



4957B RF Analyzer User Manuals



Ceyear Technologies Co., Ltd

The Manual applies to the following series signal generators based on the firmware version of 1.0 and higher.

4957B RF analyzer

Options other than standard accessories are as follows:

User's Manual (English version).

Programming Manual (English version)

Antenna test (software): It is used to test the return loss, standing wave ratio and breakpoints of cables and feeders.

Vector voltmeter (software): It is used to test the cable phase shift and electrical length of cables.

USB power measurement (software, USB power probe to be equipped separately): It supports the external USB peak/continuous wave power probe for power measurement.

Interference analysis (software): It provides such functions as waterfall chart and RSSI measurement.

Analog demodulation analysis (software): It realizes the demodulation characteristic analysis of AM/FM/PM signal.

Field strength measurement (software): It provides such field strength measurement functions as dot frequency, frequency sweep and list sweep.

Interference map (software): It is used with the GPS positioning option.

Signal analysis (software): It realizes the fast analysis of interference signal, and provides the functions of audio demodulation and IQ capture.

Power detection (software): It receives the external signal from the spectrum input port to measure the power of the signal.

GPS option: External antenna, built-in GPS module and software.

Electronic calibration support (software, additional electronic calibration parts are required): It is used for vector network analysis and calibration of antenna feeder, vector voltmeter, etc.

Version: A Jun 2022, Ceyear Technologies Co., Ltd.

Address: No. 98, Xiangjiang Road, Qingdao Economic & Technological Development Zone, Shandong Province

Service Consultation: 0532-86889847 400-1684191

Technical support: 0532-86880796

Quality Supervision: 0532-86886614

Fax: 0532-86889056

Website: www.ceyear.com

Email: sales@ceyear.com

Postal code: 266555

Foreword

Thank you for choosing and using the 4957B RF analyzer developed and produced by Ceyear Technologies Co., Ltd.!

With meeting your requirements as our duty, we will provide you with high-quality instruments as well as good after-sales service. Ceyear will insist on the consistent tenet of "high quality and considerate service" and the promise to provide our users with satisfactory products and services.

Manual No.

YQ2.732.1032SSCN

Version

A 2022.6

Ceyear Technologies Co., Ltd.

Manual Authorization

The contents of this manual are subject to change without notice. The final right to interpret the contents and terms used in this manual belongs to Ceyear Technologies Co., Ltd.

The copyright of the manual belongs to Ceyear Technologies Co., Ltd, no modification or alteration can be made to the manual contents by any unit or person without approval of the Institute, and no reproduction or propagation of the manual can be made for profits, otherwise, Ceyear Technologies Co., Ltd retains the right of pursuing legal responsibilities from any infringer.

Product warranty

The product warranty period is 18 months starting from the delivery completed. The instrument manufacturer will repair or replace the damaged components according to the user's requirements and actual conditions within the warranty period. For specific maintenance issues, see the contract.

Product quality certificate

We guarantee that the product can meet the indicator requirement in the manual upon delivery. The calibration and measurement are completed by measuring bodies with national qualification, with relevant data to be provided for reference by users.

Quality/Environmental Management

This product complies with the quality and environmental management systems during R&D, manufacturing and testing. Ceyear Technologies Co., Ltd. already has the required qualifications and has passed the certification of ISO 9001 and ISO 14001 management systems.

Safety precautions



The symbol "Warning" indicates a hazard. It reminds the user to pay attention to a certain operation process, operation method or the like. Failure to observe the rules or incorrect operation may cause personal injury. Proceed to the next step only after fully understanding and meeting the warning conditions indicated.



The "Notice" symbol indicates some important information which will not cause danger. It reminds the user to pay attention to a certain operation process, operation method or the like. Failure to observe the rules or operate correctly may cause damage to the instrument or loss of important data. Proceed to the next step only after fully understanding and meeting the caution conditions indicated.

Contents

1 MANUAL NAVIGATION	1
1.1. ABOUT THE MANUAL	1
1.2 RELATED DOCUMENTS	2
2 OVERVIEW	3
2.1 PRODUCT OVERVIEW	3
2.2 SAFE OPERATION INSTRUCTIONS	5
3 OPERATION GUIDE	13
3.1 GET PREPARED	13
3.2 FRONT PANEL AND INTERFACE DESCRIPTION	31
4 VECTOR NETWORK ANALYSIS MODE	36
4.1 INTRODUCTION TO TYPICAL MEASUREMENTS	36
4.2 MENU STRUCTURE	48
4.3 MENU DESCRIPTION	55
5 SPECTRUM ANALYSIS MODE	67
5.1 INTRODUCTION TO TYPICAL MEASUREMENTS	68
5.2 MENU STRUCTURE	95
5.3 MENU DESCRIPTION	100
6 CABLE AND ANTENNA FEEDER TEST MODE (OPTIONAL)	123
6.1 INTRODUCTION TO TYPICAL MEASUREMENTS	123
6.2 MENU STRUCTURE	129
6.3 MENU DESCRIPTION	131
7 VECTOR VOLTMETER MODE (OPTIONAL)	135
7.1 INTRODUCTION TO TYPICAL MEASUREMENTS	135
7.2 MENU STRUCTURE	140
7.3 MENU DESCRIPTION	141
8 USB POWER MEASUREMENT MODE (OPTIONAL)	143
8.1 INTRODUCTION TO TYPICAL MEASUREMENT	143
8.2 MENU STRUCTURE	145
8.3 MENU DESCRIPTION	146
9 INTERFERENCE ANALYSIS MEASUREMENT MODE (OPTIONAL)	148
9.1 INTRODUCTION TO TYPICAL MEASUREMENT	148
9.2 INTERFERENCE ANALYSIS MENU STRUCTURE	151
9.3 DESCRIPTION OF INTERFERENCE ANALYSIS MENU	153
10 DEMODULATION ANALYSIS MEASUREMENT MODE (OPTIONAL)	160
10.1 INTRODUCTION TO TYPICAL MEASUREMENT	160
10.2 DEMODULATION ANALYSIS MENU STRUCTURE	162

10.3 DESCRIPTION OF DEMODULATION ANALYSIS MENU	164
11 CHANNEL SWEEP MEASUREMENT MODE (OPTIONAL)	171
11.1 INTRODUCTION TO TYPICAL MEASUREMENTS	171
11.2 MENU STRUCTURE OF CHANNEL SWEEP	174
11.3 DESCRIPTION OF CHANNEL SWEEP MENU	175
12 FIELD STRENGTH MEASUREMENT MODE (OPTIONAL)	178
12.1 INTRODUCTION TO TYPICAL MEASUREMENTS	178
12.2 MENU STRUCTURE OF FIELD STRENGTH MEASUREMENT	182
12.3 DESCRIPTION OF FIELD STRENGTH MEASUREMENT MENU	184
13 LOCATION ANALYZER MODE (OPTIONAL)	189
13.1 INTRODUCTION TO TYPICAL MEASUREMENTS	189
13.2 MENU STRUCTURE OF LOCATION ANALYZER	192
13.3 DESCRIPTION OF LOCATION ANALYZER MENU	193
14 SIGNAL ANALYSIS MODE (OPTIONAL)	198
14.1 INTRODUCTION TO TYPICAL MEASUREMENTS	198
14.2 SIGNAL ANALYSIS MENU STRUCTURE	201
14.3 DESCRIPTION OF SIGNAL ANALYSIS MENU	203
15 TECHNICAL DESCRIPTION	212
15.1 WORKING PRINCIPLES	212
15.2 DESCRIPTION OF FAULT INFORMATION	214
15.3 REPAIR	215
16 TECHNICAL INDICATORS AND TESTING METHODS	216
16.1 VECTOR NETWORK ANALYSIS PERFORMANCE INDICATOR TEST	216
16.2 SPECTRUM ANALYSIS PERFORMANCE INDICATOR TEST	224
APPENDIX A PERFORMANCE AND PROPERTY INSPECTION RESULTS	243
APPENDIX A RECORD SHEET OF 4957B <i>RF ANALYZER</i>	243

1 Manual navigation

This chapter introduces the user's manual functions, chapter structure and main contents of the 4957B RF analyzer, as well as the instrument-related documents provided to users.

- [About the Manual](#) 1
- [Related Documents](#)..... 2

1.1. About the Manual

This manual introduces the basic functions and operation methods of the 4957B RF analyzer produced by Ceyear Technologies Co., Ltd. It describes such contents as product features, basic operations, configuration guide, menu description, remote control, maintenance, technical indicators and testing methods, etc. of the instrument to help users get familiar with and master the operation method and key points of the instrument as soon as possible. To facilitate your skillful use of the instruments, please read carefully this manual and follow its instructions for correct operation.

This manual contains the following chapters:

Overview

This part introduces in general the main performance characteristics, typical application examples and safety instructions of the 4957B RF analyzer. The purpose is to enable users to have a preliminary understanding of the main performance characteristics of the instrument and to guide users to operate the instrument safely.

Quick Start

This chapter introduces the pre-operation inspection, instrument browsing, basic measurement methods, measurement window instructions and data storage of the 4957B RF analyzer. so that users can have a preliminary understanding of the instrument itself and its measurement processes as a preparation for the comprehensive introduction of the measurement operations of the instrument hereinafter. This section contains some contents consistent with the relevant sections in the Quick Start.

Operation Guide

It introduces in detail the operation methods of various measurement functions of the instrument, including configuring the instrument, starting the measurement process and obtaining the measurement results. This part mainly includes two parts: functional operation guide and advanced operation guide. For users who are not familiar with the 4957B RF analyzer, the basic operation guide introduces and enumerates each function systematically and in detail so that users can understand and master some basic usage of the RF analyzer. The advanced operation guide introduces relatively complicated testing processes and advanced operation skills for users who have basic knowledge about using the instrument but are not familiar with some special usage, and guides them to implement the measurement processes.

Menus

This part introduces the menu structure and menu items according to the functions to facilitate the users to query for reference.

Troubleshooting and Repair

This part includes the introduction of the working principles of the instrument, troubleshooting, error information description and repair methods.

Manual navigation

Technical indicators and testing methods

This part introduces the product features, main technical indicators and recommended test methods of the 4957B RF analyzer.

Appendixes

Necessary reference information related to the 4957B RF analyzer is provided, including term description, program-controlled command quick look-up table, menu quick look-up table, error information quick look-up table, etc.

1.2 Related Documents

Documents of the 4957B RF analyzer include:

User's Manual

Program Control Manual

Quick Start Guide

User's Manual

This manual describes the functions and operation methods of the instrument in detail, including configuration, measurement, program control and maintenance, etc. The purpose is to guide users to fully understand the functional characteristics of the product and master common testing methods of the instrument. Main chapters include:

Manual Navigation

Overview

Quick Start

Operation Guide

Menus

Remote Control

Troubleshooting and Repair

Technical indicators and testing methods

Appendixes

Program Control Manual

This manual introduces remote programming basics, SCPI basics, SCPI, programming examples and I/O driver function library in detail. The purpose is to guide users to quickly and comprehensively master the program control commands and methods of the instrument. Main chapters include:

Remote Control

Program Control Commands

Programming Examples

Error Description

Appendixes

Quick Start Guide

This manual introduces the basic methods for configuration and start-up measurement of the instrument to enable users to quickly understand the characteristics of the instrument, and master the basic settings and basic operation methods. Main chapters include:

Get Prepared

Typical Applications

Get Help

2 Overview

This chapter introduces the main performance characteristics, main applications and main technical indicators of the 4957B RF analyzer. It also gives introductions on correct operation the instrument and precautions such as electrical safety.

- [Product Overview](#).....3
- [Safety operation instructions](#).....5

2.1 Product Overview

The 4957B RF analyzer has many advantages, such as high performance indexes, high sweep speed, many test functions, simple operation, etc. In terms of performance indexes, it has excellent average noise level, phase noise and high dynamic range. In terms of measurement modes, in addition to vector network analysis and spectrum analysis, abundant option measurement function modes are also provided, including cable and antenna feeder test, vector voltmeter, USB power measurement, interference analysis, demodulation analysis, channel sweep, field strength measurement, etc. Each measurement mode is provided with a variety of intelligent measurement functions. It adopts the integrated design of 8.4" liquid crystal and capacitive touch screen to improve the clarity of display and the convenience of operation. It is handheld, small in size, light in weight, flexible in power supply, easy to operate, and suitable for field use.

- [Product Features](#).....3
- [Typical applications](#).....4

2.1.1 Product Features

The 4957B RF Analyzer adopts the design idea of high integration, modularization and standardization, and has excellent performance.

2.1.1.1 Basic Functions

- 1) Vector network analysis mode (VNA): For network S-parameter analysis (insertion loss and gain);
- 2) Spectrum analysis mode (SA): For basic spectrum analysis of the signal, including field strength measurement, channel power, occupied bandwidth, adjacent channel power, spurious template, carrier-to-noise ratio, audio demodulation, IQ capture and other intelligent measurement functions;
- 3) Antenna feeder test mode (CAT) (optional): For cable and antenna feeder test (return loss and failure positioning);
- 4) Vector voltmeter mode (VVM) (optional): For amplitude, phase, standing wave ratio and impedance measurement;
- 5) USB power measurement mode (USB-PM) (optional): For accurate measurement on continuous wave power via external USB power probe;
- 6) Interference analysis function (optional): It provides such functions as waterfall chart and RSSI measurement;
- 7) Demodulation analysis function (optional): It realizes the demodulation characteristic analysis of AM/FM/PM signal;

Overview

- 8) Channel sweep function (optional): It can realize the signal power measurement of multiple channels or frequencies;
- 9) Field strength measurement function (optional): It can realize the functions of dot frequency measurement, frequency sweep measurement and list sweep measurement;
- 10) Directional analysis function (optional): It is mainly used for positioning interference sources or unknown signal sources, and the direction of interference signals can be quickly positioned by using external receiving antenna and electronic compass;
- 11) Signal analysis function (optional): It provides fast analysis of interference signals, and realizes the display and playback of historical data with the help of the waterfall chart.

2.1.1.2 High Performance

- 1) Explicit Average Noise Level: Up to -157dBm@1Hz RBW;
- 2) Phase noise performance: -106dBm/Hz@100kHz frequency deviation @1GHz carrier;
- 3) Sweep speed: The minimum sweep time of 1GHz span <20ms;
- 4) Resolution bandwidth: 1Hz~10MHz;
- 5) The dynamic range of the system can reach above 95dB;
- 6) 8.4-inch high-brightness and high-resolution touch screen LCD display, with view of 170° and sound visibility at direct sunlight conditions.

2.1.1.3 Agility

- 1) Small size, light weight and built-in lithium battery facilitating field operation;
- 4) Perfect auto-diagnosis function and status self test;
- 3) Intelligent power supply management function, with dump energy indication and low capacity warning;
- 4) Multiple options to meet different customer's requirements
- 5) Two types of USB2.0 ports available for portable storage device connection and PC communication respectively;
- 6) One 10/100Mbps network port for local network establishment and remote control;
- 7) Various auxiliary test interfaces: 10MHz reference input/output interface, GPS antenna interface, external trigger input interface, etc.;
- 8) OI in both Chinese and English, with built-in operation instruction and only help information.

2.1.2 Typical Applications

2.1.2.1 Multiple-field test

- 1) Filter performance test
Test such indicators of the filter as insertion loss, ripple, and out-of-band suppression.
- 2) Time domain measurement
Test on cable length and failure positioning via cable and antenna analysis or time domain function of the vector network analysis mode.
- 3) Radar and communication system performance test
- 4) Measure radar network scattering parameter
It can be used in the research and development of all kinds of military and civil radar systems

and communication systems. It can not only accurately test the frequency, power and phase noise of all kinds of signals in the process of signal generation, but also test the modulation characteristics of all kinds of spurious signals, parasitic signals, harmonic distortion and signals.

5) Spectrum monitoring management

It can be used to manage the airborne radio frequency signal in the control range, and quickly specify and search various interference signals. For example, it can monitor and manage the spectrum in such places as the military radio stations, broadcasting stations, communications equipment, airports, base stations and sensitive areas. It also has the audio demodulation function, which can be used for radio monitoring.

6) Communication satellite monitoring

It can be used for monitoring the signal spectrum quality, power and power control status of the communication satellite and discriminating and searching interference signals, ensuring security, reliability and stability of the communication satellite network.

7) RF identification (RFID) test

It can be used to test the transmitted stray radiation and field intensity of the interrogator, frequency deviation and occupied bandwidth, and measure the polling and timing of the RF identification system.

8) Bluetooth field test

2.1.2.2 Test on components, parts and the instrument

It can be used for the DUT S-parameter amplitude, phase and group delay measurement, featuring efficiency, strong error correction capability, which is widely used in such military and civilian fields as components, radar, aerospace, electronic jamming and countermeasures, communications, radio and television.

It can be used for testing such parameters as gain, frequency response, bandwidth, insertion loss, frequency conversion loss, isolation and distortion of such components and parts as the cable, connector, amplifier, filter, mixer, attenuator, isolator and coupler.

It can be used to test various instruments and equipment on such performance indicators as the frequency, power, phase noise, parasitic, harmonic distortion and modulation characteristics during the R&D, production and maintenance of the signal generator.

2.2 Safe Operation Instructions

Please read carefully and strictly observe the following precautions!

We will spare no effort to ensure that all production processes meet the latest safety standards and provide users with the highest safety guarantee. The design and testing of our products and the auxiliary equipment used meet relevant safety standards, and a quality assurance system has been established to monitor the product quality and ensure the products to always comply with such standards. In order to keep the equipment in good condition and ensure operation safety, please observe the precautions mentioned in this manual. If you have any questions, please feel free to consult us.

In addition, the correct use of this product is also your responsibility. Please read carefully and observe the safety instructions before starting to use this instrument. This product is suitable for use in industrial and laboratory environments or field measurement. Always use the product correctly according to its restrictions to avoid personal injury or property damage. You will be

Overview

responsible for problems caused by improper use of the product or noncompliance with the requirements, and we will not be held responsible. **Therefore, in order to prevent personal injury or property damage caused by dangerous situations, please always observe the safety instructions.** Please keep the basic safety instructions and the product documentation properly and deliver them to end users.














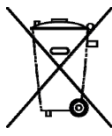



- Safety signs.....7
- Operation Status and Locations.....8
- Electricity safety.....9
- Operation precautions.....10
- Maintenance.....11
- Battery and power module.....11
- Transportation.....12
- Waste Disposal/Environmental Protection.....12

2.2.1 Safety Signs

2.2.1.1 Product-related Marks

Safety marks on the products are described as follows (Table 2.1):

Table 2.1 Products safety marks

Symbol	Meaning	Symbol	Meaning
	Notice, reminding users of information to be paid Special Notes to. It reminds users of the operation information or instructions to be paid attention to.		Turn On/Off the power
	Notice, handling heavy equipment.		Standby indication
	Danger! Hazard of electric shock.		DC
	Warning! Hot surface.		AC
	Protective conductive end		DC/AC
	Grounding		Reinforced insulation protection of the instrument
	Ground terminal		EU mark for batteries and accumulators. Please refer to Item 1 of "2.2.8 Waste Disposal/Environmental Protection" in this section for specific instructions.
	Notice, please handle classical sensitive devices with care.		EU mark for of separate collection of electronic devices. Please refer to Item 2 of "2.2.8 Waste Disposal/Environmental Protection" in this section for specific instructions.
	Warning! Radiation. Please refer to Item 7 of "2.2.4 Operation Precautions" in this section for specific instructions.		

2.2.1.2 Manual-related Marks

In order to remind users to operate the instrument safely and pay attention to relevant information, the following safety warning marks are used in the product manual, which are explained as follows:



Danger mark, personal injury or equipment damage may be caused if not avoided.



Warning mark, personal injury or equipment damage may be caused if not avoided.



Caution mark, slight or medium personal injury or equipment damage may be caused if not avoided.



The "Note" symbol indicates some important information which will not cause danger.



Tips on information about the instrument and its operation

2.2.2 Operation Status and Locations

Please note before operating the instrument:

- 1) Unless otherwise stated, the maximum altitude for operating the instrument shall not exceed 4,600m, and the maximum altitude for transporting the instrument shall not exceed 4,500m. The range of actual supply voltage is $\pm 10\%$ of the marked voltage, and the range of supply frequency is $\pm 5\%$ of the marked frequency.
- 2) Unless otherwise stated, the instrument has not received any waterproof treatment, do not place the instrument on surfaces with water, vehicles, cabinets, tables and other objects that are not fixed and do not meet the load conditions. Please place the instrument securely and fix it on the surface of a solid object (e.g., an ESD workbench).
- 3) Do not place the instrument in an environment where mist is easily formed, for example, Don't move the instrument in an environment where cold and heat are in alternation, where water droplets formed on the instrument may cause electric shock and other hazards.
- 4) Do not place the instrument on the surface of a heat-dissipating object (e.g., a radiator). The Operation environment temperature shall not exceed the value specified in the description of relevant indicators of the product. Overheating of the product will lead to electric shock, fire and other risks.

- 5) Do not insert any object into the instrument through the opening on the instrument casing, or cover up any notch or opening on the product, which is used for internal ventilation and preventing the instrument from getting overheated.

2.2.3 Electrical Safety

Precautions for electrical safety of the instrument:

- 1) Please adopt the AC-DC adapter delivered along with the instrument to supply power to the instrument. Improper use of the power adapter will cause damage to the internal hardware of the instrument.
- 2) Adopt the 220V AC 3-core stabilized voltage supply for the instrument, so as to avoid any damage to the internal hardware to the instrument due to high-power peak pulse.
- 3) Ensure good power supply grounding to avoid any damage to the instrument.
- 4) If the instrument is powered by batteries or with batteries inside, please replace the battery with one of the same type or recommended equivalent type. Do not put any object into the instrument from the opening on the shell of the instrument, or pour any liquid onto or into the instrument shell or the instrument respectively, so as to avoid any internal short circuit or electric shock, fire or personal injury.
- 5) Power off first before wiping the instrument to avoid any electric shock, and use dry or slightly-wet soft cloth to wipe the instrument surface. Do not try to wipe the internal of the instrument.
- 6) Do not use the product with damaged power line. Check regularly the power line for normal condition. Take proper safety protection measures, and place the power line properly, so as to ensure it is free of damage and personnel will not be subject to power line tripping or electric shock.
- 7) Before the instrument is powered on, the actual supply voltage shall match the required supply voltage of the instrument.
- 8) Do not damage the power cord, otherwise electric leakage will be caused, resulting in damage to the instrument and even injury of the operators. If an external power cord or extension socket is used, it should be checked before use to ensure electrical safety.
- 9) If the power supply socket does not provide an on/off switch, to cut the power of the instrument, you can just directly unplug the instrument, and therefore, it should be ensured that the power plug can be inserted or drawn conveniently.
- 10) Do not use damaged power cords. Before connecting the instrument to the power cord, check the integrity and safety of the power cord, and properly place the power cord to avoid the impact due to human factors, such as, too long power cord that may trip the operator.
- 11) Keep the socket clean and tidy, and ensure the plug and the socket in good contact and reliable engagement.
- 12) Neither the socket nor the power cord can be overloaded, otherwise fire or electric shock will be caused.

Overview

- 13) The instrument shall comply with IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards to connect with PC or IPC.
- 14) Unless otherwise allowed, do not open the housing of the instrument, which may expose internal circuits and devices of the instrument and cause unnecessary damage.
- 15) If the instrument needs to be fixed at the test site, a qualified electrician is required to install the protective earth wire between the test site and the instrument first.
- 16) Take appropriate overload protections to prevent overload voltage (caused by lightning, for instance) from damaging the instrument or causing personal injury.
- 17) When opening the housing of the instrument, do not place objects not belonging to the interior of the instrument, otherwise, short circuit, damage to the instrument and even personal injury may be caused.
- 18) Unless otherwise stated, the instrument has not received any waterproof treatment, so keep the instrument from contacting with liquid to prevent damage to the instrument or even personal injury.
- 19) Do not place the instrument in an environment where fog is easily formed, for example, moving the instrument in an environment where cold and heat are in alternation, where water droplets formed on the instrument may cause electric shock and other hazards.

2.2.4 Operation Precautions

- 1) Instrument operators need to have certain professional and technical knowledge, good psychological quality, and certain emergency response capabilities.
- 2) Before moving or transporting the instrument, please refer to the relevant instructions in "2.2.7 Transportation" of this section.
- 3) The inevitable use of substances (e.g. nickel) in the production process of the instrument may cause allergy to personnel. If an operator of the instrument has allergic symptoms (e.g. rash, frequent sneezing, ophthalmia or dyspnea) during the operations, please seek medical care in time to find out the reason and solve the symptoms.
- 4) Please refer to the relevant instructions in "2.2.8 Waste Disposal/Environmental Protection" of this section before disassembling this instrument for disposal.
- 5) RF instruments will generate high electromagnetic radiation, during which period, pregnant women and operators with cardiac pacemakers need special protection. If the radiation level is high, corresponding measures may be taken to remove the radiation sources to prevent personal injury.
- 6) In case of fire, the damaged instrument will release toxic substances. Therefore, the operators should wear appropriate protective equipment (e.g. protective masks and exposure suits) for safety.
- 7) Laser products shall have different warning signs according to the laser category, because the radiation characteristics of laser and such equipment have high-intensity electromagnetic power characteristics, which will cause harm to human body. If the product is integrated with other laser products (e.g. CD/DVD driver), it will not provide other functions except the

settings and functions described in the product manual in order to prevent the injury of the laser beam to the human body.

- 8) Electromagnetic compatibility level (in accordance with EN 55011/CISPR 11, EN 55022/CISPR 22 and EN 55032/CISPR 32 standards)

Class A equipment:

The equipment can be used except in residential areas and low-voltage power supply environment.

Note: Class A equipment is suitable for industrial operation environment, because it produces wireless communication disturbance in residential areas. Therefore, operators need to take relevant measures to reduce the impact of such disturbance.

Class B equipment:

Equipment need suitable for residential areas and low-voltage power supply environment.

2.2.5 Maintenance

- 1) Only authorized and specially trained operators are allowed to open the casing of the instrument. Before such operations, it is required to disconnect the power cord to prevent damage to the instrument or even personal injury.
- 2) The repair, replacement and maintenance of the instrument should be performed by dedicated electronic engineers of the manufacturer, and the parts subject to replacement and maintenance should receive safety tests to ensure safe use of the product in the future.

2.2.6 Batteries or Power Modules

Before using batteries and power modules, carefully read the relevant information to avoid explosion, fire and even personal injury. In some cases, disused alkaline batteries (e.g. lithium batteries) shall be disposed of in accordance with EN 62133 standard. Precautions for use of batteries include the following:

- 1) Do not damage the battery.
- 2) Do not expose batteries and power modules to heat sources such as open fire; avoid direct sunlight and keep them clean and dry; clean the connection port of the battery or power module with a clean and dry soft cotton cloth.
- 3) Do not short circuit the battery or power module. Do not store multiple batteries or power modules in cartons or drawers because the batteries are likely to cause short circuit due to being in contact with each other or other conductors; do not remove the original outer packaging of the battery and power module before use.
- 4) Batteries and power modules must not be subjected to mechanical impact.
- 5) If the battery fluid leaks, please do not touch the skin and eyes, otherwise wash it with a large amount of water and get medical treatment in time.

Overview

- 6) Please use the manufacturer's original batteries and power modules. Any incorrect replacement and charging of alkaline batteries (such as lithium batteries) is likely to cause an explosion.
- 7) Discarded batteries and power modules shall be recycled and disposed of separately from other wastes. Due to the toxic substances inside the battery, they shall be properly discarded or recycled according to local regulations.

2.2.7 Transportation

- 1) If the instrument is heavy, please handle it with care. If necessary, use tools (a crane, for instance) to move the instrument so as to prevent damaging the body.
- 2) The handle of the instrument is suitable for personal handling of the instrument and cannot be fixed on the transportation equipment when during the transportation of the instrument. In order to prevent property loss and personal injury, please follow the manufacturer's safety regulations on the transportation of the instrument.
- 3) When operating the instrument on the vehicle, the driver should drive carefully to ensure transportation safety, and the manufacturer is not responsible for any emergencies during the transportation. Therefore, please do not use this instrument during the transportation, and reinforcement and preventive measures should be taken to ensure the transportation safety of the product.

2.2.8 Waste Disposal/Environmental Protection

- 1) Do not dispose of devices marked with batteries or accumulators together with unclassified waste; Instead, such devices should be collected separately and disposed of in a suitable collection location or through the customer service center of the manufacturer.
- 2) Do not dispose of waste electronic devices together with unclassified waste; Instead, such devices should be collected separately. The manufacturer has the right and responsibility to help end users dispose of waste products. If necessary, please contact the customer service center of the manufacturer for corresponding disposal so as not to damage the environment.
- 3) During mechanical or thermal processing of the product or its internal components, toxic substances (dust of heavy metals, such as lead, beryllium, and nickel, etc.) may be released. Therefore, specially trained technicians with relevant experience are required to disassemble the product to avoid personal injury.
- 4) During the reprocessing, please refer to the safety operation rules recommended by the manufacturer to dispose of toxic substances or fuel released from the product with specific methods to avoid causing personal injury.

3 Operation Guide

This chapter introduces the pre-operation precautions, front/back panel browsing, basic measurement methods, and data file management of the 4957B RF analyzer. so that users can have a preliminary understanding of the instrument itself and its measurement processes. This section contains some contents consistent with the relevant sections in Quick Start.

- [Get prepared.....](#) 13
- [Front panel and interface description.....](#) 31

3.1 Get Prepared

Necessary preparatory work shall be carried out before the 4957B RF analyzer is ready for use.

- [Preparations before operation.....](#) 13
- [System configuration.....](#) 24
- [Routine maintenance](#) 29

3.1.1 Preparations before Operation

This section introduces the precautions before first setting and use of the 4957B RF analyzer.

Warning

Avoid damaging the instrument

Pay attention to the follow to avoid electric shock, fire and personal injury:

Do not open the cabinet arbitrarily.

Do not try to disassemble or refit any part of the instrument not mentioned in the manual. Otherwise, such consequences as reduced electromagnetic shielding property and internal component damage can occur, affecting product reliability. In this case, we will not provide any free maintenance any more even if the product is still in the warranty period.

Please carefully read the relevant contents in "[2.2 Safe Operation Guide](#)" of this manual and the safety precautions therein for operation. Also please pay attention to the requirements for specific operating environment mentioned in the data page.

Notice

Pay attention to the following when operating the instrument:

Improper operating or measuring position can damage the instrument or the one connected to it.

Pay attention to the following before powering on the instrument:

In order to ensure that the fan blades and heat radiation holes are unobstructed, the instrument shall be at least 10cm away from the wall, and ensure that all fan vents are unobstructed.

Keep the instrument dry;

Keep the instrument level, and arrange it properly;

Make sure the environment temperature meets with the requirement noted in the data page;

Make sure the port input signal amplitude is within the range specified;

Make sure the signal output port is connected properly, without any overload.

Notice

Electrostatic protection

Take electrostatic protection measures at workplaces to avoid any damage caused by the instrument. For details, please refer to the relevant contents in "2.2 Safe Operation Guide" of the manual.

Tips

Effect of electromagnetic interference (EMI)

Since EMI can affect the measurement result, pay attention to the following:

Select appropriate shield cables. For example, to use the double-shielded RF/network connection cable;

Please close any cable connection port that is enabled but temporarily unused or connect a matching load to the connection port in time;

Please refer to the EMC level labels in the Data Page.

- Unpacking..... 14
- Environmental requirements..... 15
- Turning on/off the power..... 16
- Proper operation of connectors..... 20
- User inspection..... 23

3.1.1.1 Unpacking

1) Visual examination

Step 1. Check whether the outer package and the shockproof packing of the instrument are damaged. If there is any damage, keep the outer package for standby, and proceed the inspection as per the steps below.

Step 2. Unpack the instrument and check the instrument and enclosed items for any damage;

Step 3. Carefully check whether the above items for any mistakes according to Table 3.1;

Step 4. In case of any outer package damage, or damage or problem to the instrument or articles provide in the package, never power the instrument on or start it up! Please contact our service consultation center according to the service hotline provided on the cover, and we will repair or change it as soon as possible accordingly.

Notice

Handling: As the instrument is a valuable item, it shall be handled with care during handling.

2) Model confirmation

Table 3.1 Packing List of 4957B

Name	Quantity	Function
Mainframe:		
4957B		
Standard Configuration:		
3-core power cord		
Power Adapter		
CD-ROM (User's Manual)		
Quick Start Guide		
USB cable		
Built-in rechargeable li-ion battery		
Packing list		
Product Certificate of Conformity		
Options:		
USB Power Meter	1	Power measurement via external USB power probe

3.1.1.2 Environmental Requirements

In order to ensure the service life of 4957B and the validity and accuracy of measurement, please carry out the tests under the following environmental conditions:

1) Operating environment

The operating environment should meet the following requirements:

Table 3.2 Operating Environment Requirements of 4957B

Temperature	-10°C ~ 50°C, 0°C ~ 45°C (battery powered)
Temperature range during error adjustment	23°C ±5°C (allowable temperature deviation during error adjustment < 1 ° C)
Humidity	Hygrometer measurement range at <+29°C: 20% ~ 80% (non-condensed)
Elevation	0 ~ 4600 meters (0 ~ 15091 feet)
Vibration	Max. 0.21 G, 5 Hz ~ 500 Hz

Notice

Above environmental requirements are only applicable to the operating environment factors of the instrument, and are not with the scope of technical indicators.

 **Warning**

Since the storage temperature range of the battery equipped with the instrument is $-20^{\circ}\text{C}\sim 60^{\circ}\text{C}$, the instrument should not work continuously for a long time when it is equipped with the battery at high temperature, so as to avoid danger caused by too high internal temperature. It is recommended to use an adapter for power supply.

2) Heat dissipation requirements

In order to ensure that the working environment temperature of the instrument is within the temperature range required by the operating environment, the following heat dissipation space requirements of the instrument shall be met:

Table 3.3 4957B Heat Dissipation Requirements

Instrument part	Heat dissipation distance
Back	$\geq 180\text{mm}$
Left and right sides	$\geq 60\text{mm}$

3) Electrostatic protection

Static electricity is extremely destructive to electronic components and equipment. Usually we take two anti-static measures: conductive table mat and wrist strap; conductive floor mat and ankle strap. Using the above two anti-static measurements at the same time can provide good antistatic protection. If using one of them, only the former can provide antistatic protection. $1\text{M}\Omega$ earth isolation resistor must be provided for the antistatic components at least for ensuring user safety. Correctly take the following antistatic measures to techniques to reduce electrostatic damages:

Ensure all instruments are grounded properly, so as to avoid any static electricity;

Let the internal/external conductor of the cable contact the ground shortly before connecting the coaxial cable with the instrument;

Operators must wear anti-static wrist straps or take other antistatic measures before touching the joints, core or conducting any assembly.

 **Warning**

Voltage range

The above-mentioned anti-static measures cannot be applied when the voltage exceeds 500V.

3.1.1.3 Turning On/Off the power

1) Precautions before turning on the power

Pay attention to the following when turning on the power of the instrument:

a) Confirming power supply parameters

The 4957B RF analyzer is provided with the three-core power cord meeting the international

safety standard. During use, connect the instrument to a suitable power outlet with protective earthing, so as to connect the housing of the instrument to the ground via the power cord. It is recommended to use the power cord provided together with the instrument, and replace it with the same type of 250V/10A power cord if required. 4957B can be powered in three ways:

AC power supply supplies power with an adapter

When adopting AC power supply, the enclosed AC-DC adapter must be used. The input to the adapter is 220V/50Hz AC.

To avoid overheating, please do not connect the AC-DC adapter to the analyzer when transporting or carrying it with a backpack. The voltage input range of the AC-DC adapter is wide. Please ensure that the power supply voltage is within the range required in Table 3.4.

Table 3.4 shows the external power supply requirement for normal operation of the signal generator.

Table 3.4 Working power parameter requirements of 1443

Power supply parameter	Applications			
	220V ± 10%, 50 ~ 60Hz		110V ± 10%, 50 ~ 60Hz	
Voltage, frequency	220V ± 10%, 50 ~ 60Hz		110V ± 10%, 50 ~ 60Hz	
Rated output current	>1.7A		>1.7A	
Power consumption (startup)	Basic configurations	All configurations	Basic configurations	All configurations
	<30W	<50W	<30W	<50W
Power consumption (standby)	<20W		<20W	

Tips

Prevent mutual interference of power supplies

To prevent mutual interference among multiple devices through power supplies, especially spike interference caused by high-power devices which may cause damage to instrument hardware, it is recommended to use a 220V or 110V AC stabilized power supply when using AC power supply to supply power with an adapter.

DC power supply

Voltage: 15V

Current: 3A (min.)

Built-in battery power supply

4957B can be powered by rechargeable li-ion batteries. If the battery is left unused for a long time, it will be discharged by itself, so it must be charged before being used again. See Section III for details of battery usage. The basic parameters of the enclosed battery are as follows:

Notice

Rechargeable batteries should not be exposed to fire and high temperature (higher than 70°C), thrown into fresh water or salt water or wetted, and should be kept away from children.

Rechargeable batteries can be reused and should be placed in suitable containers to avoid short-circuit. Heavy metals such as nickel and chromium in batteries will pollute the natural environment. Waste batteries should not be discarded casually, but should be put into a special battery recovery bins.

b) Confirming and connecting the power cord

The 4957B RF analyzer adopts three-core power cord interfaces, which conform to national safety standards. Before turning on the power of the RF analyzer, it is necessary to confirm **reliable grounding of the ground wire** in the RF analyzer, either floating ground or poor grounding may cause damage to the instrument and even cause injury to operators. Using a power cord without protective grounding is strictly prohibited. When the instrument is connected to a suitable power outlet, the power cord connects the housing of the instrument to the ground. The rated voltage value of the power cord should be greater than or equal to 250V, and the rated current should be greater than or equal to 1.7A.

When connecting the instrument to the power supply:

Step 1. Confirm that the working power cord is not damaged;

Step 2. Connect the power plug of the rear panel of the instrument to a well-grounded three-core power socket with the power cord.

Warning

Grounding

Poor or wrong grounding may cause damage of the instrument or personal injury. Before turning on the power of the spectrum analyzer, make sure that the ground wire is in good contact with the ground wire of the power supply.

Please use a power outlet with grounding protection. Do not use any external cable, power line or autotransformer without any protective grounding as the protective grounding line. If an auto-transformer is necessary, it is required to connect the common terminal to the protective grounding of the power connector.

c) Battery installation and replacement

The 4957B RF analyzer is provided with a high-capacity rechargeable lithium battery, with a cruising power of about 3h. Users can buy backup batteries for long-time out-field test, so as to avoid any test interruption due to insufficient battery capacity. It is recommended to buy a battery of the same model as the enclosed battery.

Notice

In order to ensure the battery life, the battery should be taken out of the battery compartment during transportation and long-term storage. Try not to make the battery power reduce to less than 5%, otherwise the battery may not be recharged.

Battery installation and replacement

The battery installation steps are as follows:

Open the battery cover, put the battery into the battery cartridge, push the battery in, and close the battery cover.

Checking the battery status

The 4957B RF analyzer is provided with a battery, and its full battery power can achieve a standby time of about 2.5h.

Users can view the battery status in any of the following ways:

The first way is to check the battery icon on the system status bar and roughly check the battery power. When the battery icon shows 15% battery power, please change the battery or charge it in time;

The second way is to remove the battery and press the button at the white point at the end of the battery, and the indicator lights above the button will go on to indicate the current remaining battery power. When only one indicator light is on, please charge the battery in time.

Charging the battery

Notice

The power indicator light is located inside the yellow power on button.

The battery can be charged when the 4957B RF analyzer is turned off or working. The charging steps are as follows:

- Step 1.** First install the battery to be charged in the machine.
- Step 2.** Use the AC-DC adapter provided alongside to turn on the external power supply.
- Step 3.** In case of charging in the power-off state, the power indicator light in the lower left corner of the front panel of the machine is yellow and flashing, indicating that the battery is being charged, and the indicator light is normally yellow after charging. In case of charging in the power-on state, the power indicator is green and flashing, indicating that the battery is being charged, and the indicator light is normally green after charging. At this time, the battery icon on the right side of the system status bar of the instrument display screen will show fully charged state.

In addition, for batteries with a battery power of more than 5%, the charging time in the power-off state is about 4h.

2) Power-on for the first time

Precautions for turning on/off the power of the instrument are as follows:

a) Connecting the power supply



Please confirm the power supply parameters and the power cord before power-on for the first time. For details, please refer to the Section [“3.1.1.3 Turning on/off the power”](#) in the user’s manual.

- Step 1.** Connecting the power cord: Connect the AC-DC adapter with the power cord matched with the RF analyzer in the packing box or the three-core power cord meeting the requirements, connect the adapter with the external power interface of the RF analyzer (as shown in Figure 3.1), and connect the other end of the power cord with the AC power

supply meeting the requirements; observe that the power indicator light on the front panel turns yellow (as shown in Figure 3.2).

Step 2. Turn on the power switch of the front panel: As shown in Figure 3.2, do not connect any equipment to the RF analyzer. If everything is normal, the instrument can be turned on, and then the power indicator light on the front panel will turn green.

b) Turning on/off the power

Gently press the yellow power switch key  on the front panel for more than 3s, observe that the front panel power indicator light turns green, and the display backlight goes on. You need to wait for about 30s for the display startup until the startup status interface is displayed. After warming-up for 10min, there shall be no alarm indication in the display interface. Press the yellow power switch key  at the lower left corner of the front panel of the 4957B RF analyzer for about 3s, and the RF analyzer will exit the measurement application program automatically and power off.

Note: If the LED "flashes", it indicates that the internal battery is not fully charged and is being charged.

c) Disconnecting the power supply

In case of emergency, in order to avoid personal injury, the RF analyzer shall be powered off immediately. At this time, you need to unplug the power cord and remove the battery. Therefore, reserve sufficient operating space when operating the instrument to facilitate direct shutdown and battery removal when necessary.

3.1.1.4 Proper operation of Connectors

Connectors are often used in various tests of signal generators. Although the connectors of calibration pieces, test cables and analyzer measuring ports are designed and manufactured according to the highest standards, the service life of all these connectors is still limited. Due to the inevitable wear and tear during normal use, the performance indicators of the connectors will decrease or even be unable to meet the measurement requirements. Therefore, correct maintenance and measurement connection of the connectors can not only ensure accurate and repeatable measurement results, but also prolong the service life of the connectors and reduce the measurement costs. In actual use, the following aspects should be paid attention to:

1) Connector check

When conducting connector inspection, anti-static wrist band should be worn. It is recommended to use a magnifier to check the following items:

- a) Whether the electroplated surface is worn or not and whether there are deep scratches;
- b) Whether the thread is deformed;
- c) Whether there are metal particles on the threads and the joint plane of the connector;
- d) Whether the inner conductor is bent or broken;
- e) Whether the screw sleeve of the connector rotates improperly.

⚠ Caution

Check the connector to prevent damaging ports of the instrument

Any damaged connector may damage the good connector connected to it even when measuring the connection for the first time. In order to protect each interface of the signal generator itself, the connector must be checked before connector operation.

2) Connection method

Before the connection, the connectors should be inspected and cleaned to ensure cleanness and intactness. Anti-static wrist straps should be worn before connection. The correct connection method and steps are as follows:

Step1. As shown in Figure 3.4, align the axes of the two interconnecting devices to ensure that the pin of the male connector slides concentrically into the socket of the female connector.



Figure 3.4 Axes of interconnected devices are in a straight line

Step2. As shown in Figure 3.5, move the two connectors leveled together so that they can be smoothly engaged. Rotate the screw sleeve of the connector (note, not the rotating connector itself) until it is tightened, and there can be no relative rotational movement between the connectors during the connection.

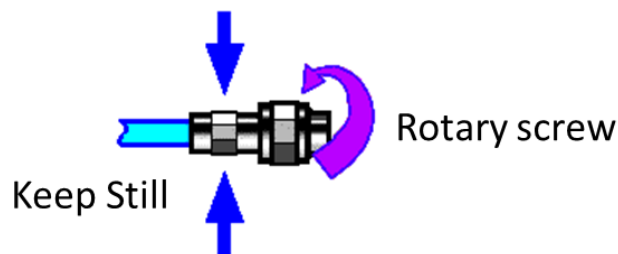


Figure 3.5 Connection method

Step3. As shown in Figure 3.6, tighten the connectors with a torque wrench to complete the connection. Pay attention that the torque wrench should not exceed the initial folding point. Use an auxiliary wrench to prevent the connector from rotating.

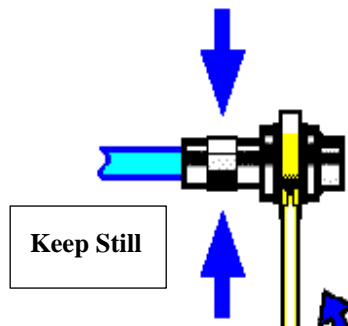


Figure 3.6 Finishing the connection with a torque wrench

3) Disconnection method

Step1. Support the connectors to prevent any connector from being twisted, shaken or bent;

Step2. An open-ended wrench can be used to prevent the connector body from rotating;

Step3. Loosen the screw sleeve of the connector with another wrench;

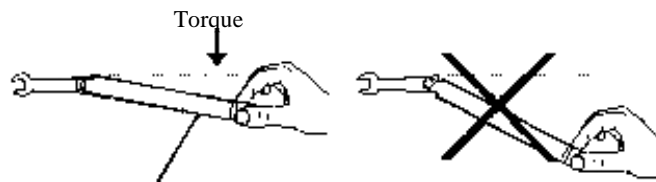
Step4. Rotate the screw sleeve of the connector by hand to complete the disconnection;

Step5. Pull the two connectors levelly apart.

4) Usage of a torque wrench

The use of a torque wrench is shown in Figure 3.7. The following points should be paid attention to when using it:

- Confirm that the torque of the torque wrench is correct set before use;
- Ensure that the angle between the torque wrench and another wrench (used to support a connector or a cable) is within 90° before applying force;
- Grasp the end of the torque wrench handle gently, and apply force in the direction perpendicular to the handle until reaching the folding point of the wrench.



Stop applying force when the

Figure 3.7. Usage of a torque wrench

5) Use and storage of connectors

- The connectors should be covered by protective sleeves when not in use;
- Do not mix various connectors, air lines and standard calibration pieces in a box because this is one of the most common causes of connector damage.
- Keep the connectors and the analyzer at the same temperature. Holding a connector by hand or cleaning a connector with compressed air will significantly change its temperature. The connectors should be calibrated after its temperature is stable.
- Do not touch the joint plane of the connectors because the grease and dust particles on the skin are difficult to be removed from the joint plane;
- Do not put the contact surface of a connector downward on a hard table surface. Contact with any hard surface may damage the electroplated layer and the joint surface of the connector.
- Always wear anti-static wrist straps and work on a grounded conductive workbench pad, which can protect the analyzer and the connectors from electrostatic discharge.

6) Connector cleaning

When cleaning the connectors, always wear antistatic wrist straps and observe the following steps:

- Remove loose particles on the thread and joint plane of the connectors with clean low-pressure air, and thoroughly inspect the connectors. If further cleaning treatment is required, proceed as follows:
- Soak (but not thoroughly soak) a lint-free cotton swab with isopropyl alcohol;

- c) Remove the dirt and debris from the joint plane and threads of the connectors with cotton swabs. When cleaning the inner surface of a connector, be careful not to apply external force to the central inner conductor and not to leave the fibers of cotton swabs on the central conductor of the connector.
- d) Let the alcohol volatilize, then blow the surface clean with compressed air;
- e) Check the connector to make sure that it is free of particles and residues;
- f) If any defects of the connector is still obvious after cleaning, it indicates that the connector may have been damaged and should not be used again. Make clear the cause of the connector damage before connection.

7) Use of adapters

When the measuring port of the RF analyzer and the connector type used are different, adapters must be used for the connection before measurement. In addition, even if the measuring port of the analyzer and the connector type of port of the tested piece are the same, it is also advisable to use adapters. Both cases can protect the measuring port, prolong its service life and reduce the maintenance cost. Before connecting an adapter to the measuring port of an analyzer, it is required to carefully check and clean the adapter. And a high-quality adapter should be used to reduce the influence of mismatching on measurement accuracy.

8) Joint plane of connectors

An important concept in microwave measurement is reference plane. And an analyzer, it is the benchmark reference plane for all measurements. During the calibration, the reference plane is defined as the plane where the measuring port and the calibration standard are engaged. Good connection and calibration depend on thorough and level contact between the connectors on the joint plane.

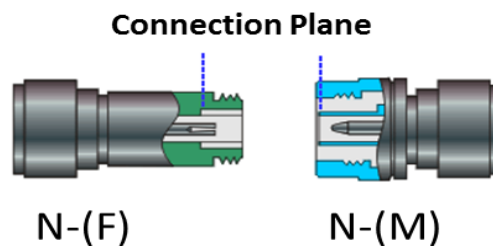


Figure 3.8 Plane calibration

3.1.1.5 User Inspection

After the 4957B RF analyzer is powered on for the first time, it is necessary to check whether the instrument works normally to ensure subsequent measuring operations.

Tip


Description of front panel hard keys and soft keys on menus

The description form of the front panel hard keys and menu soft keys is as follows:

Operation Guide

- 1) Description form of hard keys: **【XXX】** , XXX is the name of the hard key;
- 2) Description form of soft keys: [XXX], XXX is the name of the soft key.

If the key corresponds to multiple states, an state with the font color of the selected value changed and the background color darkened is valid. For example: [Sweep Time **Man** Auto] indicates that the sweep time manual option is enabled.

Connect the 4957B RF analyzer to the power supply or power it with a battery, and observe that the power indicator light on the front panel is yellow, indicating that the standby power supply is working normally. Gently press the yellow power switch key  on the front panel for more than 3s, observe that the front panel power indicator light turns green, and the display backlight goes on. You need to wait for about 30s for the display startup until the startup status interface is displayed.

After warming-up for 10min, there shall be no alarm indication in the display interface.

The 4957B instrument is provided with a self test function, which can test the working status and internal environment temperature of each component in the RF analyzer and provide test information after the self test program is activated.

Follow the step below to conduct the self test:

- a) Press [System]→[Self Test] to enable the self test program. The test result window will pop up after the self test;
- b) Click **【OK】** to close the self test result window.

3.1.2 System configuration

This chapter introduces the 4957B RF analyzer, including version serial number, self test, sleep mode, automatic shutdown, display mode and brightness, GPS function, system language, time and date, network configuration, factory debugging and reference settings, as well as the menus and menu description of the system settings.

3.1.2.1 Viewing version serial number

Each 4957B is provided with a unique and fixed serial number and internal software version information, which is set by the manufacturer upon delivery, cannot be changed the user, and can be viewed by the following steps:

- a) Press [System]→[Version Information] to pop up the instrument serial number window, display such version information as the product model, serial number, application program and firmware program.
- b) Click **【OK】** to close the window.

3.1.2.2 Self Test

The 4957B instrument is provided with a self test function, which can test the working status and internal environment temperature of each component in the RF analyzer and provide test information after the self test program is activated.

Follow the step below to conduct the self test:

- a) Press [System]→[Self Test] to enable the self test program. The test result window will pop up after the self test;
- b) Click **【OK】** to close the self test result window.

3.1.2.3 Setting sleep mode

The 4957B RF analyzer is provided with the power saving mode (including the auto sleep mode and auto shutdown mode), so as to prolong the operating time when the power is supplied via the battery. If no operations are conducted in the sleep time set with the auto sleep mode enabled, the RF analyzer will enter the sleep status, including such operations as closing the LED display and cutting off internal module power supply. Press any key to let the RF analyzer exit from the sleep mode and switch to the normal operation mode.

- a) Press [System]→[Power Saver], which is disabled in the sleep mode.
- b) Click [Sleep Off] to enable the sleep mode.
- c) Enter the sleep time to be set via the number key, and press the time unit to confirm.

3.1.2.4 Setting auto shutdown

When the auto shutdown mode is on, the instrument starts to time it, and shuts down automatically when the time set for auto shutdown is reached. The instrument will pop up a countdown prompt 10 s before entering the shutdown status and user cancel such shutdown process as per the prompt. Press [System]→[Power Saver] to enter the setting menu, and the auto shutdown function is disabled by default.

- a) Press the softkey to switch to [Shut Down/Off], and enable the auto shutdown mode to show current shutdown time.
- b) Enter the shutdown time to be set via the number key, and press the time unit to confirm.

3.1.2.5 Display mode and brightness adjustment

The RF analyzer is provided with three screen display modes to facilitate user's test in different conditions, namely, the outdoor, night and normal modes. Users can also adjust the screen brightness from five manual brightness adjustment levels as required.

- a) Press [System]→[Display] to enter the display mode and brightness adjustment menu.
- b) Switch current display mode as per corresponding modes.
- c) Press [Brightness Auto / Man] to switch to the brightness adjustment mode. If in the manual mode, the brightness adjustment dialog box will pop up. Drag the scroll bar or use the rotary knob or up/down key to set the brightness.

3.1.2.6 GPS function

The 4957B instrument is provided with the GPS function for viewing such information as the receiver status, number of satellites in use, latitude and longitude hemispheres, longitude and latitude hemispheres, altitude and UTC date/time.

- a) Press **【System】** →[Positioning System GPS] to open the GPS function menu.
- b) Press [GPS Off/On] to switch the GPS status, and enable the GPS function.
- c) Press [GPS Info] to view detailed GPS information.

3.1.2.7 System language selection

- a) Press [System]→[Language] to enter the language selection interface of the system.
- b) Press [Simplified Chinese] or [English] to set current interface operation language.

3.1.2.8 Setting date and time

- a) Press [System]→[Configuration]→[Date&Time] to pop up the date setting dialog box.
- b) Click corresponding zone in the calendar area to set the date.
- c) Click corresponding zone in the time area to enter numerical value for time setting.
- d) Press **【OK】** to complete the setting and close the dialog box.

3.1.2.9 Network setting

It is used to set the RF analyzer network, with specific steps shown below:

- a) Press [System]→[Configuration]→[Network Setting] to pop up the network configuration dialog box.
- b) Click corresponding zone to enter numerical value for setting.
- c) Press **【OK】** to complete the setting and close the dialog box.

3.1.2.10 Factory debugging

The 4957B RF analyzer is provided with a program entry for factory debugging.

- a) Press [System]→[Manage] to pop up the “Enter Password” dialog box, and enter the factory debugging menu after that.

Notice

This function can be used only for factory debugging, and users cannot try to crack the password. Otherwise, the RF analyzer can be damaged.

3.1.2.11 Setting frequency reference

The 4957B RF analyzer is provided with both the internal frequency reference and external one. The external reference frequency must be 10MHz±100Hz and amplitude of 0dBm (limit range: -2dBm~+10dBm). The external reference frequency must be entered from the “10MHz input/output” port on the cover plate.

