2 IMMediate LINE FRAME RFBurst VIDeo IF ALARm LAN IQMag IDEMod QDEMod IINPut QINPut AIQMag	Select trigger method
:TRIGger[:SEquence]:SOURce?	Query trigger method selection
:TRIGger[:SEquence]:VIDeo:DELay <time>	Set video trigger delay
:TRIGger[:SEquence]:VIDeo:DELay?	Query video trigger delay
:TRIGger[:SEquence]:VIDeo:DELay:STATe OFF ON 0 1	Set video trigger delay
:TRIGger[:SEquence]:VIDeo:DELay:STATe?	Query video trigger delay

Command	Function
:TRIGger[:SEQuence]:VIDeo:LEVel <amp>	Set video trigger level
:TRIGger[:SEQuence]:VIDeo:LEVel?	Query video trigger level
:TRIGger[:SEQuence]:VIDeo:SLOPe POSitive NEGative	Set video trigger polarity
:TRIGger[:SEQuence]:VIDeo:SLOPe?	Query video trigger polarity

Appendix C Error Message Index

Schedule 3 Table of Local Error Information

Error code	Key Error Field	Description of error
1	USBINITERR	Instrument keyboard initialization failed, please check hardware and driver
2	LANINIT ERR	LAN port initialization failed, please check hardware and driver
3	HARDINIT ERR	Hardware function initialization failed, please check hardware and driver
4	WINSOCKET ERR	Winsocket library initialization failed
5	SOCKETCRT ERR	SOCKET interface creation failed
6	SOCKETBAND ERR	SOCKET interface binding failed
7	LISTEN ERR	Listener interface failed
8	LINK ERR	Link creation failed
9	FMDATA ERR	FM offset data calling failed
15	CALFILE ERR	Calibration file calling failed
20	GPS INIT	GPS initialization failed
30	FACTDATA ERR	Factory commissioning status data calling failed
31	FLATNESS ERR	Flatness data calling failed
32	LOADFILE ERR	File loading failed
33	SAVEFILE ERR	File saving failed
34	LICENSE ERR	Invalid license
35	LICENSE OPEN	License opening failed
40	CRET EVT	System sync event creation error
41	NO MEMRY	No dynamic allocation memory
42	SHUTDOWN FAIL	Remote instrument shutdown failed
43	SPACE LOW	Low disk space
44	CRET DIRY	Folder creation failed
45	CRET FILE	File creation failed
46	CHECK DISK	Free disk space checking failed
47	READ FILE	File reading failed
48	WRITE FILE	File writing failed
90	CALCBAND	Band parameter calculation error
100	LO ALLOT	LO allocation algorithm failed
101	FRACNLOW	Lower fractional loop lock loss
102	SAMP UPR	Upper sample loop lock loss
103	YTO CHK	YTO loop lock detect

Error code	Key Error Field	Description of error
104	OVERSTEP	Error voltage zero adjustment times beyond 15
105	CORS LOW	Coarse tuned DAC out of range of 0~255 and below 0
106	CORS UPR	Coarse tuned DAC out of range of 0~255 and above 255
107	CORS LOW	Fined tuned DAC falls below 65 during coarse tuning, resulting in coarse tuned DAC below 0
108	CORS UPR	Fined tuned DAC increases to over 255 during coarse tuning, resulting in coarse tuned DAC above 255
109	CORS UPR	Fined tuned DAC increases to over 255 during fine tuning, resulting in coarse tuned DAC above 255
110	CORS UPR	Fined tuned DAC increases to over 191 during fine tuning, resulting in coarse tuned DAC beyond 0~255 and above 255
111	CORS LOW	Fined tuned DAC falls below 0 during fine tuning, resulting in coarse tuned DAC beyond 0~255 and above 255
112	CORS LOW	Fined tuned DAC falls below 65 during fine tuning, resulting in coarse tuned DAC beyond 0~255 and above 255
113	SAMP LOW	Lower sample loop lock loss
114	FRACNUPR	Upper fractional loop lock loss
201	LOAD CAL	Calibration file loading failed
202	DSP DATA	Calibration data writing into DSP failed
203	SAVE CAL	Writing or creation of file to save calibration data failed
210	GETCALTR	Calibration sweep trace acquiring during calibration failed
220	CALFLTNS	Calibration data out of limit during in-band flatness calibration
221	40MFLTNS	40 MHz in-band flatness calibration error
222	13MFLTNS	13MHz in-band flatness calibration error
223	3M FLTNS	3MHz in-band flatness calibration error
224	.1MFLTNS	100kHz in-band flatness calibration error
225	FULFLTNS	Wideband direct range in-band flatness calibration error
226	200MFLTN	200MHz in-band flatness calibration error
227	100MFLTN	100MHz in-band flatness calibration error
228	50MFLTNS	50MHz in-band flatness calibration error
230	FulBError	Wideband direct range bandwidth switching error calibration error
231	200MError	200MHz bandwidth switching error calibration error
232	100MError	100MHz bandwidth switching error calibration error
233	50MError	50MHz bandwidth switching error calibration error
234	40MError	40MHz bandwidth switching error calibration error
235	20MError	20MHz bandwidth switching error calibration error