- a) Press [System]→[Page Down] to set the frequency reference, which is the internal frequency reference by default.
- b) The 4957B RF analyzer can also output the internal reference as follows:
Press [Ref Output Off On] to enable or disable the reference output function.

3.1.2.12 Setting reference output

4957B can provide external device with a reference output of 10MHz via also the “10MHz input/output” port on the cover plate, with the steps shown below:

- a) Press [System]→[Page Down] to set the frequency reference, the reference output function disabled by default.
- b) Press [Ref Output Off/On] again to enable or disable the reference output function.

3.1.2.13 System menu structure



3.1.2.14 System menu description

System	<p>-[Measurement mode]: Press 【system】→[Measurement Mode] to select such measurement modes as spectrum analysis, interference analysis, analog demodulation analysis, interference analysis, demodulation analysis, channel sweep, field strength measurement, directional analysis and signal analysis.</p> <p>-[Special Notes]: The measurement mode menu exists only in spectrum analysis mode, but not in other modes.</p> <p>-[Version Information]: Press 【System】→[Version Information] to view the system related information, including machine serial number, application software version, image customization version and other related information.</p> <p>-[Self-test]: Press 【System】→[Self Test] to check the operating status of each component in the RF analyzer and the internal environment temperature.</p> <p>-[Display]: Press 【System】→[Display] to set the display mode, including [Default Mode], [Outdoor Mode], [Night Vision Mode] and relevant settings of [Brightness Adjustment].</p> <p>-[Positioning System]: Press 【System】→[Positioning System] to pop up the soft menus related to the positioning system, including [GPS Off On], [Details], [Cold Start], [Time Synchronization Off On], [Gaussian Coordinates Off On], [Positioning System], which are used to select the positioning system and view the position details, as well as start the resetting. Special Notes: The positioning system function is an optional function.</p> <p>-[Language]: Press 【System】→[Language] to select the language, including [Simplified Chinese] and [English].</p> <p>-[Configuration]: Press 【System】→[Configuration] to pop up the soft menus related to the system configuration. [Date&Time] is used for date and time setting, and [Network Setting] is used for network setting of the RF analyzer, including such soft menus as [Previous], [Next], [IP Setting], [Mask Setting] and [Gateway Setting].</p>
Measure Mode >	
VER Info	
Self Test	
Display >	
GNSS GPS >	
Language>	
Config >	
More 1 of 2 >	

System	<p>• [Freq Ref Int/Ext]: Press 【System】 → [Frequency Reference Internal External] to select internal frequency reference or external frequency reference as needed.</p> <p>• [Ref Output Off/On]: Press 【System】 → [Ref Output Off On] to select whether to turn on the internal reference function as needed when the frequency reference is the internal reference.</p> <p>• [Fan Auto On/Off]: Press 【System】 → [Fan Auto On Off] to set the fan status, which is automatic by default.</p> <p>• [Power Saver]: Press 【System】 → [Power Saving Mode] to set the options of automatic sleep and automatic shutdown.</p> <p>• [Error Log]: Press 【System】 → [Error Log] to view the relevant error messages.</p> <p>• [About]: Press 【System】 → [About] to see the software version of the instrument, the Company's telephone number, E-mail, website and other information.</p> <p>• [Manage]: Press 【System】 → [Manage] to enter the administrator password for the relevant management and setting of the system.</p> <p>• [Special Notes]: The system management function can be used only by the factory debugging personnel or technical supporting personnel rather than users. Otherwise, the instrument can be damaged.</p>
Freq Ref Int Ext	
Ref Out Off On	
Fan Auto On Off	
Error Log >	
About	
Admin	
More 2 of 2 >	

3.1.3 Routine Maintenance

This section introduces the routine maintenance of the 1443 series vector signal generators.

3.1.3.1 Cleaning

1) Cleaning instrument surface

Please follow the steps below when cleaning the surface of the instrument:

- Step 1. Shut down the instrument and disconnect the power cord connected to it;
- Step 2. Wipe the surface gently with dry or slightly wet soft cloth, and do not wipe the inside of the instrument.
- Step 3. Do not use chemical cleaners, such as alcohol, acetone or dilutable cleaners.

2) Cleaning the display

After a period of use, the LCD display needs to be cleaned. Please follow the steps below:

- Step 1. Shut down the instrument and disconnect the power cord connected to it;
- Step 2. Dip a piece of clean and soft cotton cloth into the cleaner and then gently wipe the display panel;
- Step 3. Dry the display with a piece of clean and soft cotton cloth;
- Step 4. Connect the power cord only after the cleaner is completely dried.

There is an antistatic coating on the surface of the display. Do not use cleaners containing fluoride, acid and alkaline. Do not spray the cleaner directly onto the display panel, otherwise it may penetrate into the instrument and damage the instrument.

3.1.3.2 Input/output port protection

The standard impedance of the RF port of the 4957B RF analyzer is 50Ω , so the test signal shall be added or appropriate load impedance shall be connected in strict accordance with the port requirements to prevent damages to the post circuit.

 **Warning**

There is a maximum allowable input level at the RF input end of the RF analyzer, and it is strictly prohibited to inject a signal beyond the limit, otherwise it will cause damages to the instrument.

3.2 Front panel and interface description

This chapter introduces the front panel and interface description and functions of the 4957B RF analyzer.

3.2.1 Front Panel

The front panel of the 4957B RF analyzer is shown in Figure 3-5.

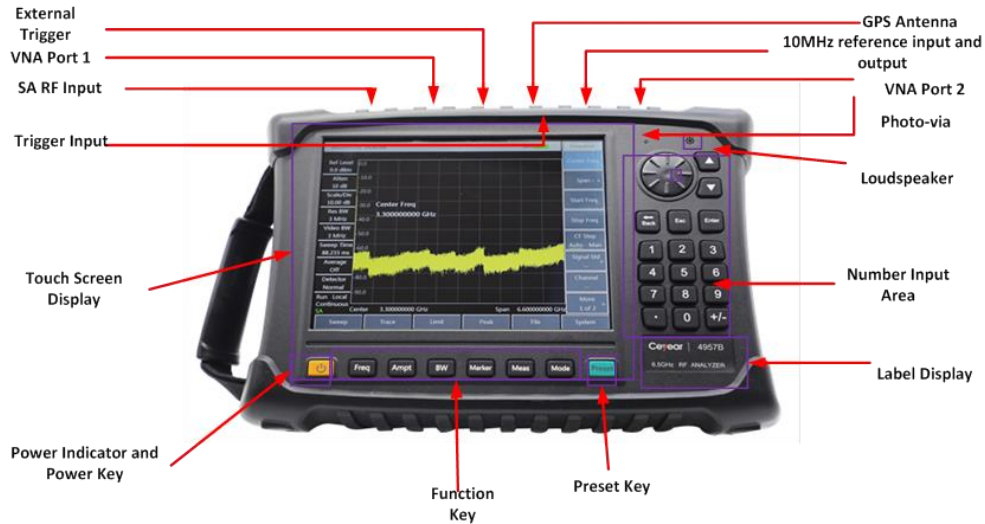


Figure 3-5 Front panels

Notice

In this manual, for primary menus, the keys on the front panel and the buttons on the bottom of the touch screen are represented by **【XXX】**, with XXX being the key name, and the menu keys on the right are represented by [XXX], with XXX being the menu name.

3.2.1.1 Display zone

The 4957B RF analyzer has an 8.4" color touch screen. The parameter setting of the instrument and the display of a large amount of information can be realized at the touch of a finger, which saves the cumbersome steps of setting the soft and hard key menus and greatly simplifies the user's operation.

When the instrument performs different functions, the display zone has the following display functions: Display multiple instrument windows, and display various settings and measurement data information of the instrument in the window; display the working status information of the instrument; display the current input data when such parameters as frequency are to be input; display the current working time of the system; display the menu information corresponding to the current effective operation of the instrument window; the specific introduction is as shown in Figure 3-6:

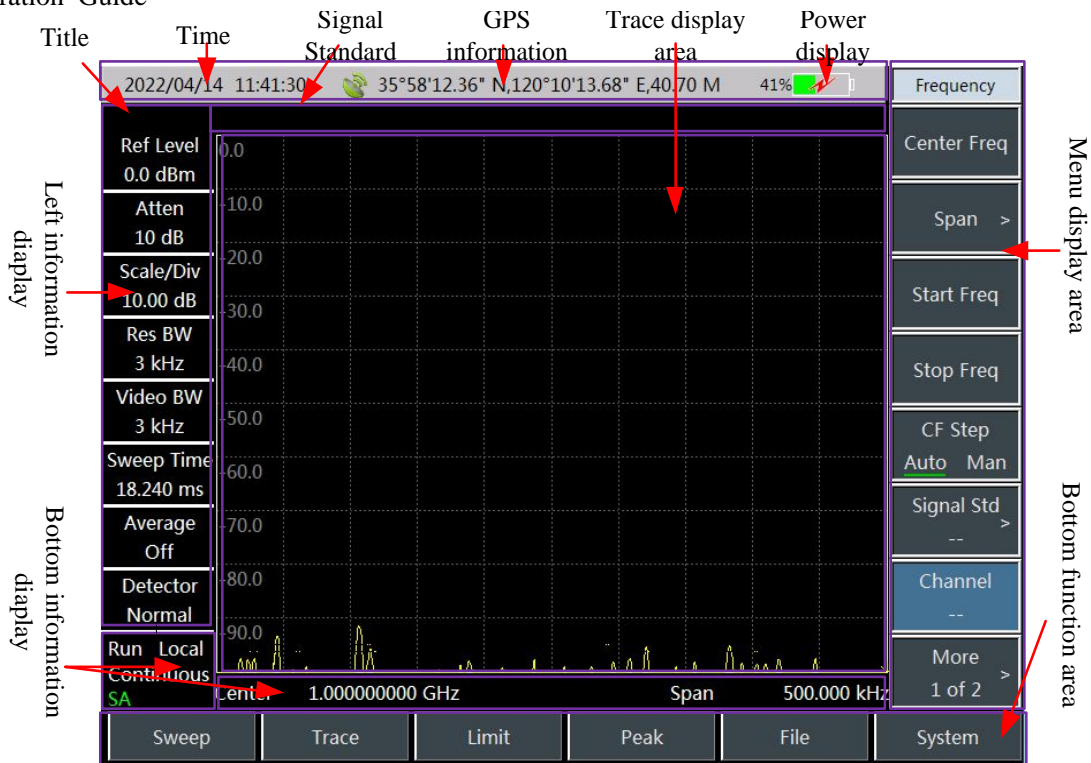


Figure 3-6 Display Zone

The information display zone under the screen display zone of the 4957B RF analyzer displays various settings for current measurement and instrument status, which can be divided into 5 zones as per the position on the screen, namely, the top information display zone, measurement data display zone, left information display zone, soft key menu display zone and bottom function button zone.

1) Top information display zone

The top information display zone is on top of the screen to display such information as the system date, time, current power supply type and battery power and GPS status of the RF analyzer from left to right in sequence.

Setting and change of system date and time: Set through **【System】** →[Date&Time].

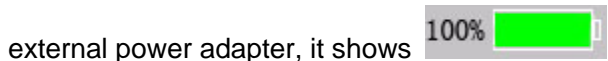
Change of date format: Set through **【System】** →[Date Format].

The signs of the power supply type and battery status indicator on the right of the top information display zone vary with the situation that whether there is external power supply or the battery power. Signs corresponding to various power supply statuses of the RF analyzer are shown below:

- a) If the RF analyzer is not provided with a battery and adopts an external power supply, it shows





- b) When the RF analyzer is provided with a fully charged battery and isn't connected with an



- c) When the battery is fully charged and the external power adapter is connected, it shows



. As the battery power decreases gradually due to use, the green zone of the battery power display will gradually decrease;

- d) When the analyzer is provided with a battery and is connected with an external power adapter, when the battery power is less than 100%, the battery is in the charging state, and the charging icon is ;
- e) When the RF analyzer is not connected to an external power supply and the battery power is less than 20%, the battery is in the undervoltage state and it shows .

When such an icon appears, please charge the battery in time. When the battery power is less than 10%, the RF analyzer can run for another 10min. Please save the measurement results in time because it will be shut down automatically after the power is used up.

2) Measurement data display zone

The measurement data display area can display the measurement data. The contents displayed vary with the measurement mode. The trace is displayed in coordinate grid in the vector network analysis and antenna test modes. Scale values and mark information are displayed in the left and upper right of the grid respectively. Measurement parameters are displayed on top of the grid, and the start/stop frequencies displayed at the bottom. The trace is displayed in coordinate grid in the spectrum analysis mode. The left side of the grid displays the scale values, the top shows the signal standard and marker information, and the bottom shows the center frequency and span information.

3) Left information display zone

This information area is located at the upper left of the screen. In the vector network analysis mode, it displays such information as start frequency, stop frequency, sweep time, sweep points and intermediate frequency bandwidth of the current measurement; in the spectrum analysis mode, it displays such information as reference level, attenuator setting, display scale, resolution bandwidth, video bandwidth and sweep time of the current measurement, each of which can be set through the corresponding function key; in the antenna feeder test mode, it displays such information as start frequency, stop frequency, sweep time, sweep points, intermediate frequency bandwidth of the current measurement; in the vector voltage measurement mode, it displays such information as current measurement type (reflection by default), measurement port (port 1 by default) and measurement format (dB by default); in the USB power measurement mode, it displays such information as zeroing, frequency, offset and relative measurement. You can quickly set the corresponding parameters by clicking these buttons on the touch screen. The contents displayed vary with the measurement mode.

4) Soft key menu display zone

In order to improve the operation flexibility of the 4957B RF analyzer and give full play to the advantages of the touch screen, the 4957B resident software is provided with eight gray touch keys on the right side, and the corresponding functions of these eight keys are directly displayed in the corresponding key zones.

5) Bottom function button zone

The function hardkeys on the main menu zone and the front panel are at the same level. For specific measurement mode, the main menu generally consists of a set of unique menu keys for supplementing the function hardkeys. It can display different menu names in different measurement modes to facilitate users to carry out the measurement.

3.2.1.2 Numeric input zone

The numeric input zone includes direction keys, knob, numeric keys, backspace key, cancel key and OK key. All inputs can be changed through keys and the knob in the input zone. The keys in

the input zone are described in detail below.

- a) **Direction keys:** The up/down key is used to increase or decrease the value, where there are no left and right keys, and the step value of the up/down key corresponds to the step of each parameter.
- b) **Knob:** It is used to increase or decrease the value. Turn the knob clockwise to increase the variable and vice versa. The knob can change the value together with the up/down key, and the step of the knob is the same as that of the up/down key.
- c) **Numeric keys:** They are used to enter numbers (including the negative sign).
- d) **Backspace key:** It can undo the last input data bit by bit according to the numeric input status.
- e) **Cancel key:** It cancels the currently input data that is not valid.
- f) **OK key:** It confirms the current parameter setting.

3.2.1.3 Function key zone

The function key zone is located at the bottom of the screen, and is used to change the measurement parameter setting, including six keys:

- a) **【Freq】** : Set the center frequency, start/stop frequency, span and frequency step for measurement in the vector network analysis mode and spectrum analysis mode;
- b) **【Amplitude】** : Set such parameters as the auto scale, reference level, reference position, scale and output power in the vector network analysis mode. Set the reference level, attenuator setting, scale display, unit and preamplifier control in the spectrum analysis mode;
- c) **【BW】** : Set such parameters as the average, smooth and intermediate frequency bandwidth in the vector network analysis mode. Set such parameters as measurement RBW, VBW, detector type and average in the spectrum analysis mode;
- d) **【Mkr】** : Set the specific parameters of the measurement marker in the vector network analysis mode and spectrum analysis mode;
- e) **【Measure】** : Select the required S-parameter measurement mode, data format and time domain in the vector network analysis mode. In the Spectrum Analysis mode, it is used to select different measurement functions, including field strength measurement, channel power, OBW, AM/FM DM, ACPR, etc. or set signal source power output.
- f) **【Mode】** : Set the working mode, including spectrum analysis, vector network analysis, cable and antenna feeder test, USB power measurement, vector voltmeter, etc.

3.2.1.4 Reset key

Press the **【Reset】** hard key system to perform the function of shutdown and power-on again.

3.2.1.5 Power switch

It is used for turning on and off the RF analyzer. If an external power adapter is used for power supply, when the instrument is in the "standby" state, the yellow indicator near the power switch is on; Press and hold the power switch for over 3 seconds, and the green indicator will be on, indicating that the instrument is in the "working" state. In the working state, press and hold the power switch for more than 3s to turn off the RF analyzer.

Note: If the LED "flashes", it indicates that the current battery is not fully charged and is being charged.

3.2.2 Interface description

The peripheral interfaces of the 4957B are mainly located on the top panel, as shown in Figure 3-7, which can be divided into three parts: power interface, test ports and digital interfaces.

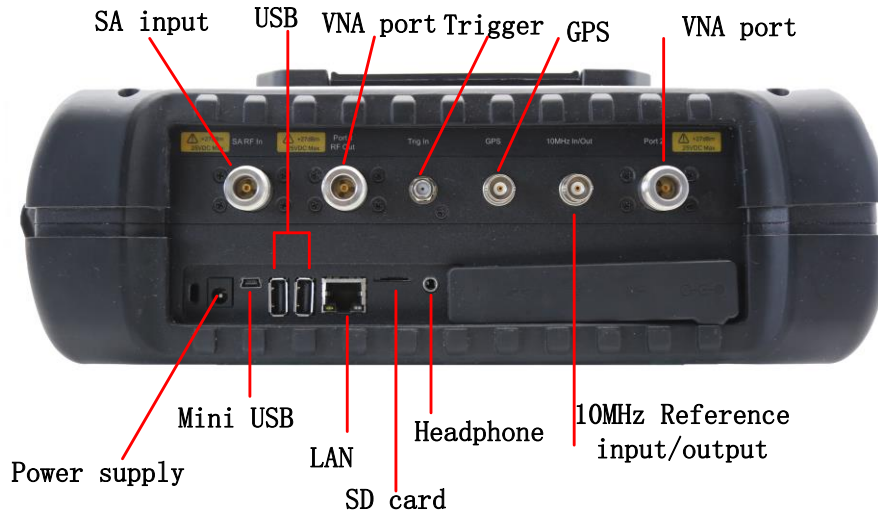


Figure 3-7 Interface Description

3.2.2.1 Power Interface

The power supply interface of the instrument can supply power to the RF analyzer through DC output of a AC-DC adapter or external DC power supply. The inner conductor of the external power interface is positive, and the outer conductor is grounded.

3.2.2.2 Test Ports

- a) Spectrum input port: It is marked as "SA RF In" and used for the input of the measured signal in the spectrum analysis mode. The test signal input port of the 4957B RF analyzer is a 50Ω and N-type female port.
- b) Network test port: The two test ports in the vector network analysis mode are two 50Ω and N-type female ports, which are marked with "Port 1" and "Port 2" respectively, and can be switched between the RF source and receiver, so as to measure the DUT in both directions.
- c) 10MHz input/output port: It is marked as "10MHz In/Out", 50Ω impedance, BNC female adapter, and can be externally connected with the 10MHz signal of other equipment as the reference signal of the analyzer; the internal 10MHz reference signal of the RF analyzer can also be output for use by the external equipment.
- d) Trigger input port: It is marked as "Trig In", and the 4957B can be set to the external trigger mode. The external trigger source is connected with the trigger input port of the RF analyzer, and the output range of the source shall be -5V~+5V. It can be set by the software whether to adopt the rising edge trigger or falling edge trigger.
- e) GPS antenna interface: It is marked as "GPS antenna" and connected with the GPS antenna equipment, and can locate the current position of the RF analyzer.



Warning

In order to better protect the RF analyzer, the test port of the instrument is provided with some symbols. When using the RF analyzer, users must pay attention to the symbols, so as to avoid permanent damages to the instrument.

3.2.2.3 Digital interfaces

- a) Mini USB interface: It is connected with the external PC, which carries out the program control of or data transmission to the 4957B through the program control instruction or program control function library.

Notice

Install a device driver first before connecting the RF analyzer to the PC via the USB for the first time.

- b) USB A interface: It is connected with the USB peripherals, e.g. USB storage device, USB power probe, etc.
- c) LAN (network) interface: It is a 10/100Mbps network interface and can be connected through the network cable with the computer (PC), which carries out the program control of or data transmission to the 4957B through the program control instruction or program control function library.
- d) SD card slot: Micro SD card slot, which can be used for expanding the storage space of the instrument.
- e) Earphone jack: It is a standard 3.5mm/3-line earphone port for outputting the sound modulated via FM/AM/SSB. If the port is not connected to the earphone, the sound is output via the speaker of the RF analyzer; when it is connected to the earphone, the sound output is switched from the speaker to the earphone automatically.

3.2.2.4 Instrument Symbols

The instrument symbol (warning label) shown in the figure indicates the maximum input power from the test port and the maximum input DC level. The maximum input power is +27dBm, and the maximum input DC level is ± 25 VDC. When using the instrument, do not connect a signal exceeding this range to the port, otherwise, the instrument may be burnt down!



4 Vector network analysis mode

4.1 Introduction to typical measurements

The vector network analysis mode (VNA) of the 4957B is the basic working mode of this product. This mode can measure the S parameters of the DUT and display them in such formats as return loss, standing wave ratio, polar coordinates and group delay, and it can also provide such functions as time domain measurement and gating.

After startup, press **【Mode】** to pop up a mode selection dialog box, select [Vector Network Analysis], and press [OK] to enter the vector network analysis mode after the progress bar is completed.

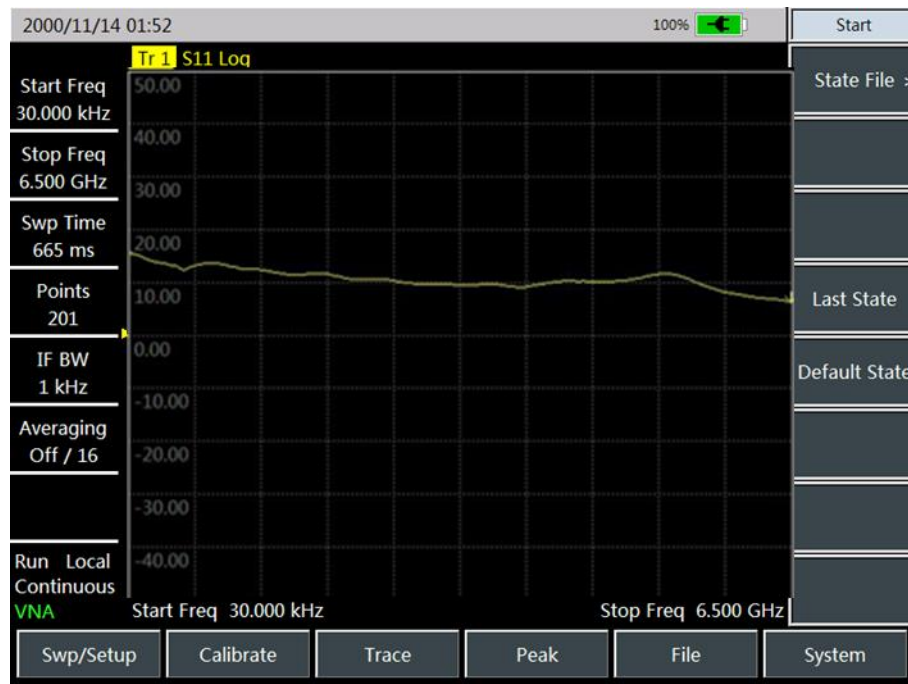


Figure 4-1 Main Interface of Vector Network Analysis Mode

Notice

All operations in this section are based on the premise of the selected vector network analysis mode, which will not be described separately later.

4.1.1 Selection of measurement parameters

The vector network analysis mode of the 4957B RF analyzer mainly measures the S parameters of the DUT, and you can press the **【Measure】** key to select the measurement parameters:

Press **【Measure】** → [S11] or [S12] or [S21] or [S22] to select different S parameters for measurement;

Press **【Measure】** → [Format>] to select different measurement parameters via the soft menu:

[Log], to select the measurement parameter and display it in the log format;

[Linear], to select the measurement parameter and display it in the linear format;

[VSWR], to select the measurement parameter and display it in the VSWR format;

[Phase], to select the measurement parameter and display it in the phase format;

[Smith>], to select the measurement parameter and display it in the Smith circle diagram format;

[Polar], to select the measurement parameter and display it in the polar format;

[Group Delay], to select the measurement parameter and display it in the group delay format;

Press **【Measure】** → [Transform] to enter the time domain transform setting menu, and press relevant menu key to set relevant parameters.

Press **【Measure】** → [Gating] to enter the gating function, and press relevant menu key to set relevant parameters.

Press **【Measure】** → [Advance>] to select the measurement parameters from A1, B1, R1, A2, B2 and R2.

4.1.2 Calibration

After the measurement parameter and frequency setting, the 4957B RF analyzer must be subject

Vector network analysis mode

to calibration first before measurement, so as to eliminate the system errors of the RF analyzer, and ensure the validity and correctness of the measurements. In case of any change in the instrument measurement setting (such as the frequency range and sweep points) or port extension cable added to the test port, recalibration is required.

Notice

Calibration is conducted for parameters rather than channels. When a parameter is selected, the instrument will check the calibration data used and use the data of such parameter. For example, when conducting B/R transmission response calibration and S11 single-port calibration on A/R at the same time, the instrument keeps on calibration and correction for the parameter displayed. Once a specific parameter or input is calibrated, such parameter measurement will be calibrated at any channel provided the incentive value is coupled. Parameter must be selected first before response and isolation calibration. Parameters will be selected automatically for other correction processes. In case of any channel change during calibration, the process executed will be invalid.

4.1.2.1 Error calibration types

The calibration types can be divided into five categories, as shown in Table 4-1, in which the full 2 ports calibration can eliminate reflection tracking error, transmission tracking error, directional error, source matching error and load matching error, ensure high-precision measurement and effectively eliminate all 12 correctable system errors.

Notice

Correction of all 12 system errors is not required in some measurements

Table 4-1 Error correction classification

Calibration Type	Corresponding measurement type	Error	Standard piece
Freq Resp.	Transmission or reflection measurement (with low accuracy requirement).	Freq Resp.	Transmission via thorough method via reflection via the open or short device
Response and isolation	Measure the transmission of the high insertion loss device or reflection of the high return loss	The transmission frequency response and isolation or reflection directivity.	With the standard isolation piece (load) added in addition to the standard piece used for response

	device. The measurement accuracy is lower than that of the single port or full 2 ports.		correction
S11 single port	Reflection measurement of any single-port piece or well-connected dual-port piece.	Directivity, source matching and frequency response	Open-circuit device, short device and load
S22 single port	Reflection measurement of any single-port piece or well-connected dual-port piece.	Directivity, source matching and frequency response	Open-circuit device, short device and load
Full 2 Ports	Transmission or reflection measurement of dual-port piece with higher accuracy.	Directivity, source matching, load matching, isolation, frequency response, and forward and reverse directions.	Open-circuit device, short device, load and circuit-closer (two loads adopted for isolation)

4.1.2.2 Standard calibration kit

Calibration kits are required in the calibration process. It is recommended to buy and use 20201 or 31101 series high-performance coaxial calibration kits developed by Ceyear Technologies Co., Ltd. The frequency range and port type of such series calibration kits are as shown in Table 4-2.

Table 4-2 Frequency range and port of such series calibration kits

Model	Frequency range	Port type
20201	DC~9GHz	N-type 50Ω
31101	DC~18GHz	N-type 50Ω

4.1.2.3 Frequency response error correction

The frequency response errors of reflection measurement and transmission measurement can be eliminated by calibration:

Vector network analysis mode

1) Frequency response error correction of reflection measurement

- a) Select the measurement type in the vector network analysis mode:
- b) To measure reflection at port 1 (forward, S11), keep the default settings of the RF analyzer.
- c) If reflection measurement is required at port 2 (reverse, S22), press [Measure] → [S22].
- d) Set other measurement parameters: Start frequency, stop frequency, output power, sweep points and intermediate frequency bandwidth.
- e) Press [Cal] to open the calibration menu.
- f) Press [Cal Kit] to select the correct calibration kit model through the soft menu, and press [OK].
- g) Press [M Cal>] → [Freq Resp>] → [OPEN S11>], and the system will automatically prompt "Connect OPEN in P1, then press corresp. menu button to start!", then connect the open circuit device to port 1.
- h) After the trace is stable, press [OPEN] to prompt "Calibrating standard piece measurement..." during standard piece measurement, and prompt "Press [Done] to complete the measurement!" after measurement and error factor calculation. And the software menu will be underlined to indicate that the project has been tested, such as [OPEN].
- i) Press [Done] to complete the error correction of reflection measurement, which allows for connection and measurement of the DUT.
- j) Similarly, repeat step e), select another frequency response error correction function, press [M Cal>] → [Freq Resp.>] → [SHORT S11>] or [OPEN S22>] or [SHORT S22>], and connect an open circuit or a short circuit device at the corresponding test port according to different prompts to perform steps f) g) .

Notice

Only one calibration kit is allowed to be measured in case of calibration. If a wrong calibration kit is selected, return to **[Cal] → **[M Cal]** → **[Freq Resp.]** and select the correct standard piece.**

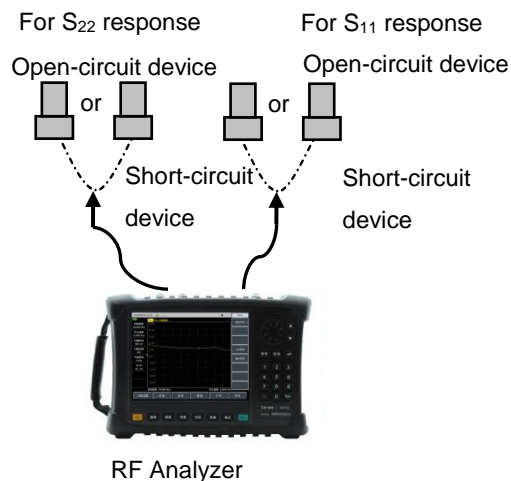


Figure 4-2 Calibration Kit Connection for Reflection Measurement Response

2) Response error correction of transmission measurement

- a) Select the measurement type in the vector network analysis mode:
- b) If transmission measurement is required in the positive direction (S21), press **[Measure]** → [S21].
- c) If transmission measurement is required in the reverse direction (S12), press **[Measure]** → [S12].
- k) Set other measurement parameters: Start frequency, stop frequency, output power, number

of sweeping points or IF bandwidth.

- d) Press [Cal] to open the calibration menu.
- e) Select the frequency response error correction function, Press [M Cal>] → [Freq Resp>] → [THRU S12>] or [THRU S21>], and the system will automatically prompt "Connect Thru cable between P1 and P2, then press corresp. menu button to start!" Then connect N-type cable between ports 1 and 2.

Notice

All adapters and cables to be used for device measurement shall be prepared, that is, to connect the standard device to the position for measurement.

- f) After the display trace is stable, press [THRU], the analyzer will display "Cal std measuring..." during the measurement of the standard piece, and after completing the measurement and calculating the error coefficient, the measured item will be underlined, e.g., [THRU], with the soft key [Done] displayed.
- g) Press [Done] to complete the transmission measurement error correction, and then connect the DUT for relevant measurements.

Notice

Do not use open circuit device or short circuit device standard pieces for transmission response correction.

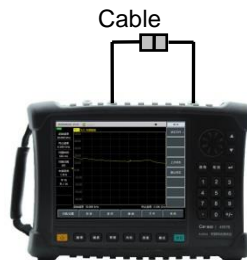


Figure 4-3 Calibration Kit Connection for Transmission Measurement Response

3) Error correction of transmission measurement response and isolation

- a) Select the measurement type in the vector network analysis mode:
- b) If transmission measurement is required in the positive direction (S21), press **【Measure】** → [S21].
- c) If transmission measurement is required in the reverse direction (S12), press **【Measure】** → [S12].
- d) Set other measurement parameters: Start frequency, stop frequency, output power, number of sweeping points or IF bandwidth.
- e) Open the calibration menu and press [Cal].
- f) Select the frequency response error correction function, press [M Cal>] → [Resp.& Iso S12] or [Resp.& Iso S21] to pop up a prompt automatically "Connect Thru cable between P1 and P2, then press corresp. menu button to start!", then perform cable connection at the point where you want to measure the DUT.

Notice

All adapters and cables to be used for device measurement shall be prepared, that is, to connect the standard device to the position for measurement.

- g) After the trace is stable, press [THRU] to prompt “Calibrating standard piece measurement...” during standard piece measurement, and show underline (for example, [THRU]) indicating item test completion after measurement and error factor calculation and prompt “Connect the load to P1 and P2, then press corresp. menu button to start!”. ”.
- h) then connect the impedance matching load to port 1 and port 2 of the analyzer.
- i) After the trace display is stable, press [ISO] to prompt “Calibrating standard piece measurement...” during standard piece measurement, and show underline (for example, [ISO]) indicating item test completion after measurement and error factor calculation and prompt “Press [Done] to complete the measurement!”. [Done] is displayed at the same time.
- j) Press [Done], the system will calculate the isolation error coefficient, and the RF analyzer will display the corrected data record line, indicating that the data of this channel is enabled.
- k) In this way, you complete the response and isolation correction of the transmission measurement, and then connect the DUT for relevant measurements.

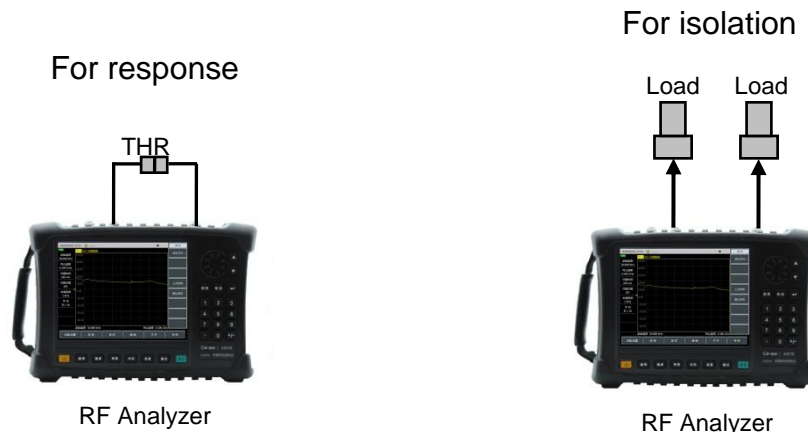


Figure 4-4 Calibration Kit Connection for Transmission Measurement Response and Isolation

4.1.2.4 One port reflection error correction

- a) Eliminate directional error during test component assembling
- b) Eliminate source matching error during test component assembling
- c) Eliminate frequency response during test component assembling
- d) Carry out single-port correction to the S11 or S22 measurement of the RF analyzer.
 - a) Select the measurement type in the vector network analysis mode:
To measure reflection at port 1 (forward, S11), keep the default settings of the RF analyzer. To measure reflection at port 2 (reverse, S22), press **【Meas】** →[S22].
 - b) Set other measurement parameters: Start frequency, stop frequency, output power, number of sweeping points or IF bandwidth.
 - c) Open the calibration menu, and press **【Calibrate】** .
【Cal】 →[Cal Kit], and press the corresponding soft key to select the correct calibration kit model. Press [Back] to return to **【Cal】** menu bar, press [M Cal>] and select the type to be corrected.
 - d) To measure reflection at port 1, press [S11 One Port].
 - e) To measure reflection at port 2, press [S22 One Port].
 - f) At port 1, the system will prompt automatically “Connect OPEN in P1, then press corresp.

menu button to start!" At this time, connect the standard connector of the open-circuit device to the port to be used as the test port (P1 for S11, and P2 for S22).

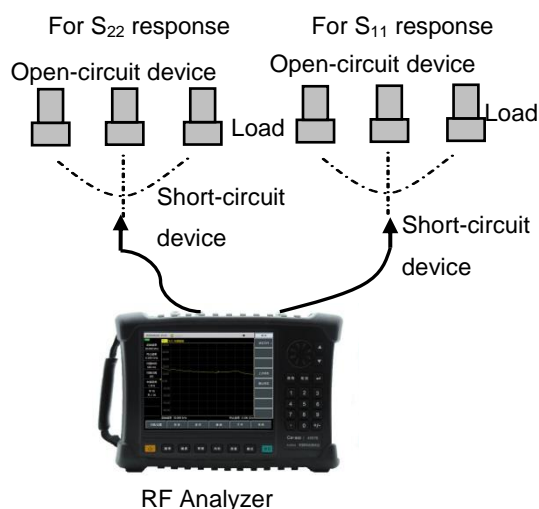
Notice

All adapters and cables to be used for device measurement shall be prepared, that is, to connect the standard device to the position for measurement.

- g) After the display trace is stable, to measure the standard piece, press [OPEN], the RF analyzer will display "Cal std measuring..." during the measurement of the standard piece, and after completing the measurement and calculating the error coefficient, it will display the prompt "Connect SHORT in P1, then press corresp. menu button to start!" And the software menu will be underlined to indicate that the project has been tested, such as [OPEN].
- h) To test the standard piece after the trace is stable, press [Short-circuit Device] to show "Measuring..." during standard piece measurement, and "P1 short-circuit device measurement is finished. Connect load at P1, and press 'Load'" after measurement and error factor calculation. Connect LOAD in P1, press 'LOAD'", and the software menu will be underlined to indicate that the project has been tested, such as [Short-circuit Device].
- i) Disconnect the short-circuit device, and connect the load to the test port.
- j) To test the standard piece after the trace is stable, press [SHORT] to show "Calibrating standard piece measurement..." during standard piece measurement, and "Connect LOAD in P1,, then press corresp. menu button to start!" after measurement and error factor calculation. And the software menu will be underlined to indicate that the project has been tested, such as [SHORT].
- k) After the trace is stable, press [LOAD] to prompt "Calibrating standard piece measurement..." during standard piece measurement, and prompt "Press [Done] to complete the measurement!" after measurement and error factor calculation. At this time, underline of the menu indicates the item is tested completely, for example, [LOAD].
- l) Record the error factor, and press [Done]to show the corrected data trace, indicating the correction is activated.
- m) That is to complete the single port calibration for reflected measurement. The DUT can be connected and measured at this time.

Notice

The open-circuit device, short-circuit device and load can be measured in any sequence regardless that mentioned here.



4.1.2.5 Full 2 ports error correction

Full 2 ports error correction allows for correction of 12 error terms such as positive and reverse directivity, source matching, load matching, frequency response and isolation, etc.

- Eliminate directional error during test component assembling in the forward and reverse directions
- Eliminate source matching error during test component assembling in the forward and reverse directions
- Eliminate load matching error during test component assembling in the forward and reverse directions
- Eliminate isolation error during test component assembling in the forward and reverse directions
- Remove the frequency response of the test component assembly in the forward and reverse directions

Notice

This is a relatively accurate error correction process. The instrument updates the measurement trace once via forward and reverse sweep, which takes more time compared with other correction process.

- a) Set other measurement parameters: Start frequency, stop frequency, output power, number of sweeping points or IF bandwidth.
- b) Open the calibration menu and press **【Calibrate】** .
- c) Press [Cal Kit], and press corresponding soft key to select the correct calibration kit model.
- d) Press [Back] and return to the **【Calibrate】** menu bar, press [M Cal] , select the type to be corrected, press [Full 2 Ports] , the system will prompt to “press [Reflect] to start the corresponding measurement! ”.
- e) To start reflection measurement, press [Reflect>] to prompt “Connect OPEN in P1, then press corresp. menu button to start!”. connect the open circuit device to test port 1 according to the diagram, and after the display trace is stable, press [P1 OPEN], the analyzer will display "Cal std measuring..." during the measurement of the standard piece, and after completing the measurement, it will display the prompt "Connect SHORT in P1, then press corresp. menu button to start!" And the software menu will be underlined to indicate that the project has been tested, such as [P1 OPEN].
- f) Disconnect the open-circuit device, and connect the short-circuit device to test port 1. After the display trace is stable, to measure the standard piece, press [P1 SHORT], the RF analyzer will display "calibration standard measurement ..." during the measurement of the standard piece, and after completing the measurement, it will display the prompt "Port 1 Short Measure Done. Connect LOAD in P1, press 'P1 LOAD'", and the software menu will be underlined to indicate that the project has been tested, such as [P1 SHORT].
- g) Disconnect the short-circuit device, connect the load to test port 1, and press [P1 LOAD] after the trace is stable to prompt “Calibrating standard piece measurement...” during standard piece measurement, and prompt “Connect the load to Port 1, then press corresp. menu button to start!” after measurement. At this time, underline of the menu indicates the item is tested completely, for example, [P1 LOAD].
- h) Disconnect the load from P1, connect the open-circuit device, short-circuit device and load to P2 as per the same standard method with P1 in sequence, and complete the measurement on such standard pieces as S22 OPEN, SHORT and LOAD.
- i) After reflection calibration on P1 and P2, the prompt “Press [Done] to complete the

- measurement.” Press [Done], and the system will calculate the reflection factor automatically.
- j) Return to previous menu for transmission calibration. Press [Tr>] to prompt “Connect Thru cable between P1 and P2, then press corresp. menu button to start!” connect test port 1 and test port 2 with cables. You can press [Auto Meas], and the system can automatically complete four transmission calibration tasks in turn, or press [Pos Match], [Pos Trans], [Rev Match] and [Rev Trans] in turn to complete each calibration task individually. When all four tasks are completed, the full 2 ports transmission calibration is completed.
 - k) Press [Back] to return to previous menu, and press [ISO] for isolation calibration.
 - l) For isolation measurement, press [ISO] to prompt “Connect LOADs in P1 and P2, then press corresp. menu button to start!”. Connect the load to test port 1 and test port 2 respectively, press [Auto Meas] to complete isolation calibration on the two items automatically in turn, or press [Pos Iso] and [Rev Iso] to complete each isolation calibration independently. Or you can press [Ignore Iso] directly to ignore isolation calibration.
 - m) Press [Done] to finish the full 2 ports calibration. After that, the prompt “Calibration Off/On” shows in the prompt zone. Connect with the DUT for measurement.

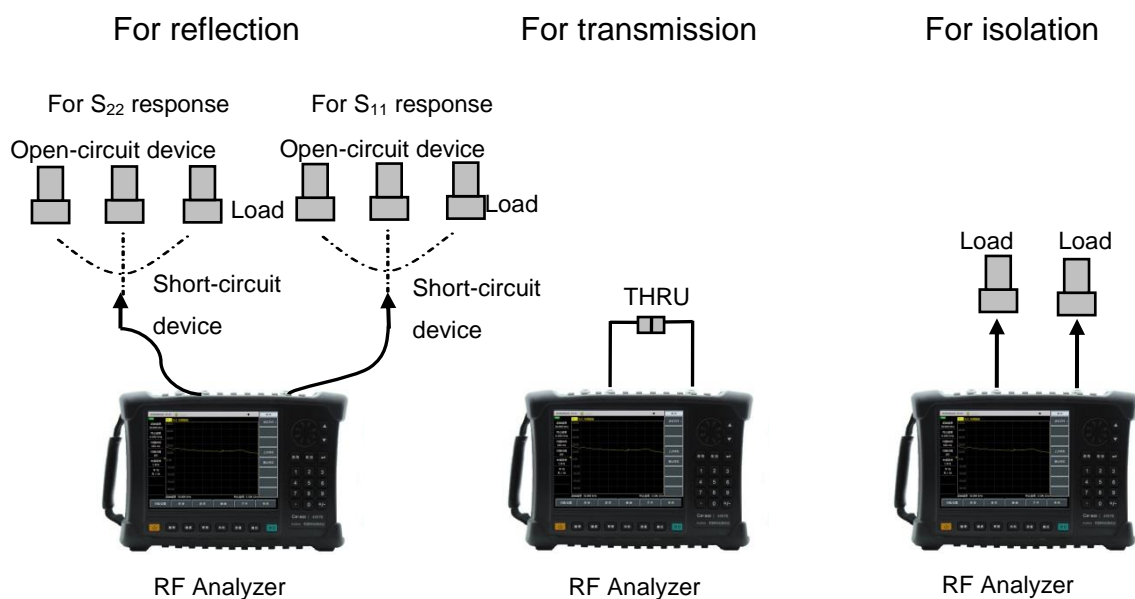


Figure 4-6 Standard piece correction for Full 2 ports error correction

4.1.3 Marker function

The 4957B RF analyzer is provided with up to eight markers to facilitate users to track the measurement results.

Select the currently displayed marker by pressing **【Mkr】**→[Sel Mkr]→[Mkr 1], [Mkr 2] ... [Mkr 6] or [More Mkrs>]→[Mkr 7], [Mkr 8].

Each marker has two operating modes, namely, normal and delta.

Press **【Mkr】**→[Max] or [Min] to let the RF analyzer search the max/min value of the measurement trace, and press **【Peak】** to search the marker peak value, including **【Mkr】**, [Sub Peak], [Right Peak] and [Left Peak]. You can also move the marker with the [↑] / [↓] keys and the roller, or position the marker by setting the standard answer according to the pop-up marker position and inputting the numerical value when pressing [Normal Mkr] and [Delta Mkr].

4.1.4 Storage and recalling function

The RF analyzer can save the setting status and measurement data to the internal memory, external USB or SD card, and recall the setting status and measurement data of the instrument from the internal memory, external USB or SD card. The specific operation is as follows:

Vector network analysis mode

Press **【File】** →[Storage State] to save the current instrument status in the memory;

Press **【File】** →[Recall State>]→[State File>], and a list of state files will pop up to display all state files saved in the memory. Select corresponding file for quick setting of the instrument. Press **【File】** →[Recall State>]→[Last State] or [Default State] to select the last setting state before starting or the default state of the system;

Press [File] → [Save Trace >] , press the menu item to select the corresponding trace storage format (trace, s1p data, s2p data, csv data), enter the file name in the pop-up dialog box, Press [OK] to save the current sweep track data into the memory;

Press [File]→[Recall Trace>] to pop up a data list showing all data files saved in the storage (trace format), and select relevant data file to recall the data from the data file to the memory for display and comparison.

Press [File]→[Print Screen] to save the display area on the screen into jpg file format. Edit and enter the name of the file to be saved, and press OK to complete the saving.

Press **【File】** →[File Mgmt] to perform file copy or file deletion.

Press [File] → [Location Int >] and select the storage medium as internal FLASH, external USB disk or SD card.

4.1.5 Measurement optimization

The dynamic range refers to the delta between the max. power and min. measurable power (noise base) that can be entered to the RF analyzer. To lower the measurement uncertainty, the dynamic range of the RF analyzer shall be larger than the response range of the DUT. The measurement accuracy can be improved effectively only when the signal under test is 10dB higher than the noise base. In order to increase the dynamic range of the RF analyzer, the following methods are usually used for measurement optimization:

4.1.5.1 Increasing the input power of the DUT

Increasing the DUT input power can help the analyzer to detect the output power of the DUT with higher accuracy. But note that too high input of the RF analyzer can cause compression distortion or even damage the receiver.

Press **【Amplitude】** →[Power High>] to adjust the output power.

Notice

Max. input level is marked on the panel of the RF analyzer, and the high output power of the RF analyzer can reach 0dBm at certain point. If the DUT has gains, use proper source power to prevent the input power from exceeding the max. input level.

4.1.5.2 Decreasing the receiver noise base

Random noise on the RF analyzer's receive path reduces measurement accuracy. "Sweep average" and "reducing intermediate frequency bandwidth" can be adopted to reduce trace noise, reduce noise base and obtain more accurate measurement results.

1) Sweep Average

Sweep average reduces the impact of random noise on the measurement, and the RF analyzer calculates each measurement value by averaging the same measurement point through multiple sweeps. The setting of the average factor determines the number of consecutive sweeps. The larger the average factor, the more effectively the effect of noise on the measurement can be reduced.

Trace averaging is applied to all measurement traces in the channel, and the channel that turns on the averaging function displays an average counter.

If the sweep average is turned on, the average counter shows the average number of sweeps that have been performed, helping to select the appropriate average factor by observing the change in the trace and average number of times that have been performed.

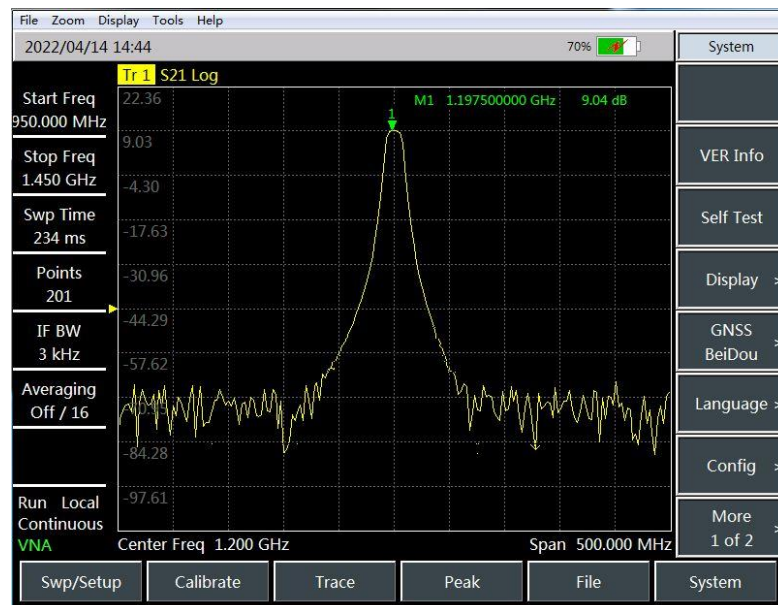
Sweeping average and reducing the IF bandwidth can reduce the noise. If you want to get very low noise, it is recommended to use the sweep average. In normal case, the sweep average is used to reduce the noise but the time required to reduce the IF bandwidth is longer, especially the average number of times is large.

Steps for setting sweep averaging are as follow.

Press [BW] → [Avg Off On] , enter the average number of times with the numeric keys.

2) Reduce IF bandwidth

The RF analyzer converts the received response signal to the intermediate frequency signal for processing. The bandwidth of the intermediate frequency band pass filter is called the intermediate frequency bandwidth, and the RF analyzer supports the variable bandwidth IF filter, wherein the intermediate frequency bandwidth is set from 100kHz to 1Hz and changes in steps of 1, 3 and 10. Reducing the IF bandwidth can lower the impact of the random noise on the measurements (reducing 10 times of the IF bandwidth can lower the noise base by 10dB), but it can prolong the sweep time. The effect of intermediate frequency bandwidth on measurements is shown in Figure 4-7:



Vector network analysis mode

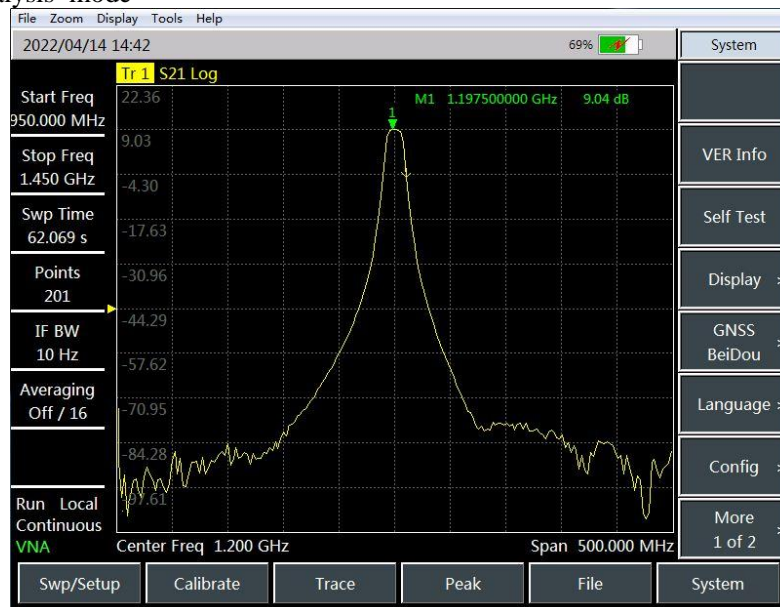


Figure 4-7 Effect of Intermediate Frequency Bandwidth on Measurement Results

Follow the steps below to set the IF bandwidth:

- Press **【BW】** → [IF Band] ;
- Press the [↑] [↓] key to move the marker bar to change the IF bandwidth value.

Notice

Sweeping average and reducing the IF bandwidth can reduce the noise. If you want to get very low noise, it is recommended to use the sweep average. In normal case, the sweep average is used to reduce the noise but the time required to reduce the IF bandwidth is longer, especially the average number of times is large.

4.2 Menu Structure

The vector network analysis mode mainly includes 10 groups of primary menus, i.e. "Frequency", "Amplitude", "Bandwidth", "Marker", "Measure", "Sweep", "Calibrate", "Trace", "Peak" and "File". The "System" menu refers to the system settings of the machine in the Basic Operations of Chapter III, and the other menu structures are as follows:

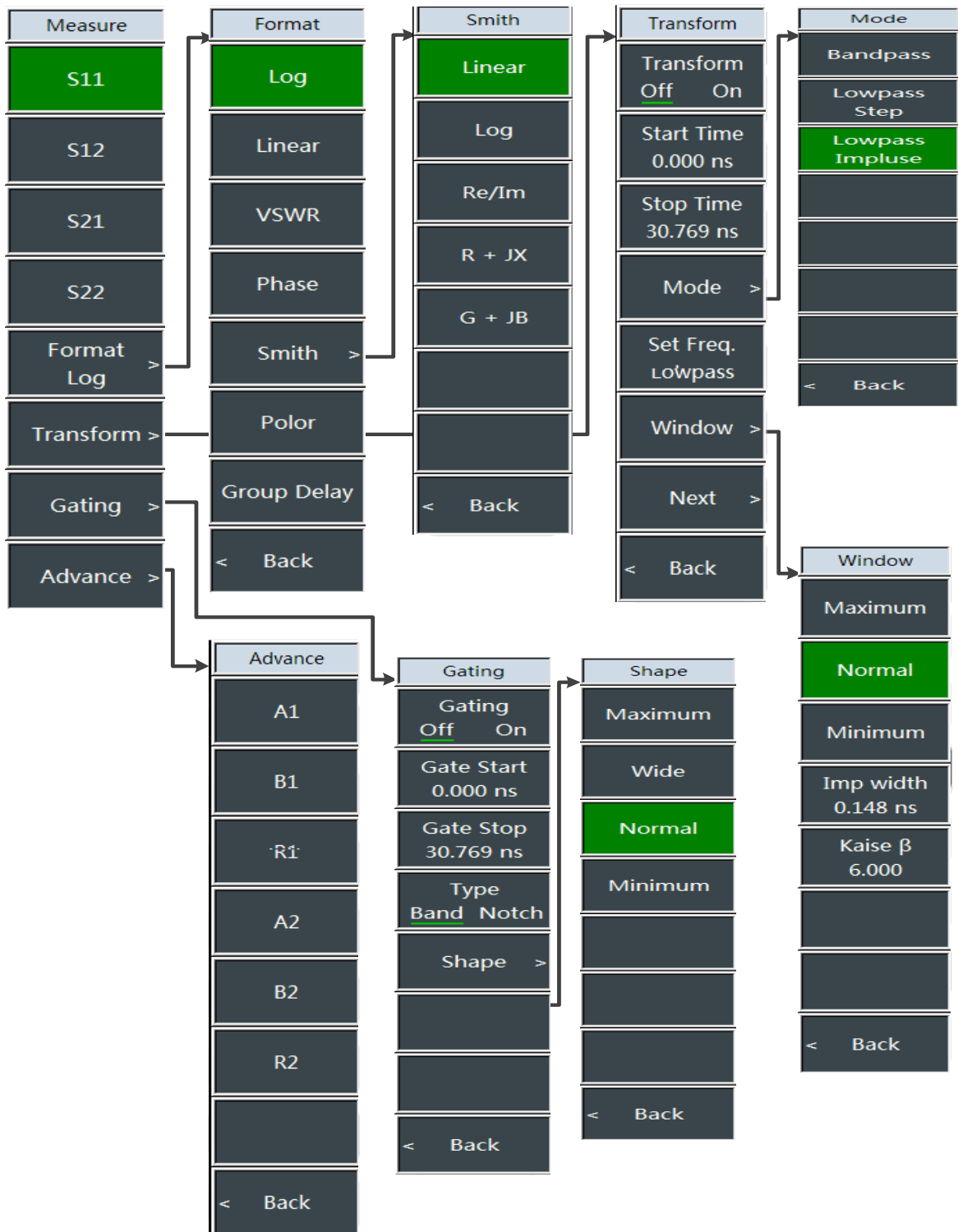


Figure 4-8 Structure of Measure Menu

Vector network analysis mode

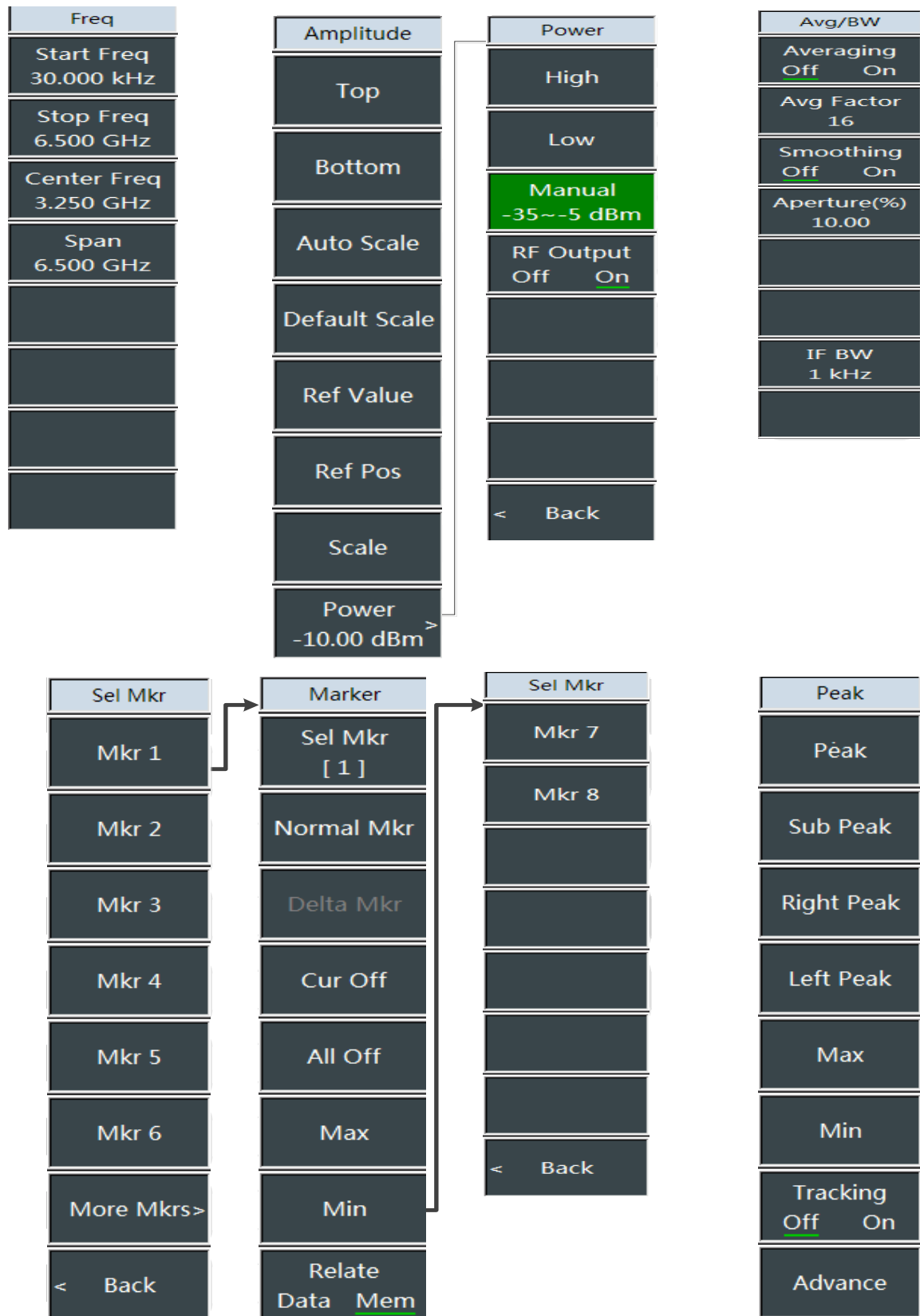


Figure 4-9 Structure of Frequency, Amplitude, Bandwidth, Marker and Peak Menus

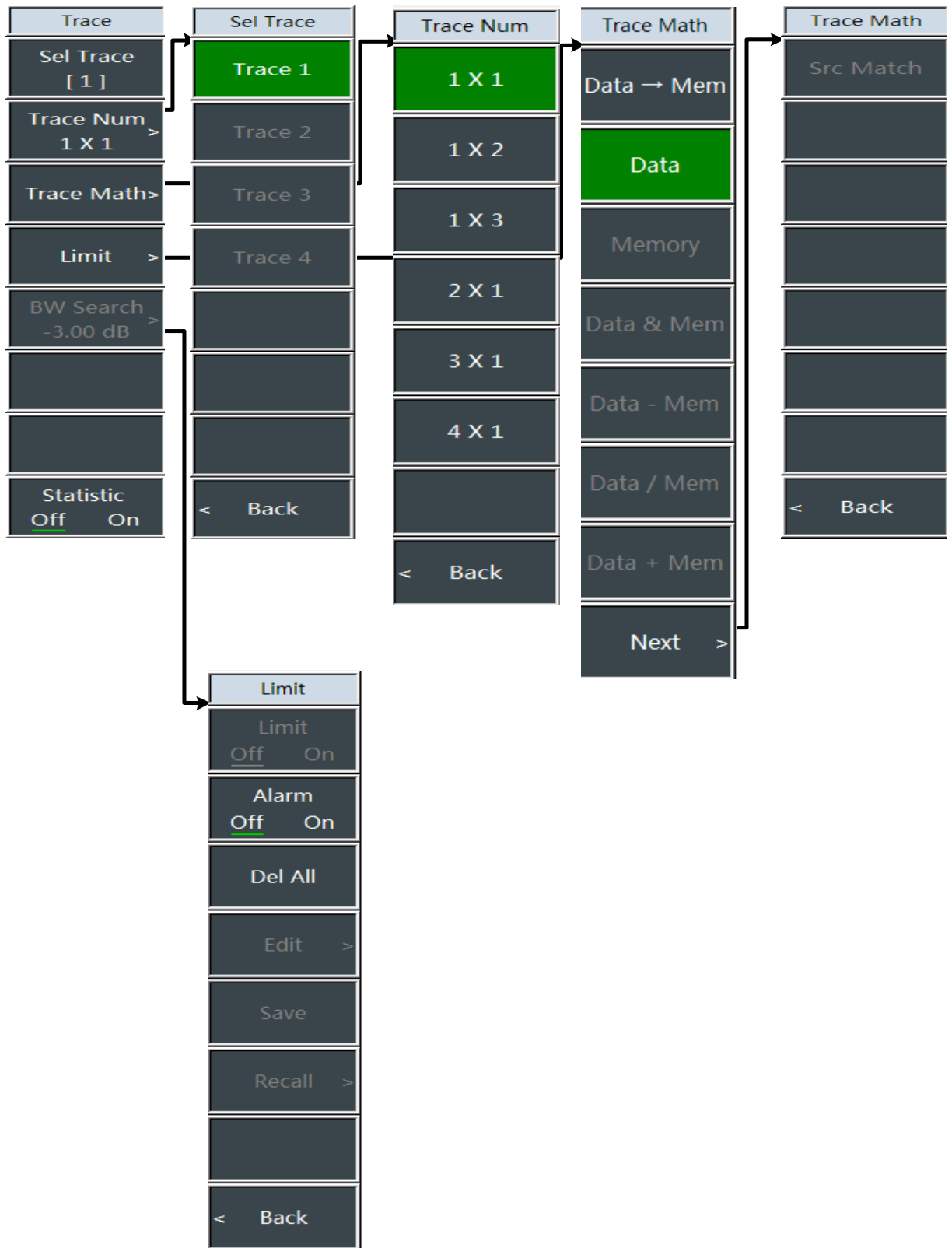


Figure 4-10 Structure of Trace Menu

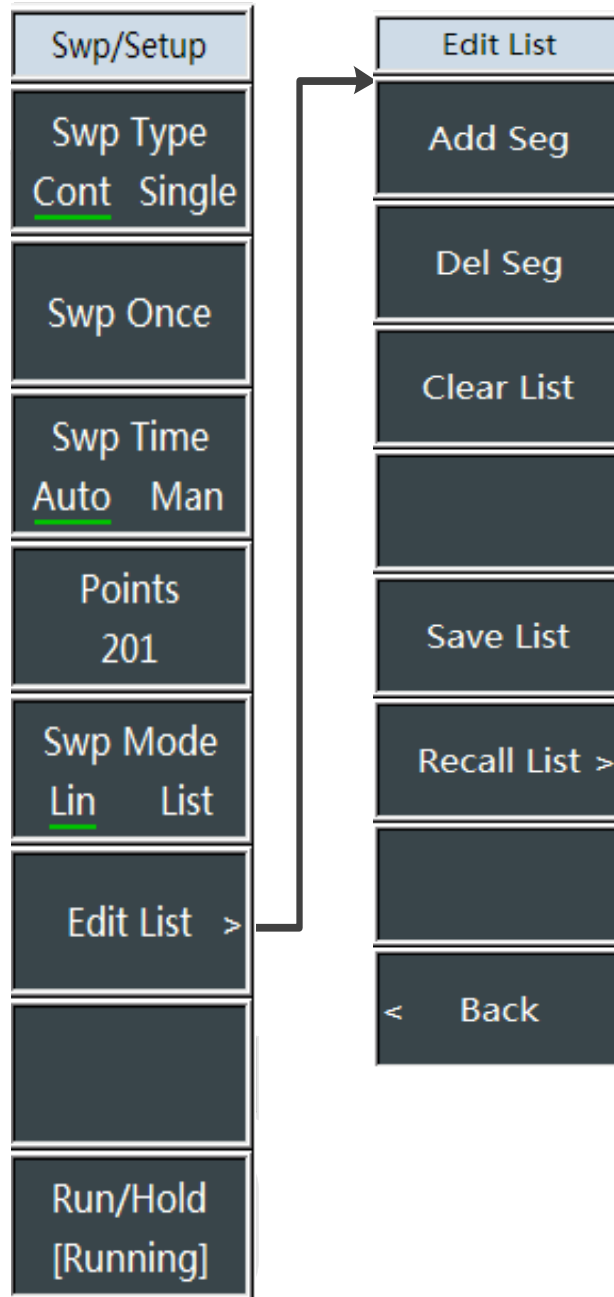


Figure 4-11 Structure of Sweep Menu

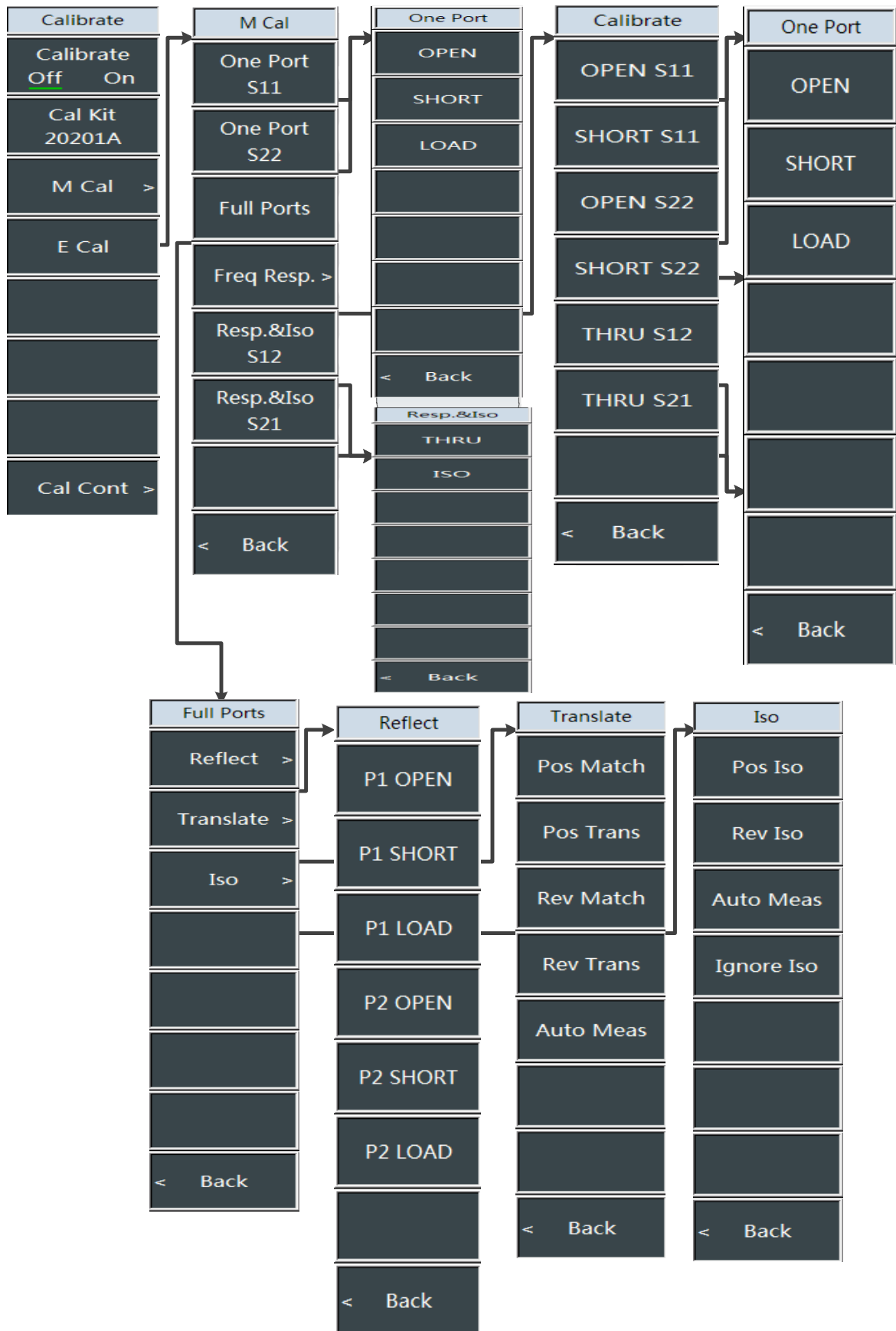


Figure 4-12 Structure of Calibrate Menu

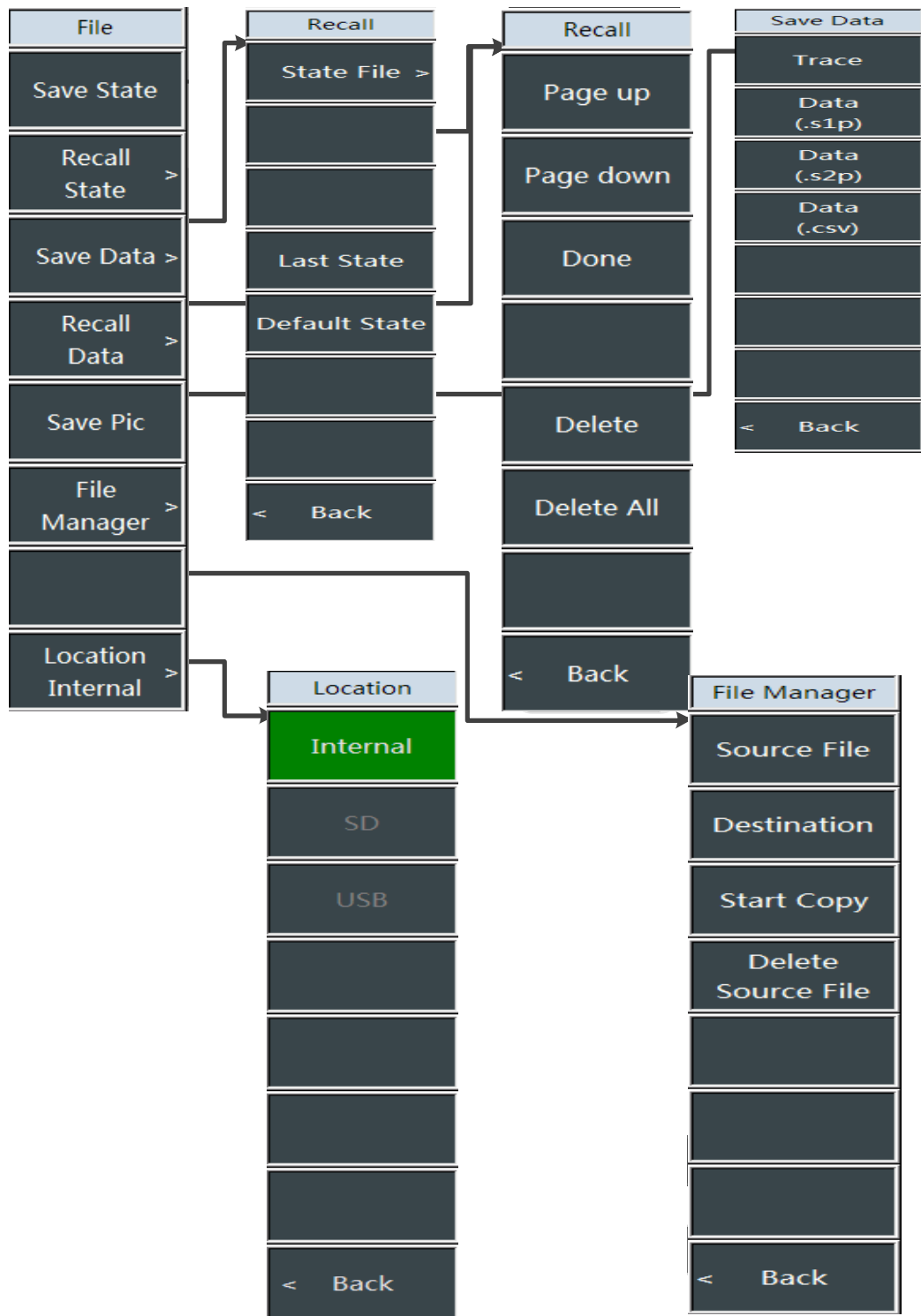


Figure 4-13 Structure of File Menu

4.3 Menu Description

Notice

In the subsequent description, the primary menu is the menu name + "【】", e.g. 【Freq】, and the remaining submenus are the menu name + "[]", e.g. [M Cal].

4.3.1 Frequency menu

Frequency range refers to the measurement frequency span. In the VNA mode, the 4957B RF analyzer must be set with proper measurement frequency range first before measurement and calibration regardless any measurement parameter is selected. Frequency range can be set in the following two methods:

- Specify the start frequency and stop frequency
- Specify the center frequency and span

Freq
Start Freq 30.000 kHz
Stop Freq 6.500 GHz
Center Freq 3.250 GHz
Span 6.500 GHz

·**[Start Freq]**: Press 【Freq】 →[Start Freq], use the numeric keys on the front panel, select the frequency unit, or use the 【↑】【↓】 keys and the knob for setting.

·**[Stop Freq]**: Press 【Freq】→[Stop Freq], use the numeric keys on the front panel, select the frequency unit, or use the 【↑】【↓】 keys and the knob for setting.

·**[Center Freq]**: Press 【Freq】 →[Center Freq], use the numeric keys on the front panel, select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu, or use the 【↑】 【↓】 keys and the knob for setting.

·**[Special Notes]**: When using the 【↑】【↓】 keys and the knob, the size of the frequency step is the same as the set value of the [Step Freq Auto/Man]. After pressing [Step Freq Auto/Man] to switch to [Step Freq Auto/Man], you can use the numeric keys or the 【↑】 【↓】 keys and the knob to set the step frequency value.

·**[Span]**: Press 【Freq】 →[Span] to activate the span submenu. You can use the numeric keys, and then select the frequency unit to change. You can also use the 【↑】 【↓】 keys and the knob to change the span. For the detailed information, please refer to the description of the [Span] menu.

·**[Special Notes]**: Use the 【↑】 【↓】 keys and the knob to change the span with a step of 1-2-5.

4.3.2 Amplitude menu

Amplitude	<ul style="list-style-type: none"> •[Top]: Press 【Amplitude】→[Top] to set the maximum scale in the top position of the vertical part of the display grid within the range of -499.9dB - +500dB. •[Bottom]: Press 【Amplitude】→[Bottom] to set the maximum scale in the bottom position of the vertical part of the display grid within the range of -500dB- +499.9dB. •[Auto Scale]: Press 【Amplitude】 →[Auto Scale] to display the trace in the scale most suitable for the screen, •[Special Notes]: which is only valid in Cartesian coordinates. •[Default Scale]: Press 【Amplitude】 →[Default Scale] to indicate that all options related to amplitude setting in the rectangular coordinate format are the default startup values. •[Ref Value]: Press 【Amplitude】 →[Ref Value], and use the numeric keys on the front panel or the 【↑】 【↓】 keys and the knob to set the reference level unit to dBm. •[Special Notes]: When the 【↑】【↓】 keys and the knob are used, the step is 10dB. •[Ref Pos]: Press 【Amplitude】→[Ref Pos], and use the numeric keys or the 【↑】 【↓】 keys and the knob to change the reference position. •[Scale]: Press 【Amplitude】 →[Scale], and use the numeric keys or the 【↑】【↓】 keys and the knob to set the scale within the setting range of 0.1dB - 20dB. •[Output Power]: It has three modes, i.e. high power, low power and manually set power.
Top	
Bottom	
Auto Scale	
Default Scale	
Ref Value	
Ref Pos	
Scale	
Power -10.00 dBm ^v	

4.3.3 Output power menu

Power	<ul style="list-style-type: none"> •[High Power]: Press [Output Power]→[High Power], and select [High Power] on the touch screen to set the output power to the high power state. •[Low Power]: Press [Output Power]→[Low Power], and select [Low Power] on the touch screen to set the output power to the low power state. •[Manual]: Press [Output Power]→[Manual], and the range is -35dB-10dBm. Enter the numbers with the numeric keys or use the knob or press 【↑】 【↓】 to adjust the manual power. •[RF Output]: Press [Output Power]→[RF Output Off On] to manually switch the RF output switch. •[Special Notes]: The manual power menu display range is -35~-10dBm, in order to ensure the setting range of power flatness index, the actual range can be set to -45 - 5dBm. If it is set to a value outside the range displayed by the menu item, there is a certain deviation in the power output at some frequency points.
High	
Low	
Manual -35~-5 dBm	
RF Output Off On	
< Back	

4.3.4 Bandwidth menu

Avg/BW	·[Ave Off On]: Press 【BW】 →[Ave Off On] to set it to on or off, and switch it via the touchscreen manually.
Averaging Off On	·[Avg Factor]: Press 【BW】 →[Avg Factor 16] and use the numeric keys or the 【↑】 【↓】 keys and the knob to set the specific number.
Avg Factor 16	·[Smooth Off On]: Press 【BW】 →[Smooth On/Off] to set it to on or off, and switch it via the touchscreen manually.
Smoothing Off On	·[Smooth Aperture (%)]: Press 【BW】 →[Aperture (%) 10.00] to select the aperture percentage, and press the number key to set it, with the aperture range of 0.01%~20%.
Aperture(%) 10.00	·[IF BW]: Press 【BW】 →[IF BW], select from the touchscreen or press 【↑】 / 【↓】 to change the IF BW value, and press [OK] to end it.
	·[Special Notes]: Use the 【↑】 【↓】 keys and the knob to change the span, and set the bandwidth down from 100kHz to 1Hz, with a step of 1, 3 and 10.
IF BW 1 kHz	

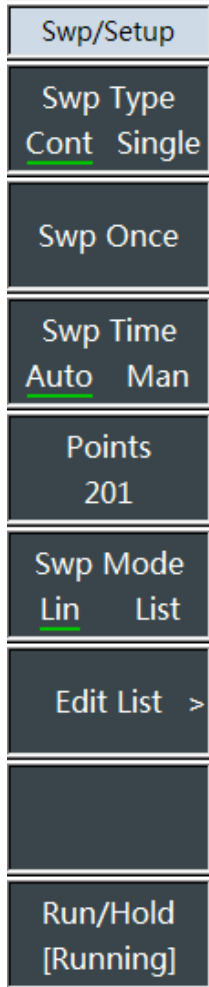
4.3.5 Marker menu

Marker	·[Mkr 1]: Press 【Mkr】 →[Sel Mkr [1]]→[Mkr 1], [Mkr 2], [Mkr 3], [Mkr 4], [Mkr 5], [Mkr 6] or [More Mkrs>]→[Mkr 7] and [Mkr 8] to select the marker displayed currently;
Sel Mkr [1]	·[Normal Mkr]: Press 【Mkr】 →[Normal Mkr], the marker is in the normal mode, which can be moved via the knob, step key or numeric key;
Normal Mkr	·[Delta Mkr]: Press 【Mkr】 →[Delta Mkr] to set the marker activated currently to the delta mode with amplitude difference and frequency difference between the delta marker and reference marker shown in the marker display area on the screen, enter the frequency value of the delta marker directly via the number key, or move it via the rotary knob or step key;
Delta Mkr	·[Off]: Press 【Mkr】 →[Off] to turn off the currently activated marker.
Cur Off	·[All Off]: Press 【Mkr】 →[All Off] to turn off all markers that have been turned on.
All Off	·[Max]: Press 【Mkr】 →[Max] to search for the maximum value of the marker;
Max	·[Min]: Press 【Mkr】 →[Min] to search for the minimum value of the marker;
Min	·[Link Data Mem]: Press 【Mkr】 →[Link] to select the data or memory, and switch it via the touchscreen manually.
Relate Data Mem	

4.3.6 Measure Menu

Measure	<ul style="list-style-type: none"> •[S11]: Press 【Measure】 →[S11] to set the measurement parameter to S11. •[S12]: Press 【Measure】 →[S12] to set the measurement parameter to S12. •[S21]: Press 【Measure】 →[S21] to set the measurement parameter to S21. •[S22]: Press 【Measure】 →[S22] to set the measurement parameter to S22. •[Meas Format]: Press 【Measure】 →[Meas Format] to select the measurement format, including [Log Amp], [Linear Amp], [VSWR], [Phase], [Smith], [Polar], [Group Delay], etc. •[Special Notes]: The measurement format submenu is just a difference in the way it is displayed and is not specifically introduced. •[Transform]: Press 【Measure】 →[Transform] to set the transform related parameters, including: [Transform Off On], [Start Time], [Stop Time], [Mode], [Set Freq Lowpass], [Window], [Velocity] and [Unit <u>m</u> ft]. •[Gating]: Press 【Measure】 →[Gating] to set the gating related parameters, including: [Gating (Off On)] selection, [Gate Start Time], [Gate Stop Time] and [Gate Type (Pass-Band Stop-Band)] selection. The gate shape options include maximum, wide, standard and minimum. •[Advance]: Press 【Measure】 →[Advance>] to select the measurement parameters from [A1], [B1], [R1], [A2], [B2] and [R2].
S11	
S12	
S21	
S22	
Format Log >	
Transform >	
Gating >	
Advance >	

4.3.7 Sweep/setting menu



·**[Swp Type Cont Single]**: Press **【Swp】** →[Swp Type Cont Single], and two sweep modes are provided in the vector network analyzer mode: Continuous sweep and sweep once. The underline marks the current state. The sweep mode setting determines how the analyzer sweeps and when it stops to enter into the hold state.

·**[Swp Once]**: Press **【Swp】** →[Swp Once], the sweep type is a single sweep, that is, the sweep is stopped after a single sweep.

·**[Swp Time Auto Man]**: Press **【Swp】** →[Swp Time Auto Man] to switch the sweep time between Auto and Manual. The underline marks the current state. If the sweep time is automatic, the RF analyzer automatically sets the sweep time to the fastest according to the current instrument status, and the screen displays the fastest sweep time under the current setting. If the sweep time is manually set, the sweep time value can be input at this time. Use the numeric keys to enter the sweep time value and select the time unit by pressing corresponding soft key to complete the setting.

·**[Swp Points]**: Press **【Swp】** →[Swp Points], and use the numeric keys on the front panel or the **【↑】** **【↓】** keys and the knob to set the sweep points.

·**[Special Notes]**: The number of sweep points in the vector network analysis mode can be set from 11 to 10001.

·**[Swp Mode Lin List]**: Press **【Swp】** →[Swp Mode Lin List], and select the sweep mode to be linear or list via the touchscreen. When the sweep mode is list sweep, you can edit the list to add and delete segments.

·**[Edit List]**: Press **【Swp】** →[Edit List>] to add or delete segments via the touchscreen, edit the start frequency, stop frequency, sweep points and intermediate frequency bandwidth of the segment, and enter the parameter value via the numeric key. See the description of the [Swp Mode Lin List] menu for details.

·**[Special Notes]**: When you press [Edit List], the sweep mode changes to list sweep by default.

·**[Run/Hold]**: Press **【Swp】** →[Run/Hold]. When you switch to run, the marker moves as per the sweep point, and when you switch to hold, the marker pauses at the current sweep point.

4.3.8 Edit list menu

	<ul style="list-style-type: none"> • [Add Seg]: Press [Edit List>]→[Add Seg] to select the start frequency, stop frequency, sweep points and intermediate frequency bandwidth of the segment to be edited via the touchscreen, enter the parameter value via the numeric key, and select the corresponding unit via the touchscreen. • [Del Seg]: Press [Edit List>]→[Del Seg] to click on any position of the segment to be deleted via the touchscreen, and then press [Del Seg] to delete it. • [Del All]: Press [Edit List>]→[Del All] to delete all the segments in the list. • [Save List]: Press [Edit List>]→[Save List] to save the segments in the list, and click to pop up a dialog box, enter the file name and press OK to save the list file +. • [Recall List]: Press [Edit List>]→[Recall List] to click on the list file to be recalled via the touchscreen, and click OK. • [Special Notes]: When the list is not saved, clicking [Recall List] will not display any list files. • [Back]: Press [Edit List>]→[Back] to return to the previous menu.
--	---

4.3.9 Calibration menu

	<ul style="list-style-type: none"> • [Cal Off On]: Press [Cal]→[Cal Off On] to turn the error correction on or off, and the calibration can only be turned on when the corresponding calibration is completed. • [Cal Kit]: Press [Cal]→[Cal Kit] to enter the calibration kit selection dialog box, and select the calibration kit type. • [Special Notes]: The mechanical calibration kit types include 31101A 31101B 31121 31123 • [M Cal]: Press [Cal] →[M Cal] to complete the relevant calibration according to the calibration steps, including one port S11, one port S22, full 2 ports, frequency response, response and isolation S12, response and isolation S21. • [E Cal]: Press [Cal] →[E Cal] to enter the electronic calibration dialog box, and click the down arrow on the touchscreen to select the [Cal Port]: One port P1, one port P2, full 2 ports; click [Start], [Interrupt] and [Exit] for relevant operations of electronic calibration. • [Cal Cont]: Press [Cal]→[Cal Cont], the submenu type is the same as the mechanical calibration, and the color invert is mainly completed. If the calibration is interrupted due to another menu is opened, press [Cal Cont] in the calibration menu to continue the calibration.
--	---

4.3.10 Mechanical calibration menu

M Cal	<p>·[One Port S11]: Press [M Cal]→[One Port S11] to connect the circuit breaker, short circuiter and load according to the prompts in the dialog box, so as to complete the calibration of one port S11.</p>
One Port S11	<p>·[One Port S22]: Press [M Cal]→[One Port S22] to select [OPEN], [SHORT] and [LOAD].</p>
One Port S22	<p>·[Full 2 Ports]: Press [M Cal]→[Full 2 Ports] to complete the relevant calibration according to the calibration steps, including one port S11, one port S22, full 2 ports, frequency response, response and isolation S12, response and isolation S21.</p>
Full Ports	<p>·[Freq Resp.]: Press [M Cal]→[Freq Resp.], open circuit S11, short circuit S11, open circuit S22, short circuit S22, straight through S12, straight through S21. Press [Back] to return to the previous submenu.</p>
Freq Resp. >	<p>·[Resp.&Iso@S12]: Press [M Cal]→[Resp.&Iso@S12] to select the response and isolation calibration.</p>
Resp.&Iso S12	<p>·[Resp.&Iso@S21]: Press [M Cal]→[Resp.&Iso@S21] to select the response and isolation calibration.</p>
Resp.&Iso S21	<p>·[Special Notes]: The measurement sequence for several different standard pieces to be measured at the same time can be ignored, for example, an open-circuit device, a short-circuit device and a load. Any standard piece can be remeasured before [OK] is pressed. Change in standard piece is normal during measurement. In case of a standard piece subjected to multiple measurement, correction shall be conducted on the latest measurement data.</p>
< Back	

4.3.11 One port S11 menu

One Port	<p>·[OPEN]: Press [One Port S11]→[OPEN] to select the calibration standard of OPEN.</p>
OPEN	<p>·[SHORT]: Press [One Port S11]→[SHORT] to select the calibration standard of SHORT.</p>
SHORT	<p>·[LOAD]: Press [One Port S11]→[LOAD] to select the calibration standard of LOAD.</p>
LOAD	<p>·[Special Notes]: The measurement sequence for several different standard pieces to be measured at the same time can be ignored, for example, an open-circuit device, a short-circuit device and a load. Any standard piece can be remeasured before [OK] is pressed. Change in standard piece is normal during measurement. In case of a standard piece subjected to multiple measurement, correction shall be conducted on the latest measurement data.</p>
< Back	

4.3.12 One port S22 menu

It is the same as the [One Port S11] menu.

4.3.13 Full 2 ports menu

Full Ports	<ul style="list-style-type: none"> · [Reflect]: Press [Full 2 Ports]→[Reflect] to set the reflection measurement for calibration of full 2 ports. It includes 6 sub-options: [P1 OPEN], [P1 SHORT], [P1 LOAD], [P2 OPEN], [P2 SHORT], [P2 LOAD] · [Special Notes]: P1 stands for one port and P2 for two ports. · [Tr]: Press [Full 2 Ports]→[Tr] to set the transmission measurement for calibration of full 2 ports. It includes [Pos Match], [Pos Trans], [Rev Match], [Rev Trans] and [Auto Meas]. · [Iso]: Press [Full 2 Ports]→[Iso] to set the isolation measurement for calibration of full 2 ports.[Pos Iso], [Rev Iso], [Auto Meas] and [Ignore Iso].
Reflect >	
Translate >	
Iso >	

4.3.14 Frequency response menu

Calibrate	<ul style="list-style-type: none"> · [Special Notes]: In case of frequency response error calibration, the errors of reflection measurement and transmission measurement can be calibrated, open circuit and short circuit are selected in reflection measurement, and straight through is selected in transmission measurement. · [OPEN S11]: Press [Freq Resp.]→[OPEN S11] to select the calibration standard of S11 OPEN. · [SHORT S11]: Press [Freq Resp.]→[SHORT S11] to select the calibration standard of S11 SHORT. · [OPEN S22]: Press [Freq Resp.]→[OPEN S22] to select the calibration standard of S22 OPEN. · [SHORT S22]: Press [Freq Resp.]→[SHORT S22] to select the calibration standard of S22 SHORT. · [THRU S12]: Press [Freq Resp.]→[THRU S12] to select the calibration standard of S12 THRU. · [THRU S21]: Press [Freq Resp.]→[THRU S21] to select the calibration standard of S21 THRU. · [Special Notes]: After selecting the above menu, there will be a prompt on the interface: “Please connect the circuit breaker (short circuiter) to the port, and press the corresponding menu key to start the measurement”
OPEN S11	
SHORT S11	
OPEN S22	
SHORT S22	
THRU S12	
THRU S21	
Back	

4.3.15 Calibration continue menu

It completes the remaining calibration steps, and is the same as the calibration menu.

4.3.16 Trace menu

This menu is used to set the trace display mode, trace math and limit function. The memory must be saved with a trace first before conducting any trace calculation, and trace calculation is conducted via vector calculation on previous complex number data displayed in formatting.

Trace	· [Select Trace] : Press 【Trace】 →[Select Trace] to select the trace. The vector network analyzer provides 1, 2, 3 and 4 tracks, and the selected track sequence number and its status menu item will be displayed directly.
Sel Trace [1]	
Trace Num 1 X 1 >	· [Trace Num] : Press 【Trace】 →[Trace Num 1×1>]→[1×1], [1×2], [1×3], [2×1], [3×1] or [4×1] to select the window number and trace number in the window;
Trace Math>	· [Trace Math] : Press 【Trace】 →[Trace Math] to open the math menu of the trace.
Limit >	· [Special Notes] : The memory must be saved with a trace first before conducting any trace calculation, and trace calculation is conducted via vector calculation on previous complex number data displayed in formatting.
BW Search -3.00 dB >	· [Limit] : Press 【Trace】 →[Limit] to edit and display the limit line and test to see if it is passed.
	· [Bandwidth Search] : Press 【Trace】 →[Bandwidth Search]:
Statistic Off On	· [Stats Off On] : Press 【Trace】 →[Stats Off On] to turn on or off the statistics, and switch it manually.

4.3.17 Math menu

Trace Math	· [Data→Mem] : Press [Trace Math]→[Data→Mem] to save current measurement trace data to the memory;
Data → Mem	· [Data] : Press [Trace Math]→[Data] to display only the trace corresponding to the measurement data;
Data	· [Save] : Press [Trace Math]→[Save] to display only the trace corresponding to the saved data.
Memory	· [Data&Mem] : Press [Trace Math]→[Data&Mem] to display the trace corresponding to both the measurement data and saved data at the same time.
Data & Mem	· [Data-Mem] : Press [Trace Math]→[Data-Mem] to display the trace corresponding to the measurement data minus the saved data.
Data - Mem	· [Data/Mem] : Press [Trace Math]→[Data/Mem] to display the trace corresponding to the measurement data divided by the saved data.
Data / Mem	· [Data+Mem] : Press [Trace Math]→[Data+Mem] to display the trace corresponding to the measurement data plus the saved data.
Data + Mem	
Next >	

4.3.18 Limit menu

Limit	<p>•[Limit Off On]: Press [Limit]→[Limit Off On] to choose whether to turn on the limit function.</p>
Limit Off On	<p>•[Alarm Off On]: Press [Limit]→[Audio Alarm Off On] to set audio alarm On/Off. If the audio alarm is on and the upper and lower limit line test is on, the function is effective. If the limit is out of range when the upper and lower limit lines are swept on the current screen, the buzzer will give a short sound.</p>
Alarm Off On	<p>•[Clear]: Clear the edited limit line displayed currently;</p>
Del All	<p>•[Edit]: Press [Limit]→[Edit]→[Sel Point] to switch the limit point on the current limit;</p>
Edit >	<p>•[Edit]: Press [Limit]→[Edit]→[Value] to set current limit point frequency, enter the number via the numeric key, and select the frequency unit for completion;</p>
Save	<p>•[Edit]: Press [Limit]→[Edit]→[Add]to add the limit point on the current limit line;</p>
Recall >	<p>•[Edit]: Press [Limit]→[Edit]→[Delete] to delete the limit point displayed on the current limit;</p>
	<p>•[Edit]: Press [Limit]→[Edit]→[Clear]to clear all limit points saved on the current limit;</p>
< Back	<p>•[Save]: Press [Limit>]→[Save], enter the name via the number key, and save the limit line edited just now to the system, which can be recalled by pressing [Limit>]→[Recall>], selecting such limit line via the touchscreen manually, and pressing [OK] for recalling when conducting the same test next time, avoiding repeated editing;</p>
	<p>•[Recall]: Press [Limit>] → [Recall] , manually select the limit line file with the touch screen and press [OK] to complete the loading. If the number of limit line storage files is large, press [Limit>] → [Recall>] → [Page Up] , [Page Up] and find the limit line file to be loaded by page, and press [Limit>] → [Load>] → [Delete] , [Del All] to delete the single and all currently selected and stored limit line files.</p>

4.3.19 Peak menu

Peak	<ul style="list-style-type: none"> • [Max Peak]: Press 【Peak】 → [Max Peak] to place a frequency marker at the highest point of the trace and display the frequency and amplitude of the frequency marker in the upper right corner of the screen.
Peak	<ul style="list-style-type: none"> • [Sub Peak]: Press 【Peak】 → [Sub Peak] to move the active frequency marker to the next highest peak point on the trace that is associated with the current frequency marker position. Press the key again, and the user can find the lower peak point quickly.
Sub Peak	<ul style="list-style-type: none"> • [Right Peak]: Press 【Peak】 → [Right Peak] to find the next peak to the right of the current frequency marker position.
Right Peak	<ul style="list-style-type: none"> • [Left Peak]: Press 【Peak】 → [Left Peak] to find the next peak to the left of the current frequency marker position.
Left Peak	<ul style="list-style-type: none"> • [Max]: Press 【Peak】 → [Max] to place a marker at the highest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen.
Max	<ul style="list-style-type: none"> • [Min Peak] Press 【Peak】 → [Min] to place a marker at the lowest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen.
Min	<ul style="list-style-type: none"> • [Peak Tracking Off On]: Press 【Peak】 → [Peak Tracking Off On], and when peak tracking is on, the current marker will perform a peak search operation after each sweep. If peak tracking is off, no operation will be performed.
Tracking Off On	<ul style="list-style-type: none"> • [Advance]: Press 【Peak】 → [Advance] to pop up the marker search dialog box, which determines the peak value by setting the marker, search type and specific frequency band.
Advance	

4.3.20 File menu

	<ul style="list-style-type: none"> -[StoreStateFile]: Press 【File】 →[Save State] to save the current sweep status parameters. -[Recall Status]: Press 【File】 →[Advance] to pop up the [Status File] list, and such soft menus as [Page Up], [Page Down], [Recall], [Delete] and [Delete All] are used to read the existing status file and recall the corresponding state parameters to the current sweep. You can also select such operations as [Last State] and [Default State]. -[Special Notes]: Select [Default State] to restore the factory setting state. -[StoreTraceFile]: Press 【File】 →[Save Data] to save the trace data. -[Recall Trace]: Press 【File】 →[Recall Status] to pop up the data file list, and such soft menus as [Page Up], [Page Down], [Immediate Recall], [Delete] and [Delete All] are used to read the existing status file and recall the corresponding data to the current sweep. -[Print Screen]: Press 【File】 →[Print Screen] to capture the current screen image. -[File Mgmt]: Press 【File】 →[File Mgmt] to pop up the file management menu, including [Source File], [Target File], [Start Copying], [Delete Files] and other relevant soft menus to copy and delete files. -[Storage location]: Press 【File】 →[Storage Location] to select the storage location, the interior is the internal memory of the instrument, and the other optional locations are the memory and SD card of the USB interface. After the security feature option is selected, the internal memory cannot be selected.
--	---

4.3.21 Storage location menu

	<ul style="list-style-type: none"> -[Internal]: Press 【File】 →[Storage Location]→[Internal], the [Internal] is in a gray state and cannot be saved internally. -[SDCard]: Press 【File】 →[Storage Location]→[SD card], and select Store Data to the SD card. -[USB]: Press【File】→[Storage Location] →[USB]and select Store Data to USB.
--	---

5 Spectrum analysis mode

This chapter mainly introduces the relevant contents of 4957B spectrum analysis mode, including some typical measurement functions and methods in the spectrum analysis mode. After reading this section, users using this instrument for the first time can have a general understanding of some typical applications of the spectrum analysis mode and the testing operation process, and are familiar with the use of the spectrum analysis mode.

Notice

All operations in this section are based on the premise of the selected spectrum analysis mode, which will not be described separately later.

4957B spectrum analysis mode has rich measurement functions, so it contains many and complex parameters. In addition to the most basic functional parameters, such as frequency parameters, amplitude parameters, bandwidth average parameters, trace parameters, sweep parameters, marker parameters, etc., it also has other characteristic function parameters, including signal tracking, noise marker, peak tracking, counter, list sweep, trigger, limit line, field strength measurement, channel power, occupied bandwidth, adjacent channel power, carrier-to-noise ratio, spurious template, IQ capture, audio monitoring, etc.

a) Signal tracking

If the measured signal is a drift signal, the activated marker is placed on the peak point of the signal using the signal tracking function of the spectrum analyzer, and the peak value of the marker will always be displayed on the center frequency of the spectrum analyzer, which can be easily measured.

b) Noise marker

The noise marker displays the noise power near the activation marker that is normalized to the 1 Hz bandwidth. Turn on the noise marker and set the detector to the RMS detection mode. If the logarithmic mode (dBm, dBmV, dBuV, dBW, dBV, dBA, dBmA/dBuA) is selected as the amplitude unit, the unit of the mark reading will be automatically switched to dBm/Hz. If V is selected as the amplitude unit, the unit of the reading will be automatically switched to $V/(Hz)^{1/2}$. If A is selected, the unit of the reading will be automatically switched to $A/(Hz)^{1/2}$. If W is selected, the unit of the reading will be automatically switched to $W/(Hz)^{1/2}$.

c) Peak tracking

If the peak tracking function is enabled, the marker will perform a peak search operation after each sweeping.

d) Counter

If the frequency counter function is enabled, the frequency counter function will make the reading of the marker more accurate, which is conducive to improving the accuracy of frequency measurement. The measurement accuracy can reach Hz level, and the error is less than 10Hz.

e) List sweep

In the list sweep mode, users can edit the sweeping frequency band, and the spectrum analyzer sweeps based on the frequency range and other parameters set by the edited list.

f) Trigger

Select the trigger modes of sweeping or measurement, including [freerun], [video trigger], [external trigger], [trigger polarity], [trigger delay]. The user can select the mode based on the actual demand. If the freerun is set after the last continuous sweeping or single sweeping, a new sweep or measurement will be started. Set the trigger mode to video trigger. As long as the positive slope of the input trigger signal passes the video trigger level set by the [trigger polarity plus/minus] command, sweeping will be triggered. In the external trigger mode, select sweeping and measurement to synchronize with the next voltage cycle.

g) Limit line

The limit line function is used to monitor the signal in a certain frequency band. The spectrum analyzer provides upper and lower limit lines, and the user can set the limit. If the amplitude of a

Spectrum analysis mode

signal in a certain frequency band exceeds the set upper limit or is less than the set lower limit, the spectrum analyzer will send out a audio alarm signal.

h) Field strength test

The spectrum analyzer provides the function of field strength measurement, including} [Field Strength Off On], [Recall Antenna], [Edit Antenna], [Save Antenna] and other related soft menus. With the corresponding test antenna, the field strength test can be carried out quickly.

i) Carrier to noise ratio

The carrier to noise ratio function is to measure the ratio of carrier power to noise power, including carrier bandwidth, noise bandwidth, offset frequency, sweep width, carrier power, noise power, carrier to noise ratio and other parameters.

j) Stray template

The function of stray template is to call the limit line as a template to measure whether the signal power is limited by the template. The template parameter is a limit line and assigned by recalling the limit line. The template can move up and down left and right according to the center frequency and reference power. The template always moves the center point of the limit line left and right to the center frequency, and moves the center point up and down to the reference power point according to the calculated reference power. The reference power is divided into peak power and channel power, and which one is selected depends on the reference power type.

k) IQ capture

IQ capture function is to capture IQ data and store them in the instrument through the capture time, sampling rate, capture mode and other parameters set by the user.

l) Audio monitoring

The spectrum analyzer has audio demodulation function used for radio monitoring. If the demodulation sound is poor, the sound effect can be improved by adjusting the resolution bandwidth. In the demodulation mode, the resolution bandwidth is set in the range of 300kHz ~ 30kHz, which will bring the optimum effect.

5.1 Introduction to typical measurements

The spectrum analysis mode of 4957B is the basic working mode. After startup, press **【Mode】**, a mode selection dialog box pops up. Then select [Spectrum Analysis Mode] in the box, and press [OK] to enter the spectrum analysis mode after completing the progress bar.

This section will introduce some advanced typical measurement functions and methods of spectrum analysis mode of 4957B, including the following:

- a) Measurement of channel power.
- b) Occupied bandwidth measurement.
- c) Measurement of adjacent channel power.
- d) TOI measurement.
- e) Drift signal measurement.
- f) Noise signal measurement.
- g) Distortion measurement.
- h) Pulsed RF signal measurement.
- i) Signal generation measurement (option).
- j) Interference map (option).

Notice

Press the **【Reset】** key on the front panel, and the RF analyzer will run again. In the following examples, unless otherwise specified, first press the **【Reset】** key.

5.1.1 Measurement of channel power

This Section illustrates how to use the channel power measurement function of the spectrum

analysis mode of 4957B to measure the signal channel power by taking the application of measurement of channel power of the FM signal as an example.

5.1.1.1 Definition of channel power

Channel power measurement is one of the most common measurements in RF transmission systems. Therefore, channel power is defined as the power transmitted by a signal over a range of frequencies at a specified time interval. In the test of the power amplifier and the filter circuit, the system is faulty if the specific power is not measured. The communication transmitter is evaluated by measurement of channel power, and its quality of the RF transmission is determined by comparing it to specific communication protocol. The spectrum analysis mode of 4957B can be used to measure the channel power of FM signal. Since the FM signal and continuous wave signal differ in many respects, an accurate setting can make the measured FM signal more accurate.

5.1.1.2 Measurement steps

The steps of using the spectrum analysis mode of 4957B to measure the FM signal channel power are as follows:

- a) Set the signal generator to output the FM signal:
- b) Generate an FM signal with a signal generator, set the frequency to 1GHz, the power to -10dBm, the FM deviation to 500KHz and the modulation rate to 10kHz. Connect the output of the signal generator to the RF input end of the spectrum analyzer via a cable, as shown in Figure 5-1. Turn on the modulation output switch and the RF switch.

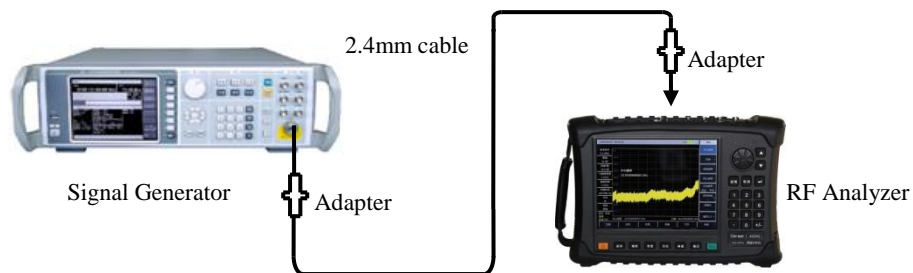


Figure 5-1 Connection Between Signal Generator and Spectrum Analyzer

- c) Reset the spectrum analyzer to the default state:
- d) Press **【Reset】**.
- e) Turn on the channel power measurement function:
Press **[Measure]**, **[Ch Power >]**, **[Ch Power Off On]**. Enable the channel power measurement function.
 - a) Set center frequency:
 - b) Press **【Measure】**, **[Channel Power]** and **[Center Freq]** and set the center frequency with the number keys. The center frequency of the spectrum analyzer is set to the frequency of the measured signal, i.e., 1GHz.
 - c) Set the channel power bandwidth:
 - d) Press **【Measure】**, **[Channel Power]** and **[Channel Bandwidth]** and set the channel power bandwidth with the number keys to 1MHz.
 - e) Set the span of channel power:
 - f) Press **【Measure】**, **[Channel Power]** and **[Channel Span]** and set the channel power span with the number keys to 2 MHz.
 - g) Set the resolution bandwidth and video bandwidth with a spectrum analyzer:

Spectrum analysis mode

- h) Press **【BW】** , [RBW Auto Man], set the resolution bandwidth to 30kHz;
- i) Press **【BW】** , [VBW Auto Man] to set the video bandwidth to 30kHz or less.

Notice

The channel power bandwidth is a frequency width of the power displayed by the spectrum analyzer within this bandwidth, while the channel power span is the frequency range over which the spectrum analyzer sweeps. The channel power span should be set to be greater than or equal to the channel power bandwidth. Otherwise, the spectrum analyzer will automatically set the channel span equal to the channel power bandwidth. The ratio of channel power span to channel power bandwidth remains constant (maximum: 10; minimum: 1) This ratio remains constant as the channel power bandwidth changes. Changing the channel power span can change this ratio. For example, when the channel power bandwidth is doubled, the spectrum analyzer will also increase the channel power span by the same factor.

- j) Enable the averaging function:

Press **【BW】** and [Avg Off On], set the average number of times to 16 and enable the averaging function.

After the channel power measurement function is enabled, if the detection mode is automatic, it will be set to the root mean square detection mode. The two vertical white lines displayed on the screen indicate the bandwidth of the channel power. The measurement results are displayed at the bottom of the screen. See Figure 5-2 for the channel power measurement interface.