Error code	Key Error Field	Description of error
236	10MError	10MHz bandwidth switching error calibration error
237	5M Error	5MHz bandwidth switching error calibration error
238	5M Error	2MHz bandwidth switching error calibration error
239	5M Error	1MHz bandwidth switching error calibration error
240	500kError	500kHz bandwidth switching error calibration error
241	200kError	200kHz bandwidth switching error calibration error
242	100kError	100kHz bandwidth switching error calibration error
243	50kError	50kHz bandwidth switching error calibration error
244	20kError	20kHz bandwidth switching error calibration error
245	10kError	10kHz bandwidth switching error calibration error
246	<10kError	<10 kHz bandwidth switching error calibration error
255	RF GAIN	RF variable gain calibration error
256	FLATGDAC	Flatness amplifier gain calibration error
258	NBIFGAIN	Narrowband IF variable gain calibration error
259	WBIFGAIN	Wideband IF variable gain calibration error
260	300MAMPL	Absolute amplitude error calculation error when narrowband pre-amplifier is off
261	300MAMPL	Absolute amplitude error calculation error when wideband pre-amplifier is off
262	300MAMPL	Absolute amplitude error calculation error when narrowband pre-amplifier is on
263	300MAMPL	Absolute amplitude error calculation error when wideband pre-amplifier is on
300	NB DEV	Narrowband acquisition equipment opening failed
301	NB INIT	Narrowband acquisition equipment initialization failed
302	NB FPGA	Narrowband acquisition equipment FPGA configuration failed
303	NB WRKP	Narrowband equipment operating parameter setting failed
304	FIR FILE	FIR file loading failed
305	FPGA FILE	Narrowband acquisition equipment FPGA file opening failed
306	NB EVT	Narrowband acquisition equipment driver sync event creation failed
310	NBOVERTIME	Narrowband acquisition equipment sampling overtime
311	DIRVER READ	Narrowband acquisition equipment driver reading failed
312	DIRVER WRITE	Narrowband acquisition equipment driver writing failed
313	DRIVER DMA	Narrowband acquisition equipment driver DMA failed
315	WBOVERTIME"	Wideband acquisition equipment sampling overtime
320	WB DEV	Wideband acquisition equipment opening failed
321	WB INIT	Wideband acquisition equipment initialization failed

Error code	Key Error Field	Description of error
322	WB FPGA	Wideband acquisition equipment FPGA configuration failed
323	WB WRKP "	Wideband equipment operating parameter setting failed
325	FPGA FILE	Wideband acquisition equipment FPGA file opening failed
326	WB EVT	Wideband acquisition equipment driver sync event creation failed
330	OVERTIME	Wideband acquisition equipment sampling overtime
331	DIRVER READ	Wideband acquisition equipment driver reading failed
332	DIRVER WRITE	Wideband acquisition equipment driver writing failed
333	DRIVER DMA	Wideband acquisition equipment driver DMA failed
340	BBS DEV	Audio acquisition equipment opening failed
341	BBS INIT	Audio acquisition equipment initialization failed
342	BBS FPGA	Audio acquisition equipment FPGA configuration failed
343	BBS WRKP	Audio equipment operating parameter setting failed
345	FPGA FILE	Audio acquisition equipment FPGA file opening failed
346	BBS EVT	Audio acquisition equipment driver sync event creation failed
350	OVERTIME	Audio acquisition equipment sampling overtime
351	DIRVER READ	Audio acquisition equipment driver reading failed
352	DIRVER WRITE	Audio acquisition equipment driver writing failed
353	DRIVER DMA	Audio acquisition equipment driver DMA failed
354	DATA LACK	Too short data length of audio acquisition equipment
360	LARGEREF	Audio board wide range reference calibration error
361	LARGEEND	Audio board wide range calibration error
362	SMALLREF	Audio board wide range reference calibration error
363	SMALLEND	Audio board wide range calibration error
400	FIR TMOUT	Timeout error in continuous sweep
401	FIR RDERR	Data reading error in continuous sweep and reading points mismatch
500	NODSPDEV	Data processor opening error
501	DEV INIT	Data processor initialization error
502	DSP PARM	Data processor operating parameter setting error
503	DSPA ERR	DSPA initialization failed
504	DSPB ERR	DSPB initialization failed
505	DSPC ERR	DSPC initialization failed
506	FPGA ERR	Data processor FPGA configuration error
507	FPGA PARM	Data processor FPGA operating parameter setting error

Error code	Key Error Field	Description of error
508	FPGA FILE	Data processor FPGA file opening failed
509	DSP FILE	dsp file opening failed
510	CRET EVT	Data processor driver sync event creation failed
511	DIRVER READ	Data processor driver reading failed
512	DIRVER WRITE	Data processor driver writing failed
513	DRIVER DMA	Data processor driver DMA failed

Schedule 4 Table of Remote Control Error Messages

Error code	Key Error Field	Description of error
600	CMD ERR	No parameter allowed in command
601	CMD ERR	Command parameter error
602	GPIB ERR	Current mode command file damaged
603	CMD ERR	Remote command not exist
604	CMD ERR	Command not exist in current mode
605	GPIB ERR	Receiver mode command file damaged
606	GPIB ERR	Phase noise mode command file damaged
607	CMD ERR	Too much key words with number
608	CMD ERR	No number allowed in key words
610	SFP ERR	Recorder path link failed
650	GPIBINIT ERRO	GPIB initialization failed
651	Register ERRO	GPIB access to registry failed
652	GPIBMEMERRO	GPIB storage initialization failed