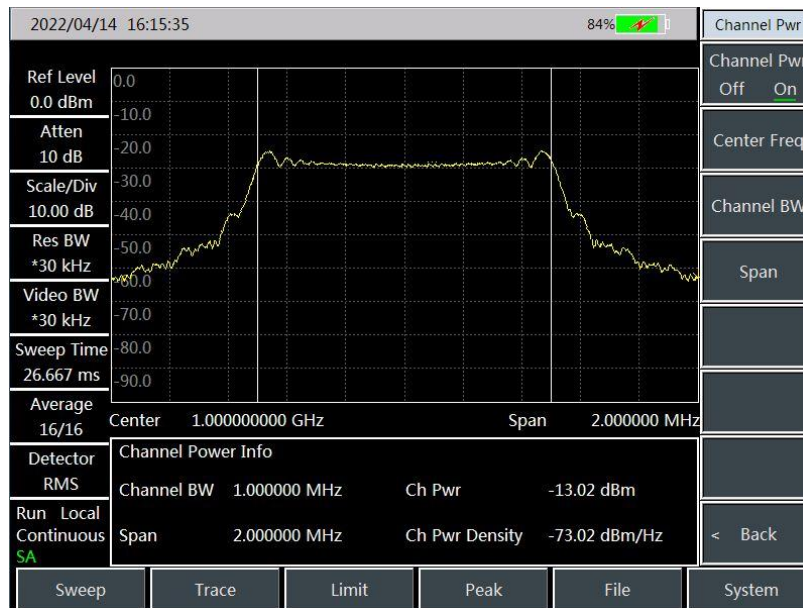


Figure 5-2 FM Signal Channel Power Measurement

5.1.2 Occupied bandwidth measurement.

This Section illustrates how to use the occupied bandwidth measurement function of the spectrum analysis mode of 4957B to measure the signal occupied bandwidth by taking the application of measurement of occupied bandwidth of the FM signal as an example.

5.1.2.1 Definition of occupied bandwidth

The occupied bandwidth refers to the frequency bandwidth corresponding to the total transmit power of a certain ratio of the energy, which is centered as the center frequency of the specified channel. The occupied bandwidth measurement of the spectrum analysis mode of 4957B can present the measurement results in a quick, clear and accurate manner. There are two methods for calculating the occupied bandwidth depending on the modulation method:

a) Power percentage method:

The occupied bandwidth of the signal is obtained by calculating the bandwidth of the portion of the frequency containing a certain percentage of the total transmitted signal power, and the percentage of power can be set by the user.

b) Power drop XdB method:

This calculation method defines the occupied bandwidth as: the distance between the two frequency points when the signal power drops by XdB on both sides of the frequency point where the peak power of the signal is located. The XdB of the signal power drop is set by the user.

5.1.2.2 Test steps

Steps for measuring the occupied bandwidth in the spectrum analysis mode of 4957B are as follows:

a) Set the signal generator to output the FM signal:

Use the signal generator to generate a frequency modulation signal, and set the frequency to 1GHz, the power to -10dBm, the frequency modulation offset to 500kHz and the modulation rate to 10kHz. Connect the output of the signal generator to the RF input of the spectrum analyzer by cable, as shown in Figure 5-1. Turn on the modulation output switch and the RF switch.

b) Reset the spectrum analyzer to the default state:

Press **【Reset】**.

c) Set center frequency:

Press **【Freq】** and **[Center Freq]** and set the center frequency with the number keys. The center frequency of the spectrum analyzer is set to the frequency of the measured signal, i.e., 1GHz.

d) Set resolution bandwidth:

e) Press **[BW]**, **[RBW Auto Man]** to set the resolution bandwidth to the appropriate value.

f) Set video bandwidth:

g) Press **[BW]**, **[VBW Auto Man]** to set the video bandwidth to the appropriate value.

In order to improve measurement accuracy, it is recommended that the ratio of resolution bandwidth to video bandwidth be greater than 10. Press **[RBW/VBW]** to change the ratio of resolution bandwidth to video bandwidth.

h) Switch the spectrum analyzer to the occupied bandwidth measurement mode:

i) Press **[Measure]**, **[OBW]**, **[OBW Off On]**.

After the occupied bandwidth measurement function is enabled, the spectrum analyzer switches to the occupied bandwidth measurement interface, and the measurement result is displayed at the bottom of the screen. See Figure 5-3 for the occupied bandwidth measurement. The two vertical white lines on the screen visually indicate the frequency range of occupied bandwidth. If the detection mode of the spectrum analyzer is automatic after the occupied bandwidth measurement function is enabled, it will automatically switch to the root mean square detection mode. Users can change the measurement method, occupied bandwidth, span and other parameters through the corresponding menu to get more accurate measurement results.

Spectrum analysis mode

j) Select measurement method:

k) Press **【Measure】** , [Occupied Bandwidth] and [Measurement Method % XdB] to select the measurement method for occupied bandwidth. The measurement method can be set to the power percentage method, or the power drop XdB method, the underline marks the currently selected mode, and the default is the percentage method.

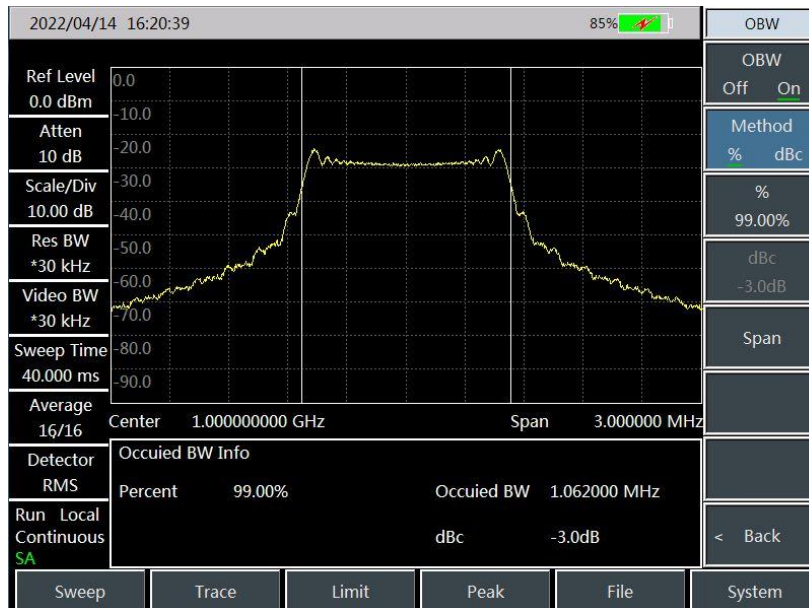


Figure 5-3 Occupied Bandwidth Measurement

l) Change percentage:

If the measurement method is selected as the percentage method, press **【Measure】** , [Occupied Bandwidth] and [% 99%] and use the numeric keys, up and down keys or the knob to change the percentage value. The percentage setting range is 10% to 99.99%, the minimum step is 0.01%, and the default is 99%.

m) Change X dB:

If the measurement method is selected as XdB method, press **【Measure】** , [Occupied Bandwidth] and [XdB - 3.00dB], use the numeric keys, up and down keys or the knob to change the value of XdB. The range of XdB value is set from -0.1dB to -100dB, the minimum step is 0.01dB, and the default is -3dB.

n) Change the occupied bandwidth span:

Press **【Measure】** , [Occupied Bandwidth] and [Channel Span], input the occupied bandwidth span with the numeric keys and press the corresponding soft key input unit. The default value is 3MHz.

o) Disable occupied bandwidth measurement:

Press **【Measure】** , [Occupied Bandwidth] and [OBW Off On], select Off to exit the occupied bandwidth measurement, and the interface switches back to the spectrum measurement interface.

5.1.3 Measurement of adjacent channel power

This Section illustrates the operation method of the adjacent channel power ratio measurement with the 4957B spectrum analyzer by taking the measurement of the adjacent channel power ratio of the FM signal as an example.

5.1.3.1 Definition of adjacent channel power ratio

The adjacent channel power ratio (ACPR), also called the adjacent channel leakage power ratio (ACLR), is the ratio of the transmit power of a channel to the radiated power of its adjacent channel. It is usually expressed by the ratio of the power in the specified bandwidth to the total

channel power at different frequency offsets of adjacent channels. The size of adjacent channel power mainly depends on the extension of the edge band and noise of the transmitter.

The measurement method for adjacent channel power ratio can replace the traditional two-tone intermodulation distortion measurement method applied to the nonlinear system test, and the adjacent channel power ratio measurement result can be expressed as two different ways of power ratio or power density.

5.1.3.2 Measurement steps

In traditional measurements, for narrowband signals, two-tone intermodulation measurements are commonly used to evaluate the distortion performance of the transmitter. Wideband modulated signal that not only has very tight spectral components, but also has a very high peak signal (called a crest factor). These intermodulation products from the spectral components of the signal will locate around the spectrum. Since the intermodulation measurement of WBFM signals is very complicated, and the adjacent channel power ratio (ACPR) is closely related to intermodulation products caused by nonlinear distortion, the adjacent channel power ratio (ACPR) is a better method to measure the nonlinear distortion of WBFM signals.

Steps for measuring the adjacent channel power ratio of the WBFM signal using the adjacent channel power ratio measurement function of 4957B spectrum analyzer are as follows:

- a) Set the output frequency of the signal generator:
Use the signal generator to generate a frequency modulation signal, and set the frequency to 1GHz, the power to -10dBm, the frequency modulation offset to 500kHz and the modulation rate to 10kHz. Connect the output of the signal generator to the RF input of the spectrum analyzer by cable, as shown in Figure 5-1. Turn on the modulation output switch and the RF switch.
- b) Reset the spectrum analyzer to the default state:
Press **【Reset】**.
- c) Set the reference level of the spectrum analyzer:
Press **【Amplitude】**, [Ref Level] and -10 [dBm];
Press **【Amplitude】** and [Scale/Div] to set the scale to 10dB/div.
- d) Set the resolution bandwidth and video bandwidth:
Press **【BW】**, [RBW Auto Man], set the resolution bandwidth to 30kHz;
Press **【BW】**, [VBW Auto Man] to set the video bandwidth to 30kHz or less.
- e) Switch to adjacent channel power ratio measurement:
Press **【Measure】**, [Adjacent Channel Power] and [ACPR Off On] to switch to the measurement interface of adjacent channel power ratio.
- f) Set the center frequency of the main channel:
Press [Center Freq] and set the center frequency of the main channel with the numeric keys to 1GHz.
- g) Set the main channel bandwidth:
Press [Main Ch BW] and set the bandwidth of the main channel with the numeric keys to 1MHz.
- h) Set the adjacent channel bandwidth:
Press [Adj Ch BW] and set the required adjacent channel bandwidth with the numeric keys to 2MHz.
- i) Set the channel offset:
Press [Ch Offset], set the desired channel offset with the numeric keys, and enter 1MHz.
- j) Turn on the adjacent channel power ratio test:
Press [Adj Ch Power OFF ON], and the measurement results will be displayed at the bottom of the screen. See Figure 5-4 for the measurement of ACPR.

Spectrum analysis mode

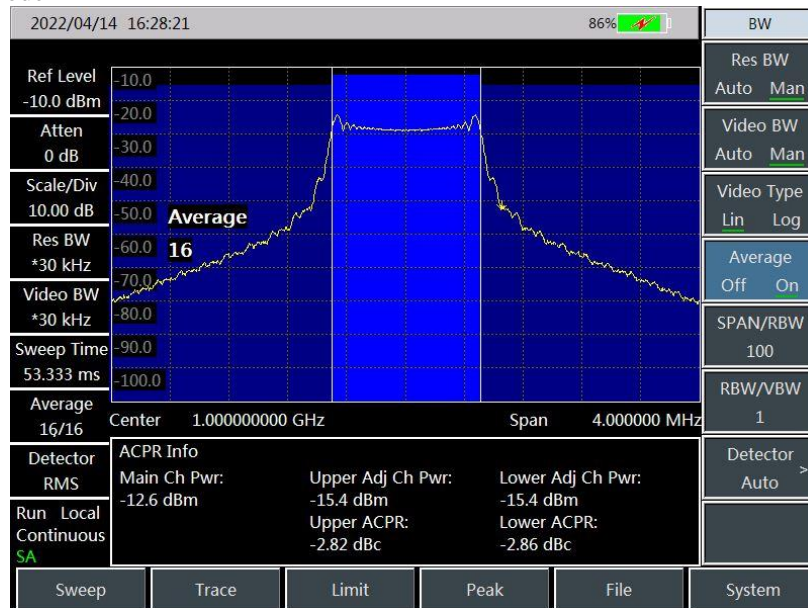


Figure 5-4 Measurement of ACPR

k) Threshold setting:

The threshold test function will facilitate the user to observe whether the adjacent channel power exceeds the set range. Press **【Measure】**, [Adjacent Channel Power] and [Page Down 1/2] to enter the ACPR threshold test setting menu.

Press [Upper Ch Threshold] and use the numeric keys to enter the upper adjacent channel threshold;

Press [Down Ch Threshold] and use the numeric keys to enter the lower adjacent channel threshold.

l) Open the threshold test function:

Press [Threshold Test Off On] to open the threshold test function. If the adjacent channel power ratio exceeds the set threshold, the screen will be marked with a red background.

5.1.4 TOI measurement

5.1.4.1 Definition of TOI

In the crowded environment of the communication system, the mutual interference between devices is a common problem. For example, the problem of second-order and third-order intermodulation distortion is often encountered in the narrowband system. If a system has two signals (F_1 and F_2), both signals mix with the generated second harmonic distortion signals ($2F_1$ and $2F_2$) to generate TOI products $2F_2 - F_1$ and $2F_1 - F_2$ close to the original signal. High order intermodulation distortion will also occur. Most of these distortion products are produced by amplifiers and mixers in the system.

The following describes how to measure the TOI, including illustrating how to display two signals simultaneously on the spectrum analyzer screen, and introducing how to set the resolution bandwidth, mixer level and reference level, as well as the use of some marker functions.

5.1.4.2 Measurement steps

a) Connect the tested instrument with the spectrum analyzer as shown in Figure 5-5:

In this example, a 6dB directional coupler and two signal generators set to 1GHz and 1.001ghz respectively are used. Of course, the frequency of the signal generator may also be other values, but in this example, the frequency interval must be maintained at about 1MHz.

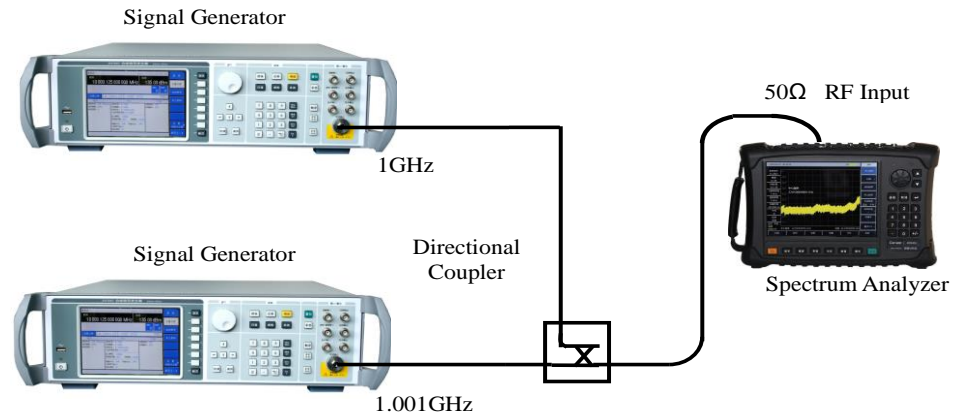


Figure 5-5 Connecting TOI Measurement System

Set the output frequency of one signal generator to 1GHz and the output frequency of the other signal generator to 1.001GHz to keep 1MHz frequency interval between the two signals input to the spectrum analyzer.

Set the output amplitude of the two signal generators to be equal (-20dBm in this example).

- b) Set the spectrum analyzer to keep two signals displayed on the spectrum analyzer screen simultaneously:

Press **【Reset】**.

Press **【Freq】**, [Center Freq] and 1.001[GHz].

Press **【Frep】**, [Span], 5 [MHz].

The user can see two signals in the center of the screen, as shown in Figure 5-6. If the frequency interval used is different from that used in this example, a span greater than three times the frequency interval of the signal generator should be selected.

- c) Reduce the resolution bandwidth until the distortion product is visual:

Press **【BW】** and use the step key **【↓】** to reduce the resolution bandwidth:

- d) Adjust the two signal generators to ensure that the input signal amplitude is equal:

Press **【Mkr】**, [Difference Mode], **【Peak】**, [Sub Peak], or [Left Peak] or [Right Peak]. Adjust the signal generator corresponding to the marker until the amplitude difference reading is zero. If necessary, reduce the video bandwidth.

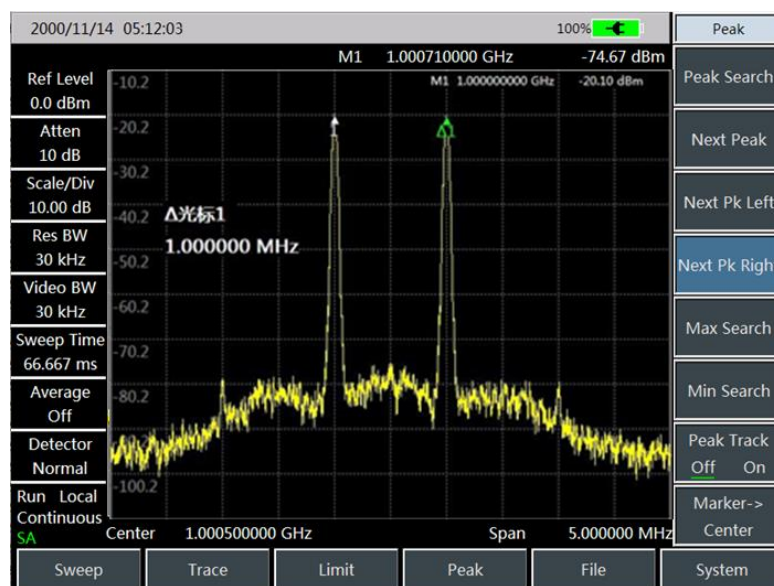


Figure 5-6 Signal in the Center of Spectrum Analyzer Display

Spectrum analysis mode

- e) Set the reference level and place the signal peak at the reference level:

Press **【Peak】** and [Max Peak] to read the power value of the peak.

Press **【Amplitude】** , [Ref Level].

In order to obtain the best measurement accuracy, the generator should be set at the reference level as shown in Figure 5-7.

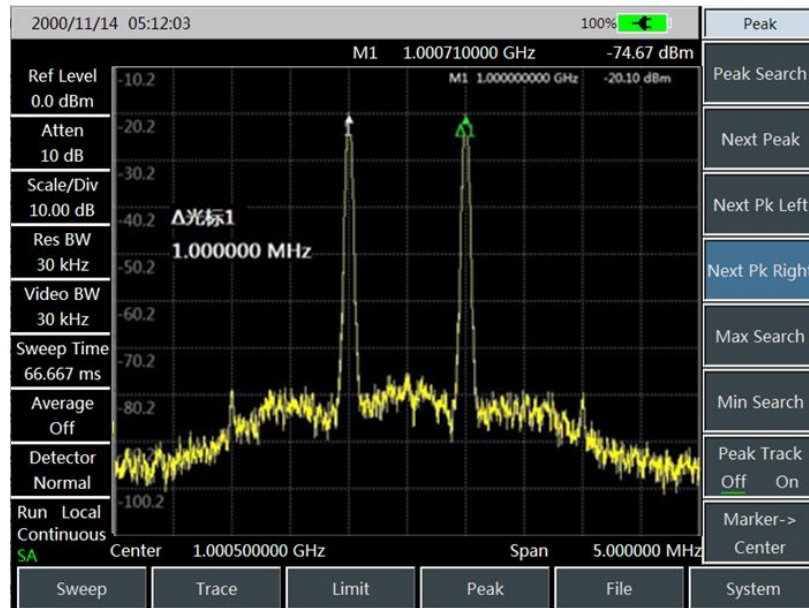


Figure 5-7 Set the Signal Peak at the Reference Level:

- f) Set the second marker and measure the distortion product:

Once the marker is activated, the difference marker function can generate a second marker and the difference between the two markers will be displayed. At this time, the relative measurement can be carried out conveniently.

Press the **【Peak】** key to activate the marker 1.

Press **【Mkr】** [difference mode] to activate the marker 2.

Press **【Peak】** , and then press [Left Peak] or [Right Peak] to set the marker 2 on the peak point of distortion product next to the signal of signal generator. The frequency and amplitude differences of the two markers are displayed in the marker display area, as shown in Figure 5-8, and the marker amplitude difference is the measured value of TOI.

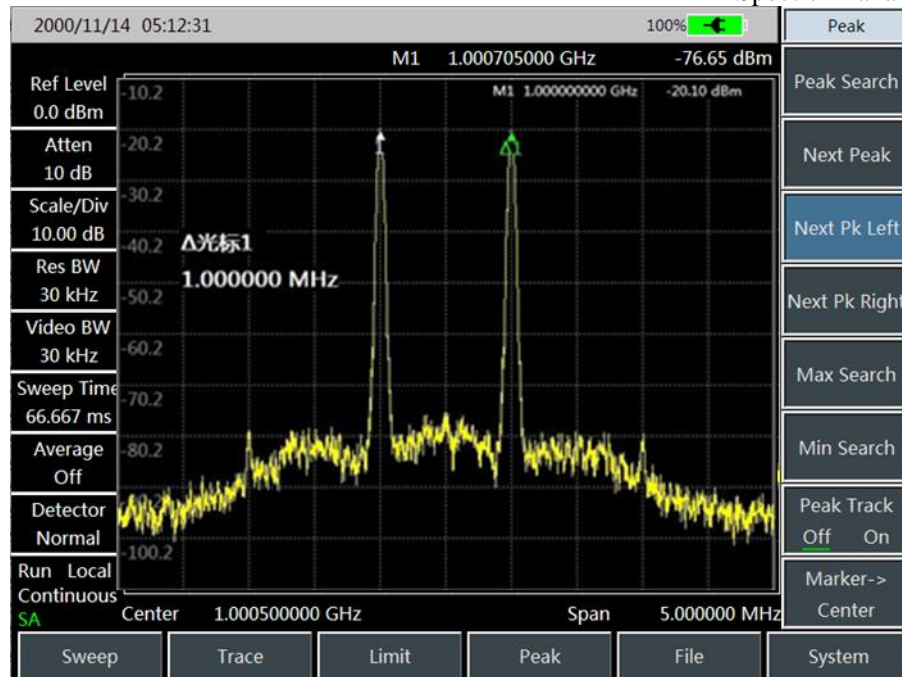


Figure 5-8 Relative Measurement of Internal Modulation Distortion

g) Calculation method of TOI:

The ratio of distortion component level to signal level (expressed in dB) specifies the distortion of the system, which is not significant, unless the signal level is also specified. The concept of TOI can be used to specify and preestimate the distortion level of the system. The difference between the TOI component level and the fundamental wave signal level is twice that between the fundamental wave signal level and the TOI. Therefore, the TOI can be calculated by the following formula:

$$TOI = L_{in} - \frac{\Delta dB_{im3}}{2}$$

Where: L_{in} : two input signal levels, in dBm.

ΔdB_{im3} : the difference between the third-order intermodulation product and the input signal level, in dB.

As shown in Figure 5-7, if the difference marker reading is -61.62dB and the signal level is -20.24dBm, the input TOI is:

$$TOI = -20.24 - (-61.62/2) = 10.57(\text{dBm})$$

5.1.5 Measurement of drift signal

5.1.5.1 Definition of drift signal

If the measured signal is a drift signal, it can only be observed by changing the center frequency at different times when measured with a spectrum analyzer. If the signal tracking function of the spectrum analyzer is used, the marker peak will always be displayed on the center frequency of the spectrum analyzer for measurement.

This part will introduce how to measure the drift signal, and use the signal tracking, marker function and maximum hold function of the spectrum analyzer to observe the amplitude track and occupied bandwidth of the drift signal.

5.1.5.2 Measure the frequency drift of the signal generator

The spectrum analyzer can measure the short-term and long-term stability of the signal generator. With the maximum track hold function, the spectrum analyzer can display the maximum peak amplitude and frequency drift of the input signal. If you want to measure the occupied bandwidth of the signal, you can also use the maximum track hold function.

In this example, the signal tracking function of the spectrum analyzer is used to keep the drift signal always displayed in the center, and the maximum track hold function of the spectrum analyzer is used to capture the drift.

- a) Set the signal generator to output the signal:
Set the frequency of the signal generator to 300MHz and the amplitude to -80dBm. Connect the output of the signal generator to the input port of the spectrum analyzer, as shown in Figure 5-1, and enable its RF output.
- b) Set the center frequency, span and reference level of the spectrum analyzer:
Press **【Reset】** .
Press [Frep], [Center Freq], 300 [MHz].
Press **【Freq】** , [Span] and 10 [MHz].
Press **【Amplitude】** , [Ref Level], -10[dBm].
- c) Put the marker at the signal peak position, and enable the signal tracking function:
Press **【Peak】** and [Peak Tracking Off On].
Press **【Freq】** and [Signal Tracking Off On].
- d) Reduce the span:
Press **【Freq】** , [Span] and 500[kHz] to see that the signal remains in the center all the time.
- e) Turn off the signal tracking function:
a) Press[Frequency] and [Signal Tracking Off On].
- f) Measure signal drift using the maximum hold function:
Press [Trace] , [Max Hold] .
If the signal changes, the maximum hold function will maintain the maximum response to the input signal.
- g) Activate trace 2 and set it to continuous refresh mode:
Press **【Trace】** , [Trace 1 2 3] and [Refresh Trace].
- h) Change the output frequency of the signal generator:
Slowly change the output frequency of the signal generator to keep it step by 1kHz and change at ± 50 kHz. The display of the spectrum analyzer is shown in Figure 5-9.

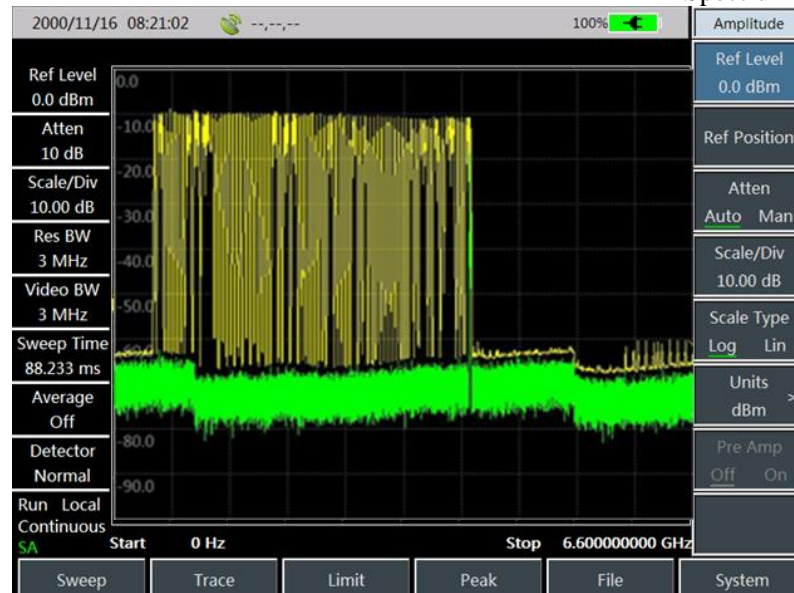


Figure 5-9 Observe the Drift Signal Using the Maximum Hold Function

5.1.6 Noise signal measurement

5.1.6.1 Definition of noise signal

In communication system, the signal-to-noise ratio is usually used to characterize the noise. If the noise level added to the system is much larger, the signal-to-noise ratio will be worse, resulting in more difficult in demodulating the modulated signal. In a communication system, the signal to noise ratio measurement also normally refers to the ratio measurement of carrier to noise.

The following illustrates how to use the marker function of 4957B spectrum analyzer to measure the SNR and noise. The measurement of SNR when the signal (carrier) is in a single frequency point is described in the example. If the system under test is a modulation signal, the test process shall be modified to correct the level of the modulation signal.

5.1.6.2 Measure SNR

- a) Set the signal generator to output the signal:
Set the frequency of the signal generator to 1GHz and the power to -10dBm, connect the signal generator output to the input port of the spectrum analyzer, as shown in Figure 5-1, and turn on the RF switch.
- b) Set the center frequency, span, reference level and attenuator.
Press **【Reset】**.
Press [Frep], [Center Freq], 1 [GHz].
Press **【Frep】**, [Span], 5 [MHz].
Press **【Amplitude】**, [Ref Level], -10[dBm].
Press **【Amplitude】**, [Attenuator Auto Man], 40[dB] (the maximum attenuation value of 4957BA/B/C is 30dB, and only 30dB attenuation is set).
- c) Place the marker at the peak position of the signal, then place the difference marker at the noise position with a frequency offset of 200 kHz:
Press **【Peak】** and [Max. Peak].
Press **【Mkr】**, [Difference Mode] and 200[kHz].
- d) Enable the noise marker function to view the SNR:

Spectrum analysis mode

Press [Mkr], [Noise Mkr Off On], as shown in Figure 5-10.

The reading of SNR is expressed in dB/Hz because the noise value is a value of noise bandwidth normalized to 1Hz. The ratio is decreased by $10 \times \log(BW)$. If it is desired to obtain noise values at different channel bandwidths, the measurement results will be corrected according to the current bandwidth. For example, if the data read by the spectrum analyzer is -85dB/Hz, and the channel bandwidth is 30kHz at this time, the signal-to-noise ratio is:

$$S/N = 85\text{dB/Hz} - 10 \times \log(30\text{kHz}) = 40.2\text{dB}/(30\text{kHz})$$

At this time, if the difference marker is less than a quarter of the signal peak-to-response edge distance, there is a potential error in the noise measurement.

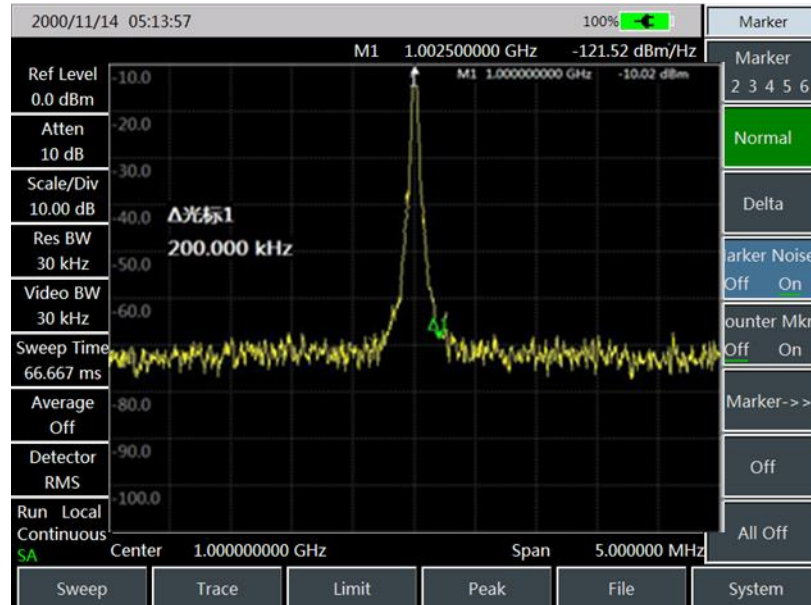


Figure 5-10 Measure SNR

5.1.6.3 Measure noise with noise marker function

The noise with a 1Hz bandwidth is measured with the noise marker function in the example, and 1GHz external signal is used for measurement.

- a) Set the signal generator to output the signal:

Set the frequency of the signal generator to 1GHz and the power to -10dBm. Connect the output of the signal generator to the input port of the spectrum analyzer, and turn on the RF switch.

- b) Set the center frequency, span, reference level and attenuator.

Press **【Reset】**.

Press **【Freq】**, [Center Freq] and 999.98[MHz].

Press **【Freq】**, [Span] and 1 [MHz].

Press **【Amplitude】**, [Ref Level], -10[dBm].

Press **【Amplitude】**, [Attenuator Auto Man], 40[dB] (the maximum attenuation value of 4957BA/B/C is 30dB, and only 30dB attenuation is set).

- c) Activate the noise marker:

Press **【Mkr】** -> [Noise Mk Off On] -> [Peak] -> [Max],

Note that the detection mode at this time will be automatically set to the root mean square detection mode. If you want to get the noise power values under different bandwidths, such

Spectrum analysis mode

values will be corrected with the current bandwidth of $10 \times \log(BW)$. For example, if you want to get the noise power in the 1 kHz band, please add $10 \times \log(1000)$ or 30 dB to the read data.

- d) Reduce the measurement error by increasing the sweep time.

Press **【BW】**, [RBW Auto Man] and 100[kHz].

Press **【Swp】**, [Swp Time Auto Man] and 3[s].

If average detection is used, increase the sweep time to make the trace data average in a longer time interval and further reduce the measurement error.

- e) Move the marker to 1GHz.

Press **【Mkr】** and turn the knob in the front panel to make the noise marker readout 1GHz.

The noise marker value is calculated based on 5% of the entire sweep track points which are centered on the marker position. The position of the noise marker is not located at the peak point of the signal. Since the peak position of the signal does not have enough track points to calculate, so when the resolution bandwidth is narrow, the noise marker will also average the track point below the signal peak. as shown in Figure 5-11.



Figure 5-11 Measure Noise with Noise Marker Function

- f) Set the span of the spectrum analyzer to zero with the marker position as the center.

Press **【Peak】** and [Mkr→Center Freq].

Press [Frep], [Span], [Span Zero].

Press **【Mkr】**.

At this point the amplitude reading of the noise marker is correct because the average of all points is based on the same frequency and is not affected by the shape of the resolution bandwidth filter. The noise marker is calculated based on the average of the interested frequency points. When performing power measurements at discrete frequency points, it should first tune the spectrum analyzer to the interested frequency point and then measure the power at zero span.

5.1.7 Distortion measurement

In the crowded environment of the communication system, the mutual interference between devices is a common problem. For example, the problem of second-order and third-order intermodulation distortion is often encountered in the narrowband system. If a system has two signals (F_1 and F_2), both signals mix with the generated second harmonic distortion signals ($2F_1$ and $2F_2$) to generate TOI products $2F_2 - F_1$ and $2F_1 - F_2$ close to the original signal. High order intermodulation distortion will also occur. Most of these distortion products are produced by amplifiers and mixers in the system. Most transmission devices and signal generators contain harmonics, and the harmonic components often need to be measured.

5.1.7.1 Identify the distortion generated by the spectrum analyzer

The spectrum analyzer inputs a large signal, which will cause distortion of the spectrum analyzer and further affect the distortion measurement results of the real signal. Through the attenuator setting, you can determine which signal is the distorted signal generated inside the spectrum analyzer. In this example, the input signal generated by the signal generator will be used to explain whether the spectrum analyzer generate harmonic distortion.

- a) Set the signal generator to output the signal:

Set the frequency of the signal generator to 200MHz and the power to 0dBm. Connect the output of the signal generator to the input port of the spectrum analyzer, as shown in Figure 5-12, and turn on the RF switch.

- b) Set the center frequency and span of the spectrum analyzer:

Press **【Reset】** .

Press **【Freq】** , [Center Freq] and 400[MHz].

Press **【Freq】** , [Span] and 500 [MHz].

It can be seen from the track of the spectrum analyzer that the harmonic distortion generated by the signal has 200MHz frequency offset from the original 200MHz signal, as shown in Figure 5-12.

- c) Set the center frequency of the spectrum analyzer to the position of the first harmonic distortion.

Press **【Peak】** and [Sub Peak].

Press **【Peak】** and [Mkr→Center Freq].

- d) Set the span to 50MHz and reset the center frequency.

Press **【Freq】** , [Span] and 50 [MHz].

Press **【Mkr→】** and [Mkr→Center Freq].

- e) Set the attenuator to 0dB.

Press **【Amp】** , [Atten Auto/Man] and 0[dB].

Press **【Peak】** and [Peak Tracking Off On].

Press **【Mkr】** and [Difference Mode].

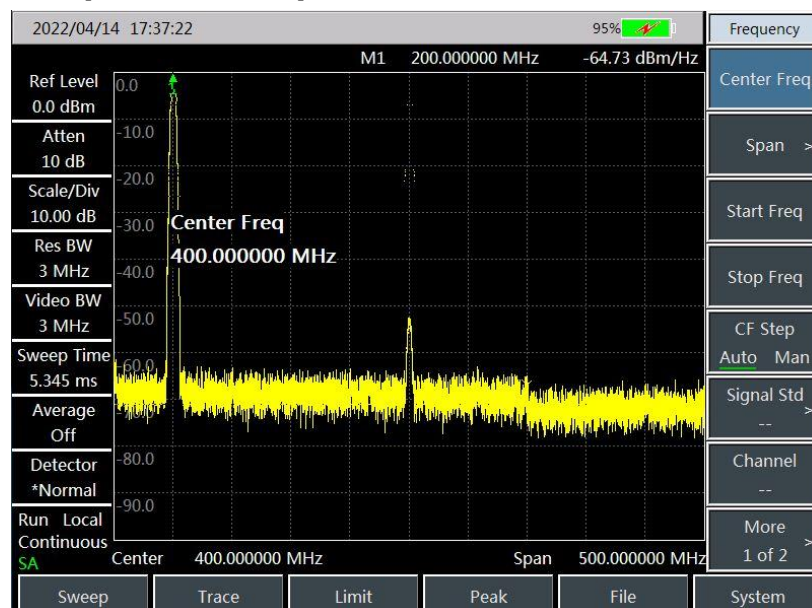


Figure 5-12 Observed Harmonic Distortion

- f) Increase the attenuator setting to 10dB:

Press **【Amp】** , [Atten Auto/Man] and 10[dB].

Spectrum analysis mode

Observe the reading of the difference marker, as shown in Figure 5-13. This reading is the distortion difference generated by the attenuator at 0dB and 10dB. When the attenuator changes, if the difference frequency marker reading is greater than or equal to 1dB, it indicates that the spectrum analyzer has produced certain distortion. If the difference marker reading is unobvious, the attenuation can also be increased.

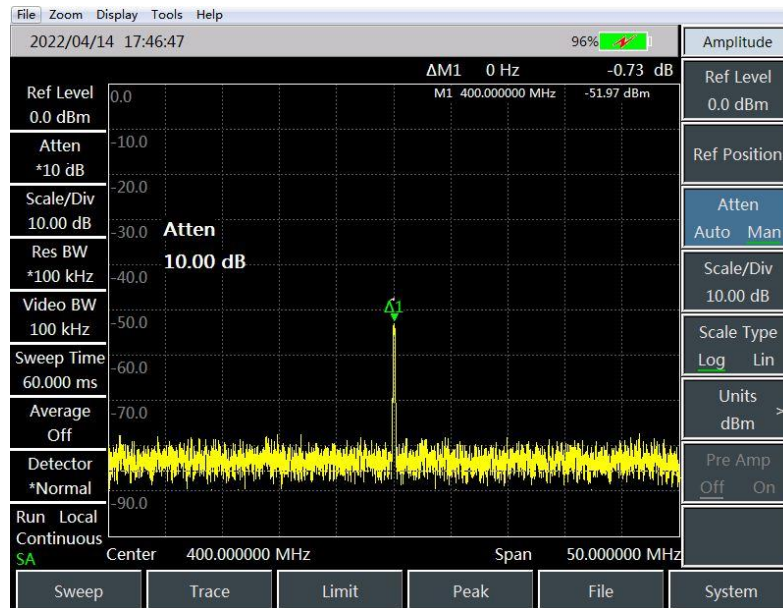


Figure 5-13 Set the Attenuator to 10dB

The amplitude reading of the difference marker comes from two sources: First, the increase of RF attenuation will reduce the signal-to-noise ratio, making the reading positive; Second, the harmonic distortion generated by the spectrum analyzer circuit is reduced, which will make the reading to be negative. The larger the reading, the greater the measurement error. The absolute amplitude of the difference marker reading can be reduced by changing the attenuator.

5.1.7.2 Fast harmonic measurement method

The harmonic component of the signal with the frequency of 1GHz and power of -10dBm generated by the signal generator is measured in this example.

- a) Set the signal generator to output the signal:

Set the frequency of the signal generator to 1GHz and the power to -10dBm, connect the signal generator output to the input port of the spectrum analyzer, as shown in Figure 5-1, and turn on the RF switch.
- b) Set the start and stop frequencies of the spectrum analyzer.

Press **【Reset】** key.

Press **【Reset】**, [Start Freq], 800 [MHz], [Stop Freq], 2.5 [GHz].

The fundamental wave and second harmonic wave are displayed on the screen, as shown in Figure 5-14.

Spectrum analysis mode

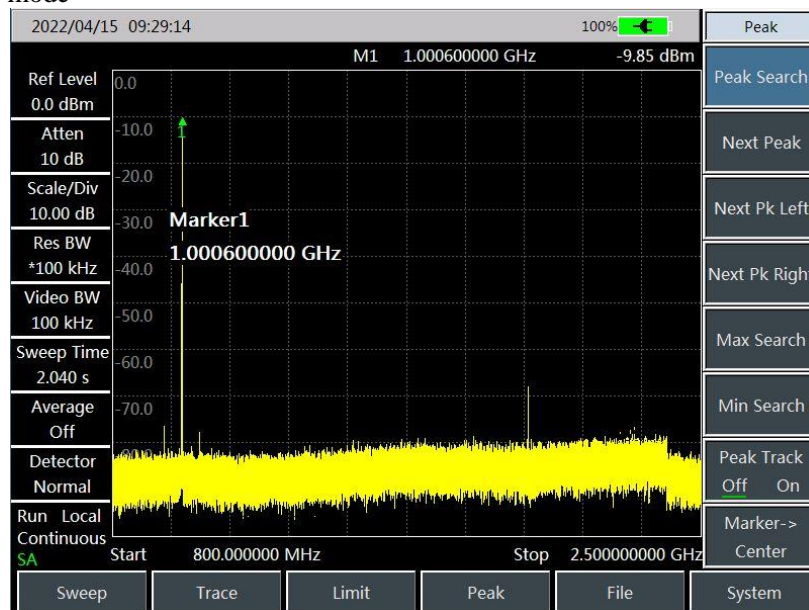


Figure 5-14 Input Signals and Harmonics

- c) Set video bandwidth and smooth noise to improve resolution.
Press **【BW】** , [VBW Auto Man] to enable the manual mode.
Use the step decrement key **【↓】** to reduce the video bandwidth.
- d) Set the fundamental wave peak level as the reference level to improve the measurement accuracy.
Press **【Peak】** , [Max Peak] to read the peak power.
Press **【Amplitude】** , [Ref Level] to set to the peak power. The results are shown in Figure 5-15.

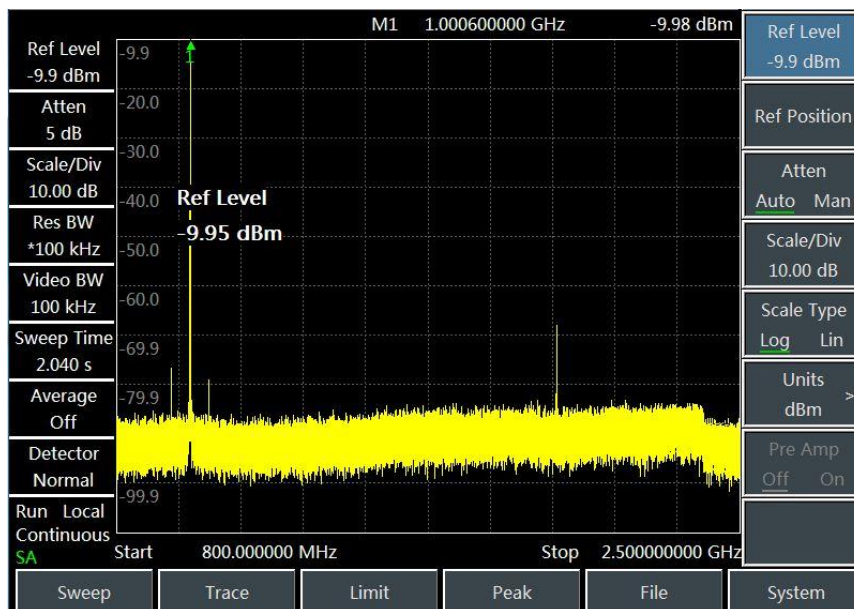


Figure 5-15 Set the Signal Peak at the Reference Level to Obtain the Maximum Accuracy

- e) Activate the marker 2.
Press **【Mkr】** [Difference Mode] and **【Peak】** [Sub Peak].
At this time, the fixed marker is marked on the fundamental wave, and the active marker is located on the peak point of the second harmonic, as shown in Figure 5-16.

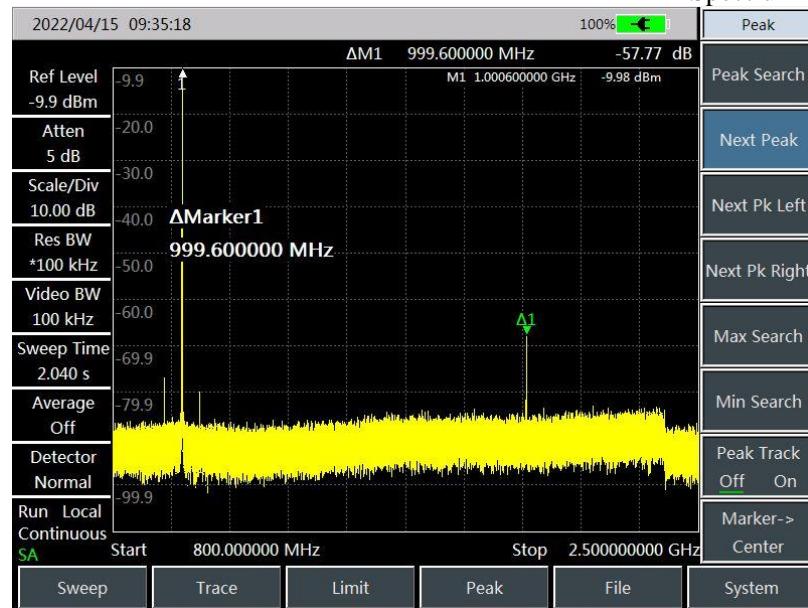


Figure 5-16 Measure the Second Harmonic with marker difference

- f) Measure harmonic distortion (method 1).

The figure shows that the amplitude difference between the fundamental wave and the second harmonic is about -60dB, or the harmonic distortion is 0.1%. (see Figure 5-17).

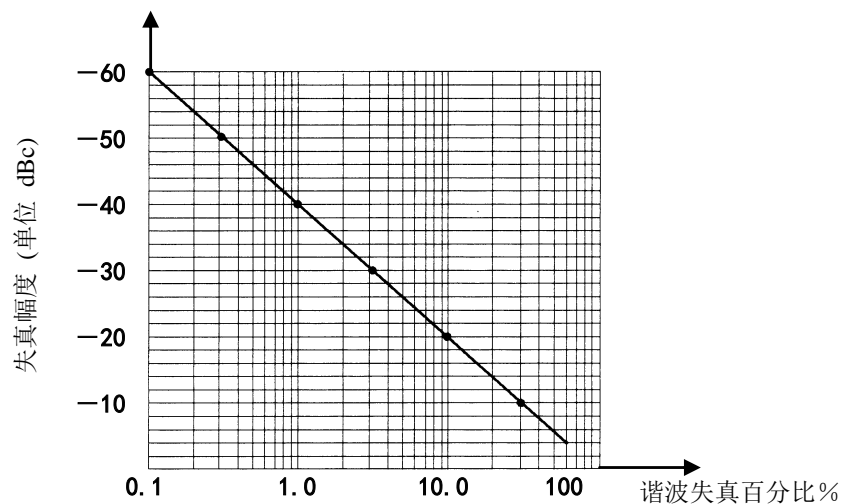


Figure 5-17 Harmonic Distortion Amplitude Percentage Change

To measure the third harmonic, press the [Right Peak] key again and continue reading the amplitude ratio of other harmonics to the fundamental wave.

- g) Measure harmonic distortion (method 2).

Press **【Amp】**, [Amp Unit] and [Volt].

At the moment, the difference marker unit automatically changes to volt. An easy way to determine the distortion percentage is to change the unit to volt. Move the decimal point of the scale shown by the difference marker to the right by two digits to get the distortion percentage. The minimum scale displayed is 0.01 or one percent.

5.1.7.3 Accurate harmonic measurement method

The steps of this method are slightly tedious, but because each signal is measured within a small sweep width and resolution bandwidth, the signal-to-noise ratio is improved, and the measurement result is more accurate. The following describes how to measure the harmonic of 1GHz signal.

- a) Set the signal generator to output the signal:
Set the frequency of the signal generator to 1GHz and the power to -10dBm, connect the signal generator output to the input port of the spectrum analyzer, as shown in Figure 5-1, and turn on the RF switch.
- b) Set the start and stop frequencies of the spectrum analyzer:
Press **【Reset】** key.
Press **【Reset】** , [Start Freq], 800 [MHz], [Stop Freq], 2.5 [GHz].
- c) Set video bandwidth and smooth noise to improve resolution:
Press **【BW】** , [VBW Auto Man] to enable the manual mode.
Use the step decrement key **【↓】** to reduce the video bandwidth.
- d) Reduce the span by using the signal tracking function:
Press **【peak】** key to activate the marker to search for the signal peak.
Press **【Freq】** and [Signal Tracking Off On].
Press **【Freq】** , [Span] and 100 [kHz].
- e) Turn off signal tracking.
Press **【Freq】** and [Signal Tracking Off On].
- f) The best amplitude measurement accuracy can be obtained by moving the signal peak to the top line.
Press **【Peak】** , [Max Peak] to read the peak power.
Press **【Amplitude】** , [Ref Level] to set to the peak power. The results are shown in Figure 5-18.

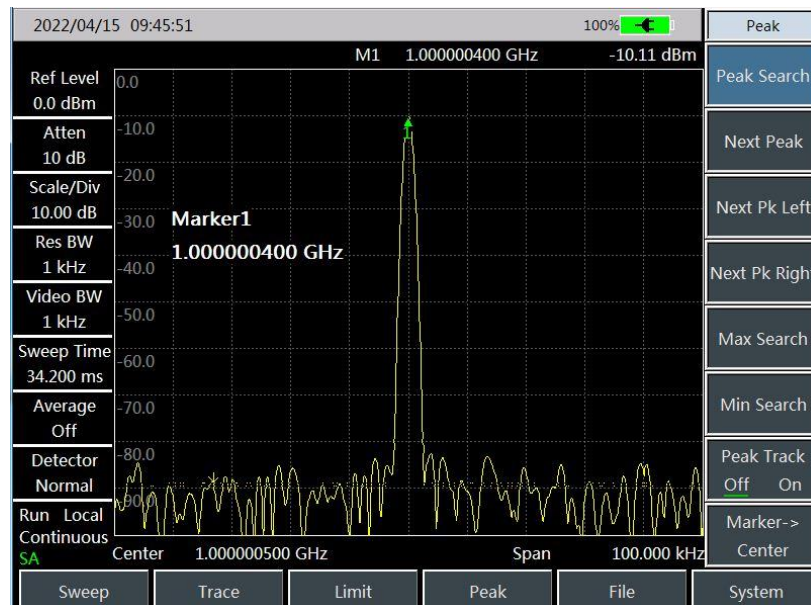


Figure 5-18 Input Signal displayed within 100kHz Span

- g) Set the center frequency step as the fundamental wave signal frequency value.
Press **【Freq】** , [Step Freq Auto Man] and 1[GHz].
- h) Measure the second harmonic.
Press **【Mkr】** , [Mkr→], [Mkr→Center Freq] and step key **【↑】** . The central frequency of the

spectrum analyzer is shifted to the second harmonic by step operation. Press **【Peak】**, [Max Peak] to read the peak power.

Press **【Amplitude】**, [Ref Level] to set to the peak power. Adjust the harmonic peak to the reference level, and the second harmonic amplitude is shown in Figure 5-19.

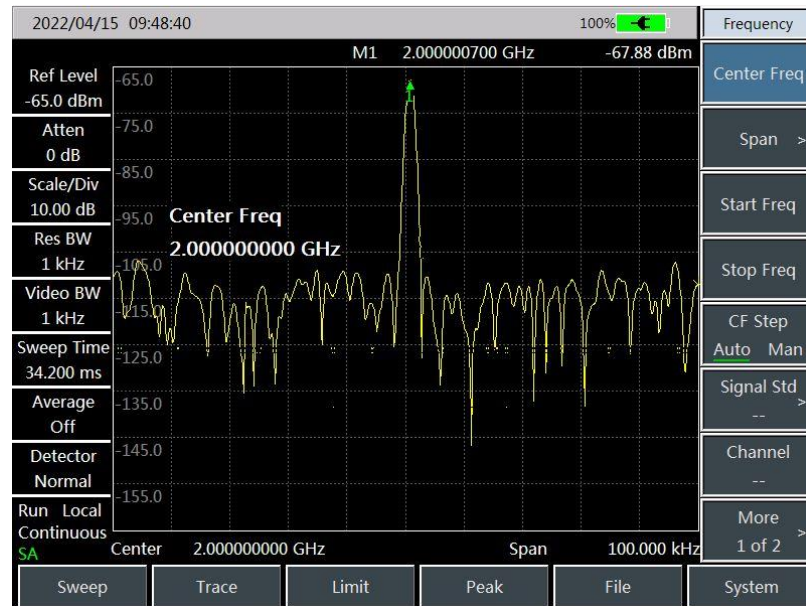


Figure 5-19 Second Harmonic Amplitude

- i) Calculate harmonic distortion.

The change in percent of distortion between the second harmonic and the fundamental wave is shown in Figure 5-17. The unit can be converted into volt to read out the voltage ratio of the two signals.

- j) Measure other harmonics.

Repeat steps (i) to (j) for other harmonics to be measured. Calculate the percentage of each harmonic distortion.

The total harmonic distortion percentage of the signal is also a parameter that is to be tested often. To test this parameter, the amplitude of each harmonic must be measured in linear units (such as volt), instead of relative unit dBc. Press **【Amp】**, [Amp Unit] and [Volt] The amplitude unit is volt. The measured signal amplitude value is used to calculate the total harmonic distortion in the following equation:

$$THD = \frac{100 \times \sqrt{(A_2)^2 + (A_3)^2 + \dots + (A_n)^2}}{A_1} \%$$

Where:

A1 ——— fundamental wave amplitude, unit: volt

A2 ——— second harmonic amplitude, unit: volt

A3 ——— third harmonic amplitude, unit: volt

An ——— Nth harmonic amplitude, unit: volt

If the signal amplitude can be measured carefully in the steps in the previous example, the harmonic distortion percentage measured in this process is very accurate.

5.1.8 Pulsed RF signal measurement

5.1.8.1 Definition of pulsed RF signal

Pulsed RF signal is a series of RF pulses with the same repetition frequency, constant pulse width, constant shape and amplitude. Several methods for measuring the parameters of pulsed RF signals will be illustrated in this section. Such methods will explain how to measure the center frequency, pulse width and pulse repetition frequency. In addition, the measurement of peak pulse power will also be discussed.

The resolution bandwidth has a great influence on the measurement of pulsed RF signal. The relationship between resolution bandwidth and pulse repetition frequency must be understood. If the resolution bandwidth is narrower than the pulse repetition frequency, only individual frequency components of the pulsed RF signal are displayed on the screen, which is called as narrowband mode. If the resolution bandwidth is wider than the pulse repetition frequency, it is called as the broadband mode. At the moment, the spectrum envelope drawn by the pulse burst divided by the pulse repetition frequency can be seen.

5.1.8.2 Measurement of center frequency, SLR and pulse width of pulsed RF signal

- a) Set the signal generator to output the signal:

Set the frequency of the signal generator to 1GHz and the power to -20dBm. Connect the output of the signal generator to the input port of the spectrum analyzer, as shown in Figure 5-1. The pulse modulation is set to the repetition frequency of 1kHz and the pulse width of 900ns. Enable the pulse modulation and the RF output.

- b) Set the spectrum analyzer:

The pulsed RF signal is generally measured in broadband mode. In order to ensure that the video filter does not interfere with the measurement results, the video bandwidth is set to 3MHz.

Press **【Reset】** key.

Press [Frep], [Center Freq], 1 [GHz].

Press **【Freq】**, [Span], 10[MHz], **【Swp】** and [Swp Time Auto Man] 60[ms].

Press **【BW】**, [RBW Auto Man], 100[kHz], [VBW Auto Man] and 100[kHz].

Press **【BW】**, [Detection] and [Positive peak] to activate positive peak detection.

Select the center frequency function and adjust the span so that the center side lobe and at least one pair of side lobes are displayed on the screen, as shown in Figure 5-20.

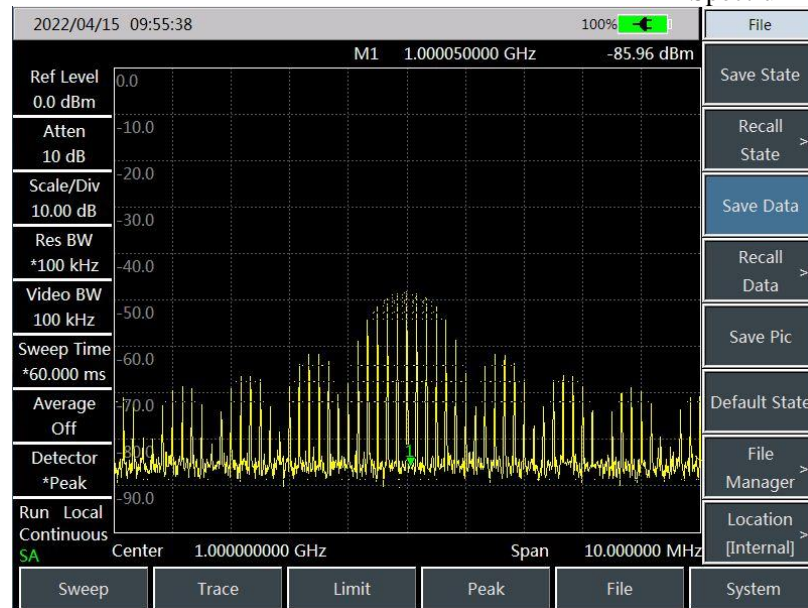


Figure 5-20 Main and Side Lobes

Increase the sweep time (sweeping slows down) until the figure is filled and becomes a solid line, as shown in Figure 5-21. If the spectral line isn't filled in, the instrument is not in broadband mode. In this case, the following measurement steps for side lobe ratio, pulse width and peak pulse power are not applicable, and the resolution bandwidth has to be set to greater than 1kHz.

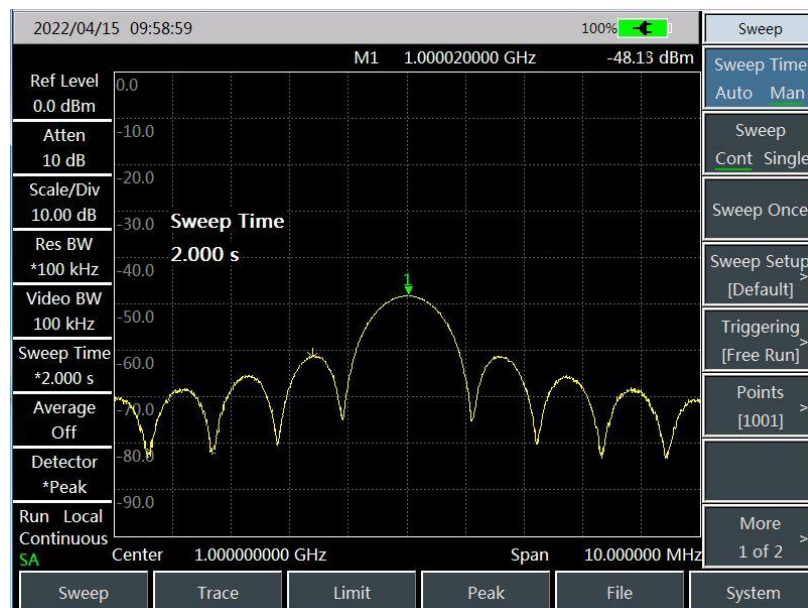


Figure 5-21 Track Displayed in a Solid Line

- c) Read out the pulse center frequency and main lobe amplitude:
Press [peak];
At this time, the marker reading is the pulse center frequency and main lobe amplitude.
- d) when the marker is at the center frequency of the main lobe, measure the side lobe ratio:
Press **【Peak】** , **【Mkr】** , [Difference Mode] **【Peak】** and [Sub Peak].
The amplitude difference between the main lobe and the side lobe is the side lobe ratio, as

Spectrum analysis mode shown in Figure 5-22.

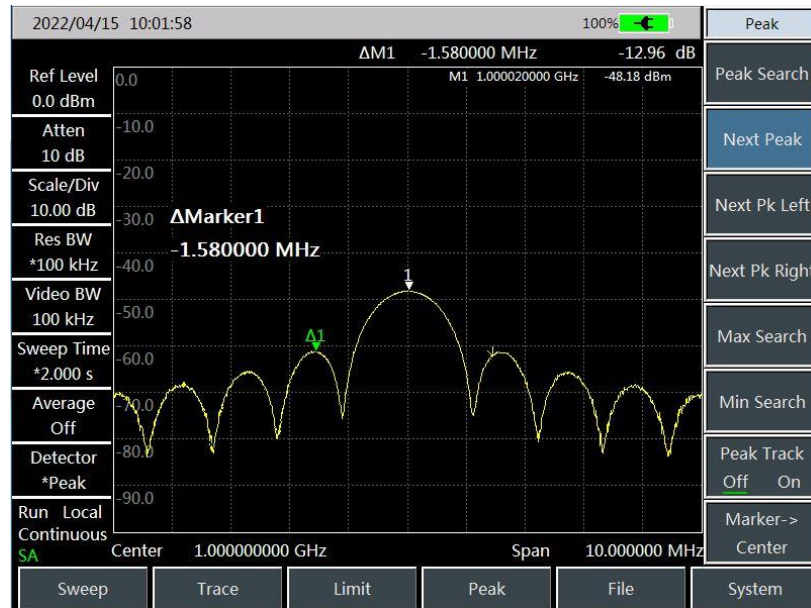


Figure 5-22 The Marker Displays the Side Lobe Ratio

- e) Measure the pulse width, which is equal to the reciprocal of the frequency difference between the peak points of the two side lobe envelopes:

Press **【Mkr】**, [Difference Mode], **【Peak】** [Right Peak] and [Right Peak].

At the moment, the reciprocal of the frequency difference of the difference marker is the pulse width, as shown in Figure 5-23. To obtain the most accurate pulse width value, you can manually adjust the marker position and measure the distance between two adjacent side lobes crossing the zero point. If the resolution bandwidth is reduced to make the zero crossing sharper, the measurement accuracy is higher.

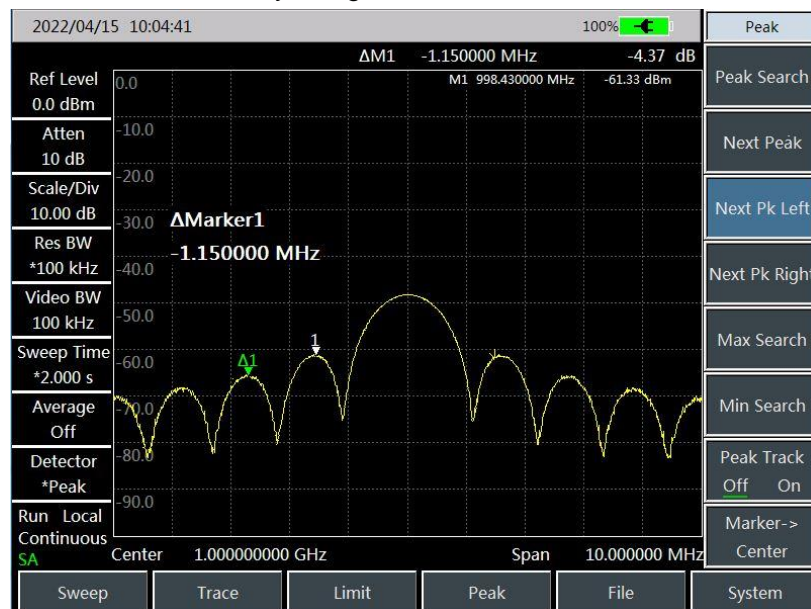


Figure 5-23 The Marker Displays the Pulse Width

5.1.8.3 PRF measurement

Pulse repetition interval (PRI) is the time interval between any two adjacent pulse responses.

- a) Set the signal generator to output the signal:

Set the frequency of the signal generator to 1GHz and the power to -20dBm. Connect the

Spectrum analysis mode

output of the signal generator to the input port of the spectrum analyzer. Set the pulse modulation to the repetition frequency of 1kHz and the pulse width of 900ns. Open the pulse modulation and the RF output.

- b) Set the spectrum analyzer:

Press **【Reset】** key.

Press **【Freq】** and 1[GHz].

Press **【Freq】**, [Span], 10[MHz], **【Swp】** and [Swp Time Auto Man] 1.705[s].

Press **【BW】**, [RBW Auto Man] and 1[kHz].

Press **【BW】**, [VBW Auto Man] and 3[MHz].

Press **【BW】**, [Detection] and [Positive Peak] to activate positive peak detection.

Adjust the span so that the main lobe and at least one pair of side lobes are displayed on the screen.

Readjust the output amplitude of the signal generator to keep it on the screen, and reduce the sweep time (i.e. speed up the sweep speed) until the display is similar to Figure 5-24.

- c) Measure the pulse repetition interval (PRI).

Select **【Swp】** and [Swp Type Cont Single].

Press **【Peak】**, **【Mkr】**, [Difference Mode], **【Peak】** and [Sub Peak]. The displayed difference between the two markers is equal to the pulse repetition interval (PRI), and its reciprocal is the pulse repetition frequency (PRF).

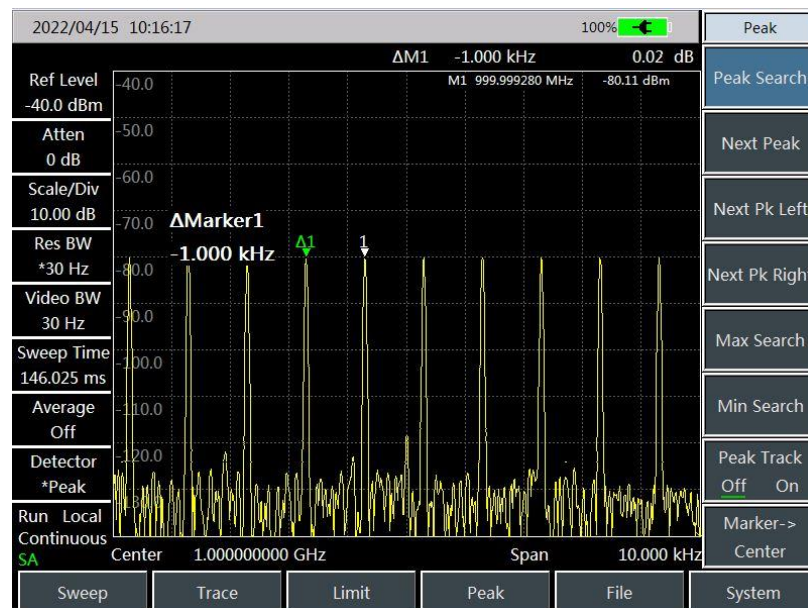


Figure5-24 Measure the Pulse Repetition Frequency (PRF)

5.1.8.4 Peak pulse power measurement

Now that the main lobe amplitude and pulse width are given, and the resolution bandwidth of the spectrum analyzer can be easily got, thus the peak pulse power can be obtained from these parameters.

If the spectrum analyzer is in broadband measurement mode:

- a) Peak pulse power = (main lobe amplitude) - (20 log $T_{eff} \times BW_i$)

Where:

- b) T_{eff} - pulse width, unit: Second

- c) BW_i —Impact bandwidth, Hertz (resolution bandwidth used to measure pulse width when

Spectrum analysis mode

the value is 1.5×)

If the spectrum analyzer is in narrowband measurement mode:

d) Peak pulse power = (main lobe amplitude) $-(20 \log T_{\text{eff}}/T)$
Where:

e) T_{eff} - pulse width, unit: Second
 T —pulse repetition frequency

The phenomenon that the peak pulse power is not equal to the amplitude of the main lobe is called pulse desensitization. The pulse signal will not reduce the sensitivity of the spectrum analyzer. Specifically, the apparent desensitization is due to the fact that the power of the pulse modulated continuous wave (CW) carrier is allocated to a large number of spectrum components (i.e. carrier and sideband). Therefore, each spectrum component contains only a part of the total power.

Notice

For measuring the main lobe amplitude, change the attenuator of the spectrum analyzer and verify that the main lobe amplitude does not change with it. If the change exceeds 1dB, the spectrum analyzer is in the gain compression state, and the attenuation of the attenuator must be increased.

5.1.9 Signal generation measurement (option)

The generation and measurement mode of signal source is independent source mode, and the independent source mode is point frequency source mode, which can realize the signal output of single frequency point and fixed power.

5.1.9.1 Signal generation measurement

In the signal generation measurement mode, the fixed frequency signal is output in the following steps:

- a) Press **【Measure】** →[Page Down 1/2]→[Signal Generation]→[Signal Generation Off On], and in the default state, select the point frequency source 3.25GHz output after the signal source switch is turned on.
- b) Press **【Measure】** →[Page Down 1/2]→[Signal Generation]→[Freq 3.25GHz] and set the frequency of the output signal.
- c) Press **【Measure】** →[Page Down 1/2]→[Signal Generation]→[High Power] to set the power of the output signal to high power output.
- d) Press **【Measure】** →[Page Down 1/2]→[Signal Generation]→[Low Power] to set the power of the output signal to low power output.
- e) Press **【Measure】** →[Page Down 1/2]→[Signal Generation]→[Manual Power -18dBm] to set the power of the desired output signal power according to the needs of users. The signal with output frequency of 1GHz and output power of 0dBm is shown in Figure 5-25 below:

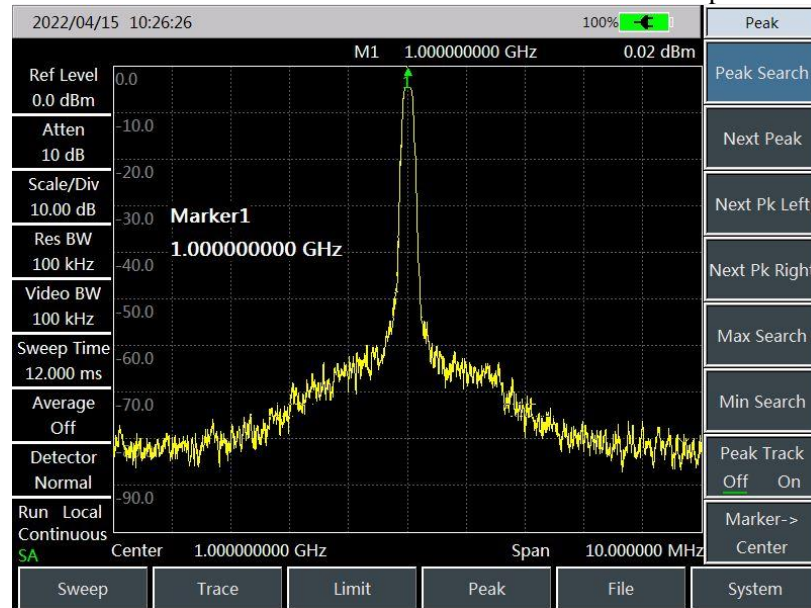


Figure 5-25 Point Frequency Source Output Signal

5.1.10 Interference map (option)

The interference map option can be used for RSSI test and ACPR test, and the test results can be marked on the map in real time according to time or distance. The test results on the map can be saved in the instrument for future recalling. Because the offline map is too large, the map stored internally when the instrument leaves the factory is the map of the user's province or country. Maps of other provinces or countries can be downloaded from the external network disk or the Company's website, and the downloaded maps are placed in the offline map folder of the instrument or SD card.

5.1.10.1 RSSI measurement

RSSI measurements are set as follows:

- Press **【Measure】** → [Interference Map] → [Interference Map Off On]. By default, when the interference map switch is turned on, the measurement mode is RSSI measurement;
- Press **【Measure】** → [Center Freq] to set the frequency of the signal to be measured.
- Press **【Measure】** → [Interference Map] → [Measure] → [RSSI] to set the colors marked on the map for different powers of the received signal.
- Press **【Measure】** → [Interference Map] → [Distance Time] → [Repetition Type Time Distance] to set the method according to time interval or moving distance when marking information on the map.
- Press **【Measure】** → [Interference Map] → [Distance Time] → [Repetition Time] to set the time interval of data marking on the map.
- Press **【Measure】** → [Interference Map] → [Distance Time] → [Repetition Time] to set the distance of data marking on the map.
- Press **【Measure】** → [Interference Map] → [Start Acquisition] to start RSSI test and mark the test results on the map.

5.1.10.2 Adjacent channel power ratio (ACPR) measurement

ACPR measurements are set as follows:

- Press **【Measure】** → [Interference Map] → [Interference Map Off On]. By default, when the

Spectrum analysis mode

interference map switch is turned on, the measurement mode is RSSI measurement;

- b) Press **【Measure】** →[Center Freq] to set the frequency of the signal to be measured.
- c) Press **【Measure】** →[Interference Map]→ [Measure]→[ACPR] to set the adjacent channel power ratio measurement.
- d) Press**【Measure】** →[Interference Map]→ [Measure]→[ACPR] →[Main CHBW] to set the main channel bandwidth.
- e) Press **【Measure】** →[Interference Map]→ [Measure]→[ACPR] →[Adj CHBW] to set the adjacent channel bandwidth.
- f) Press **【Measure】** →[Interference Map]→ [Measure]→[ACPR] →[Ch Space] to set the channel space.
- g) Press **【Measure】** →[Interference Map] →[Distance/Time] → [Repetition Type Time Distance] to set the method according to time interval or moving distance when marking information on the map.
- h) Press **【Measure】** →[Interference Map] →[Distance/Time] → [Repetition Time] to set the time interval of data marking on the map.
- i) Press **【Measure】** →[Interference Map] →[Distance/Time] → [Repetition Time] to set the distance of data marking on the map.
- j) Press **【Measure】** →[Interference Map]→[Start Acquisition] to start ACPR test and mark the test results on the map.

5.2 Menu Structure



Figure 5-28 Structure of Frequency, Amplitude, Bandwidth and Marker Menu

Spectrum analysis mode



Figure 5-29 Structure of Sweep, Trace and Limit Menu

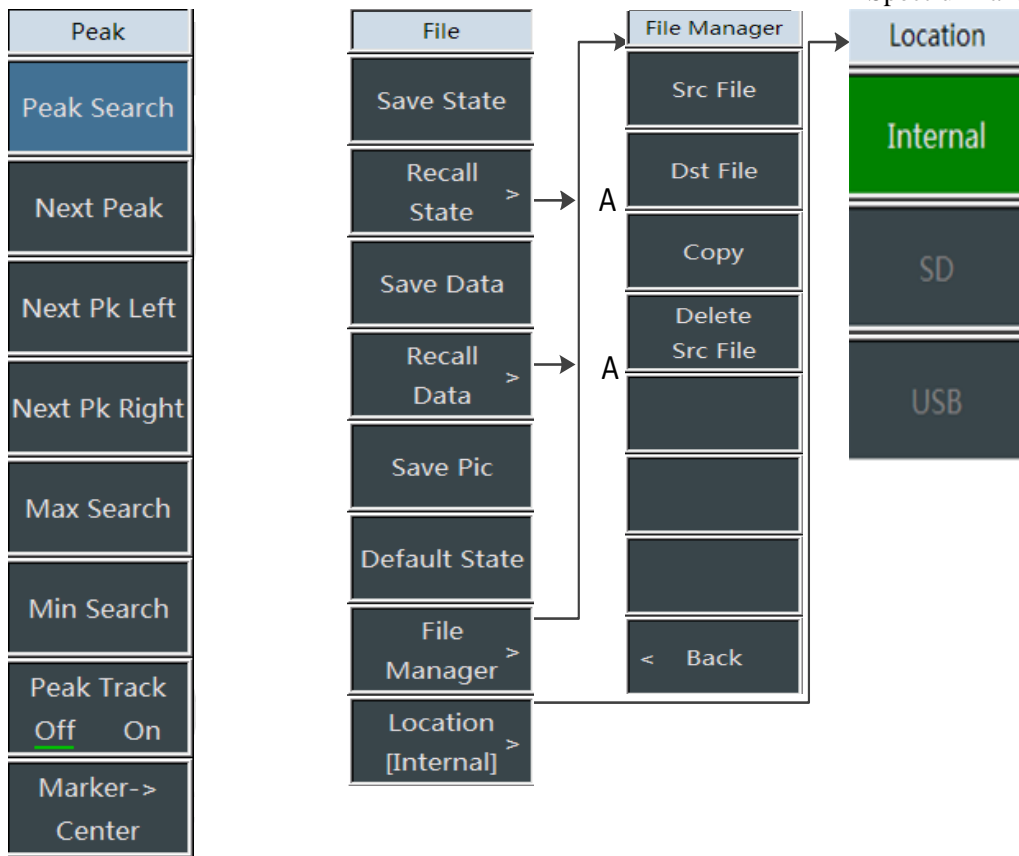


Figure 5-30 Structure of Peak and File Menu



Figure 5-31 Measure Menu Structure



Figure 5-32 Measure Menu Structure

5.3 Menu Description

5.3.1 Frequency menu 1/2

Frequency	<p>-[Center frequency]: Press 【Freq】 → [Center Frequency], select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu with the numeric keys on the front panel, or use the 【↑】【↓】 keys and the knob to set the center frequency value.</p>
Center Freq	<p>-[Span]: Press 【Freq】 → [Sweep] and open the span setting submenu. For details, please refer to the description of the [Span] menu.</p>
Span >	<p>-[Start frequency]: Press 【Freq】 → [Start Frequency] to select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu with the numeric keys on the front panel, or use the 【↑】【↓】 keys and the knob to set the start frequency value.</p>
Start Freq	<p>-[Stop Frequency]: Press 【Freq】 → [Stop Frequency] to select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu with the numeric keys on the front panel, or use the 【↑】【↓】 keys and the knob to set the stop frequency value.</p>
Stop Freq	<p>-[Step Frequency]: Press 【Freq】 → [Step Frequency] to select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu with the numeric keys on the front panel, or use the 【↑】【↓】 keys and the knob to set the step frequency value.</p>
CF Step Auto Man	<p>-[Signal Standard]: Click this menu to pop up the signal standard menu, including [Header], [Footer], [Page Up], [Page Down], [Recall Immediately] and other soft menus, press [Recall Immediately] to select the required signal standard file.</p>
Signal Std >	<p>-[Channel No.]: Click the menu to display the content and number of the selected signal standard.</p>
--	<p>-[Special Notes]: The setting of the channel number shall be carried out under the premise of loading the signal standard, otherwise a prompt that it cannot be set will pop up.</p>
Channel --	
More >	
1 of 2	

5.3.2 Frequency menu 2/2

Frequency	<p>·[Signal Tracking Off On]: Click this menu, and select whether to track the signal. After each sweep, the signal tracking function will place the activated marker on the peak point of the signal and set the peak frequency as the center frequency. Enable [Signal Tracking On Off] to automatically keep the slowly drifting signal in the center of the display screen.</p> <p>·[Signal Search]: Click this menu, the menu will search for the signal within the current span, and place the activated marker on the peak point of the signal. In case of no signal within the current span, the prompt of search failure will be given.</p> <p>·[Channel No.]: Click the menu to display the content and number of the selected signal standard.</p> <p>·[Special Notes]: The setting of the channel number shall be carried out under the premise of loading the signal standard, otherwise a prompt that it cannot be set will pop up.</p>
Signal Track Off On	
Signal Search	
More 2 of 2 >	

5.3.3 Sweep menu

Span	<p>·[Span]: Press 【Freq】 → [Span] to set the span value in the current state. Then select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu with the numeric keys on the front panel, or press the [↑], [↓] keys and the knob to set the span. The span is stepped by 1, 2 and 5.</p> <p>·[Full Span]: Press 【Freq】 → [Span] → [Full Span] to set the span in the current measurement state as the maximum span value.</p> <p>·[Zero Span]: Press 【Freq】 → [Span] → [Zero Span] to set the span in the current measurement state as the minimum span value and set the full span value as 0Hz.</p> <p>·[Last Span]: Press 【Freq】 → [Span] → [Last Span], and set the span in the current measurement state as the span value set last time.</p> <p>·[Special Notes]: Full and zero span functions are invalid when some measurement functions are enabled.</p>
Span	
Full Span	
Zero Span	
Last Span	
Zero Span IF Out >	
< Back	

5.3.4 Amplitude menu

Amplitude	<p>-[Ref Level]: Press [Amplitude] → [Ref Level], and then select [dBuV], [-dBuV], [mV] and [uV] in the frequency unit menu with the numeric keys on the front panel, or use the 【↑】【↓】 keys and the knob to set it.</p>
Ref Level 0.0 dBm	<p>-[Ref Pos]: Press 【Amplitude】 → [Ref Pos], and select the position of the reference line in the rectangular coordinate graph by clicking the corresponding numeric key.</p>
Ref Position	<p>-[Atten Auto/Man]: Press 【Amplitude】 → [Atten <u>A</u>uto <u>M</u>an] to adjust the input attenuation of the spectrum analyzer. In the automatic mode, the input attenuator is associated with the reference level. In the manual mode, the attenuation of the attenuator can be adjusted by numeric keys, step key or knob. The attenuation range is 0dB ~ 50dB.</p>
Atten Auto Man	<p>-[Scale/Div]: Press 【Amplitude】 → [Scale/Div] to adjust the size of the screen grid line. Then select the frequency unit with the numeric keys on the front panel, or use the 【↑】【↓】 keys and the rotating knob to set it. Select between 0.1dB/div and 20dB/div. The default value is 10dB/div.</p>
Scale/Div 10.00 dB	<p>-[Scale <u>L</u>og <u>L</u>ine]: Press【Amplitude】 → [Scale <u>L</u>og <u>L</u>ine] to select the vertical axis scale type of log or linear. Log scale is generally in dBm, and linear scale is generally in mV by default.</p>
Scale Type Log Lin	<p>-[Amp Unit] Press【Amplitude】 → [Amp Unit], and select the units of the vertical axis, including [dBm], [dBmV], [dBuV], [Volt], and [Watt].</p>
Units dBm >	<p>-[Pre Amp <u>O</u>ff <u>O</u>n]: This function is used to control the On/Off state of the preamplifier. Such function will be activated only when the reference level is less than -40dBm.</p>
Pre Amp Off On	<p>-[Special Notes]: When the preamplifier is opened, don't input the signal of >+13dbm, otherwise the instrument will be damaged.</p>

5.3.5 Bandwidth menu

BW	<p>·[RBW Auto Man]: Press 【BW】 , [RBW Auto Man], and set the resolution bandwidth from 1Hz to 10MHz. In manual mode, the resolution bandwidth can be changed in steps of 1, 3 and 10with numeric keys, step key or knob. In automatic mode, it changes with the span at the SPAN/RBW ratio. The 10 MHz resolution bandwidth is not automatically associated with the span and needs to be set manually.</p>
Res BW Auto Man	<p>·[VBW Auto Man]: Press 【BW】 → [VBW Auto Man]to adjust the video bandwidth displayed in the active function zone. Adjust the video bandwidth with the range from 1Hz to 10MHz. In manual mode, use the numeric keys, step keys or knob to change the video bandwidth in steps of 1, 3, and 10. In the automatic mode, the RBW/VBW ratio changes with resolution bandwidth.</p>
Video BW Auto Man	<p>·[Ave Off On]: Press 【BW】 → [Ave Off/On] to select the averaging function. This function continuously averages the traces to achieve a smooth trace.</p>
Video Type Lin Log	<p>·[SPAN/RBW]: press 【BW】 → [SPAN/RBW] to set the ratio of current frequency bandwidth to resolution bandwidth and display it in the input area. The default value is 100. This ratio is used in the correlation mode of resolution bandwidth.</p>
Average Off On	<p>·[RBW/VBW]: press 【BW】 →[RBW/VBW] to set the ratio of current video bandwidth to resolution bandwidth. The default value is 1. If the resolution bandwidth changes, the video bandwidth will automatically change to meet the ratio when it is automatic. The ratio is displayed in the input zone and used in the association mode of two bandwidths. If a new ratio is selected, the video bandwidth is changed to meet the new ratio, while the resolution bandwidth remains unchanged.</p>
SPAN/RBW 100	<p>·[Detection]: press 【BW】 → [Detection] to pop up the soft menu of setting detection mode. For details, please refer to the description of[Detection]menu.</p>
RBW/VBW 1	
Detector Auto >	

5.3.6 Detection menu

	<p>·[Auto]: Enter the detection menu, and it will automatically default to the normal mode.</p> <p>·[Normal] In this mode, when noise is detected, the measurement results of positive and negative peaks are displayed simultaneously to achieve a similar display effect to the analog instrument. However, only positive peak is displayed when the signal is detected. This is the most common method of detector. The signal and noise base can be seen simultaneously without losing any signal.</p> <p>·[PosPeak]: Select the positive peak detection mode. Make sure that no peak signals are missed, which is suitable for measuring signals that are very close to the noise base. Select the positive peak detector when [Max Hold].</p> <p>·[NegPeak]: Select the negative peak detection mode. This mode enables the trace to display a negative peak level. In most cases, it is used in self-tests of the broadband millimeter wave spectrum analyzer and is rarely used in measurements. It can fully reproduce the modulation envelope of the AM signal. Select the negative peak detector when [Min Hold].</p> <p>·[Sample]: Set the detector to sample detection mode. It is suitable for measuring noise signals and can measure noise better than normal detection methods. It is usually used for video averaging and noise frequency marker functions.</p> <p>·[Ave]: Set the detector to average detection mode. The average of the sampled data of the trace in each sampling interval is displayed in the average detection mode.</p> <p>·[Rms]: Set the detector to Rms detection mode. The average of the sampled data of the trace in each sampling interval is displayed in the Rms detection mode.</p> <p>·[Back]: return to the previous menu.</p>
Detector	
Auto	
Normal	
Peak	
Neg Peak	
Sample	
Average	
RMS	
< Back	

5.3.7 Marker menu

	<p>•[Marker 1 2 3 4 5 6]: Press 【Mkr】 → [Marker <u>1</u> 2 3 4 5 6] to select different frequency markers, activate a single frequency marker, place the frequency marker in the center of the trace, and display these values in the frequency marker display area in the upper right corner of the screen.</p>
Marker	
Marker <u>1</u> 2 3 4 5 6	<p>•[Normal Mode]: Press 【Mkr】 → [Normal Mode] to display the frequency and amplitude of the frequency marker. Use the knob, step key or numeric key to move the active frequency marker. The displayed amplitude difference is in dB by default.</p>
Normal	
Delta	<p>•[Difference Mode]: Press 【Mkr】 → [Difference Mode] to display the amplitude difference and frequency difference between the two frequency markers (time difference in case of zero bandwidth). Use the knob, step key or numeric key to move the active frequency marker. The displayed amplitude difference is in dB by default.</p>
Marker Noise <u>Off</u> On	<p>•[Noise Mkr <u>Off</u> On]: Press 【Mkr】 → [Noise Mkr <u>Off</u> On] and select noise marker ON/OFF. When the menu is on, activate the noise marker. The noise marker will read noise power near the activated marker that is normalized to the 1 Hz bandwidth. At this time, the detector is in the Rms detection mode.</p>
Counter Mkr <u>Off</u> On	<p>•[Counter <u>Off</u> On]: Press 【Mkr】 → [Counter <u>Off</u> On] to open or close the frequency marker count function. If the frequency marker is not currently activated, an active frequency marker will be activated in the middle of the screen when the frequency marker count function is enabled.</p>
Marker->>	
Off	<p>•[Mkr]: By pressing 【Mkr】 → [Mkr→], soft menus related to the marker function pop up, which are related to whether the frequency, bandwidth and frequency marker of the spectrum analyzer are in normal or difference frequency marker mode. These marker functions allow the user to change the settings of the spectrum analyzer with the marker as a reference.</p>
All Off	<p>•[Marker Off]: Press 【Mkr】 → [Mkr Off] to close the currently selected marker and its related functions, such as: [Noise marker].</p> <p>•[All Off]: Press 【Mkr】 → [All Off] to close all markers and their related functions, such as: [Noise marker].</p>

Marker->	·[Mkr→Center Freq]: Press 【Mkr】 →[Mkr→]→[Mkr→Center Freq], the marker will move to the center frequency, and the reading at the center frequency is displayed on the screen.
Marker-> Center	·[Mkr →Step Freq]: Press 【Mkr】 →[Mkr→]→[Mkr→Step Freq] to set the stepping amount of the center frequency, that is, the value of the frequency step is equal to the marker frequency. If the difference marker function is activated, the frequency step value is equal to the frequency of the difference marker.
Marker-> CF Step	·[Mkr →Start Freq]: Press 【Mkr】 →[Mkr→]→[Mkr→Start Freq] to set the start frequency equal to the marker frequency.
Marker-> Start	·[Mkr →Stop Freq]: Press 【Mkr】 →[Mkr→]→[Mkr→Stop Freq] to set the stop frequency equal to the marker frequency.
Marker-> Stop	·[Back]: Return to the previous menu
< Back	

5.3.8 Measurement menu

	- [Field Strength Meter]: Press 【Measure】 →[Field Strength Measurement], select the field strength measurement function, and call out the relevant function menu. For details, please refer to the menu description of [Field Strength Measurement].
Measure	
Field Strength >	- [Ch Power]: Press 【Measure】 →[CHPower], select the channel power function, and call out the relevant function menu. For details, please refer to the menu description of [CHPower].
Channel Power >	
OBW >	- [OBW]: Press 【Measure】 →[OBW], select the occupied bandwidth function, and call out the relevant function menu. For details, please refer to the menu description of [OBW].
ACPR >	
Emission Mask >	- [Adj CH Power]: Press 【Measure】 →[Adj CH Power], select the adjacent channel power function, and call out the relevant function menu. For details, please refer to the menu description of [Adj CH Power].
C/N >	
All Meas Off	- [Stray Template]: Press 【Measure】 →[Stray Template], select the stray template function, and call out the relevant function menu. For details, please refer to the menu description of [Stray Template].
More 1 of 2 >	
	- [Carrier-to-Noise Ratio]: Press 【Measure】 →[Carrier-to-Noise Ratio], select the carrier-to-noise Ratio measurement function, and call out the relevant function menu. For details, please refer to the menu description of [Carrier-to-Noise Ratio].
	- [Close Measurement]: Press 【Measure】 →[Close Measurement] and close measurement.
Measure	
Tune Listen >	- [Audio Demodulation]: Press 【Measure】 →[Page Down 1/2]→[Audio Demodulation] to start the audio demodulation function. For details, please refer to the menu description of [Audio Demodulation].
IQ Capture >	
Coverage Map >	- [IQ Capture]: Press 【Measure】 →[Page Down 1/2]→[IQ Capture] to start the IQ capture function. For details, please refer to the menu description of [IQ Capture].
Generator>	
All Meas Off	
More 2 of 2 >	

The spectrum analyzer provides the function of field strength measurement, including} [Field Strength Off On], [Recall Antenna], [Edit Antenna], [Save Antenna] and other related soft menus. With the corresponding test antenna, the field strength test can be carried out quickly.

Spectrum analysis mode

Field Strength	- [Field Strength Off On]: Press 【Measure】 →[Field Strength Measurement]→[Field Measurement Off On] to start or stop the field strength measurement function.
Field Strength Off On	
Recall Antenna >	- [Recall Antenna]: Press 【Measure】 →[Field Strength Measurement]→[Recall Antenna], soft menus such as [Header], [Footer], [Last Page], [Next Page], [Recall Immediately] and [Delete] pop up, and you can select and call the saved antenna factor file in the spectrum analyzer
Edit Antenna >	- [Edit Antenna]: Press 【Measure】 →[Field Strength Measurement]→[Edit Antenna] to pop up[Add Edit Point],[Delete Edit Point],[Clear Edit Point],[Complete Editing],[Cancel Editing]and other soft menus for editing antenna factors.
Save Antenna	- [Save Antenna]: Press 【Measure】 →[Field Strength Measurement]→[Save Antenna] to save the antenna factor.
< Back	- [Back]: Press 【Measure】 →[Field Strength Measurement]→[Back] to exit the field strength menu and return to the measurement menu.

The spectrum analyzer provides the channel power measurement function. The channel power of the signal can be measured by setting the relevant parameters in the function menu and selecting the appropriate resolution bandwidth and sweep width. Please refer to Section 1 Channel Power Measurement of this chapter for specific operations.

Channel Pwr	- [Ch Power Off On]: Press 【Measure】 →[Ch Power] →[Ch Power Off On] to start or stop the channel power measurement.
Channel Pwr Off On	- [Center frequency]: Press 【Measure】 →[Ch Power] →[Center Freq] and set the center frequency with numeric keys.
Center Freq	- [Ch BW]: Press 【Measure】 →[Channel Power] → [Channel Bandwidth] and set the channel bandwidth with the numeric keys.
Channel BW	- [Channel Span]: Press 【Measure】 →[Channel Power] → [Channel Span] and set the channel span with the numeric keys.
Span	- [Special Notes]: The channel power bandwidth is a frequency width of the power displayed by the spectrum analyzer within this bandwidth, while the channel power span is the frequency range over which the spectrum analyzer sweeps. The channel power span should be set to be greater than or equal to the channel power bandwidth. Otherwise, the spectrum analyzer will automatically set the channel bandwidth equal to the channel power span. The ratio of channel power span to channel power bandwidth remains constant. This ratio remains constant as the channel power span changes. Changing the channel power bandwidth can change this ratio. For example, when the channel power span is doubled, the spectrum analyzer will also increase the channel power bandwidth by the same factor.
< Back	

The occupied bandwidth measurement of the spectrum analyzer can present the measurement results in a quick, clear and accurate manner. There are two methods for calculating the occupied

bandwidth depending on the modulation method: power percentage method and power drop XdB method. Users can choose the appropriate bandwidth measurement method according to their own needs. Please refer to Section 1 Occupied Bandwidth Measurement of this Chapter for specific operations.

OBW	· [OBW Off On]: Press 【Measure】 →[OBW]→[OBW Off On] to start or stop the OBW measurement function.
OBW Off On	· [Measurement method]: Press 【Measure】 →[OWB] →[Measurement Method % XdB] to select the measurement methods, including percentage method and drop XdB method. The occupied bandwidth of the signal is obtained by calculating the bandwidth of the portion of the frequency containing a certain percentage of the total transmitted signal power, and the percentage of power can be set by the user. The descending XdB method defines the occupied bandwidth as: the distance between the two frequency points when the signal power drops by XdB on both sides of the frequency point where the peak power of the signal is located. The X dB of the signal power drop is set by the user.
Method % dBc	
% 99.00%	
dBc -3.0dB	
Span	
	· [Percent]: Press 【Measure】 →[OWB]→ [Percentage]. If the percentage measurement method is selected, it is used to set the percentage of power.
	· [XdB]: Press 【Measure】 →[OWB]→[XdB]. If the drop XdB method is selected, you can set the XdB value of signal power drop.
< Back	· [Channel Span]: Press 【Measure】 →[OWB]→[Channel Sweep] to set the sweep width of occupied bandwidth measurement.

The spectrum analyzer has the measurement function of adjacent channel power ratio. Users can obtain the measurement results of adjacent channel power ratio by setting channel related parameters. The threshold test function will facilitate the user to define the adjacent channel threshold and observe whether the adjacent channel power exceeds the set range. Please refer to Section 1 Adjacent Channel Power Ratio Measurement of this chapter for specific operations.

Spectrum analysis mode

ACPR	·[ACPR Off On]: Press 【Measure】 →[ACPR] →[ACPR Off On] to start or stop the ACPR measurement.
ACPR Off On	·[Center frequency]: Press 【Measure】 →[ACPR] →[Center Freq] and set the center frequency with numeric keys.
Center Freq	·[Main Ch BW]: Press 【Measure】 →[ACPR] → [Main CHBW] and set the main channel bandwidth with the numeric keys.
Main Ch BW 3.000 MHz	·[Adj Ch BW]: Press 【Measure】 →[ACPR] → [AdjCHBW] and set the adjacent channel bandwidth with the numeric keys.
Adj Ch BW 3.000 MHz	·[Ch Offset]: Press 【Measure】 →[ACPR] → [Ch Offset] and set the channel offset with the numeric keys.
Ch Spacing 3.000 MHz	
More 1 of 2 >	
< Back	

ACPR	·[Threshold Test Off On]: Press 【Measure】 →[ACPR] → [Threshold Test Off On] to start or stop the tests for the upper and lower adjacent channel power thresholds.
Limit Test Off On	·[Upper Adj Ch Threshold]: Press 【Measure】 →[ACPR] → [Upper Adj Ch Threshold] to set the power threshold of upper adjacent channel test.
Upper Limit 0.00 dB	·[Lower Adj Ch Threshold]: Press 【Measure】 →[ACPR] → [Lower Adj Ch Threshold] to set the power threshold of lower adjacent channel test.
Lower Limit 0.00 dB	·[Special Notes]: When the threshold test function is started, if the adjacent channel power ratio exceeds the set threshold, it will be marked with a red background.
More 2 of 2 >	
< Back	

The spectrum analyzer has the function of carrier-to-noise ratio measurement which is used to measure the ratio of carrier power to noise power.

C/N	·[CNR Off On]: Press 【Measure】 →[CNR]→[CNR Off On] and start or stop the carrier-to-noise ratio function.
C/N Off On	
Center Freq	·[Center frequency]: Press 【Measure】 →[CNR] →[Center Freq] and set the center frequency with numeric keys.
Carrier BW 3.000 MHz	·[Carrier Bandwidth]: Press 【Measure】 →[CNR] →[Carrier Bandwidth] and set the carrier bandwidth with numeric keys, with the default value of 3MHz.
Noise BW 3.000 MHz	·[Noise BW]: Press 【Measure】 →[CNR] →[Noise BW] and set the noise bandwidth with numeric keys, with the default value of 3MHz.
Offset 3.000 MHz	·[Freq Offset]: Press 【Measure】 →[CNR] →[Freq Offset] and set the frequency offset with numeric keys, with the default value of 3MHz.
< Back	

The function of stray template is to recall the limit line as a template to measure whether the signal power is limited by the template. The template can move up and down left and right according to the center frequency and reference power. The template always moves the center point of the limit line left and right to the center frequency, and moves the center point up and down to the reference power point according to the calculated reference power.

Emission Mask	·[Stray Template Off On]: Press 【Measure】 →[Stray Template]→[Stray Template Off On] to start or stop the stray template function.
Emission Mask Off On	
Channel BW 1.000 MHz	·[Ref Ch BW]: Press 【Measure】 →[Stray Template] → [Ref Ch BW] and set the reference channel bandwidth with the numeric keys.
Recall Limit as Mask >	·[Recall Limit Line]: Press 【Measure】 →[Stray Template] →[Recall Limit Line] and show related soft menus, including[Header],[Footer],[Page Up],[Page Down],[Recall Immediately]and[Delete], the user can select the limit file to be recalled.
Ref Power Peak Ch	·[Ref Power]: Press 【Measure】 →[Stray Template] →[Ref Power] to set the mode of reference power setting, including taking peak power as reference power or channel power as reference power.
Peak Markers Off On	·[Peak Mkr Off On]: Press 【Measure】 →[Stray Template] →[Peak Mkr Off on] to open or close the peak marker.
Page Up	·[Information on Last Page]: Press 【Measure】 →[Stray Template] →[Information on Last Page] to view the information on the last page.
Page Down	·[Information on Next Page]: Press 【Measure】 →[Stray Template] →[Information on Next Page] to view the information on the next page.
< Back	

The IQ capture function is to capture the original IQ data with the capture time, sampling rate, capture mode and other parameters set by the user, and save them as a data file for data analysis.

IQ Capture	- [IQ Capture Off On]: Press 【Measure】 →[Page Down 1/2]→[IQ Capture]→[IQ Capture Off On] to start or stop the IQ capture function.
IQ Capture Off On	- [Start Capture]: Press 【Measure】 →[Page Down 1/2]→[IQ Capture]→[Start Capture] and select to start IQ capture
Start Capture	- [Capture Time]: Press 【Measure】 →[Page Down 1/2]→[IQ Capture]→[Capture Time] to set the IQ capture time.
Capture Time 1.000 ms	- [Capture Mode]: Press 【Measure】 →[Page Down 1/2]→[IQ Capture]→[Capture mode] to set the mode of IQ capture as single or continuous. If the capture mode is set as single, the capture will end only once. If the capture mode is multiple times, the sweep thread will capture once after each sweep. The capture will stop only when the user sets to Stop Capture.
Capture Mode Single Cont	- [Sampling Rate]: Press 【Measure】 →[Page Down 1/2]→[IQ Capture]→[Sampling Rate] to set the sampling rate of IQ capture.
Sample Rate 56.100 MHz	- [Trig]: Press 【Measure】 →[Page Down 1/2]→[IQ Capture]→[Trigger]. The trigger methods include [Freerun] and [External Trigger]. Select external trigger to set [Trigger Polarity] and [Trigger Delay].
Triggering [Free Run]	- [Save Name]: Press 【Measure】 →[Page Down 1/2]→[IQ Capture]→[Save Name] to save the captured data.
Save Name IQCapture	
< Back	

Tune&Listen	- [Audio Demodulation Off On]: Press 【Measure】 →[Page Down 1/2]→[Audio Demodulation]→[Audio Demodulation Off On] to start or stop the audio demodulation function.
Tune&Listen Off On	- [Demodulation type]: Press 【Measure】 →[Page Down 1/2]→[Audio Demodulation]→[Demodulation Type] to set the demodulation type. You can select the demodulation type of [FM], [AM], [Upper Sideband] or [Lower Sideband].
Demod Type FM	- [Demodulation Time]: [Page Down 1/2]→[Audio Demodulation]→[Demodulation Time] to set the demodulation time.
Listen Time 100.000 ms	- [Demodulation Mode]: Press 【Measure】 →[Page Down 1/2]→[Audio Demodulation]→[Demodulation Time] to set the demodulation time. Set the demodulation mode. In intermittent mode, the data is swept for one screen and then demodulated for a period of time according to the demodulation time, and then the data is swept for one screen and then demodulated for a period of time according to the demodulation time, and that cycle repeats. In continuous mode, the data is continuously demodulated after being swept for one screen, and then the data is no longer swept.
Listen Mode Int Cont	
Volume 95	- [Volume]: Press 【Measure】 →[Audio Demodulation]→[Volume] to set
< Back	

the speaker volume in the demodulation mode.

5.3.9 Signal generation menu

Generator	- [Signal Generation Off On]: Press 【Measure】 →[Page Down 1/2]→[Signal Generation]→[Signal Generation Off On] to set the signal source of the signal generation function ON or OFF.
Output Off On	
Freq 3.300 GHz	- [Freq 3.25GHz]: Press 【Measure】 →[Page Down 1/2]→[Signal Generation]→[Freq 3.25GHz], press numeric keys and then soft unit keys to confirm your entry, or change the output frequency with 【↑】【↓】 keys and knob.
High	- [High Power]: Press 【Measure】 →[Page Down 1/2]→[Signal Generation]→[High Power] and directly set the output power of the signal source to high power.
Low	- [Low Power]: Press 【Measure】 →[Page Down 1/2]→[Signal Generation]→[High Power] and directly set the output power of the signal source to low power.
Manual -18.0 dBm	- [Manual Power -18dBm]: Press 【Measure】 →[Page Down 1/2]→[Signal Generation]→ [Manual Power -18dBm] , press numeric keys and then soft unit keys to confirm your entry, or change the power with 【↑】【↓】 keys and knob.
< Back	- [Special Notes]: The manual power is set to - 35 ~ - 10dBm, and the default value is - 18dBm.

5.3.10 Interference map menu (option)

Coverage Map	- [Interference Map Off On]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Interference Map <u>Off</u> On] to set interference map ON or OFF.
Coverage Map Off On	
Save Recall >	- [Save/Recall]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Save/Recall] to open the save/recall submenu
Measurement Setup >	- 【Measure】 : Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure] to open the measurement submenu
Distance Time >	- [Distance/Time]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Distance/Time] to open the distance/time measurement submenu.
Start Collection	- [Start Acquisition]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Start Acquisition]. and start data measurement and mark the location and measurement results on the map. The interval between two marks can be set through the [Distance/Time] menu.
Zoom In	- [Zoom In]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Zoom In] and set map Zoom IN.
Zoom Out	- [Zoom Out]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Zoom Out]. and set map Zoom Out.
< Back	

Save Recall	- [Save Collected Data]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Save/Recall]→[Save Collected Data] to store the collected data to the instrument.
Save Data	
Save CSV	- [Save CSV File]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Save/Recall]→[Save CSV File] to store the collected data as a file in CSV format.
Save BMP	
Recall Data >	- [Save BMP file]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Save/Recall]→[Save BMP File] to store the collected data as images.
	- [Recall Collected Data]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Save/Recall]→[Recall Collected Data] to call out the stored historical data for viewing.
< Back	

Measurement Setup	- [RSSI] : Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[RSSI] to open the RSSI measurement submenu.
RSSI >	
ACPR >	- [ACPR] : Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[ACPR] to open the ACPR measurement submenu.
Center Freq	- [Center Freq] : Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[Center Freq] and set the center frequency.
RBW	- [RBW] : Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[RBW] and set the resolution bandwidth.
Detection Auto v	- [Detection] : Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[Detection] to open the detection submenu.
< Back	

Distance Time	- [Repetition Type] : Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Distance/Time]→[Repetition Type] and set the repetition type.
Repeat Type Time Dist	
Repeat Time 10.000 s	- [Repetition Time] : Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Distance/Time]→[Repetition Time] and set the interval between two acquisitions. The time interval is valid if and only if the repetition type is set to time.
Repeat Dist 100 m	
Delete All Points	- [Repetition Distance] : Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Distance/Time]→[Repetition Distance] and set the distance between two acquisitions. The distance is valid if and only if the repetition type is set to distance.
	- [Del All] : Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Distance/Time]→[Del All] and delete all collected data on the map.
< Back	

Spectrum analysis mode

RSSI	- [Excellent]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[RSSI]→[Excellent] and set the color when the measured signal is greater than this value.
Excellent: ≥ 0.0 dBm	
Very Good: ≥ -20.0 dBm	- [Very Good]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[RSSI]→[Very Good] and set the color when the measured signal is greater than this value.
Good: ≥ -40.0 dBm	
Fair: ≥ -60.0 dBm	- [Good]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[RSSI]→[Good] and set the color when the measured signal is greater than this value.
Poor: < -60.0 dBm	- [General]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[RSSI]→[General] and set the color when the measured signal is greater than this value.
	- [Poor]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[RSSI]→[Poor] and set the color when the measured signal is less than this value.
< Back	

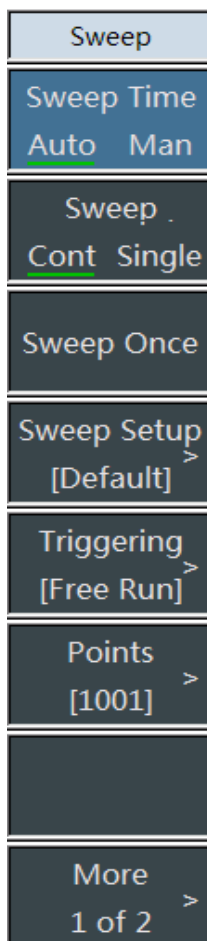
ACPR	- [Main Ch BW]: Press 【Measure】 →[Page Down 1/2] →[Interference Map]→ [Measure]→[ACPR] →[Main ChBW] and set the main channel bandwidth.
Main Ch BW 3.000 MHz	
Adj Ch BW 3.000 MHz	- [Adj Ch BW]: Press 【Measure】 →[Page Down 1/2] →[Interference Map]→ [Measure]→[ACPR] →[Adj Ch BW] and set the adjacent channel bandwidth.
Ch Spacing 3.000 MHz	- [CHSpace]: Press 【Measure】 →[Page Down 1/2] →[Interference Map]→ [Measure]→[ACPR] →[CHSpace] and set the channel space.
Adj Ch Offset 0.00 dB	- [Adj Ch Threshold]: Press 【Measure】 →[Page Down 1/2] →[Interference Map]→ [Measure]→[ACPR] →[Adj Ch Threshold] and set the adjacent channel threshold.
Good: ≥ 0.0 dBm	- [Good]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[ACPR]→[Good] and set the color when the measured signal is greater than this value.
Poor: < 0.0 dBm	- [Poor]: Press 【Measure】 →[Page Down 1/2]→[Interference Map]→[Measure]→[ACPR]→[Poor] and set the color when the measured signal is less than this value.
< Back	

5.3.11 Sweep menu

The sweep time is the time required for the local oscillator of the spectrum analyzer to tune the selected frequency interval. It directly affects the time it takes to complete a test, and may vary from span, resolution bandwidth and video bandwidth. In automatic mode, the spectrum analyzer

will use the quickest sweep time after the measurement setup is completed. In the manual mode, the sweep time can be increased to meet specific measurement needs.

In sweep mode, the default mode is linear sweep, and the list sweep function, as an option, can realize continuous sweep and measurement of multiple frequency bands, including editing list, save list and recalling list functions to facilitate the users.



-**[Swp Time Auto Man]:** Press **【Swp】** → [Swp Time] to adjust the sweep time of the spectrum analyzer. Adjust the sweep time with numeric keys, step keys or the knob. The underlined Manual indicates that the sweep time can be set manually. When the automatic mode is selected, the sweep time will be automatically correlated based on the resolution bandwidth, frequency bandwidth and video bandwidth settings.

-**[Swp Type Cont Single]:** Press **【Swp】** → [Swp Type] to set continuous sweep mode or single sweep mode.

-**[Swp Again]:** Press **【Swp】** → [Swp Again] and sweep again.

-**[Swp Mode]:** Press **【Swp】** → [Swp Mode] and set fast sweep or default sweep.

-**[Trigger]:** Press **【Swp】** → [Trigger] and select the trigger modes of sweeping, including [Freerun], [Video Trigger], [External Trigger], etc. Refer to the trigger menu for details.

-**[Swp Points]:** Press **【Swp】** → [Swp Points] and set the sweep points. Sweep points can be set as 201, 501, 1001, 2001 and 4001.

-**[Swp Mode Lin List]:** Press **【Swp】** → [Swp Mode] and select linear or list mode. Linear sweep refers to sweep at linear frequency spacings with equal frequency spacing between adjacent measurement points. The list mode is optional. In the list sweep mode, the spectrum analyzer sweeps based on the frequency range and other parameters set by the edited list.

-**[Edit List]:** This function is a list sweep option. Press **【Swp】** → [Page Down 1/2] → [Edit List], and open the list editing soft menu. The user can use [Add Edit Segment], [Delete Edit Segment] and [Clear All Segments] and other soft keys to manage and edit the sweep list. The selected sweep segment is represented by green font; After editing the sweep segment, press the [Complete Editing] soft key to confirm to return to the sweep submenu.

-**[Save List]:** This function is a list sweep option. Press **【Swp】** → [Page Down 1/2] → [Save List], and store the current edited list in the spectrum analyzer for subsequent recalls.

-**[Recall List]:** This function is a list sweep option. Press **【Swp】** → [Page Down 1/2] → [Recall List], and the sweep list dialog box pops up to recall or delete the required sweep list.

5.3.12 Trigger menu

Select the trigger mode of sweeping or measurement, including [Freerun], [Video Trigger], [External Trigger], [Trigger Polarity] and [trigger Delay]. The user can select the trigger mode based on the actual demand.

Triggering	<p>•[Freerun]: If the freerun is set after the last continuous sweeping or single sweeping, a new sweep or measurement will be started.</p> <p>•[Video Trigger]: Set the trigger mode to video trigger. As long as the input signal exceeds the set video trigger level, sweeping will be triggered. The trigger level value can be set by numeric keys, step keys or knob, and the green line on the screen indicates the selected trigger level.</p> <p>•[External Trigger]: Set the spectrum analyzer to the external trigger mode. Select sweeping and measurement to synchronize with the next voltage cycle.</p> <p>•[Trigger Polarity]: The control level triggers the positive and negative polarity. The positive polarity is triggered by the rising edge, and the negative polarity is triggered by the falling edge.</p> <p>•[Trigger delay]: It is allowed to set the time delay of level trigger. The spectrum analyzer will wait within this time period after receiving the external trigger signal and then start sweeping.</p>
Free Run	
Video	
External(TTL) 1.50 V	
Slope Rising Falling	
Delay 1.000 μ s	
< Back	

5.3.13 Trace menu

The trace menu is used to set the display of trace, and the user can select refresh trace, maximum hold, minimum hold and other related settings according to different needs of user test.

Trace	<p>•[Trace 1 2 3]: Press 【Trace】→【Trace 1 2 3】 for trace selection. The spectrum analyzer provides traces 1, 2, 3, the selected trace number and the status menu item where the trace is located are underlined.</p>
Trace 1 2 3	<p>•[Refresh trace]: Press 【Trace】→【Refresh Trace】 to refresh all data of the previously displayed trace and continuously display the signal received by the spectrum analyzer in the sweep state.</p>
Clear Write	<p>•[Max Hold]: Press 【Trace】→【Max Hold】 to keep the maximum value of the points on the selected trace, and update the value with the new maximum value detected in each sweep. If the detection mode is automatic, it will switch to the positive peak detection mode.</p>
Max Hold	<p>•[Min Hold]: Press 【Trace】→【Min Hold】 to keep the minimum value of the points on the selected trace, and update the value with the new minimum value detected in each sweep. If the detection mode is automatic, it will switch to the negative peak detection mode.</p>
Min Hold	<p>•[Hold Trace]: Press 【Trace】→【Hold Trace】 to keep and display the amplitude data of the selected trace. However, such data won't be updated when the spectrum analyzer sweeps.</p>
View	<p>•[Hide Trace]: Press 【Trace】 → 【Hide Trace】 to process the signal on the background. However, such signal is not displayed on the screen.</p>
Blank	

5.3.14 Limit menu

Limit	<p>·[Limit Up Low]: Press 【Limit】 →[Limit Up Low], and select the current limit line as the upper limit line or the lower limit line</p>
Limit Upper Lower	<p>·[Limit Off On]: Press 【Limit】→[Limit Off On], and select limit function ON/OFF.</p>
Display Off On	<p>·[Test Off On]: Press 【Limit】 →[Test Off On] to start/stop the limit line test.</p>
Test Off On	<p>·[Edit Limit Line]: Press 【Limit】 →[Edit Limit Line], including[Frequency],[Amplitude],[Add Point],[Delete Point],[Last Point],[Next Point],[Set Default]]and other soft menus to view the frequency and amplitude of limit points and add or delete limit points.</p>
Edit Limit >	<p>·[Offset]: Press 【Limit】 → [Offset] to set the offset allowance.</p>
Margin 0.00 dB	<p>·[Audio Alarm Off On]: Press 【Limit】 →[Audio Alarm Off On] to set audio alarm On/Off. If the audio alarm is on and the upper and lower limit line test is on, the function is effective. If the limit is out of range when the upper and lower limit lines are swept on the current screen, the buzzer will give a short sound.</p>
Alarm Off On	<p>·[Save Limit]: Press 【Limit】 →[Save Limit] to store the limit.</p>
Save Limit	<p>·[Recall Limit]: Press 【Limit】 →[Recall Limit], including[Header],[Footer],[Last Page],[Next Page],[Recall Immediately],[Delete][Cancel]and other soft menus to call or delete saved limits.</p>
Recall Limit >	

5.3.15 Peak menu

Peak	· [Max Peak] : Press 【Peak】 →[Max Peak] to place a frequency marker at the highest point of the trace and display the frequency and amplitude of the frequency marker in the upper right corner of the screen.
Peak Search	· [Sub Peak] : Press 【Peak】 →[Sub Peak] to move the active frequency marker to the next highest peak point on the trace that is associated with the current frequency marker position. Press the key again, and the user can find the lower peak point quickly.
Next Peak	· [Left Peak] : Press 【Peak】 →[Left Peak] to find the next peak to the left of the current frequency marker position.
Next Pk Left	· [Right Peak] : Press 【Peak】 →[Right Peak] to find the next peak to the right of the current frequency marker position.
Next Pk Right	· [Max] : Press 【Peak】 →[Max] to place a marker at the highest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen.
Max Search	· [Min Peak] Press 【Peak】 →[Min] to place a marker at the lowest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen.
Min Search	· [Peak Tracking Off On] : Press 【Peak】 →[Peak Tracking <u>Off</u> On]. If peak tracking is on, the current marker will perform a peak search operation after each sweep. If peak tracking is off, no operation will be performed.
Peak Track Off On	· [Mkr→] : Press 【Peak】 → [Mkr →] to set the marker frequency equal to the center frequency. This function quickly moves the signal to the center of the screen.
Marker-> Center	

5.3.16 File menu

File	<ul style="list-style-type: none"> •[StoreStateFile]: Press 【File】 →[Save State] to save the current sweep status parameters.
Save State	
Recall State >	<ul style="list-style-type: none"> •[Recall Status]: Press 【File】 →[Recall State] to pop up the state file list. The soft menus, including[Header],[Footer],[Last Page],[Next Page],[Recall Immediately]and [Delete], are used to read the existing state file and recall the corresponding state parameters to the current sweep.
Save Data	<ul style="list-style-type: none"> •[Save Data]: Press 【File】 →[Save Data] to store trace data.
Recall Data >	<ul style="list-style-type: none"> •[Recall Data]: Press 【File】 →[Recall Data] to pop up the data file list. The soft menus, including[Header],[Footer],[Last Page],[Next Page],[Recall Immediately]and [Delete], are used to read the existing data files and recall the corresponding data to the current sweep.
Save Pic	<ul style="list-style-type: none"> •[Save Image]: Press 【File】 →[Save Image] to capture the current screen image.
Default State	<ul style="list-style-type: none"> •[Default State]: Press 【File】 →[Default State] to restore to factory settings.
File Manager >	<ul style="list-style-type: none"> •[File Mgmnt]: Press 【File】 →[File Mgmnt] to pop up the file management menu, including [Source File], [Target File], [Start Copy], [Delete Files] and other relevant soft menus to copy and delete files.
Location [Internal] >	<ul style="list-style-type: none"> •[Storage location]: Press 【File】 →[Storage Location] to select the storage location, the interior is the internal memory of the instrument, and the other optional locations are the memory and SD card of the USB interface. After the security feature option is selected, the internal memory cannot be selected.

5.3.17 Security data menu

In case of the security data option, the spectrum analyzer will not be able to select the internal memory, but only the memory and SD card with USB interface will be selected.

Location	<ul style="list-style-type: none"> •[Internal]: Press 【File】 →[Storage Location]→[Internal], the [Internal] is in a gray state and cannot be saved internally.
Internal	<ul style="list-style-type: none"> •[SDCard]: Press 【File】 →[Storage Location]→[SD card], and select Store Data to the SD card.
SD	<ul style="list-style-type: none"> •[USB]: Press【File】→[Storage Location] →[USB]and select Store Data to USB.
USB	

6 Cable and antenna feeder test mode (optional)

6.1 Introduction to typical measurements

The cable and antenna feeder test mode (CAT) is used for the contact performance tests of radar, antenna and feeder, Including VSWR, return loss, impedance and Distance-To-Fault (DTF).

Start the instrument, press **【Mode】** to pop up the mode selection dialog box, then select [CAT] in the dialog box, and press [OK] to enter the CAT mode after the progress bar is completed.

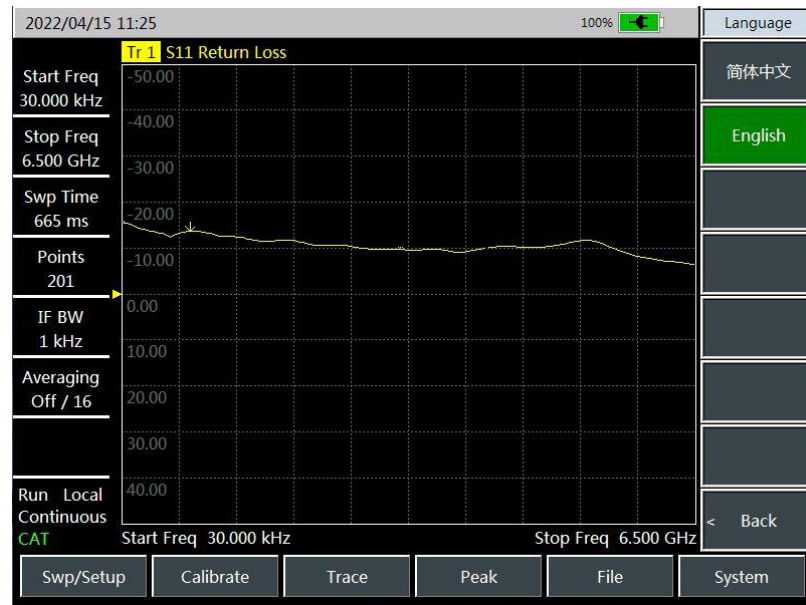


Figure 6-1 Main Interface of CAT

Notice

All operations in this section are based on the premise of the selected CAT, which will not be described separately later.

6.1.1 Selection of measurement parameters

In the CAT mode, the RF analyzer can measure the return loss, VSWR, impedance, cable loss and other parameters of the device under test, and also provides the fault point Distance-To-Fault (DTF) function to accurately locate the impedance mismatch point. Press the **【Measure】** key to select different measurement parameters.

- [Return Loss] , select the return loss parameter and display it in logarithmic format;
- [Cable Loss] , select the test parameter for cable loss;
- [VSWR] , select the test parameter as standing wave ratio;
- [DTF Return Loss] , select the test parameter fault location point for return loss test;
- [DTF VSWR] , select the test parameter fault location point for standing wave ratio test;
- [Impedance] , select the test parameter as impedance, and the coordinate system is Smith chart;
- [Smith] , select the test parameter as the Smith chart;
- [Phase] , select the test parameter as the reflection phase;

6.1.2 Calibration

The calibration in CAT mode is basically the same as that in vector network analysis mode. The calibration steps in antenna feeder test mode are as follows:

Cable and antenna feeder test mode

- a) Press the [Cal] key and the [Cal Kit] key, select the calibration part model, and Press [OK] ;
- b) Press [M Cal], a message will pop up on the display: "Please connect the open-circuit device to port 1, and press the corresponding menu button to start measuring!" Connect the open-circuit device to test port 1. Press [Opener], the RF analyzer will display "cal std measuring..." during the measurement of standard piece. After the measurement and calculation of the error factor, the prompt message will pop up on the display: "please connect the short-circuit device on port 1, and then press the corresponding menu button to start measuring!" ;
- c) Remove the open-circuit device from test port 1, connect the short-circuit device, press [Short-circuit Device] , and a message pops up on the display: "Please connect the load on port 1, then press the corresponding menu button to start measurement!" ;
- d) Remove the short-circuit device from test port 1, connect the load, press [LOAD] , and a message will pop up on the display: "Press [Done] to complete the measurement!" ;
- e) Press [Done] to complete the calibration process of the cable and antenna analysis mode;

After the calibration is complete, the calibration off On is displayed in the menu bar under calibration. Connect with the DUT for measurement.

6.1.3 Marker function

The marker function in CAT mode is the same as that in vector network analysis mode.

6.1.4 Saving and recalling function

The saving and recalling function in CAT mode is the same as that in vector network analysis mode.

6.1.5 DTF measurement

CAT provides DTF measurement function. The DTF (Distance-To-Fault) measurement, also known as the fault point location function, shows the magnitude of the response signal at different positions of the signal path of the kit under test, thus providing a basis for judging the impedance change on the transmission path. DTF measurements are also referred to as time domain measurements in some vector network analyzers, and the time domain measures the display time of x-axis and DTF measures the distance of x-axis, and the relationship between the two is:

$$\text{Distance} = \text{time} \times \text{speed of light} \times \text{rate factor}$$

For the kit under test, the rate factor is a constant greater than zero and less than 1, and the speed of light is the rate at which light travels in a vacuum, so the distance and time are proportional.

6.1.5.1 Principle of measurement

In the usual measurement, the vector network analyzer displays the response of the kit under test as the change of frequency, which is called frequency domain measurement. The modern vector network analyzer obtains time domain data by inverse Fourier transform of the frequency domain data, and the measurement result is displayed as time on the X axis, and the response value appears at discrete time points, and the impedance change point of the kit under test can be analyzed. The following figure shows the frequency and time domain reflection measurements for the same cable, and this cable has two bends, each of which causes a mismatch in the transmission line or a change in impedance.

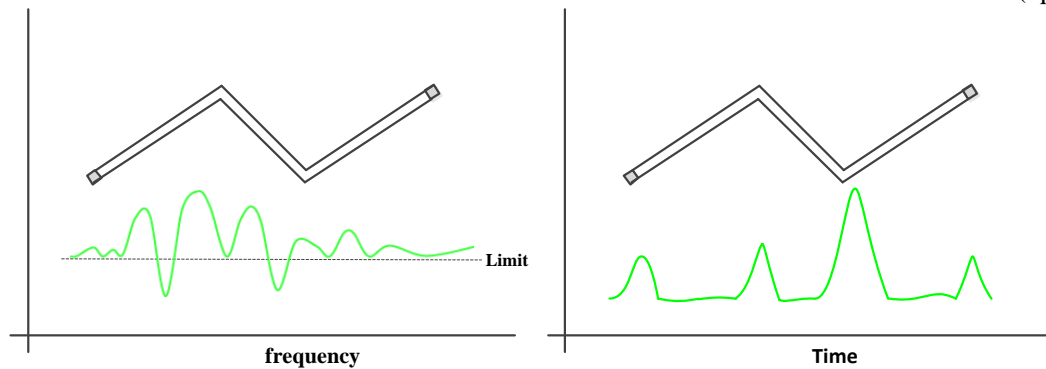


Figure 6-2 Measurement of Frequency and Time Domain

The frequency domain response of the S11 measured at the input port shows a combined reflection response due to multiple cable mismatch point interactions, but it is difficult to determine the exact physical location at which the cable mismatch occurs.

The time domain response shows the location and magnitude of each impedance mismatch point. From the response we can see that there is a significant mismatch in the second bend of the cable.

the RF analyzer's time domain measurement function simulates a traditional time domain reflection (TDR). The time domain reflexometer emits an impulse or step signal to the kit under test, and then observe the energy of the reflected signal. By analyzing the amplitude, duration and waveform of the reflected signal, the impedance change of the kit under test can be determined. If time domain measurement is performed in the cable and antenna mode but the incident impulse or step signal does not create, and the frequency sweep measurement is performed, then it will calculate the time domain information from the frequency domain measurement result by the Fourier algorithm, so it is also called the frequency domain reflexometer .

The CAT mode of 4957Bis to measure S11 and then perform time domain conversion measurement. The S11 reflection measurement is not a simple display of the size of the reflected signal received by the A or B receiver, but shows the ratio measurement between the measurement receiver and reference receiver. The S11 ratio measurement can be used to remove system errors in the calibration. This is especially important for DTF measurements because the measurement reference plane is established by calibration, and the calibration point becomes the zero point of the X time axis, and all time and distance data will use this point as the reference point. In that case, time and amplitude data are very accurate due to calibration. The time domain measurement of the RF analyzer usually involves the following steps:

- a) Collect raw data of receiver (A and R) and perform a ratio operation;
- b) Perform error correction;
- c) Transform the frequency domain data into the time domain;
- d) Display measurement result

6.1.5.2 DTF measurement resolution and range

This Section discusses how to observe the effective DTF data of the device under test and how to make settings for the highest resolution and greater measurement range.

1) Response Resolution

The RF analyzer's DTF response resolution refers to the RF analyzer's ability to distinguish between two adjacent responses. For equal amplitude response, it is equal to the pulse width of the impulse response defined by the 50% (6dB) amplitude point, or the rise time of step response defined by 10%~90% amplitude point as shown in the following figure:

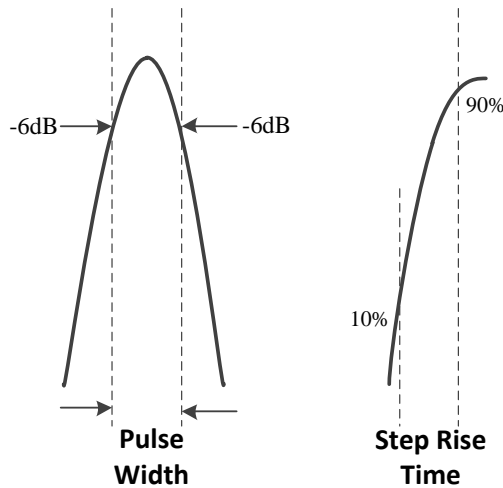


Figure 6-3 Time Domain Response Resolution

The time domain response resolution is subject to the several factors:

A) Frequency span

The figure below shows the effect of the frequency span on the response resolution:

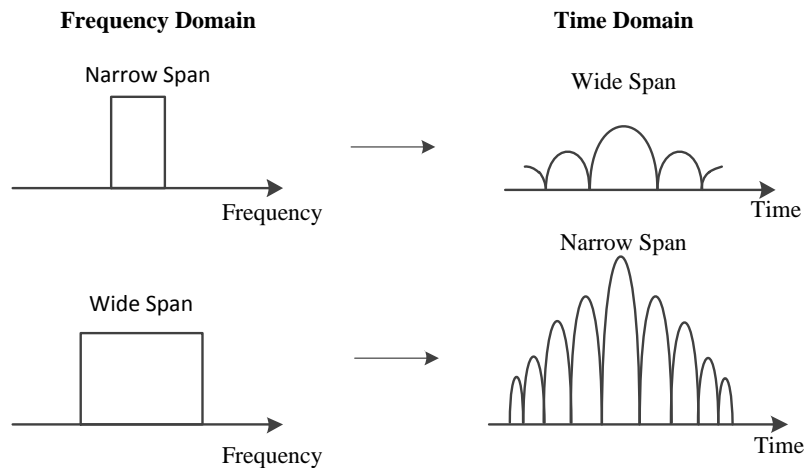


Figure 6-4 Effect of Frequency Span on the Response Resolution

The time domain measurement response under a narrow frequency span shows that the impulse response pulses that should be separated independently overlap each other. The RF analyzer can distinguish between different response pulses when performing time domain measurements over a wide frequency span.

The frequency span is inversely proportional to the pulse width. The wider the frequency span, the narrower the impulse response pulse, and the shorter the step response rise time, the higher the resolution of the response measurement.

b) Window function

If the cable and antenna mode is used for frequency time domain transformation, the length of data processed is limited. To reduce the effects of ringing caused by data truncation, the RF analyzer usually provides the option of windowing. Windowing can reduce the ringing effect and reduce the side lobes, but it will increase the width of the main lobe and reduce the resolution.

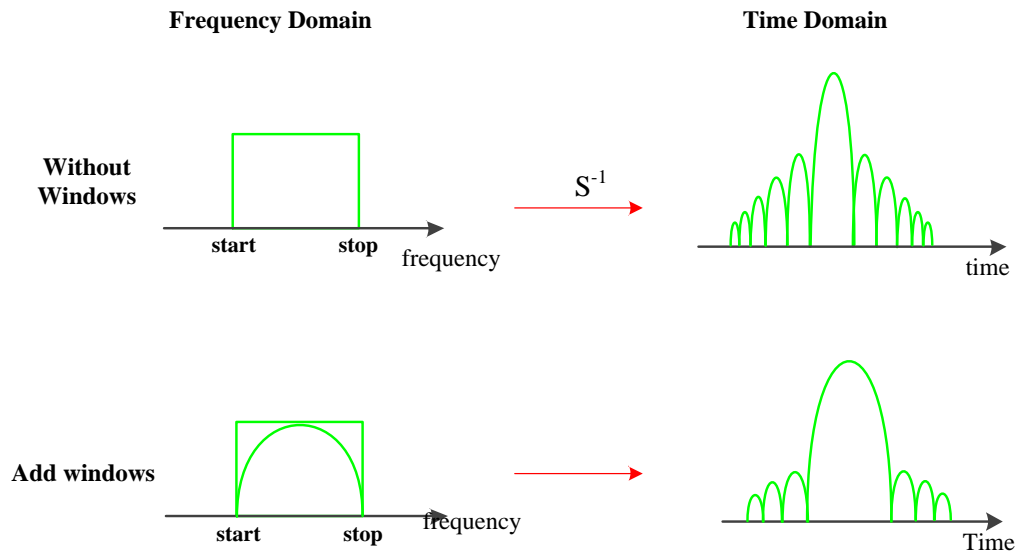


Figure 6-5 Using Window Filtering to Suppress Side Lobes

4957B provides three kinds of window functions, which are maximum value, normal value, minimum value. The main lobe width and side lobe height of three kinds of window functions can select different window according to specific test needs.

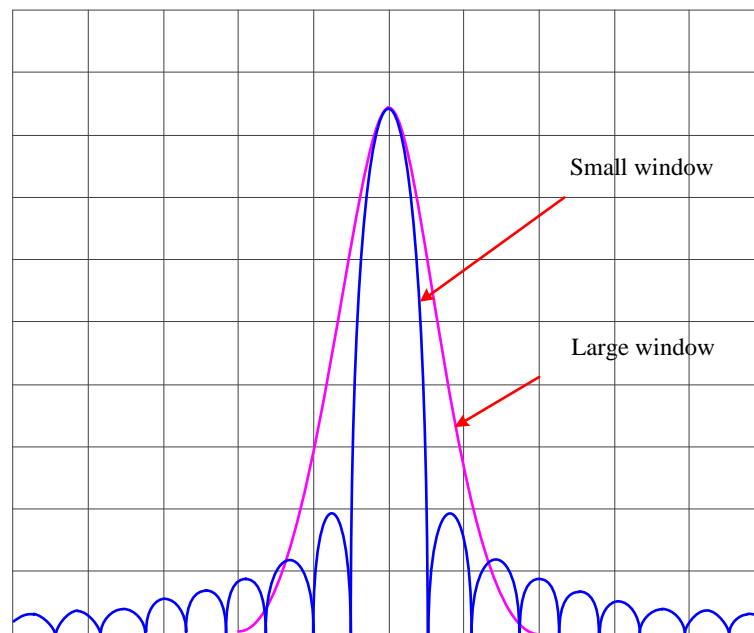


Figure 6-6 Effects of Different Windows

6) Measurement Range

In time domain measurements, the measurement range is defined as the maximum length of time that can be set, and no repeated response occurs when measurements are taken over this length of time.

The measurement range is inversely proportional to the response resolution. If one is increased, the other is decreased.

The time domain waveform is a periodic signal that repeats over time, so a repetitive response occurs. The repeated response (false response) is not the true response of the kit under test, which only occurs at specific time intervals ($1/\text{sweep point frequency interval}$), so the measurement range is determined by the frequency interval ΔF of the sweeping point:

Cable and antenna feeder test mode

For time domain measurements, the maximum measurable stop time is: $1/\Delta F$. In the reflection measurement, since the signal will circle within the kit to be tested, the maximum measurement distance is:

$$\text{Distance} = 0.5 * (\text{sweep points} - 1) * C * \text{Speed factor}$$

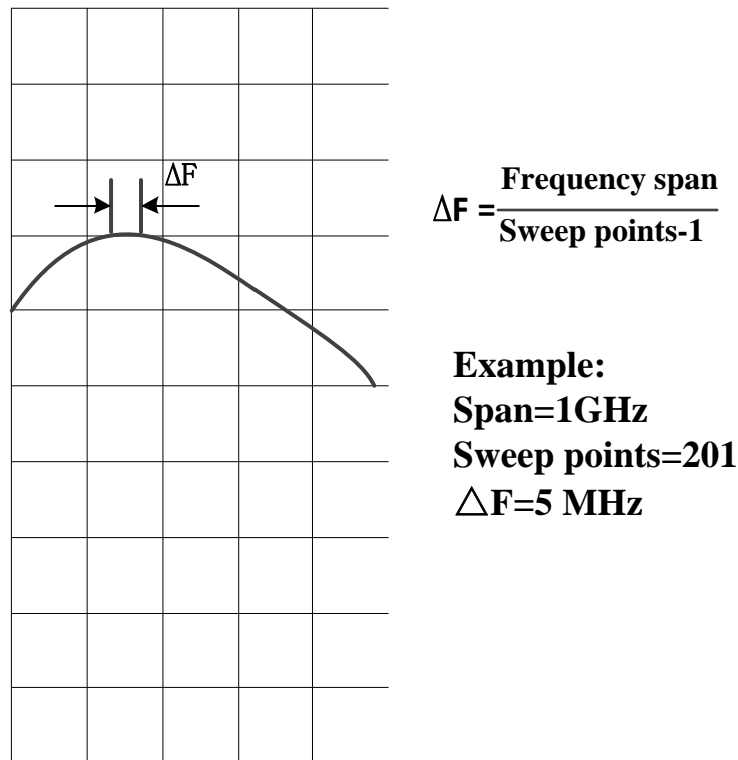


Figure 6-7 Definition of the Sweeping Point Frequency Space

The measurement range is proportional to the number of sweep points -1, which is inversely proportional to the span. To improve the measurement range, the following two settings can be modified:

- Increase the number of sweep points
- Decrease the frequency span.

6.1.5.3 Setting of time domain conversion measurement

Before entering the DTF measurement mode, measurement parameters such as Meas Freq Range, Points, IF BW, etc. should be set up to complete single port calibration, and then the DTF test should be carried out according to the following steps. First, connect the tested cable to network port 1:

- a) Press **【Measure】** , press [DTF VSWR] or [DTF Return Loss] to activate the time domain conversion function and enter the DTF measurement mode.
- b) Press **【Frep】** , [Start Dist] , input the starting distance to be observed, and complete the input based on the corresponding distance unit;
- c) Press **【Frep】** , [Stop Dist] , enter the end distance to be observed, and complete the input based on corresponding distance unit;
- d) If you want to set the window function, press **【Frep】** , [Window >] , display the submenu of

[Window >] , and select different window functions;

- e) Press [Return] , [Unit m/ft] , set the required distance unit system;
- f) Press [Cable Specification>] , [Load Cable] , select the model of the cable to be tested in the cable model selection list, press [OK] to complete the selection and close the dialog box;
- g) If there is no corresponding cable type, press [Cable Specification >] , [Cable Loss] , input the cable loss of cable to be tested, press [OK] to complete the setting and close the dialog box;
- h) Press [Velocity] and input the transmission rate factor of the device under test, press [OK] to complete the setting and close the dialog box.
- i) Observe and record the test results.

6.2 Menu Structure

This Section describes the menu structure of the 4957B RF analyzer in the antenna feeder test mode.

The CAT mode includes 10 groups of primary menus such as “Frequency”, “Amplitude”, “Bandwidth”, “Marker”, “Measure”, “Sweep/set”, “Calibrate”, “Trace”, “Peak” and “File”. The “Measure”, “Frequency” and “Calibrate” menus are illustrated in this section. For other menus, refer to the menu description in vector network analysis mode.

Cable and antenna feeder test mode

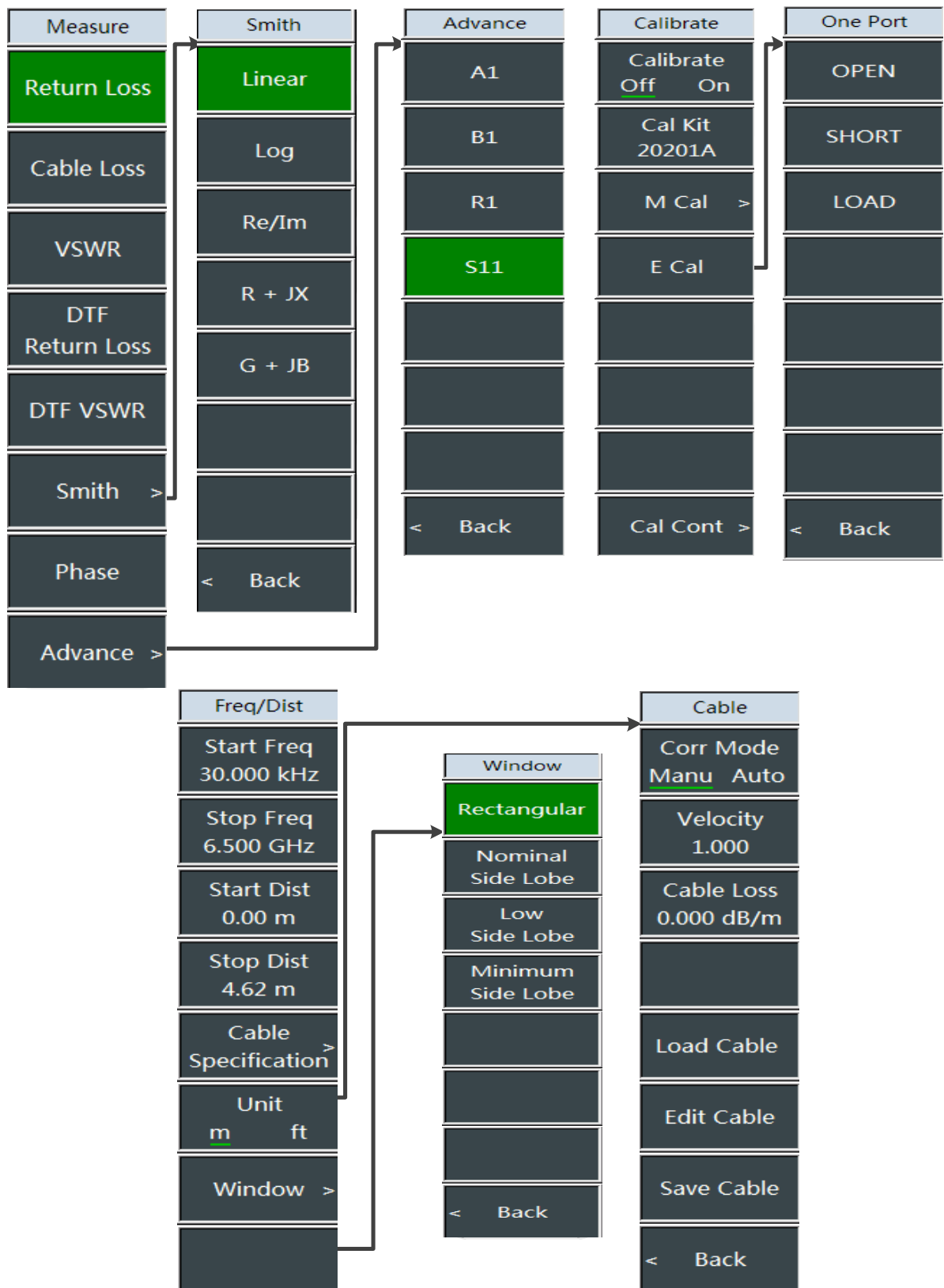


Figure 2-8 Menu Structure of “Measure”, “Frequency/Distance” and “Calibrate”

Notice

Only when the measurement format is "DTF return loss" and "DTF standing wave ratio", select **【 Freq 】** to display the **【Frequency/Distance】** menu.

6.3 Menu Description

6.3.1 Frequency menu

In the antenna feeder measurement mode and the DTF return loss and DTF standing wave ratio measurement format, press the **【Freq】** button, and the frequency and distance setting menus, including [Start Freq], [Stop Freq], [Start Dist], [Stop Dist] and [Cable Specification] pop up.

Freq/Dist	<ul style="list-style-type: none"> •【Start Freq】: Press 【Freq】 → [Start Freq], use the numeric keys on the front panel, select the frequency unit, or use the 【↑】【↓】 keys and the knob for setting.
Start Freq 30.000 kHz	<ul style="list-style-type: none"> •【Stop Freq】: Press 【Freq】→[Stop Freq], use the numeric keys on the front panel, select the frequency unit, or use the 【↑】【↓】 keys and the knob for setting.
Stop Freq 6.500 GHz	<ul style="list-style-type: none"> •【Start Dist】: Press 【Freq】 → [Start Dist], the default is 0.00m, and then select [m] in the right menu of the screen with a numeric key on the front panel, or set it with the 【↑】 【↓】 keys and the knob.
Start Dist 0.00 m	<ul style="list-style-type: none"> •【Special Notes】: With the 【↑】 【↓】 keys and the knob, the increase or decrease step of the starting distance is 0.1m.
Stop Dist 4.62 m	<ul style="list-style-type: none"> •【Stop Dist】: Press 【Freq】 → [Stop Dist], and then select [m] in the right menu of the screen with a numeric key, or set it with the 【↑】 【↓】 keys and the knob.
Cable Specification >	<ul style="list-style-type: none"> •【Cable Specification】: Press 【Freq】 → [Cable Specification] and switch to the setting menu of cable specification, including [Corr Mode Man Auto] , [Velocity], [Cable Loss], [Load Cable], [Edit Cable], [Save Cable], etc.
Unit m ft	<ul style="list-style-type: none"> •【Unit <u>m</u> ft】: Press 【Freq】 → [Unit <u>m</u> ft], and set the type of distance unit used for DTF measurements.
Window >	<ul style="list-style-type: none"> •【Special Notes】: Metric units are m and English units are ft. •【WinFunc】: Switch to the window function menu and set the window function according to the corresponding menu item: rectangular window, nominal edge smoothing, low edge smoothing and minimum edge smoothing.

6.3.2 Cable specification menu

	<ul style="list-style-type: none"> •[Corr Mode <u>Man</u> Auto]: Press [Cable Specification] → [Corr Mode Man Auto] to set the cable parameter mode. When manually setting, use the menu item to set and display the rate factor and cable loss. When automatically setting, use the parameters of the loaded cable model.
Cable	
Corr Mode Manu Auto	<ul style="list-style-type: none"> •[Velocity]: Press [Cable Specification] → [Velocity], enter the velocity with a numeric key on the front panel, and press [↵] key for confirmation; or set it with [↑] [↓] keys and the knob.
Velocity 1.000	<ul style="list-style-type: none"> •[Special Notes]: The velocity should not be greater than 1.000. If it is greater than 1.000, the software will automatically set it to 1.000.
Cable Loss 0.000 dB/m	<ul style="list-style-type: none"> •[Cable Loss 0.00dB/ft]: Press [Cable Specification] → [Cable Loss], set the cable loss with a numeric key on the front panel with reference to actual parameters, and press[↵] key for confirmation.
	<ul style="list-style-type: none"> •[Load Cable]: Press [Cable Specification] → [Load Cable], and load the edited cable model. In the pop-up cable model list, select the cable model to be called, press [Recall] or [OK] to load the cable model. The cable parameters of the cable model are valid when the correction mode is automatic.
Load Cable	
Edit Cable	<ul style="list-style-type: none"> •[Edit Cable]: Press [Cable Specification]→[Edit Cable], the Edit Cable dialog box pops up. In the dialog box, set the velocity and the cable loss at each frequency point to define a new cable model. After editing is complete, press [Done] to complete the cable parameter setting.
Save Cable	<ul style="list-style-type: none"> •[Save Cable]: Press [Cable Specification]→[Save Cable], the file naming box pops up. Edit the name of the cable model in the box and press[↵] to save the current cable model.
< Back	

6.3.3 Measurement menu

Measurement menu in antenna feeder mode

Measure	<ul style="list-style-type: none"> ·[Return Loss]: Press 【 Measure 】 →[Return Loss], and set the measurement format to return loss. ·[Cable Loss]: Press【 Measure 】→[Cable Loss], and set the cable loss for DTF measurement, and this parameter is valid when the correction mode is manual. After the setting tab is popped up, enter the value to be set with numeric keys, press the [OK] key to complete the parameter setting, or adjust it by the step key or rotary knob. ·[VSWR]: Press 【 Measure 】 →[VSWR], and set the measurement format to VSWR. ·[DTF Return Loss]: Press 【 Measure 】 →[DTF Return Loss], and set the measurement format to DTF return loss. ·[DTF VSWR]: Press 【 Measure 】 →[DTF VSWR], and set the measurement format to DTF VSWR. ·[Smith]: Press 【 Measure 】 → [Smith], and set the measurement format as impedance chart, with the marker information of impedance chart displayed as linear, logarithmic, Re/Im, impedance ([R + JX]) and admittance ([G + JB]). ·[Phase]: Press 【 Measure 】→[Phase]: Set the measurement format to phase. ·[Advance]: Press 【 Measure 】 →[Advance>] to select the measurement parameters from A1, B1, R1 and S11.
Return Loss	
Cable Loss	
VSWR	
DTF Return Loss	
DTF VSWR	
Smith >	
Phase	
Advance >	

6.3.4 Smith menu

Smith	<ul style="list-style-type: none"> ·[Linear]: Press [Smith] → [Linear], and set the display format of marker information as linear in Smith format. ·[Log]: Press [Smith] → [Log], and set the display format of marker information as log in Smith format. ·[Re/Im]: Press [Smith] → [Re/Im], and set the display format of marker information as Re/Im in Smith format. ·[R+JX]: Press [Smith] → [R+JX], and set the display format of marker information as impedance in Smith format. ·[G+JB]: Press [Smith] → [G+JB], and set the display format of marker information as admittance in Smith format.
Linear	
Log	
Re/Im	
R + JX	
G + JB	
< Back	

6.3.5 Calibration menu

The calibration menu is the same as that in vector network analysis mode.

Calibrate	<p>·[Cal Off On]: Press [Cal]→[Cal Off <u>O</u>n] to turn the error correction on or off, and the calibration can only be turned on when the corresponding calibration is completed.</p>
Calibrate Off On	<p>·[Cal Kit]: Press [Cal]→[Cal Kit] to enter the calibration kit selection dialog box, and select the calibration kit type.</p>
Cal Kit 20201A	<p>·[Special Notes]: The mechanical calibration kit types include 31101A 31101B 31121 31123</p>
M Cal >	<p>·[M Cal]: Press [Cal] → [M Cal] and complete the relevant calibrations in the calibration steps, including open circuit, short circuit and load.</p>
E Cal	<p>·[E Cal]: Press [Cal]→[E Cal] to enter the electronic calibration dialog box, and click the down arrow on the touchscreen to select the 【Cal Port】 : One port P1, one port P2, full 2 ports; click [Start], [Interrupt] and [Exit] for relevant operations of electronic calibration.</p>
Cal Cont >	<p>·[Cal Cont]: Press [Cal] → [Cal Cont]. If the submenu type is consistent with the mechanical calibration, continue to complete the calibration.</p>

6.3.6 Mechanical calibration menu

One Port	<p>·[OPEN]: Press 【M Cal】 →[Open] and select the calibration standard of OPEN.</p>
OPEN	<p>·[SHORT]: Press 【M Cal】→[Short] and select the calibration standard of SHORT.</p>
SHORT	<p>·[LOAD]: Press 【M Cal】 →[Load] and select the calibration standard of Load.</p>
LOAD	
< Back	

6.3.7 File menu

Refer to the file menu in the vector network analysis mode

7 Vector voltmeter mode (optional)

The 4957B Vector Voltage Measurement Mode (VVM) is a convenient tool for phase matching of radio frequency cables, which is mainly used to measure the electrical length of cables or other kits to be measured. This mode can directly replace a vector voltmeter and has the same flexible and convenient operation interface as the vector voltmeter. The results of single port electrical length measurement are displayed in amplitude and phase formats, while the results of all port are only displayed in the amplitude format.

As shown in the figure (a), measuring the electrical length of the kit under test with a vector voltmeter requires a directional coupler and a signal source to transmit the fixed carrier frequency. In the figure (b) below, the signal source and directional coupler are integrated into one instrument. Therefore, the kit under test can be directly connected through the RF output port of 4957B and are tested directly without any external devices.

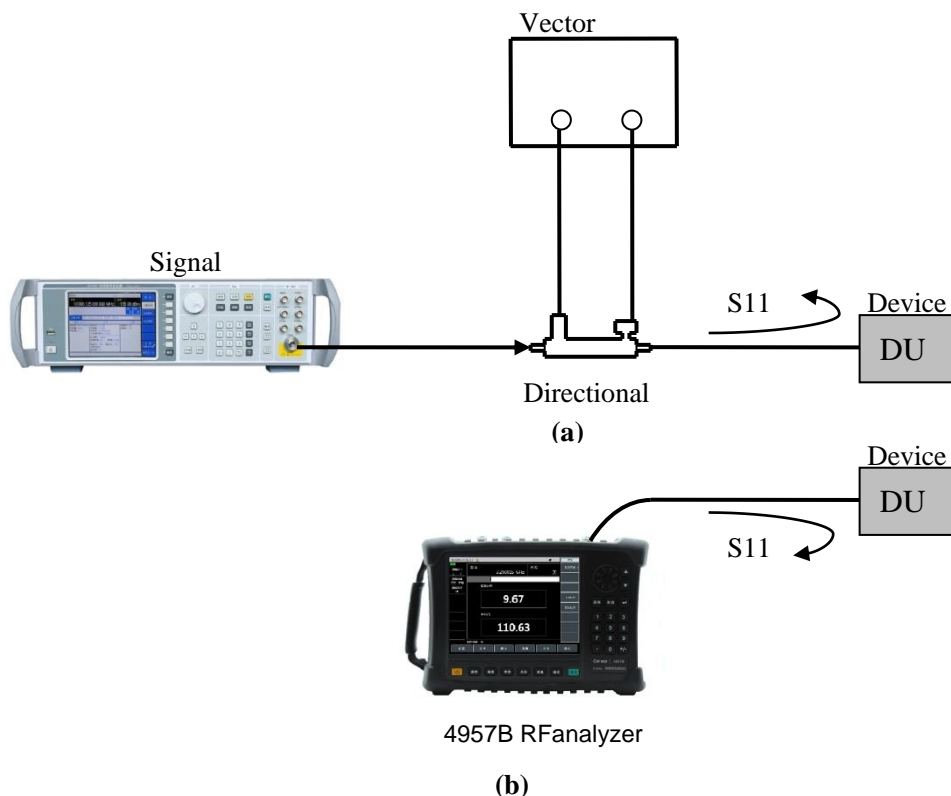


Figure 7-1 Measurement Structure Comparison of Vector Voltmeter and 4957B Vector Voltage Measurement Mode

7.1 Introduction to typical measurements

The vector voltmeter mode can directly replace a vector voltmeter to measure the electrical length of cables or other kits to be measured.

After startup, press **【Mode】** to pop up a mode selection dialog box, select the [Vector Voltmeter], and press [OK] to enter the vector voltmeter mode after completing the progress bar.

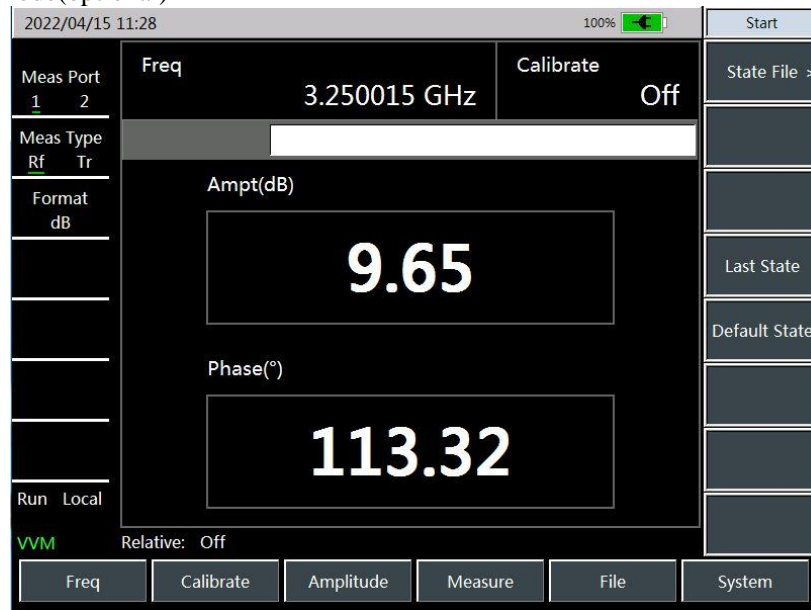


Figure 6-2 Main Interface of Vector Voltmeter Mode

Notice

All operations in this section are based on the premise of the selected vector voltmeter mode, which will not be described separately later.

7.1.1 Frequency range setting

Before performing the vector voltage measurement, set the frequency value of the point frequency signal to be tested. The frequency range of the 4957B instrument in vector voltage measurement mode is 30kHz~6.5GHz (4957B). The frequency range should be met during the setting, the corresponding button operations are as follows:

a) Press **【Frep】** and input the frequency value, and complete the center frequency setting by pressing corresponding frequency unit on the touch screen.

7.1.2 Setting of measurement port

If reflection measurement is required at port 1, keep the default setting of the setting of the instrument analyzer.

If reflection measurement is required at port 2,

a) Press **【Measure】** → **[Meas Port 1 2]**, switch **[Meas Port 1 2]** and change the default measurement type from 1 port to 2 port.

If transmission measurement is required, when the excitation source port is port 1 or port 2, switch with the same operation method.

7.1.3 Calibration

Before performing the vector voltage test, after completing the frequency setting and other measurement settings, calibration must be performed to eliminate the systematic error of the RF analyzer to ensure the validity and correctness of the measurement results.

7.1.3.1 One port reflection error correction

Single port correction can be conducted on S11 or S22 measurement of the instrument. The two processes are basically the same, the difference is that the selected parameters and ports.

Vector voltmeter mode(optional)

- a) In vector voltage measurement mode, select the type of measurement you want to make:
To measure reflection at port 1 (forward, S11), keep the default instrument settings.
If reflection measurement (reverse, S22) is required at port 2, press **【Measure】**
→[Measurement Port 1 2],switch to [Measurement Port 1 2] , switch port 1 to port 2, and measure parameters automatically switch from S11 to S22.
- b) Set other parameters for measurement: Center frequency, measurement type is the default reflection measurement etc.
- c) Open the calibration menu, and press **【Calibrate】** .
- d) Press **【Calibrate】** → [Cal Kit] to see if the calibration kit is consistent with the kit specified under the current softkey. If not, press the corresponding softkey to select the correct calibration kit model. Press [Back] to return to **【Calibrate】** menu bar, press [M Cal >] and select the type to be corrected.
 - a) If user wants to make a reflection measurement on port 1, press [S11 One Port] .
 - b) To measure reflection at port 2, press [S22 One Port].
- e) If it is on the port 1, the system will automatically prompt user to connect the open device to the port 1, and then press the corresponding menu button to start the measurement! At this time, connect the standard connector of the open-circuit device to the port to be used as the test port (P1 for S11, and P2 for S22).

Notice

All adapters and cables to be used for device measurement shall be prepared, that is, to connect the standard device to the position for measurement.

- f) After the display trace is stable, to measure the normal part, press [OPEN] and analyzer will display "Cal std measuring....." during the measurement of the normal kit. After the measurement is completed and the error coefficient is calculated , it will display the prompt of "Connect Short in P1, then press corresp. menu button to start!" And the software menu will be underlined to indicate that the project has been tested, such as [OPEN].
- g) Disconnect the open device and connect the short device to the test port.
- h) When the trace to be displayed is stable, to measure the normal kit, press [Short-circuit Device], the analyzer will display "Measuring....." during the measurement of the normal part. After the measurement is completed, it will display the prompt of "Port 1 short measurement has completed. Connect load at P1, and press 'Load'" after measurement. Connect LOAD in P1, press 'LOAD"', and the software menu will be underlined to indicate that the project has been tested, such as [Short-circuit Device].
- i) Disconnect the circuit breaker and connect the load to the test port.
- j) When the trace to be displayed is stable, to measure the normal kit, press [SHORT] and analyzer will display "Cal std measuring....." during the measurement of the normal kit. After the measurement is completed and the error coefficient is calculated, it will display the prompt of "Connect load in P1, then press corresp. menu button to start!" And the software menu will be underlined to indicate that the project has been tested, such as [SHORT].
- k) Press [Done] , the RF analyzer displays the corrected data trace indicating that the correction is enabled.

That is to complete the single port calibration for reflected measurement. The DUT can be connected and measured at this time.

Notice

The open-circuit device, short-circuit device and load can be measured in any sequence regardless that mentioned here.

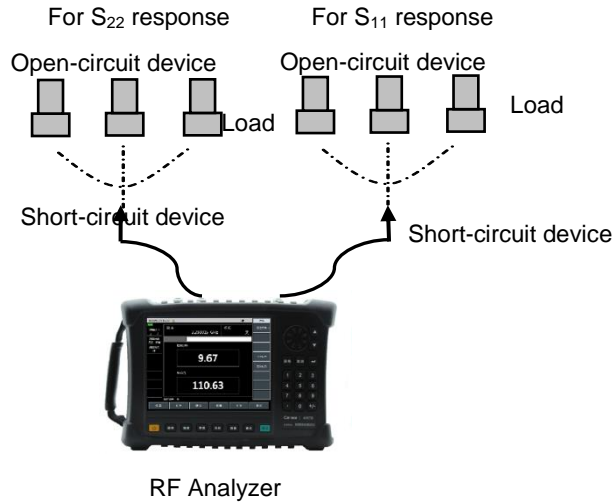


Figure 6-3 Standard Piece Connection of Single Port Reflection Error Correction

7.1.3.2 Error correction of full 2 ports

- Eliminate directional error during test component assembling in the forward and reverse directions
- Eliminate source matching error during test component assembling in the forward and reverse directions
- Eliminate load matching error during test component assembling in the forward and reverse directions
- Eliminate isolation error during test component assembling in the forward and reverse directions
- Remove the frequency response of the test component assembly in the forward and reverse directions

Notice

This is a relatively accurate error correction process. The RF analyzer updates the measurement trace once via forward and reverse sweep, which takes more time compared with other correction process.

- Set parameters for device measurement: Frequency, measurement mode, measurement port, measurement format, relative measurement switch etc. Start frequency, stop frequency, output power, number of sweeping points or IF bandwidth.
- Open the calibration menu and press **【Calibrate】**.
- Press **【Calibrate】** and see if the calibration kit is consistent with the kit specified under the current softkey. If not, press the appropriate softkey to select the correct calibration kit model.
- Press **[Back]** and return to the **【Calibrate】** menu bar, press **[M Cal]**, select the type to be corrected, press **[Full 2 Ports]**, the system will prompt to "press **[Reflect]** to start the corresponding measurement!"

Vector voltmeter mode(optional)

- e) To start reflection measurement, press [Reflect>] to prompt "Connect OPEN in P1, then press corresp. menu button to start!". connect the open circuit device to test port 1 according to the diagram, and after the display trace is stable, press [P1 OPEN], the analyzer will display "Cal std measuring..." during the measurement of the standard piece, and after completing the measurement, it will display the prompt "Connect SHORT in P1, then press corresp. menu button to start!" And the software menu will be underlined to indicate that the project has been tested, such as [P1 OPEN].
- f) Disconnect the opener, and connect the short circuit device to the test port 1. After the display trace is stable, to measure the standard piece, press [P1 SHORT], the analyzer will display "calibration standard measurement ..." during the measurement of the standard piece, and after completing the measurement, it will display the prompt "Port 1 Short Measure Done. Connect LOAD in P1, press 'P1 LOAD'", and the software menu will be underlined to indicate that the project has been tested, such as [P1 SHORT].
- g) Disconnect the short-circuit device, connect the load to test port 1, and press [P1 LOAD] after the trace is stable to prompt "Calibrating standard piece measurement..." during standard piece measurement, and prompt "Connect the load to Port 1, then press corresp. menu button to start!" after measurement. At this time, underline of the menu indicates the item is tested completely, for example, [P1 LOAD].
- h) Disconnect the load from P1, connect the open-circuit device, short-circuit device and load to P2 as per the same standard method with P1 in sequence, and complete the measurement on such standard pieces as S22 OPEN, SHORT and LOAD.
- i) After reflection calibration on P1 and P2, the prompt "Press [Done] to complete the measurement." Press [Done], and the system will calculate the reflection factor automatically.
- j) Return to previous menu for transmission calibration. Press [Tr>] to prompt "Connect Thru cable between P1 and P2, then press corresp. menu button to start!" connect test port 1 and test port 2 with cables. You can press [Auto Meas], and the system can automatically complete four transmission calibration tasks in turn, or press [Pos Match], [Pos Trans], [Rev Match] and [Rev Trans] in turn to complete each calibration task individually. When all four tasks are completed, the full 2 ports transmission calibration is completed.
- k) Press [Back] to return to previous menu, and press [ISO] for isolation calibration.
- l) For isolation measurement, press [ISO] to prompt "Connect LOADs in P1 and P2, then press corresp. menu button to start!". Connect the load to test port 1 and test port 2 respectively, press [Auto Meas] to complete isolation calibration on the two items automatically in turn, or press [Pos Iso] and [Rev Iso] to complete each isolation calibration independently. or directly press [Ignore Iso] to ignore isolation calibration.
- m) Press [Done] to finish the full 2 ports calibration. After that, the prompt "Calibration Off/On" shows in the prompt zone. Connect with the DUT for measurement.

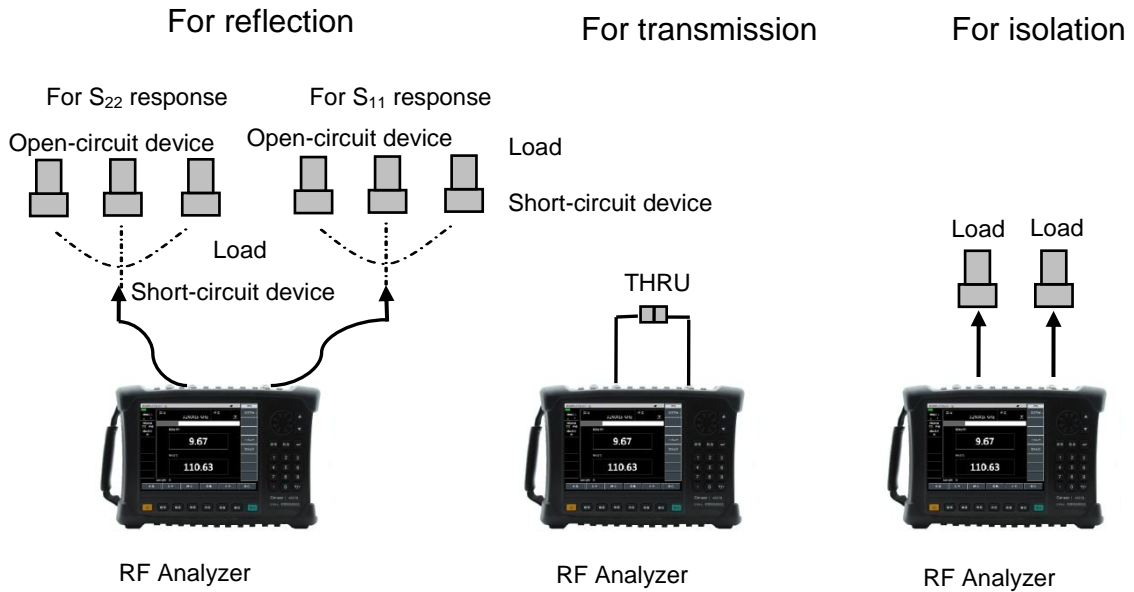


Figure 6-4 Standard Piece Connection of Full 2 Ports Error Correction

7.1.4 Selection of measurement format

The vector voltage measurement mode of the instrument measures the amplitude, phase, standing wave ratio and impedance of the device under test.

- Press **【Measure】** -> [Format] ;
- Select different measurement parameters via the menu soft key, and the default is dB format. [dB], select the measurement parameter as amplitude, with the amplitude value and phase value displayed; [VSWR], select the measurement parameter as VSWR; [Re/Im], select the test parameter as impedance, with the information displayed in the real value and the imaginary value.

7.1.5 Setting of measurement type

If single port measurement is required, keep the default setting of the instrument.

For dual port measurements, please perform the following operations:

- Press **【Measure】** → [Meas Type Rf/ Tr], switch to [Meas Type Rf/ Tr], and change the default measurement from reflection to transmission.

7.1.6 Setting of output power

It is used to set the output power of the RF analyzer source, including the high power, low power and manually-entered power. The actual output power varies with the RF analyzer model. The operation for setting the output function is as follows:

- Press the **【Amplitude】** and select [High] or [Low] on the touch screen to select the required power.
- To improve the output power accuracy, follow the steps below to set it manually:
- Press [Man -18dBm] to select the manual input power;
- Use the numeric keys to enter the number and select the unit on the touch screen to complete the input or adjust the manual power by turning the wheel or pressing [↑] [↓] .

7.2 Menu Structure

The vector voltage measurement mode mainly has four groups of menus: “Measurement”, “Calibration”, “File” and “Amplitude”. The “frequency” can be directly input by the **【Freq】** key, and “calibration” and “File” can refer to the vector grid analysis mode. The menus of "Measure" and

"Amplitude" are mainly introduced, with the structures being as follows:

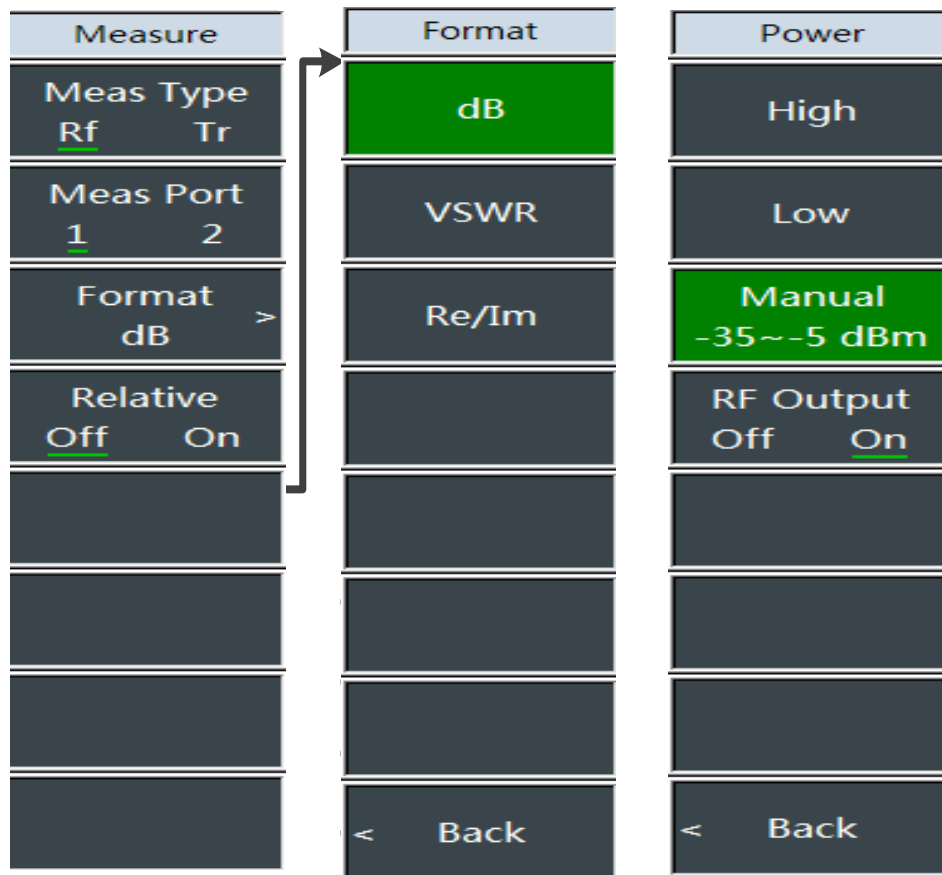


Figure 6-5 Structure of Measurement and Amplitude Menus

7.3 Menu Description

7.3.1 Measurement menu

Measurement menu in the vector voltmeter mode

Measure	· [Measurement Type <u>Reflection</u> Transmission] Press 【Measure】 →\ [Measurement Type Reflection Transmission] to set the measurement type.
Meas Type Rf Tr	
Meas Port 1 2	· [Measurement Port 1 2] Press 【Measure】 →\ [Measurement Port 1 2] to set the measurement port.
Format dB >	· [Measurement Format Standing-wave Ratio (SWR)] : Press 【Measure】 →\ [Measurement Format], and set the measurement format to be such that the standing-wave ratio, the impedance and dB can be selected.
Relative Off On	· [Relative Measurement <u>Off</u> On] : Press 【Measure】 →\ [Relative Measurement Off On] to select the relative measurement switch status.

7.3.2 Amplitude menu

Click the amplitude menu, corresponding to the [Output Power] menu to set output power.

Power	·[High Power]: Press 【Amplitude】 → \[High Power] key, and select \[High Power] on the touch screen to set the output power as the high power status.
High	·[Low Power]: Press 【Amplitude】 → [Low Power] key, and select [Low Power] on the touch screen to set the output power as the low power status.
Low	·[Manual]: Press 【Amplitude】 → [Manual] key, and the range is -35dB~-10dBm. Enter the numbers with the numeric keys or use the knob or press 【↑】 【↓】 to adjust the manual power.
Manual -35~-5 dBm	·[Radio Frequency Output]: If it is currently off, press 【Radio Frequency Output】 to turn on; and if it is currently on, press it to turn off.
RF Output Off On	·[Back]: Return to the 【Measure】 menu.
< Back	· [Special Notes] : The manual power menu display range is -35~-10dBm, in order to ensure the setting range of power flatness index, the actual range can be set to -45 - 5dBm. If it is set to a value outside the range displayed by the menu item, there is a certain deviation in the power output at some frequency points.

7.3.3 File menu

Refer to the file menu in the vector network analysis mode

8 USB power measurement mode (optional)

8.1 Introduction to typical measurement

The 4957B USB power measurement mode of the 4957B instrument uses the USB interface to externally connect the USB power sensor via a USB cable for the power test. With the 8723X USB power sensor provided by China Electronics Instrument and Meter Co., Ltd., it can test up to 6.5 GHz radio frequency/ signal and perform true average power measurements over a high dynamic range of -60 dBm to +20 dBm. The measurement reading is displayed on the display interface of the USB Power Meter mode of 4957B. The test block diagram is shown in Figure 4-1, and attenuators can be added as required.

After startup, press **【Mode】** to pop up a mode selection dialog box, select [USB Power Measurement], and press [OK] to enter the USB power measurement mode after completing the progress bar.

Notice

All operations in this section are based on the premise of the selected power measurement mode, which will not be described separately later.

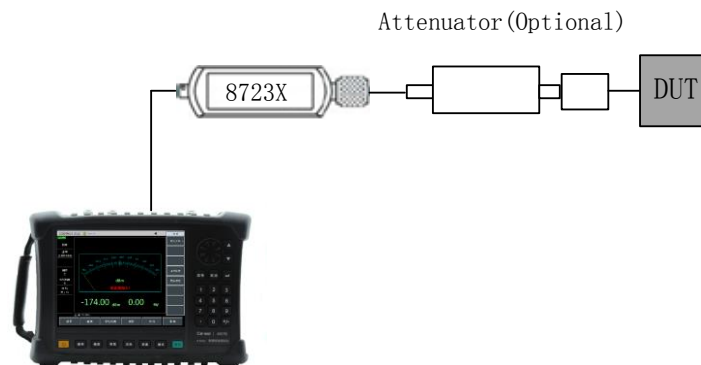


Figure 8-1 Power Measurement Structure Chart



Figure 8-2 USB Power Measurement Interface

USB power measurement mode(optional)

The USB power sensor of 4957B recommends that you purchase the high-performance microwave power sensor based on the USB interface developed by China Electronics Instrument and Meter Co., Ltd., which provides following types and can be purchased based on your testing requirements:

Notice

First, observe the maximum input power range of the USB power sensor identification to ensure that the input is within the specified range to avoid damage to the probe caused by excessive power!

Table 8-1 8723XUSB Power Sensor

Model	Frequency range	Input Power Range	Input Connector Mode
87230	9kHz~6GHz	-50dBm~+20dBm	N(m)
87231	10MHz~18GHz	-60dBm~+20dBm	N(m)
87232	50MHz~26.5GHz	-60dBm~+20dBm	3.5mm(m)
87233	50MHz~40GHz	-60dBm~+20dBm	2.4mm(m)

Connect the power sensor

- a) Connect the small port of the USB cable to the 8723XUSB power sensor.
- b) Then connect the large end of the USB cable to the USB interface of the spectrum analyzer, and the green indicator light of the power sensor will be on later.
- c) If user wants to power off, please unplug the USB cable to turn off the USB power sensor, and then the green LED will go out.

Notice

The 8723XUSB power sensor is enclosed with the USB cable. The user can use his own USB cable, but make sure that the cable meets international safety standards!

8.2 Menu Structure

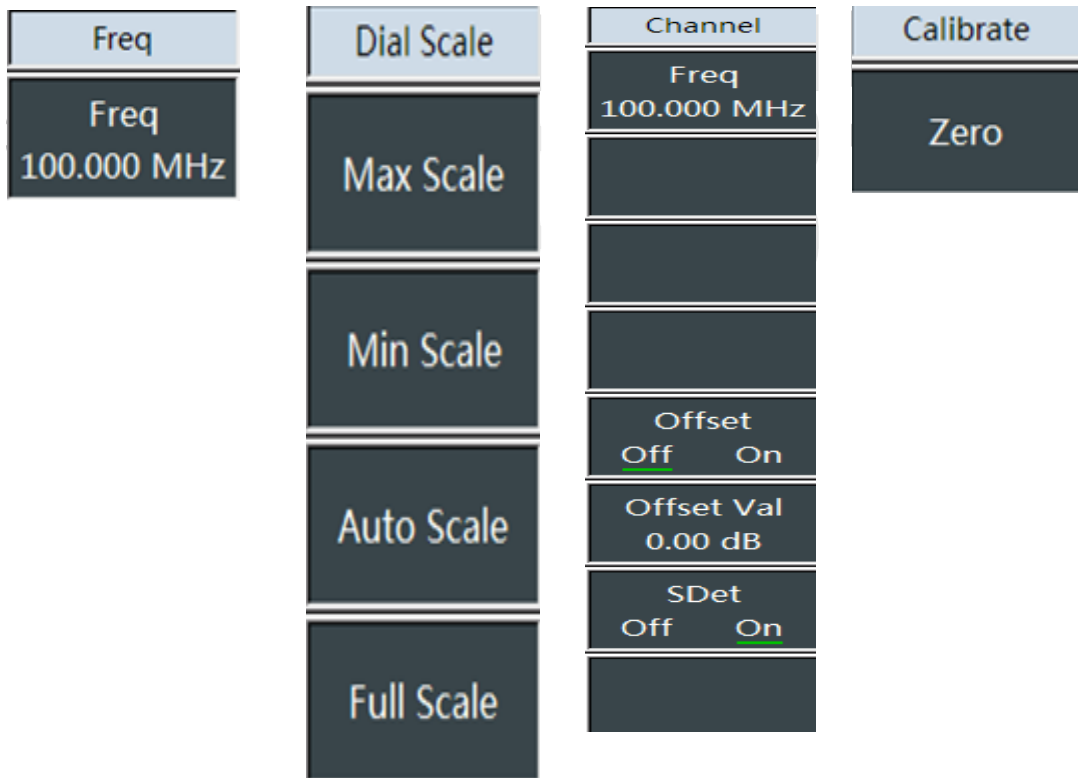

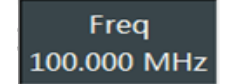



Figure 8-3 Overall Block Diagram of Power Measurement Menu

8.3 Menu Description

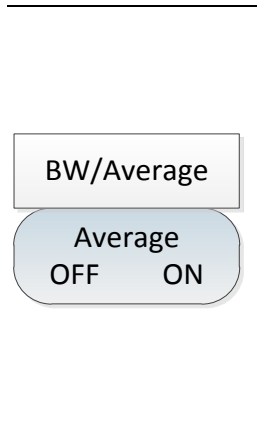
8.3.1 Frequency menu

	<p>·[Frequency]: Press 【Freq】 → [Frequency], you can use the number keys, and then select the corresponding frequency menu, or use 【↑】【↓】 or the knob to change, and the frequency modification step is 10 MHz.</p>
	<p>·[Special Notes]: The setting range of the frequency is related to the selected USB power sensor. For the specific range, refer to Table 6-1.</p>

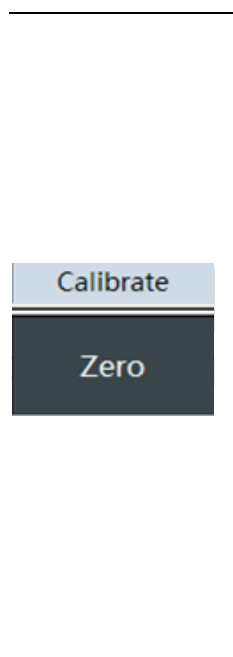
8.3.2 Amplitude menu

	<p>·[Maximum Scale]: Press 【Amplitude】 → [Max Scale], the maximum value of the currently displayed signal can be changed by using the number keys, or using 【↑】【↓】 or the knob, and the default modification step is 1 dB.</p> <p>·[Minimum Scale]: Press 【Amplitude】 → [Minimum Scale], the minimum value of the currently displayed signal can be changed by using the number keys, or using 【↑】【↓】 or the knob, and the default modification step is 1 dB.</p> <p>·[Auto Scale]: Press 【Amplitude】 → [Auto Scale] to display the measurement signal within the scope of 10 dB.</p> <p>·[full Scale]: Press 【Amplitude】 → [Full Scale] to display the measurement signal within the scope of 10 dB.</p> <p>·[Offset <u>Off</u> On]: Press 【Amplitude】 → [Offset <u>Off</u> On], when the power of the kits to be measured is greater than the maximum power value that the instrument can measure, the measured power can be reduced within the normal measurement range by connecting an attenuator. The power offset function allows for setting offset values to offset attenuation values or cable losses for added attenuators or connecting cables. It also allows for setting power offsets for gains of added amplifiers. Positive values can compensate losses and negative values can compensate gains.</p> <p>·[Offset]: Press 【Amplitude】 → [Offset]</p> <p>·[Relative Measurement <u>Off</u> On]: Press 【Amplitude】 → [Relative Measurement <u>Off</u> On], the relative measurement function reflects the change in power that has been set to the reference signal. In the event of using the unit of dBm , it is the difference between the measured value and the saved value, and the reading is expressed in dB; and in the event of using the unit of W , it is the ratio of the measured value to the saved value, and it is expressed in percentage %. If the relative measurement switch is turned on, the instrument will measure and save the current power level. At the same time, the power measurement will show a power level relative to the saved value.</p>
--	--

8.3.3 Bandwidth menu

	<p>·[Ave Off On]: Press 【Amplitude】 → [Average Off On], you can use the number keys, or use 【↑】 【↓】 or the knob to change, and the average modification step is 1.</p> <p>·[Special Notes]: The averaging function is generally used to measure low-power signals or signals close to noise power. It can smooth traces to reduce the influence of random noise on the measurement and improve measurement accuracy, but at the same time it will reduce measuring speed. The times of averaging determine the times for reading averaging. The more averaging times, the more the noise will be reduced.</p>
---	--

8.3.4 Zero menu

	<p>·[Zero]: Press [Zero] → [Zero].</p> <p>•[Special Notes]: In order to improve the measuring accuracy of the instrument, zeroing is necessary before using 8723X series USB power probes to measure small signal power. Zeroing refers to measuring and storing the noise of the whole measuring channel. During the measurement, it is required to deduct the zeroing value from the actual measurement value, namely, deducting the noise of the channel, and after that the reading should be the input signal level of the channel. The zeroing of USB power probes is consistent with that of ordinary power probes. The zero refers to the internal zero of the USB power sensor, and the internal zero adds a switch at the front end of the measurement channel, and user does not need to disconnect the sensor from the device under test, and test and measure and save the noise of the channel. During the internal zero process, the RF signal is constantly applied to the power sensor, which reduces the wear on the sensor connector and shortens the test time.</p>
--	---

8.3.5 File menu

Refer to the file menu in the vector network analysis mode

Interference analysis measurement mode(optional)

9 Interference analysis measurement mode (optional)

9.1 Introduction to typical measurement

The interference analysis measurement is an extension for the spectrum measurement mode. After startup, press **【Mode】** to pop up a mode selection dialog box, select [Spectrum Analysis], and press [OK] to enter the spectrum analysis mode after completing the progress bar. Then press [System]→[Measurement Mode]→[Interference Analysis] on the touch screen to enter the interference analysis mode.

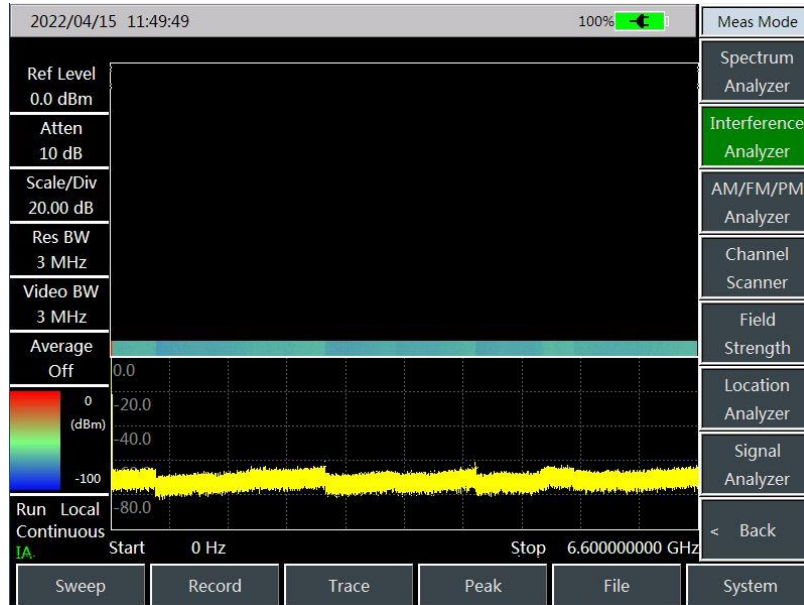


Figure 9-1 Main Interface of Interference Analysis

The interference analysis mode of the 4957B instrument is divided into the following three common measurement modes:

Spectrum measurement (for specific operations, please refer to the chapter on spectrum analysis, which will not be described repeatedly in this section);

Waterfall chart measurement;

Received signal strength indication (RSSI) measurement.

Notice

All operations in this section are based on the premise of the selected interference analysis mode, which will not be described separately later.

9.1.1 Waterfall Chart Measurement

The waterfall chart uses the frequency-amplitude-time three-dimensional display method, so as to easily observe periodic or intermittent signals. The intensity of the timing signal amplitude is reflected by the difference in the color display of the waterfall chart.

In order to facilitate the observation of the measurement signal, the following steps can be taken:

- Press **【Freq】** → [Sweep Width] → [Full Sweep Width], then press **【Peak】** to get the maximum value point of the current measurement signal, Then press [Marker → Center Frequency] to set the current peak point as the center frequency, and at this moment the maximum value will be displayed at the center of the trace area.
- Press **【BW】** → [Resolution Bandwidth Auto Man], use the number keys or **【↑】** **【↓】** keys or the knob to set the appropriate resolution bandwidth, and similarly set the appropriate video bandwidth value.

Demodulation analysis measurement mode(optional)

- c) Press **【Amplitude】** → [Ref Level] to bring the current maximum value point close to the topmost position of the display area, and press [Scale/Graduation] to set the appropriate scale/graduation value for easy viewing.
- d) Press [Auto Save] → [Scan Interval] to set the scan interval value.

Notice

When the scan interval is greater than 0, the trace will be set to the maximum hold state, ensuring that the maximum value of the signal obtained by each scan will be displayed on the interface.

- e) Press [Sweep Width Time] to set the time to be recorded, then through [Auto Save Off On], you can set the automatic storage, which will be automatically carried out after each screen is completed.
- f) Press [Auto Save] → [Time Marker], and move the horizontal straight line in the vertical direction of the waterfall chart by using the number keys or **【↑】** **【↓】** or the knob, and the spectrogram below will display the trace information in the straight line position.

Notice

When the time marker value is greater than 0, the trace is no longer refreshed, and the waterfall chart area is no longer updated.

- g) The interference analysis for the 4957 provides six independent markers for reading out the amplitude and frequency values of the marker position. The specific usage methods are as follows: **【Mkr】** → \[Marker 1 2 3 4 5 6].
- h) If you want to save the current waterfall chart measurement information as a picture, you can use **【File】** → [Save Picture].
- i) The waterfall chart test structure is as shown in Figure 5-1 (the display is different under different parameter settings, and Figure 5-1 is just an example):

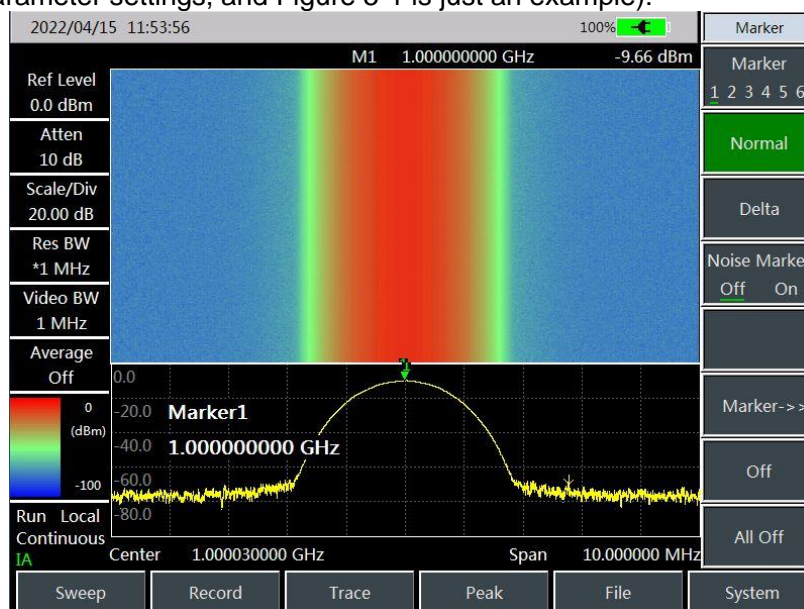


Figure 9-2 Interference Analysis Waterfall Chart

9.1.2 RSSI measurement

RSSI measurement is mainly used to measure the intensity change of a point frequency signal over a period of time.

Interference analysis measurement mode(optional)

In order to facilitate the observation of the measurement signal, the following steps can be taken:

- a) To set the scan interval time, [Auto Save] → [Scan Interval], and the scan interval time represents the sweep time of two adjacent points in each scan;
- b) To set the sweep width recording time, [Auto Save] → [Sweep Width Time], set the time to be recorded and displayed. After reaching the set sweep width time, the display interface will no longer refresh the display.
- c) To turn on the Auto Save switch, [Auto Save] → [Auto Save Off On], the data will be automatically saved to the file after each screen is completed.

Notice

After setting the sweep width time, the data points displayed on the screen only record the data points in the most recent time, not the data points in the whole sweep width time.

The RSSI test structure is as shown in Figure 5-2 (the display is different under different parameter settings, and Figure 5-2 is just an example):



Figure 9-3 Interference Analysis RSSI Test Chart

9.2 Interference Analysis Menu Structure



Figure 9-4 Overall Menu Block Diagram of Interference Analysis

Interference analysis measurement mode(optional)

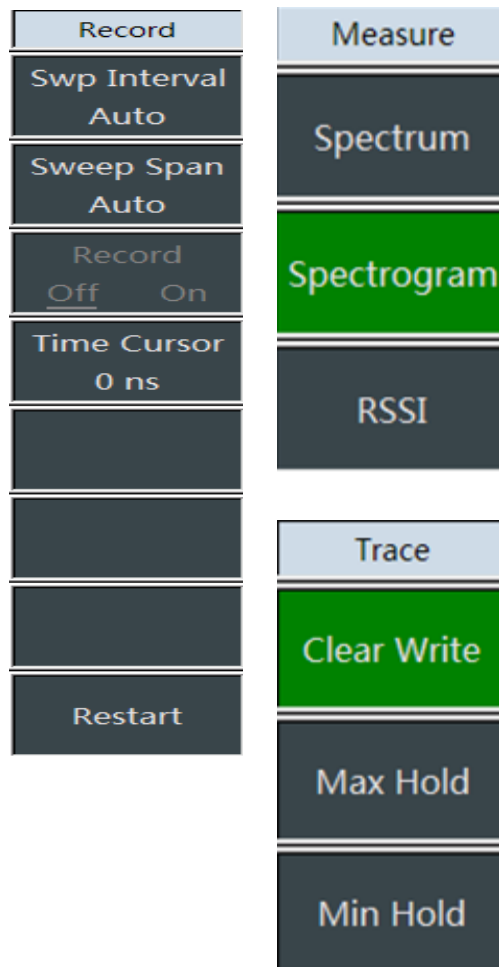


Figure 9-5 Overall Menu Block Diagram of Interference Analysis (Continued)

9.3 Description of Interference Analysis Menu

9.3.1 Frequency menu

Frequency	<p>•[Center frequency]: Press 【Freq】 →[Center Freq], use the numeric keys on the front panel, select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu, or use the 【↑】【↓】 keys and the knob for setting.</p>
Center Freq	<p>•[Special Notes]: When using the 【↑】【↓】 keys and the knob, the size of the frequency step is the same as the set value of the [Step Freq]. After pressing [Step Freq Auto/Man] to switch to [Step Freq Auto/Man], you can use the numeric keys or the 【↑】【↓】 keys and the knob to set the step frequency value.</p>
Span >	<p>•[Span]: Press 【Freq】 →[Span] to activate the span submenu. You can use the numeric keys, and then select the frequency unit to change. You can also use the 【↑】【↓】 keys and the knob to change the span. For the detailed information, please refer to the description of the [Span] menu.</p>
Start Freq	<p>•[Special Notes]: Use the 【↑】【↓】 keys and the knob to change the sweep width, and change based on the step of 1-2-5 (in the RSSI mode, it can only be the zero sweep width mode) .</p>
Stop Freq	<p>•[Start Freq]: Press 【Freq】 →[Start Freq], use the numeric keys on the front panel, select the frequency unit, or use the 【↑】【↓】 keys and the knob for setting.</p>
CF Step Auto Man	<p>•[Stop Freq]: Press 【Freq】→[Stop Freq], use the numeric keys on the front panel, select the frequency unit, or use the 【↑】【↓】 keys and the knob for setting.</p>
Signal Std -- >	<p>•[Signal Standard]: Press 【Freq】 →[Signal Standard], use the 【↑】【↓】 keys and the knob to select the signal standard, and use the dialog box menu [Immediate Recall] or [OK] key for recalling. Refer to the dialog box menu for details of the dialog box menu.</p>
Channel --	<p>•[Special Notes]: After the signal standard is loaded, the center frequency and the span are set to the center frequency and the span value defined in the signal standard.</p>
	<p>•[Channel No.]: Press 【Freq】 →[Channel No.] to pop up the channel number setting dialog box, and use the numeric keys or the 【↑】【↓】 keys and the knob to set the channel number.</p>
	<p>•[Special Notes]: The setting of the channel number shall be carried out under the premise of loading the signal standard, otherwise a prompt that it cannot be set will pop up.</p>

9.3.2 Sweep width menu

Span	- [Span]: Press 【Freq】 →[Span] to activate the span submenu. You can use the numeric keys, and then select the frequency unit to change. You can also use the 【↑】【↓】 keys and the knob to change the span. For the detailed information, please refer to the description of the [Span] menu.
Span	- [Special Notes]: Use the 【↑】【↓】 keys and the knob to change the span with a step of 1-2-5.
Full Span	- [Full Span]: Press [Span]→[Full Span] to set the current span to 44.1GHz.
Zero Span	- [Span]: Press 【Freq】 →[Span]→[Zero Span] to set the current span to 0Hz.
Last Span	- [Last Span]: Press 【Freq】 →[Span]→[Last Span] to restore the span to the value set last time.
< Back	- [Back]: Press 【Freq】 →[Span]→[Back] to return to the 【Freq】 menu.
	- [Special Notes]: The RSSI mode can only be a zero sweep width mode.

9.2.3 Amplitude menu

Amplitude	- [Ref Level]: Press 【Amplitude】 →[Ref Level], use the numeric keys on the front panel, and then select [dBuV], [-dBuV], [mV] and [uV], or use the 【↑】【↓】 keys and the knob to set it.
Ref Level 0.0 dBm	- [Special Notes]: When the 【↑】【↓】 keys and the knob are used, the step is 10dB.
Ref Position	- [Ref Pos]: Press 【Amplitude】 →[Ref Pos], and use the numeric keys or the 【↑】【↓】 keys and the knob to change it.
Atten Auto Man	- [Atten Auto Man]: Press 【Amplitude】 →[Atten Auto Man] to switch the automatic and manual switch of the attenuator through the menu. You can use the numeric keys or the 【↑】【↓】 keys and the knob to change it.
Scale/Div 10.00 dB	- [Special Notes]: The setting range of the attenuation value is 0 dB - 60 dB, with the step value of 10 dB.
Pre Amp Off On	- [Scale]: Press 【Amplitude】 →[Scale], and use the numeric keys or the 【↑】【↓】 keys and the knob to set the scale within the setting range of 0.1dB - 20dB.
	- [Amp Unit]: In the interference analysis mode, the amplitude unit is uniformly displayed in dBm.
	- [Pre Amp Off On]: Press 【Amplitude】 →[Pre Amp Off On] to turn the preamplifier on or off.

9.3.4 Bandwidth menu

	<p>·[RBW Auto Man]: Press 【BW】 →[RBW Auto Man], and use the numeric keys on the front panel or the 【↑】【↓】 keys and the knob to set it.</p> <p>·[Special Notes]: Since the resolution bandwidth is subject to the bandwidth of the IF filter, the shape of trace depends on the IF filter. This instrument supports variable resolution bandwidth settings, ranging from 1 Hz. ~10MHz, which can be changed with a step of 1-3-10.</p>									
<table border="1"> <tbody> <tr> <td>BW</td> </tr> <tr> <td>Res BW Auto Man</td> </tr> <tr> <td>Video BW Auto Man</td> </tr> <tr> <td>Video Type Lin Log</td> </tr> <tr> <td>Average Off On</td> </tr> <tr> <td>SPAN/RBW 100</td> </tr> <tr> <td>RBW/VBW 1</td> </tr> <tr> <td>Detector Auto ></td> </tr> <tr> <td></td> </tr> </tbody> </table>	BW	Res BW Auto Man	Video BW Auto Man	Video Type Lin Log	Average Off On	SPAN/RBW 100	RBW/VBW 1	Detector Auto >		<p>·[VBW Auto Man]: Press 【Amplitude】→[VBW Auto Man], and use the numeric keys or the 【↑】【↓】 keys and the knob to change it.</p> <p>·[Special Notes]: The video bandwidth filter is used to smooth the traces, aiming to improve the ability of detecting weak signals in noise signals. This instrument supports variable resolution bandwidth settings, ranging from 1Hz~10MHz, which can be changed with a step of 1-3-10.</p>
BW										
Res BW Auto Man										
Video BW Auto Man										
Video Type Lin Log										
Average Off On										
SPAN/RBW 100										
RBW/VBW 1										
Detector Auto >										
	<p>·[Ave Off On]: Press 【BW】 →[Ave Off On], the average function can smooth the display trace without changing the video bandwidth filter, and use the numeric keys or the 【↑】【↓】 keys and the knob to change it.</p>									
	<p>·[SPAN/RBW]: Press 【BW】 →[SPAN/RBW] to set the ratio of span to resolution bandwidth. In automatic mode, the resolution bandwidth will automatically change with the change of span. You can use numeric keys or the 【↑】【↓】 keys and the knob to change it.</p>									
	<p>·[RBW/VBW]: Press 【BW】 →[RBW/VBW]. In automatic mode, the video bandwidth will change with the change of resolution bandwidth. You can use numeric keys or the 【↑】【↓】 keys and the knob to change it.</p>									
	<p>·[Detection]: Press 【BW】 →[Detection] to open the detection function submenu. Please refer to the [Detection] menu for details.</p>									

Interference analysis measurement mode(optional)

Detector	•[Auto]: Press 【BW】 →[Detection]→[Auto], the detection is the same as that in the spectrum analysis mode.
Auto	• [Standard] : Press 【BW】 →[Detection]→[Standard], the most commonly used detection method can see the signal and noise base at the same time without losing any signal.
Normal	• [PosPeak] : Press 【BW】 →[Detection]→[PosPeak] to ensure that no peak signal is missed and to measure the signals that are very close to the noise base.
Peak	• [NegPeak] : Press 【BW】 →[Detection]→[NegPeak], it is used in the self-inspection of the bandwidth millimeter wave RF analyzer in most cases, but it is rarely used in the test, and it can reproduce the modulation envelope of the AM signal very well.
Neg Peak	• [Sampling] : Press 【BW】 →[Detection]→[Sampling], it is beneficial to measuring the noise signal, and can measure the noise better than the standard detection.
Sample	• [Ave] : Press 【BW】 →[Detection]→[Ave] to average the data in the sampling interval.
Average	• [Rms] : Press 【BW】 →[Detection]→[Rms] to calculate the root mean square of the data in the sampling interval.
RMS	
< Back	

9.3.5 Marker menu

	<ul style="list-style-type: none"> - 【Mkr】 →[Mkr 1 2 3 4 5 6]: Press 【Mkr】 →[Mkr 1 2 3 4 5 6] to switch between different marker displays, and the selected marker will be marked with an underline. -[Normal Mode]: Press 【Mkr】 →[Normal Mode] to set the currently selected marker display mode to normal mode. -[Difference Mode]: Press 【Mkr】 →[Difference Mode] to display the amplitude difference and frequency difference between the two frequency markers (time difference in case of zero bandwidth). Use the knob, step key or numeric key to move the active frequency marker. The displayed amplitude difference is in dB by default. -[Noise Mkr <u>Off</u> On]: Press 【Marker】 → [Noise Marker Off On], the noise marker shows the noise power that normalizes the noise to the 1Hz bandwidth near the active marker. At this time, the detector is set to the root-mean-square detection mode. In the default state, when the noise marker is turned on, the unit of the marker reading is automatically switched to dBm/Hz. -[Mkr→]: Press 【Mkr】 →[Mkr→] to open the marker function submenu, which allows users to use the marker as a reference to change the instrument display. Please refer to the [Mkr→] function menu for details. -[Mkr Off]: Press 【Mkr】 →[Mkr Off] to turn off the currently activated marker. -[All Off]: Press 【Mkr】 →[All Off] to turn off all markers that have been turned on. -[Special Notes]: There is no marker function in RSSI measurement mode.
	<ul style="list-style-type: none"> -[Mkr→Center Freq]: Press 【Mkr】 →[Mkr→]→[Mkr→Center Freq], the marker will move to the center frequency, and the reading at the center frequency is displayed on the screen. -[Mkr→Step Freq]: Press 【Mkr】 →[Mkr→]→[Mkr→Step Freq] to set the stepping amount of the center frequency, that is, the value of the frequency step is equal to the marker frequency. If the difference marker function is activated, the frequency step value is equal to the frequency of the difference marker. -[Mkr→Start Freq]: Press 【Mkr】 →[Mkr→]→[Mkr→Start Freq] to set the start frequency equal to the marker frequency. -[Mkr→Stop Freq]: Press 【Mkr】 →[Mkr→]→[Mkr→Stop Freq] to set the stop frequency equal to the marker frequency. -[Back]: Return to the previous menu (not available in RSSI measurement mode)

9.3.6 Peak menu

Peak	- [Max Peak] : Press 【Peak】 →[Max Peak] to set the current active marker to the maximum peak point of the measurement trace and display the frequency and amplitude of the marker in the upper center of the screen.
Peak Search	- [Sub Peak] : Press [Peak]→[Sub Peak] to move the active marker to the next highest point on the trace that is associated with the current marker position.
Next Peak	- [Left Peak] : Press 【Peak】 →[Left Peak] to find the next peak to the left of the current frequency marker position.
Next Pk Left	- [Right Peak] : Press 【Peak】 →[Right Peak] to find the next peak to the right of the current frequency marker position.
Next Pk Right	- [Max] : Place a marker at the highest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen. Pressing this button will not change the activated functions.
Max Search	- [Min] : Press [Peak]→[Min] to place a marker at the lowest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen. Pressing this button will not change the activated functions.
Min Search	- [Mkr→Center Freq] : Press [Peak]→[Mkr → Center Freq] and set the center frequency equal to the marker frequency. This function quickly moves the signal to the center of the screen.
Marker-> Center	(not available in RSSI measurement mode)

9.3.7 Scan menu

Sweep	- [Swp Time <u>Auto</u> Man] : Press 【Swp】 →[Swp Time <u>Auto</u> Man] to switch the sweep time between Auto and Manual. The underline marks the current state. If the sweep time is automatic, the RF analyzer automatically sets the sweep time to the fastest according to the current instrument status, and the screen displays the fastest sweep time under the current setting. If the sweep time is manually set, the sweep time value can be input at this time. Use the numeric keys to enter the sweep time value and select the time unit by pressing corresponding soft key to complete the setting. If the sweep time is automatic, the sweep speed may change depending on the change of RBW and VBW. The larger the values of RBW and VBW, the faster the sweeping speed and vice versa. If the sweep time of the instrument meet the minimum scanning time limit, the maximum non-zero sweep width can be set to 800 s, and the maximum zero sweep width can be set to be 600 s.
Sweep Time Auto Man	- [Swp Type <u>Cont</u> Single] : Press 【Swp】 →[Swp Type <u>Cont</u> Single]. The sweep type setting determines how the RF analyzer sweeps and when it stops to enter into the hold state. In the interference analysis mode, it provides two sweep modes: Continuous sweep and single sweep.
Sweep Cont Single	- [Re-sweep] : Press 【Swp】 →[Re-sweep] to restart the sweep.
Sweep Once	
Points >	

9.3.8 Auto Save menu

Record	<ul style="list-style-type: none"> -[Swp Interval]: Press [Auto Save]→[Swp Interval Auto] to set the sweep interval. After setting the sweep time, the trace will be switched to the maximum hold state by default to ensure that all signals measured during the sweep interval can be recorded.
Swp Interval Auto	
Sweep Span Auto	<ul style="list-style-type: none"> -[Span Time]: Press [Auto Save]→[Span Time Auto], and the span time is the entire sweep time. After the sweep reaches the span time, it will stop recording.
Record Off On	
Time Cursor 0 ns	<ul style="list-style-type: none"> -[Auto Save Off On]: Press [Auto Save]→[Auto Save Off On], and press the menu to switch the automatic save switch.
	<ul style="list-style-type: none"> -[Special Notes]: The automatic save function cannot be turned on until the span time is set.
	<ul style="list-style-type: none"> -[Time Mkr]: Press [Auto Save]→[Time Mkr] to view the historical data.
	<ul style="list-style-type: none"> -[Special Notes]: It can only be used in the waterfall chart measurement mode.
	<ul style="list-style-type: none"> -[Re-measure]: Press [Auto Save]→[Re-measure] to restart the sweep.
Restart	
	<ul style="list-style-type: none"> -[Special Notes]: This menu shall not be used in spectrum measurement; <p>The time marker menu function shall not be used in RSSI.</p>

9.3.9 Measurement menu

Measure	<ul style="list-style-type: none"> - [Spectrum Measurement]: Press 【Measure】 → [Spectrum Measurement] to switch the measurement mode to spectrum measurement. - [waterfall Chart]: Press 【Measure】 → [Waterfall] to switch the measurement mode to waterfall chart. - [RSSI]: Press 【Measure】 → [RSSI] to switch the measurement mode to RSSI.
Spectrum	
Spectrogram	
RSSI	

10 Demodulation Analysis measurement mode (optional)

10.1 Introduction to typical measurement

The demodulation analysis measurement mode is an extension of the spectrum measurement mode. After startup, press **【Mode】** to pop up a mode selection dialog box, select [Spectrum Analysis Mode], and press [OK] to enter the spectrum analysis mode after completing the progress bar. Then press **【System】** → [Measurement Mode] → [Demodulation Analysis] on the touch screen to enter the demodulation analysis mode.

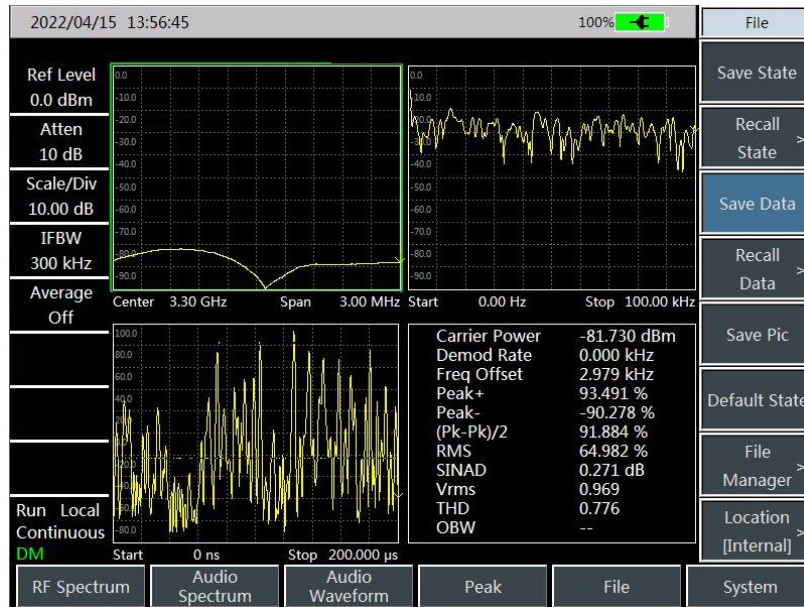


Figure 10-1 Main Interface of Demodulation Analysis Mode

The demodulation analysis measurement mode provides the display of AM, FM and PM modulation signal spectrums and the analysis of related parameters. The main maps and the measurements of related parameters are as shown below:

Radio frequency spectrum: Similar to the spectrum analysis mode, it displays the spectrogram of the modulated signal, and it can be used to measure the occupied bandwidth.

Audio map: It displays a spectrogram of the demodulated audio signal.

Audio waveform: It displays the waveform of the demodulated audio signal in the time domain.

Parameter analysis: It can measure and analyze the parameters such as carrier power, modulation rate, carrier frequency offset, modulation depth (AM), modulation frequency offset (FM), modulation phase offset (PM), signal-to-noise-and-distortion ratio, modulation distortion, total harmonic distortion, etc. of modulated signals.

Notice

All operations in this section are based on the premise of the selected demodulation analysis mode, which will not be described separately later.

The demodulation analysis can display three kinds of maps at the same time, or each map can be displayed separately. You can press the **【Measure】** menu, and select [Radio Frequency Map], [Audio Map], [Audio Waveform], and [Show all] to choose to display a certain map or to display all maps at the same time.

In order to facilitate the observation of the measurement signal, the following steps can be taken:

- Press **【Measure】** → [Demodulation Type AM FM PM] to select the type of analog signal to be demodulated.
- Press **【Freq】** → [Center Frequency] to set the center frequency of the measurement signal.
- Press **【BW】** → [Intermediate Frequency Bandwidth], and use the number keys or the **【↑】**

Demodulation analysis measurement mode(optional)

【↓】 keys or the knob to set an appropriate intermediate frequency bandwidth.

- d) Press **【Amplitude】** → [Ref Level] to set the reference level of the radio frequency spectrum, and press [Scale/Graduation] to set the appropriate scale/graduation value to facilitate viewing the radio frequency spectrum.
- e) Press **【Audio Map】** → [Sweep Width] to set the appropriate sweep width, and press [Scale/Graduation] to set the appropriate scale/graduation value to facilitate viewing the spectrogram of audio signals.
- f) Press **【Audio Waveform】** → [Sweep time] to set the display time of the audio signal waveform, press [Scale/Graduation] to set the appropriate scale/graduation value to facilitate viewing the spectrogram of audio signals.

Notice

When setting the intermediate frequency bandwidth, you need to select an appropriate value. The intermediate frequency bandwidth shall be greater than the width of the modulation signal in order to accurately demodulate the signal. You can observe the bandwidth of the modulation signal in the radio frequency spectrum. At the same time, if the intermediate frequency bandwidth is too large, noise would be introduced, which would affect the accuracy of parameter measurement.

The following takes the measurement of FM signal as an example to introduce the measurement method of demodulation analysis. First, input an FM modulation signal generated by a signal source at the radio frequency input end of the instrument. The frequency of the signal is 6 GHz, the amplitude is -10 dBm, the modulation rate is 3 kHz, and the modulation frequency offset is 30 kHz. The measuring steps are shown as follows:

- a) Press **【Measure】** → [Demodulation Type AM FM PM] to select FM.
- b) Press **【Freq】** → [Center Frequency] to set the center frequency of the measurement signal to be 6 GHz.
- c) Press **【BW】** → [Intermediate Frequency Bandwidth] to set the intermediate frequency bandwidth to be 100 kHz.
- d) Press **【Audio Map】** → [Sweep Width] to set the sweep width to be 50 kHz.
- e) Press **【Audio Waveform】** → [Sweep time] to set to be 2 ms.

The measurement result is shown in Figure 7-1:

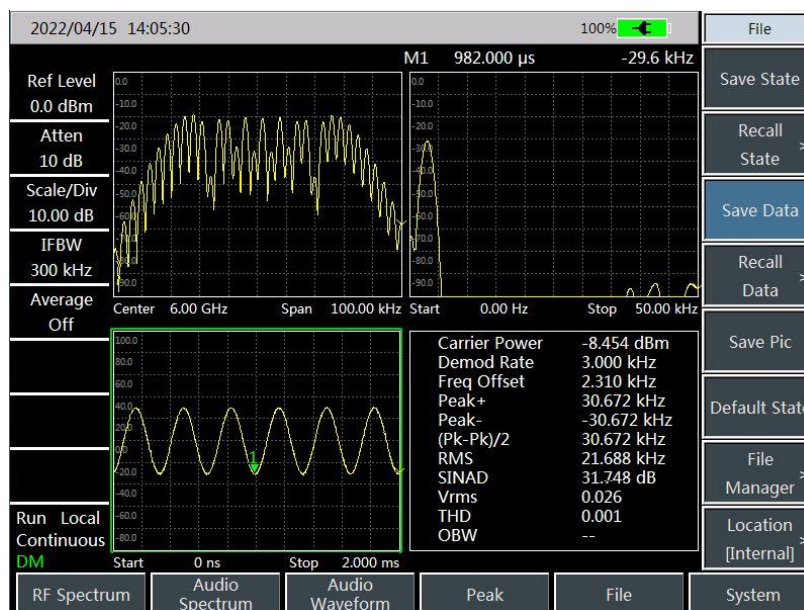


Figure 10-2 FM Demodulation Analysis Result

Demodulation analysis measurement mode(optional)

10.2 Demodulation analysis menu structure



Figure 10-3 Demodulation Analysis Menu


Demodulation analysis measurement mode(optional)

Audio Waveform	Measure
Sweep Time	Demod Type AM FM PM
Scale/Div 20.0 %	RF Spectrum
	Audio Spectrum
	Audio Waveform
	Summary
	Sweep Cont Single
	Sweep Once

Figure 10-4 Demodulation Analysis Menu (Continued)

10.3 Description of demodulation analysis menu

10.3.1 Frequency menu

	<p>·[Center frequency]: Press 【Freq】 → [Center Frequency], through the number keys on the front panel, select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu, or use the 【↑】【↓】 keys and the knob to set the center frequency.</p> <p>·[Special Notes]: When using the 【↑】【↓】 keys and the knob, the size of the frequency step is the same as the set value of the [Step Frequency]. After pressing the [Step Frequency Auto Man] to switch to [Step Frequency Auto Man], you can use the number keys or the 【↑】【↓】 keys and the knob to set the step frequency value.</p> <p>·[Sweep Width]: Press 【Freq】 → [Sweep Width] to activate the sweep width submenu. You can use the number keys, and then select the frequency unit to change. You can also use the 【↑】【↓】 keys and the knob to change the sweep width. For the detailed information, please refer to the description of the [Sweep Width] menu.</p> <p>·[Special Notes]: Use the 【↑】【↓】 keys and the knob to change the span with a step of 1-2-5.</p> <p>· [Start Frequency]: Press 【Freq】 → [Start Frequency], and then select the corresponding frequency unit through the number keys on the front panel, or use the 【↑】【↓】 keys and the knob to set.</p> <p>·[Stop Frequency]: Press 【Freq】 → [Stop Frequency], and then select the corresponding frequency unit through the number keys on the front panel, or use the 【↑】【↓】 keys and the knob to set.</p> <p>·[Signal Standard]: Press 【Freq】 → [Signal Standard] to pop up the related soft menu, including [Header], [Footer], [Page Up], [Page Down], and [Recall Immediately], select the relevant signal standard, and use the [Recall Immediately] key or the [OK] key to call.</p> <p>·[Special Notes]: After the signal standard is loaded, the center frequency and the sweep width are set to the center frequency and the sweep width value defined in the signal standard.</p> <p>·[Channel No.]: Press 【Freq】 → [Channel number] to pop up the channel number setting dialog box, and use the number keys or the 【↑】【↓】 keys and the knob to set the channel number.</p> <p>·[Special Notes]: The setting of the channel number shall be carried out under the premise of loading the signal standard, otherwise a prompt that it cannot be set will pop up.</p>
--	---

10.3.2 Sweep width menu

Span	<p>•[Sweep Width]: Press 【Freq】 → [Sweep Width] to activate the sweep width submenu. You can use the number keys, and then select the frequency unit to change the sweep width. You can also use the 【↑】 【↓】 keys and the knob to change.</p> <p>•[Special Notes]: Use the 【↑】 【↓】 keys and the knob to change the span with a step of 1-2-5.</p> <p>•[Last Sweep Width]: Press 【Freq】 → [Sweep Width]→[Last Sweep Width], and restore the sweep width to the last set sweep width value.</p> <p>•[Back]: Press 【Freq】 → [Sweep Width]→[Back], and return the 【Freq】 menu.</p>
Span	
Last Span	
< Back	

10.3.3 Amplitude menu

Amplitude	<p>•[Ref Level]: Press 【Amplitude】 → [Ref Level], use the number keys on the front panel, and then select [dBm], [-dBm], [mV] and [uV], or use the 【↑】 【↓】 keys and the knob to set.</p> <p>•[Special Notes]: When using the 【↑】 【↓】 keys and the knob, the step is 10 dB.</p> <p>•[Reference Position]: Press 【Amplitude】 → [Reference Position], you can use the number keys, and you can also use the 【↑】 【↓】 keys and the knob to change.</p> <p>•[Attenuator <u>Auto</u> Man]: Press 【Amplitude】 → [Attenuator <u>Auto</u> Man] to switch the automatic and manual switch of the attenuator through the menu. You can use the number keys, and you can also use the 【↑】 【↓】 keys and the knob to change.</p> <p>•[Special Notes]: The setting range of the attenuation value is 0 dB ~ 60 dB, with the step value of 10 dB.</p> <p>•[Scale/Graduation]: Press 【Amplitude】 → [Scale / Graduation] to set via the number keys or the 【↑】 【↓】 keys and the knob, and the setting range of scale / graduation is 0.1 dB ~ 20 dB.</p> <p>•[Pre Amp <u>Off</u> On]: Press 【Amplitude】 to control the on/off state of the preamplifier. Only when the reference level is less than -40 dBm, this function will be activated.</p>
Ref Level 0.0 dBm	
Ref Position	
Atten Auto Man	
Scale/Div 10.00 dB	
Pre Amp <u>Off</u> On	

10.3.4 Bandwidth menu

BW	<p>•[Immediate Frequency Bandwidth]: Press 【BW】 → [Immediate Frequency Bandwidth], through the number keys on the front panel, select the corresponding frequency units of [GHz], [MHz], [kHz] and [Hz], or use the 【↑】【↓】 keys and the knob to set.</p>
IFBW	<p>•[Special Notes]: The intermediate frequency bandwidth shall be greater than the width of the modulation signal in order to accurately demodulate the signal. You can observe the bandwidth of the modulation signal in the radio frequency spectrum. At the same time, if the intermediate frequency bandwidth is too large, noise would be introduced, which would affect the accuracy of parameter measurement. The immediate frequency bandwidth ranges from 10 kHz to 300 kHz, changing in the steps of 1-3-10.</p>
Average Off On	<p>•[Average <u>Off</u> On]: Press 【BW】 → [Avg <u>Off</u> On], the average function can smooth the displayed trace. When the average function is turned on, you can use the number keys to select the average times, and you can also use the 【↑】【↓】 keys and the rotary round to change.</p>

10.3.5 Marker menu

Marker	· [Marker 1 2 3 4 5 6] : Press 【Mkr】 → [Marker 1 2 3 4 5 6] to switch between different marker displays, and the selected marker will be marked with an underline.
Marker 1 2 3 4 5 6	
Normal	· [Normal Mode] : Press 【Mkr】 → [Normal Mode], and set the currently selected marker display mode to be the normal mode.
Delta	· [Delta Mode] : Press 【Mkr】 → [Delta Mode], and set the currently selected marker display mode to be the delta mode. The delta mode displays the frequency difference and the amplitude difference between the difference marker and the reference marker (it is the time difference at the zero sweep width). When the amplitude unit is selected to be dBm, dBmV, dBuV, dBW, dBV, dBA, dBmA and dBuA, the displayed amplitude value unit is dB, and when the amplitude unit is displayed to be A, W and V, the displayed amplitude unit is % .
Select Trace >	· [Selection Trace] : Press 【Mkr】 → [Selection Trace]to pop up the related soft menu of the trace, including [Radio Frequency Spectrum], [Audio Map] and [Audio waveform]. For details, please refer to the menu of [Selection Trace].
Off	· [Marker Off] : Press 【Mkr】 →[Marker Off] to turn off the currently activated marker.
All Off	· [All Off] : Press 【Mkr】 →[All Off] to turn off all the activated markers.

Select Trace	· [Selection Trace] : Press 【Mkr】 → [Selection Trace]
RF Spectrum	· [Radio Frequency Spectrum] : Press 【Mkr】 → [Selection Trace]→[Radio Frequency Spectrum], select the current trace to be the trace in the radio frequency spectrum, and the marker operates only on this trace.
Audio Spectrum	· [Audio Map] : Press 【Mkr】 → [Selection Trace]→[Audio Map], select the current trace to be the trace in the audio map, and the marker operates only on this trace.
Audio Waveform	· [Audio Waveform] : Press 【Mkr】 → [Selection Trace]→[Audio Waveform], select the current trace to be the trace in the audio waveform, and the marker operates only on this trace.
< Back	

10.3.6 Peak menu

Select Trace	- [Max Peak] : Press 【Peak】 →[Max Peak] to set the current active marker to the maximum peak point of the measurement trace and display the frequency and amplitude of the marker in the upper center of the screen.
RF Spectrum	- [Sub Peak] : Press [Peak]→[Sub Peak] to move the active marker to the next highest point on the trace that is associated with the current marker position.
Audio Spectrum	- [Left Peak] : Press [Peak] →[Left Peak] to find the next peak to the left of the current marker position.
Audio Waveform	- [Right Peak] : Press [Peak] →[Right Peak] to find the next peak to the right of the current marker position.
	- [Max] : Place a marker at the highest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen. Pressing this button will not change the activated functions.
	- [Min] : Press [Peak]→[Min] to place a marker at the lowest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen. Pressing this button will not change the activated functions.
	- [Marker -> Center Frequency] : Press 【Peak】 →[Marker → Center Frequency], and set the center frequency equal to the marker frequency. This function quickly moves the signal to the center of the screen, and this operation is only effective to the radio frequency spectrum.
< Back	- [Special Notes] : The operations of searching each peak value, the maximum value and the minimum value are all carried out on the selected trace. For details, see the menu of [Selection Trace].

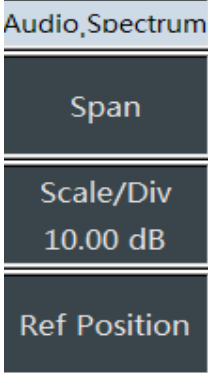
10.3.7 Radio frequency spectrum menu

RF Spectrum	- [Special Notes] : The occupied bandwidth measurement in the radio frequency spectrum is similar to that in the spectrum analysis mode, except that it is only applied to the radio frequency spectrum in the demodulation analysis measurement mode.
OWB Off On	- [Occupied Bandwidth Off On] : Press [Radio Frequency Spectrum]→[Occupied Bandwidth <u>Off</u> On], and set the occupied bandwidth measurement switch.
Method % dBc	- [Measuring Method Percentage XdB] : Press [Radio Frequency Spectrum]→[Measuring Method <u>Percentage</u> XdB], and select different measuring methods, including the percentage method or the XdB drop method. The occupied bandwidth of the signal is obtained by calculating the bandwidth of the portion of the frequency containing a certain percentage of the total transmitted signal power, and the percentage of power can be set by the user. The descending XdB method defines the occupied bandwidth as: the distance between the two frequency points when the signal power drops by XdB on both sides of
% 99.00%	
dBc -3.0dB	


Demodulation analysis measurement mode(optional)

	<p>the frequency point where the peak power of the signal is located. The X dB of the signal power drop is set by the user.</p> <p>-[Percentage]: Press [Radio Frequency Spectrum]→[Percentage] to set the percentage.</p> <p>-[XdB]: Press [Radio Frequency Spectrum]→[XdB] to set the XdB value.</p>
--	--

10.3.8 Audio map menu

	<p>-[Sweep Width]: Press [Audio Map]→[Sweep Width]to set the sweep width of the audio map. The sweep width here shall be set large enough to display the audio signal and associated harmonics. You can use the number keys and then select the frequency unit to change the sweep width, or you can use the 【↑】【↓】 keys and the knob to change.</p> <p>-[Scale]: Press [Audio Map]→[Scale / Graduation], and set the scale of the audio map to facilitate the observation of the audio map trace. You can change the scale unit by using the number keys and then selecting the power units of [dB] , [-dB] , and you can also use the 【↑】【↓】 keys and the knob to change.</p> <p>-[Reference Position]: Press [Audio Map]→[Reference Position], and set the reference position of the audio map to facilitate the observation of the audio map trace. You can use the number keys and then click to confirm, and you can also use the 【↑】【↓】 keys and the knob to change the reference position.</p>
--	--

10.3.9 Audio waveform menu

	<p>-[Sweep Time]: Press [Audio Waveform]→[Sweep Time] to set the sweep time of the audio waveform. The larger the sweep time is set here, the more sampling points, and the more stable the measurement results are.</p> <p>-[Scale]: Press [Audio Waveform]→[Scale / Graduation], and set the scale of the audio waveform to facilitate the observation of the audio map trace. You can change the scale unit by using the number keys and then selecting [%] or click the OK key, and you can also use the 【↑】【↓】 keys and the knob to change.</p> <p>-[Special Notes]: The scale unit changes based on the type of the demodulated signal. When measuring the AM signal, the scale unit is percentage (%), when measuring the FM signal, the scale unit is the frequency unit (Hz, kHz and GHz), and when measuring the PM signal, the scale unit is the radian (Rad).</p>
---	--

10.3.10 Measurement menu

Measure	- [Demodulation Type AM FM PM]: Press 【Measure】
Demod Type AM FM PM	[Demodulation Type <u>AM</u> FM PM] to select the type of the signal to be demodulated.
RF Spectrum	- [Radio Frequency Spectrum]: Press 【Measure】 →[Radio Frequency Spectrum], and choose to only display the radio frequency spectrum.
Audio Spectrum	- [Audio Map]: Press 【Measure】 →[Audio Map], and choose to only display the audio map.
Audio Waveform	- [Audio Waveform]: Press 【Measure】 →[Audio Waveform], and choose to only display the audio waveform.
Summary	- [Display All]: Press 【Measure】 →[Display All], and choose to display the radio frequency spectrum, the audio map, and the audio waveform simultaneously.
Sweep Cont Single	- [Swp Type Cont Single]: Press 【Measure】 →[Sweep Type <u>Continuous</u> Single], and select continuous sweep or single sweep.
Sweep Once	- [Sweep again]: Press 【Measure】 →[Sweep Again], and select to trigger the single sweep. Only when the sweep type is set to be the single sweep, it makes sense sweep again.

11 Channel sweep measurement mode (optional)

11.1 Introduction to typical measurements

The channel sweep measurement mode is an extension of the spectrum measurement mode. After startup, press **【Mode】** to pop up a mode selection dialog box, select [Spectrum Analysis Mode], and press [OK] to enter the spectrum analysis mode first after completing the progress bar. Then press [System]→[Measurement Mode]→[Channel Sweep] on the touch screen to enter the channel sweep measurement mode.

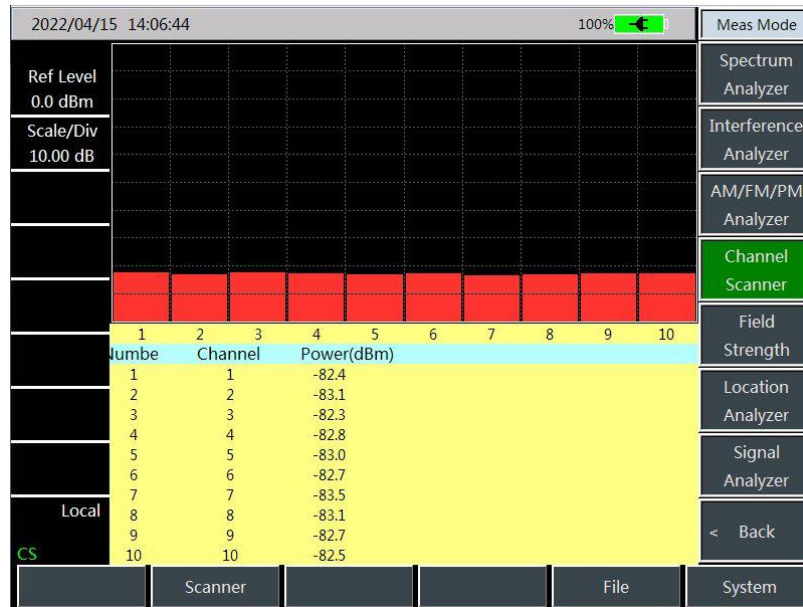


Figure 11-1 Main Interface of Channel Sweep Measurement Mode

The channel sweep measurement mode provides the measurement of signal power for multiple channels. The signal power is displayed in the form of a bar graph or a list, and the signal power of up to 20 channels can be measured. Channel sweep is divided into three measurement methods according to the way of setting the channel: Channel sweep, frequency sweep, and list sweep.

Channel sweep: Set the channel to be measured by setting the signal standard, the start channel, and the channel step.

Frequency sweep: Set the channel to be measured by setting the start frequency and the frequency step.

List sweep: Set the channel to be measured by setting the list.

All the three measurement methods can be used to set the bandwidth of the channel and the number of channels to be measured.

Notice

All operations in this section are based on the premise of channel sweep measurement, which will not be described separately later.

11.1.1 Channel sweep

The following is a measurement example of channel sweep. The main operation steps are as follows:

- Press **【Sweep】** →[Channel Sweep] →[Signal Standard] to set the standard of the channel to be measured.
- Press **【Sweep】** →[Channel Sweep]→[Start Channel] to set the start channel number to be measured. This start channel shall meet the requirements of the selected signal standard.
- Press **【Sweep】** →[Channel Sweep] →[Number of Channels], set the number of channels to be measured, and up to 20 channels can be measured simultaneously.

Channel sweep measurement mode(optional)

- d) Press **【Sweep】** →[Channel Sweep] →[Channel Step] to set the step of the channel to be measured. The instrument will take the start channel number as the initial measurement channel, and measure a certain number of channels successively in the set channel step.
- e) Press **【Sweep】** →[Display Diagram Table], and set to be the diagram display mode.
- f) Press **【Sweep】** →[Power Display Real-time Maximum], select the Maximum option, and set to display the maximum power of each channel.

Notice

Only when the maximum hold switch is on can set the power display to be maximum.

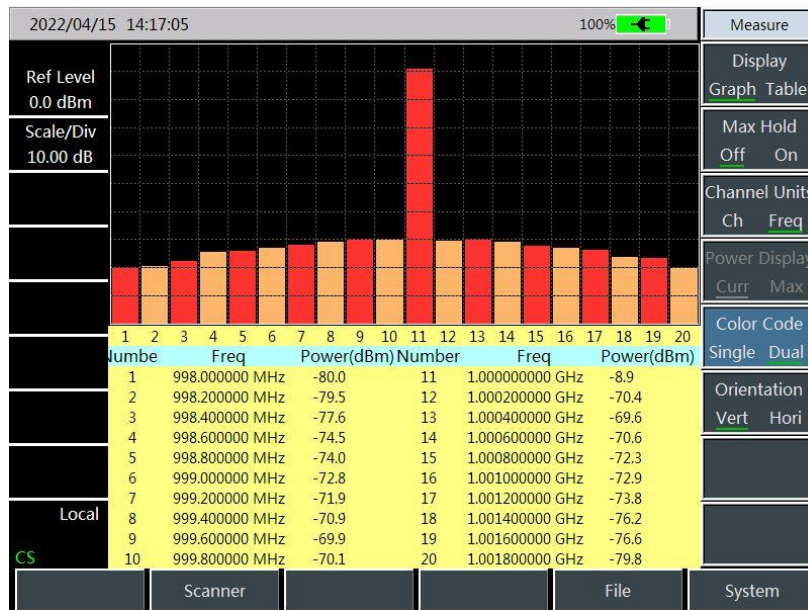


Figure 11-2 Schematic Diagram of Channel Sweep

11.1.2 Frequency sweep

The following is a measurement example of frequency sweep. The main operation steps are as follows:

- a) Press **【Sweep】** →[Frequency Sweep] →[Start Frequency], and set the center frequency of the start channel to be measured.
- b) Press **【Sweep】** →[Frequency Sweep] →[Frequency Step], and set the frequency step of the channel to be measured.
- c) Press **【Sweep】** →[Frequency Sweep] →[Channel Bandwidth], and set the bandwidth of the channel to be measured.
- d) Press **【Sweep】** →[Channel Sweep] →[Number of Channels], set the number of channels to be measured, and up to 20 channels can be measured simultaneously.
- e) Press **【Measure】** →[Display Diagram Table], and set to be the diagram display mode.
- f) Press **【Measure】** →[Power Display Real-time Maximum], select the Real-time option, and set to display the real-time power of each channel.
- g) Press **【Measure】** →[Color Single Double] to select the double color option.
- h) Press **【Measure】** →[Chart Direction Vertical Parallel] to select the parallel chart display mode.

Channel sweep measurement mode(optional)

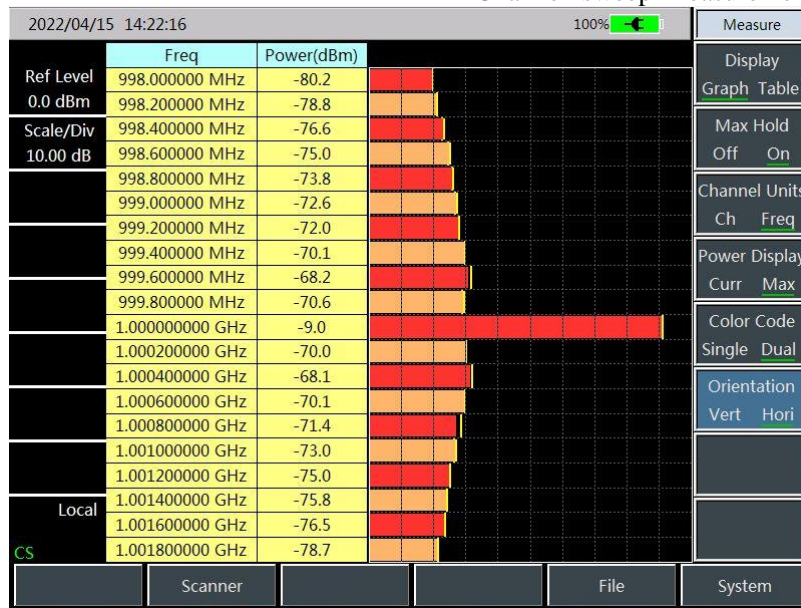


Figure 11-3 Schematic Diagram of Frequency Sweep

11.1.3 List Sweep

The following is a measurement example of frequency sweep. The main operation steps are as follows:

- Press **【Sweep】** →[List Sweep] →[Edit List], edit the channel list to be swept. In the list, the information of each channel can be set by setting the signal standard and the channel number, and the channel information can also be set by setting the frequency and the bandwidth.
- Press **【Sweep】** →[List Sweep] →[Number of Channels], set the number of channels to be measured, and up to 20 channels can be measured simultaneously.
- Press **【Sweep】** →[Display Diagram Table], and set to be the diagram display mode.
- Press **【Sweep】** →[Power Display Real-time Maximum], select the Real-time option, and set to display the real-time power of each channel.

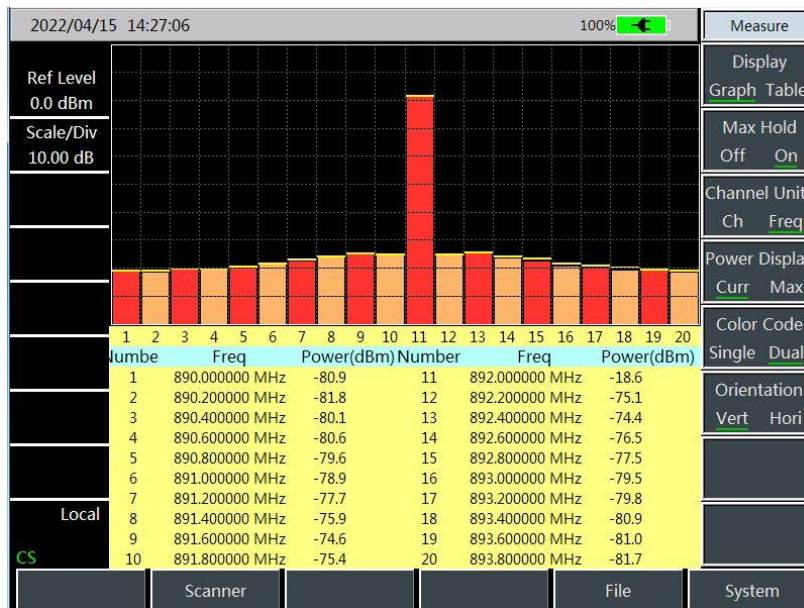


Figure 11-4 Schematic Diagram of List Sweep

Channel sweep measurement mode(optional)

11.2 Menu structure of channel sweep

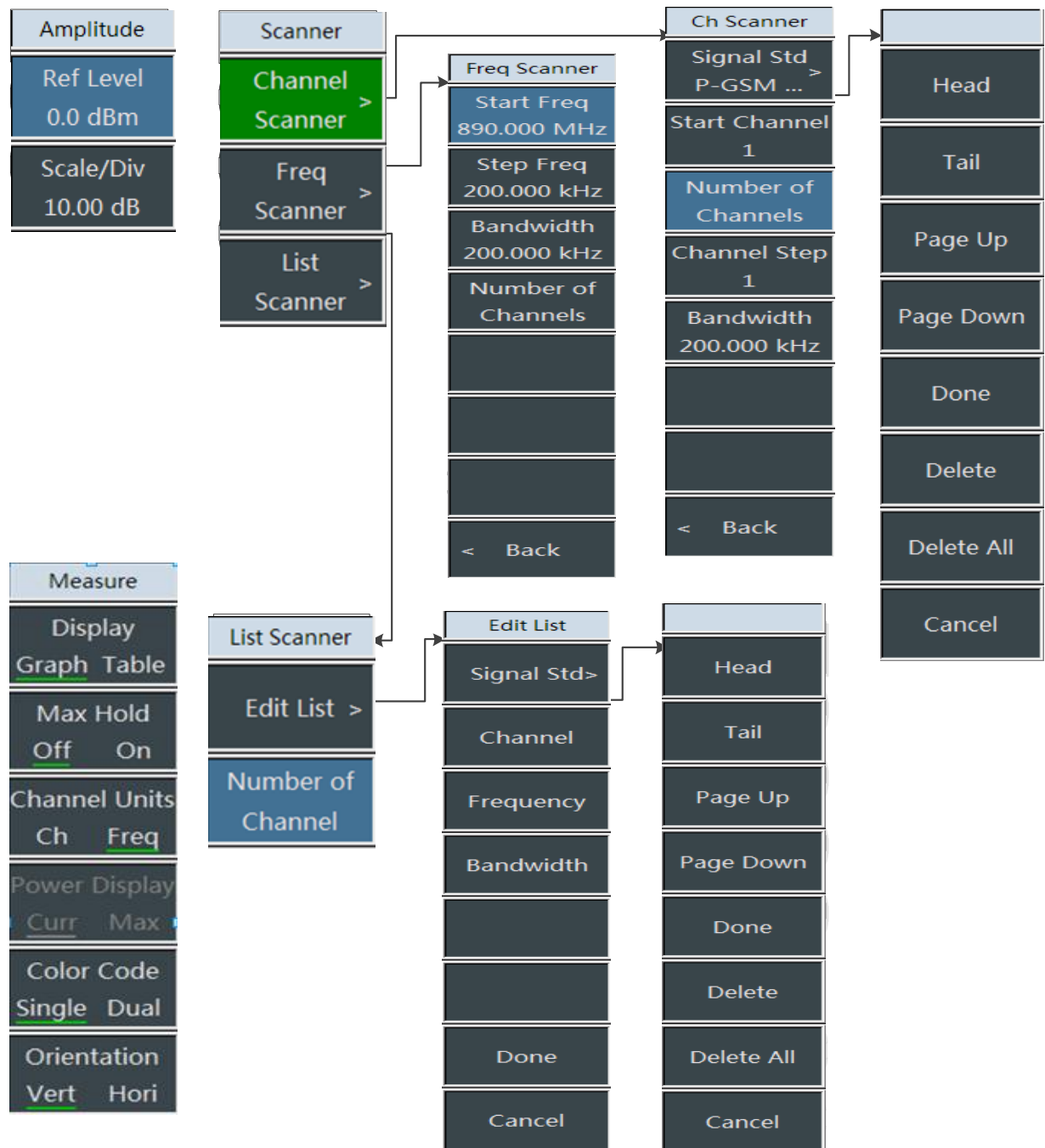


Figure 11-5 Channel Sweep Menu

11.3 Description of channel sweep menu

11.3.1 Sweep menu

Scanner	<p>·[Channel Sweep]: Press 【Sweep】→[Channel Sweep], and set the channel sweep measurement mode and activate the submenu of[Channel Sweep]. You can set the sweep channel parameters in the submenu of [Channel Sweep]. For details, see the submenu of[Channel Sweep].</p>
Channel Scanner >	<p>·[Freq Sweep]: Press 【Sweep】 →[Frequency Sweep], and set the frequency sweep measurement mode and activate the submenu of[Frequency Sweep]. You can set the sweep channel parameters in the submenu of [Frequency Sweep]. For details, see the submenu of[Frequency Sweep].</p>
Freq Scanner >	<p>·[List Sweep]: Press 【Sweep】 →[List Sweep], and set the list sweep measurement mode and activate the submenu of[List Sweep]. You can set the sweep channel parameters in the submenu of [List Sweep]. For details, see the submenu of[List Sweep].</p>
List Scanner >	

11.3.2 Channel sweep menu

Ch Scanner	<p>·[Signal Standard]: }Press 【Sweep】 →[Channel Sweep]→[Signal Standard] to pop up the list of existing signal standards. Through the related menus of [Header], [Footer], [Page Pp], [Page Down], etc., click [Recall Immediately] to select the corresponding signal standard.</p>
Signal Std P-GSM ... >	<p>·[Start Channel]: Press 【Sweep】 →[Channel Sweep]→[Start Channel] to set the start channel number. This channel is the initial channel for measurement, and this channel number can only be set under the premise of selecting the signal standard.</p>
Start Channel 1	<p>·[Channel Num]: Press 【Sweep】 →[Channel Sweep]→[Number of Channels] to set the number of channels to be measured, and up to 20 channels can be measured.</p>
Number of Channels	<p>·[Cannel Step]: Press 【Sweep】 →[Channel Sweep]→[Channel Step] to set the step between the channels to be measured.</p>
Channel Step 1	<p>·[Channel BW]: Press 【Sweep】 →[Channel Sweep]→[Channel Bandwidth] to set the bandwidth of the channel to be measured.</p>
Bandwidth 200.000 kHz	

11.3.3 Frequency sweep menu

Freq Scanner	- [Start Frequency]: Press 【Sweep】 →[Frequency Sweep]→[Start Frequency] to set the center frequency of the start channel.
Start Freq 890.000 MHz	- [Freq Step]: Press 【Sweep】 →[Frequency Sweep]→[Frequency Step] to set the frequency step between the channels.
Step Freq 200.000 kHz	- [Channel BW]: Press 【Sweep】 →[Frequency Sweep]→[Channel Bandwidth]to set the bandwidth of the channel to be measured.
Bandwidth 200.000 kHz	- [Channel Num]: Press 【Sweep】 →[Frequency Sweep]→[Number of Channels]to set the number of channels to be measured, and up to 20 channels can be measured.
Number of Channels	

11.3.4 List sweep menu

List Scanner	- [Edit List]: Press 【Sweep】 → [List Sweep]→[Edit List] to pop up the corresponding edit list menu. For details, please refer to the menu of [Edit List].
Edit List >	
Number of Channel	- [Channel Num]: Press 【Sweep】 →[List Sweep]→[Number of Channels]to set the number of channels to be measured, and up to 20 channels can be measured.

Edit List	- [Signal Standard]: Press [Edit List] →[Signal Standard] to pop up the list of signal standards. Through [Header], [Footer], [Page Up], and [Page Down], select the required signal standard, and click [Recall Immediately].
Signal Std>	
Channel	- [Channel Number]: Press [Edit List]→[Channel Number] to display the information such as the selected signal standard, the channel range, etc. The user can also edit the channel number, and click [Complete Editing] to save the settings.
Frequency	
Bandwidth	- [Center Frequency]: Press [Edit List]→[Center Frequency] to edit the center frequency of the selected channel, and click [Complete Editing] to save the settings.
	- [Channel BW]: Press [Edit List]→[Channel Bandwidth] to edit the bandwidth of the selected channel, and click [Complete Editing] to save the settings.
Done	- [Complete Editing]: Press [Edit List]→[Complete Editing] to save the changed settings, and return to the list sweep menu.
Cancel	- [Cancel Editing]: Press [Edit List]→[Cancel Editing] to cancel the changed settings, and return to the list sweep menu.

11.3.5 Measurement menu

Measure	• [Display Diagram Table]: Press 【Measure】 →[Display <u>Diagram</u> Table] to select the icon display mode. For two kinds of diagrams, see Figure 8-7and Figure 8-8.
Display Graph Table	• [Max Hold <u>Off</u> On]: Press 【Measure】 →[Max Hold <u>Off</u> On] to set the maximum hold switch.
Max Hold <u>Off</u> On	• [Unit <u>Channel</u> Frequency]: Press 【Measure】 →[Unit <u>Channel</u> Frequency], and set to display the channel as the channel number or the frequency.
Channel Units Ch <u>Freq</u>	• [Power Display <u>Real-time</u> Maximum]: Press 【Measure】 →[Power Display <u>Real-time</u> Maximum], and set to display power as real-time or maximum. Only when the maximum hold is on can set the maximum display of power.
Power Display <u>Curr</u> Max	• [Color <u>Single</u> Double]: Press 【Measure】 →[Color <u>Single</u> Double], and set to display the channel in a single color or double colors.
Color Code <u>Single</u> Dual	• [Icon Direction <u>Vertical</u> Parallel]: Press 【Measure】 →[Icon Direction <u>Vertical</u> Parallel], and set to display the channel diagram in the vertical or parallel manner.
Orientation <u>Vert</u> Hori	

Field strength measurement mode(optional)

12 Field strength measurement mode (Optional)

12.1 Introduction to typical measurements

The field strength measurement mode is an extension of the spectrum measurement mode. After startup, press **【Mode】** to pop up a mode selection dialog box, select [Spectrum Analysis Mode], and press [OK] to enter the spectrum analysis mode after completing the progress bar. Then press **【System】** →[Measurement Mode]→[Field Strength Measurement] on the touch screen to enter the field strength measurement mode.

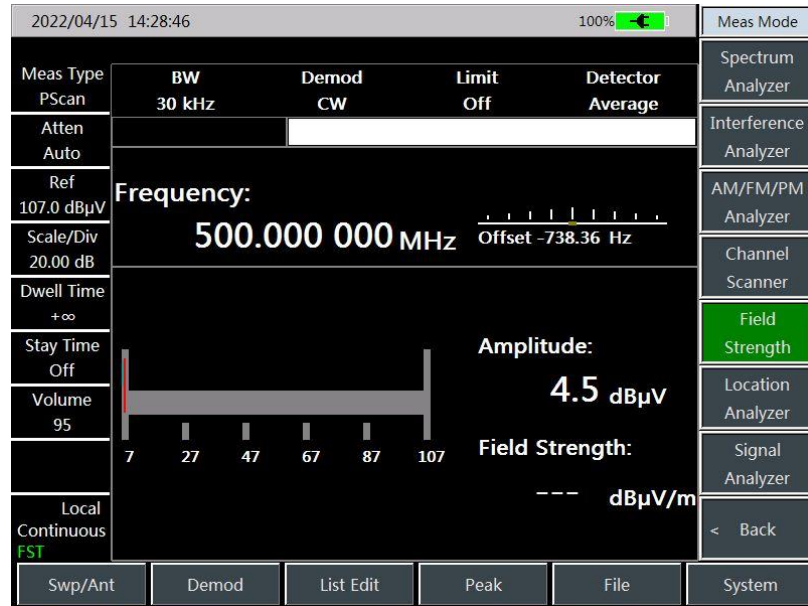


Figure 12-1 Main Interface of Field Strength Measurement Mode

Field strength measurement is indispensable in the radiant intensity measurement of measured equipment. According to different measurement modes, the field strength measurement can be divided into: Three modes of point frequency measurement, frequency sweep measurement and list sweep measurement.

Point frequency measurement: Observe the frequency offset, the amplitude value and the field strength value of the current point by setting the point frequency.

Frequency sweep measurement: By setting the start frequency, the step frequency and the number of sweep points to observe the changes of the amplitude value and the field strength value within a frequency range.

List sweep measurement: Observe the amplitude value and the field strength value of the list frequency point by calling a pre-edited or saved list.

Notice

All operations in this section are based on the premise of field strength measurement, which will not be described separately later.

12.1.1 Point frequency measurement

The main operation steps of point frequency measurement are as follows:

- Press **【Measure】** →[Point Frequency Measurement] to select the point frequency measurement mode;
- Press **【Freq】** →[Point Frequency] to set the point frequency value. The setting range of the point frequency value is [1 MHz, 44.1 GHz];
- Press **【BW】** →[BW] to set the bandwidth value, which will be set to 150Hz, 300Hz, 600Hz, 1.5kHz, 2.4kHz, 6kHz, 9kHz, 15kHz, 30kHz, 50kHz, 120kHz, 150kHz;
- Press **【Sweep/Antenna】** →[Recall Antenna] to select the antenna factor file;
- Press **【Demodulation】** to set the demodulation type and demodulation volume.
- The schematic diagram of point frequency measurement is shown in the following figure (for example only)

Field strength measurement mode(optional)

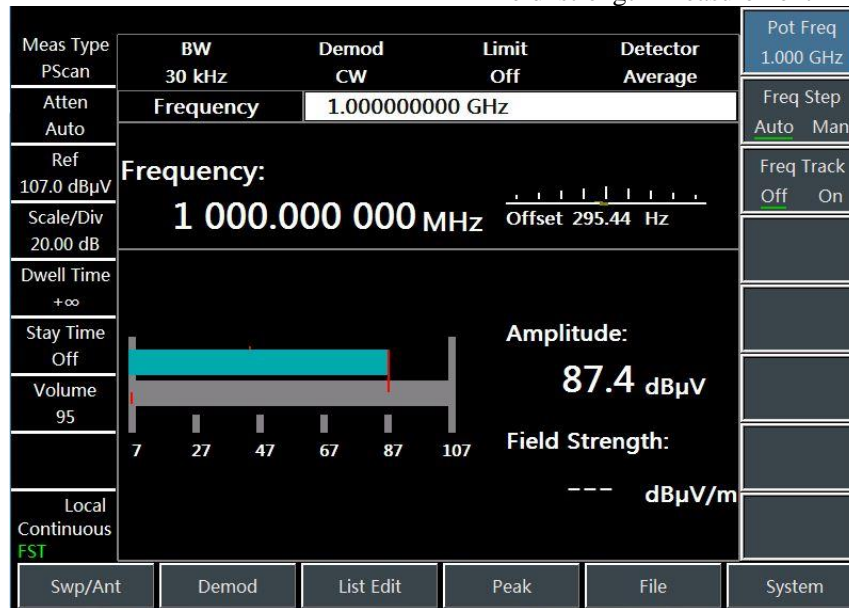


Figure 12-2 Schematic Diagram of Point Frequency Measurement Mode

12.1.2 Frequency sweep measurement

The main operation steps of frequency sweep measurement are as follows:

- Press **【Measure】** →[Frequency Sweep] to select the frequency sweep mode;
- Press **【Freq】** →[Start Frequency] to set the start frequency value of frequency sweep;
- Press **【Freq】** →[Step Frequency] to set the step frequency value of frequency sweep;
- Press **【Freq】** →[Sweep Points] to set the number of sweep points for frequency sweep;
- Press **【BW】** →[Bandwidth] to set the bandwidth value, which will be set to be 150 Hz, 300 Hz, 600 Hz, 1.5 kHz, 2.4 kHz, 6 kHz, 9 kHz, 15 kHz, 30 kHz, 50 kHz, 120 kHz, and 150kHz;
- Press [Sweep/Antenna] →[Recall Antenna] to select the antenna factor file;
- Press [Sweep/Antenna] →[Residence time +∞ Manual] to set the residence time;
- Press [Sweep/Antenna] →[Dwell time Off On] to set the residence time switch.
- Press **【Marker】** →[Marker Off On] to turn on or off the marker;
- Press **【Peak】** to directly position the marker at the maximum point.

Notice

The residence time refers to the time staying at the frequency point after the measured value of the current frequency point exceeds the set limit value after the limit switch is turned on.

The schematic diagram of frequency sweep measurement is shown in the following figure (for example only)

Field strength measurement mode(optional)

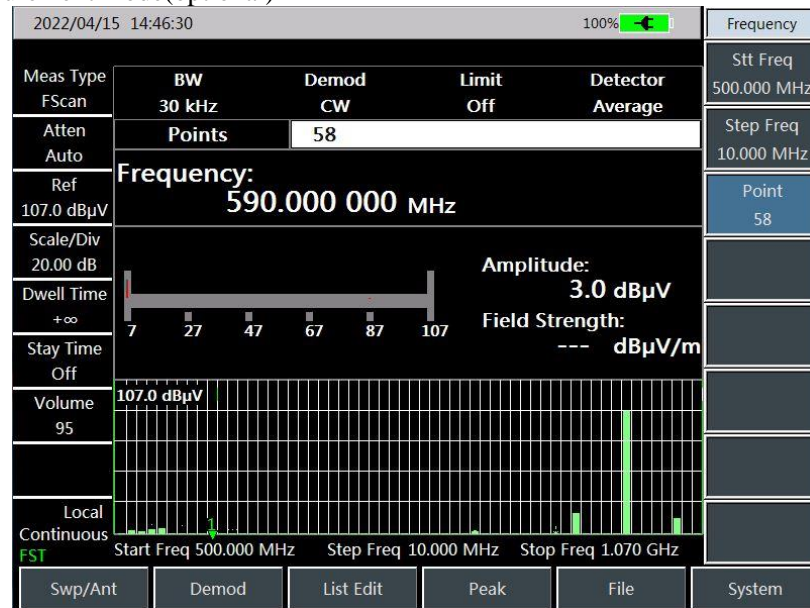


Figure 12-3 Schematic Diagram of Frequency Sweep Measurement Mode

12.1.3 List sweep measurement

The main operation steps of list sweep measurement are as follows:

- Press **【List Edit】** →[Edit List] to edit the current list;
- Press **【List Edit】** →[Edit List]→[Frequency] to set the frequency value of each segment;
- Press **【List Edit】** →[Edit List] →[Bandwidth] to set the bandwidth value, which will be set to be 150 Hz, 300 Hz, 600 Hz, 1.5 kHz, 2.4 kHz, 6 kHz, 9 kHz, 15 kHz, 30 kHz, 50 kHz, 120 kHz, and 150kHz;
- Press **【Measure】** →[List Sweep] to switch the current measurement mode to the list sweep mode;
- Press [Sweep/Antenna] →[Recall Antenna] to select the antenna factor file;
- Press [Sweep/Antenna] →[Residence time +∞ Manual] to set the residence time;
- Press [Sweep/Antenna] →[Dwell time Off On] to set the residence time switch.
- Press **【Mkr】** →[Marker Off On] to turn on or off the marker;
- Press **【Peak】** to directly position the marker at the maximum point.

Notice

The list sweep mode can only be switched when the list exists!

The schematic diagram of list sweep measurement is shown in the following figure (for example only)

Field strength measurement mode(optional)

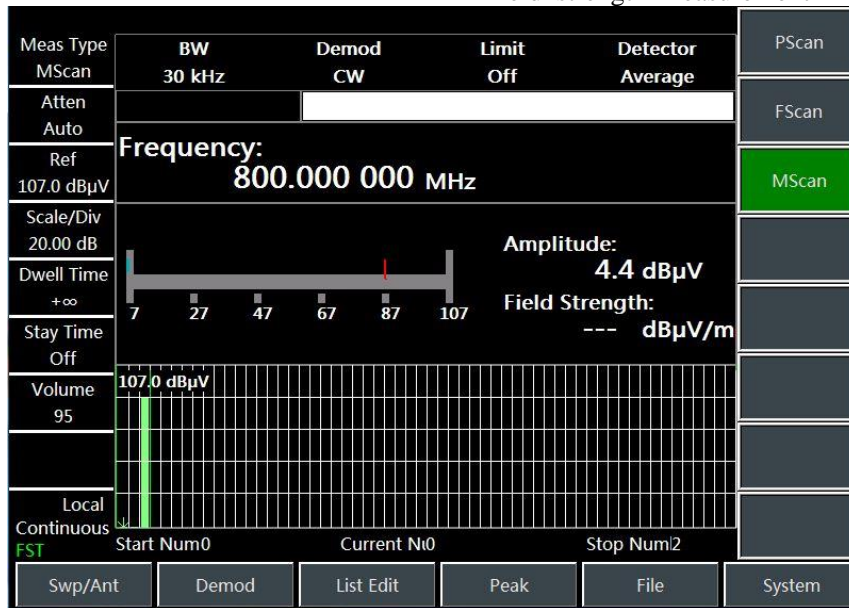


Figure 12-4 Schematic Diagram of List Sweep Measurement Mode

Field strength measurement mode(optional)

12.2 Menu structure of field strength measurement

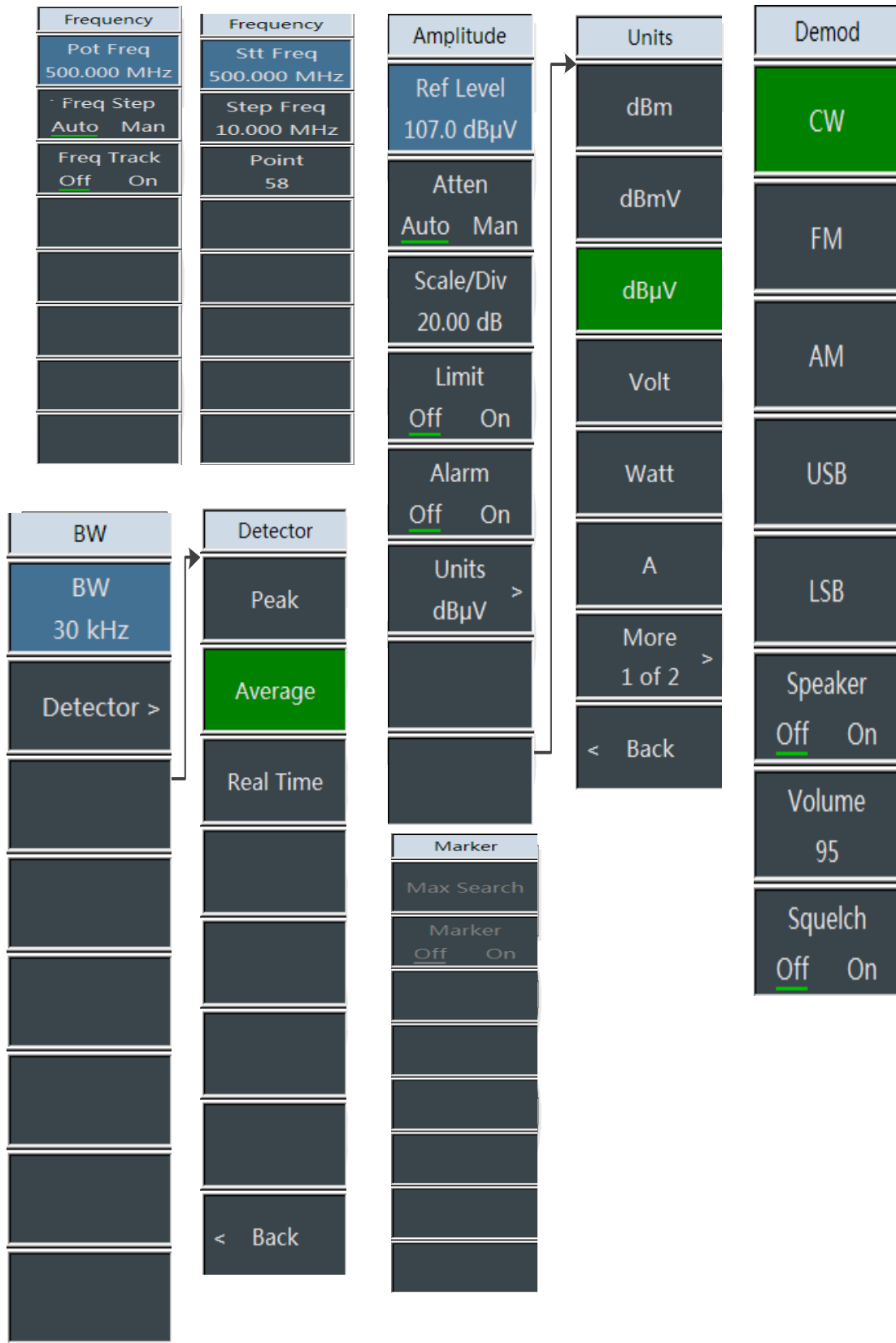


Figure 12-5 Overall Menu Block Diagram of Field Strength Measurement

Field strength measurement mode(optional)

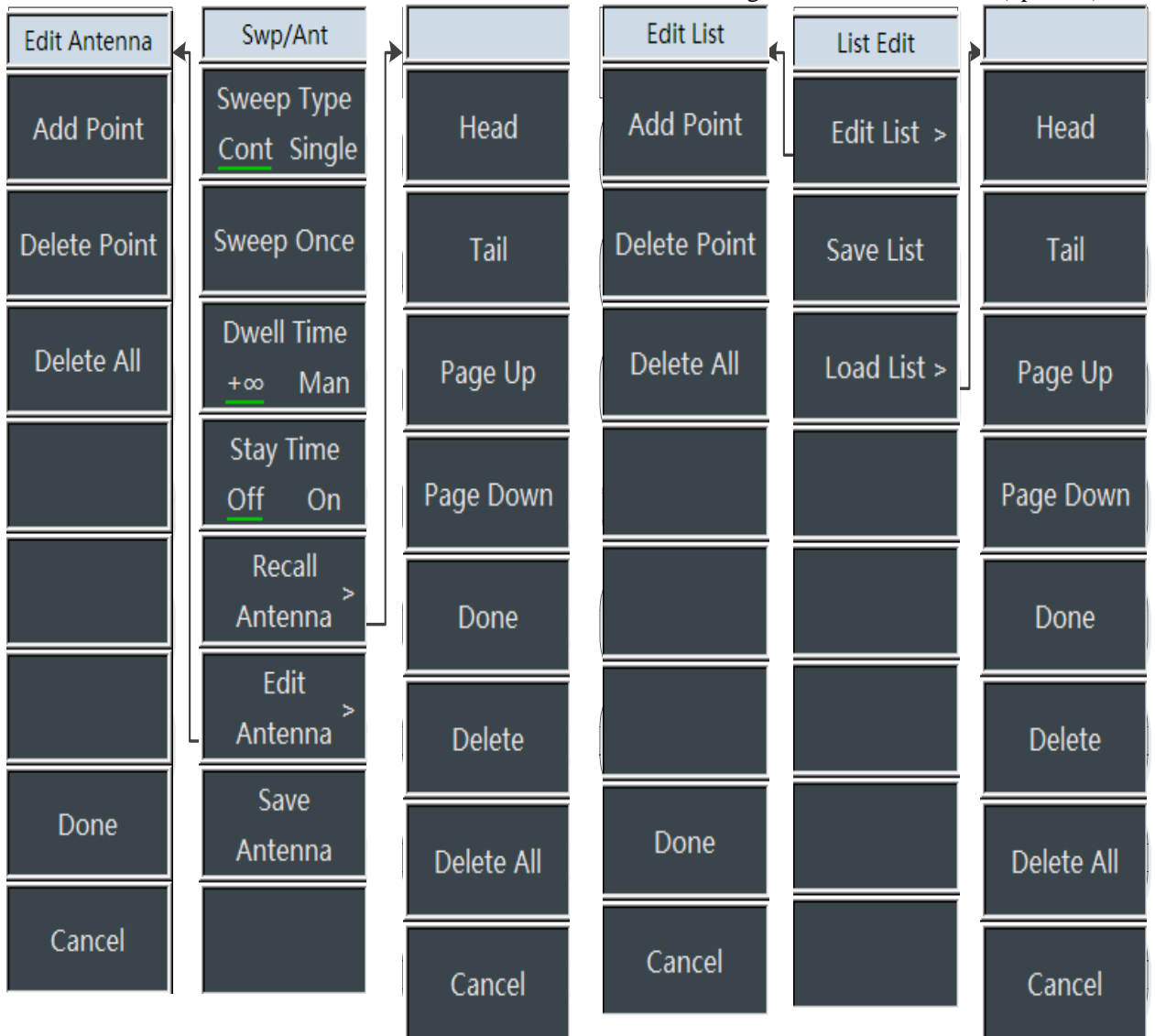


Figure 12-6 Overall Menu Block Diagram of Field Strength Measurement (Continued)

12.3 Description of field strength measurement menu

12.3.1 Frequency menu (point frequency measurement mode)

Frequency	<p>-[Point Frequency]: Press 【Freq】 → [Point Frequency], through the number keys on the front panel, select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu, or use the 【↑】【↓】 keys and the knob to set the point frequency.</p> <p>-[Special Notes]: The point frequency setting range is 1 MHz ~ 44 GHz.</p> <p>-[Freq Step]: Press 【Freq】 → [Frequency Step <u>Auto</u> Man], and set the 【↑】【↓】 keys and the knob to change the step value of the point frequency . In the automatic state, the frequency step is set to be 1 MHz.</p> <p>-[Frequency Tracking Off On]: Press 【Freq】 → [Frequency Tracking <u>Off</u> On] to set the frequency tracking switch. In the state of frequency tracking on, the instrument can automatically track the frequency value of the peak point, and display the frequency of the tracked peak point in the frequency display area of the current screen.</p> <p>-[Special Notes]: The peak point tracked by the frequency is the peak point of the search amplitude signal in the current bandwidth range.</p>
Pot Freq 500.000 MHz	
Freq Step Auto Man	
Freq Track Off On	

12.3.2 Frequency menu (frequency sweep measurement mode)

Frequency	<p>-[Start Frequency 500 MHz]: Press 【Freq】 → [Start Frequency 500MHz] , through the number keys on the front panel, select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu, or use the 【↑】【↓】 keys and the knob to set the start frequency.</p> <p>-[Special Notes]: The start frequency setting range is 1 MHz ~ 44 GHz.</p> <p>-[Step Frequency 10 MHz]: Press 【Freq】 → [Step Frequency 10MHz] , and set the 【↑】【↓】 keys and the knob to change the step value of the sweep frequency .</p> <p>-[Number of Sweep Points 58]: Press 【Freq】 → [Number of Sweep Points 58], set the number of sweep points for frequency sweep, and the setting range for the number of sweep points is 2~58.</p>
Stt Freq 500.000 MHz	
Step Freq 10.000 MHz	
Point 58	

12.3.3 Amplitude menu

Amplitude	- [Reference Value 107 dBuV]: Press 【Amplitude】 → [Reference Value 107dBuV], use the number keys on the front panel, and then select [dBuV], [-dBuV], [mV] and [uV], or use the 【↑】 【↓】 keys and the knob to set the reference value.
Ref Level 107.0 dBuV	- [Special Notes]: The reference value setting range is -43 dBuV ~ 147 dBuV.
Atten Auto Man	- [Attenuator <u>Auto Man</u>]: Press 【Amplitude】 →[Attenuator Auto Man], in the automatic state of the attenuator, the attenuator will automatically adjust the attenuation value according to the reference value, and in the attenuator manual state, the attenuator will always use the set attenuation value.
Scale/Div 20.00 dB	- [Scale/Graduation 20.0 dB]: Press 【Amplitude】 → [Scale/ Graduation 20.0dB], use the number keys on the front panel, and then select [dB] and [-dBm] in the frequency unit menu, or use the 【↑】 【↓】 keys and the knob to set the reference value.
Limit Off On	- [Limit Value <u>Off On</u>]: Press 【Amplitude】 →[Limit Value <u>Off On</u>]. By pressing this menu, you can choose to turn on or off the limit value switch .
Alarm Off On	- [Audible Alarm <u>Off On</u>]: Press 【Amplitude】 →[Audible Alarm <u>Off On</u>]. By pressing this menu, you can choose to turn on or off the audible alarm switch .
Units dBuV >	- [Unit dBuV]: Press 【Amplitude】 →[Unit], open the unit function menu, and you can select the menu types, including [dBm], [dBmV], [dBuV], [Volt], and [Watt].

12.3.4 Bandwidth menu

BW	- [Bandwidth 30 kHz]: Press 【Amplitude】 → [Bandwidth 30kHz], use the number keys on the front panel, and then select [GHz], [MHz], [kHz] and [Hz], or use the 【↑】 【↓】 keys and the knob to set the reference value.
BW 30 kHz	- [Special Notes]: The bandwidth value can only be set as 150 Hz, 300 Hz, 600 Hz, 1.5 kHz, 2.4 kHz, 6 kHz, 9 kHz, 15 kHz, 30 kHz, 50 kHz, 120 kHz, and 150kHz.
Detector >	- [Detection]: Press 【BW】 →[Detection] to open the detection menu. The available detection types include: Peak, average, and real-time.

12.3.5 Marker menu

Marker	<p>·[Max]: Press 【Mkr】 →[Maximum]. By pressing this menu, you can display the marker at the maximum point position.</p> <p>·[Mkr Off On]: Press 【Mkr】 →[Marker <u>Off</u> On]. By pressing this menu, you can choose to turn off or on the marker display.</p> <p>·[Special Notes]: The marker menu is only effective in the frequency sweep mode and the list sweep mode.</p>
Max Search	
Marker <u>Off</u> On	

12.3.6 Peak menu

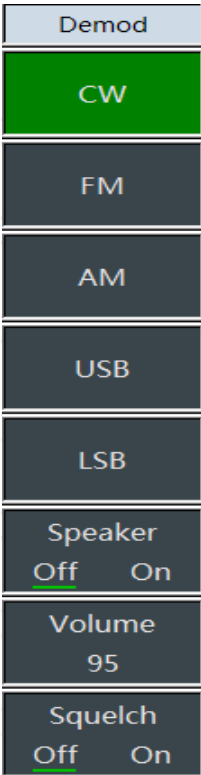
Marker	<p>·[Max]: Press 【Peak】 →[Max]. By pressing this menu, you can display the marker at the maximum point position.</p> <p>·[Mkr Off On]: Press 【Peak】 →[Marker <u>Off</u> On]. By pressing this menu, you can choose to turn off or on the marker display.</p> <p>·[Special Notes]: The peak menu is only effective in the frequency sweep mode and the list sweep mode.</p>
Max Search	
Marker <u>Off</u> On	

12.3.7 Sweep/antenna menu

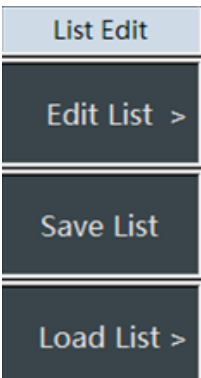
Swp/Ant	<p>·[Swp Type <u>Cont</u> Single]: Press 【Sweep /Antenna】 → [Sweep Type <u>Continuous</u> Single], and it is used to set the continuous sweep mode or the single sweep mode .</p> <p>·[Re-sweep]: Press 【Sweep /Antenna】 →[Sweep Again], and it is used to sweep again.</p> <p>·[Residence time <u>+∞</u> Manual]: Press 【Sweep /Antenna】 →[Residence time <u>+∞</u> Manual], and it is used to set the residence time. The residence time refers to the time staying at this point when the amplitude of the sweep point exceeds the limit value. The default is infinity, and the manual setting range is 1 ms ~ 40 s.</p> <p>·[Special Notes]: The residence time is only effective when the limit switch is turned on.</p> <p>·[Dwell Time Off On]: Press 【Sweep /Antenna】 →[Dwell Time <u>Off</u> On], and it is used to set the dwell time. The dwell time refers to the waiting time of sweep at each time. The default is Off, and the manual setting range is 1 ms ~ 40 s.</p> <p>·[Special Notes]: Dwell time and residence time are only effective in the frequency sweep mode and the list sweep mode.</p> <p>·[Recall Antenna]: Press 【Sweep /Antenna】 →[Recall Antenna] to pop up the soft menus such as [Header], [Footer], [Page Up], [Page Down], [Recall Immediately], [Delete], etc. You can select the saved antenna factor file and call .</p> <p>·[Edit Antenna]: Press 【Sweep /Antenna】 →[Recall Antenna] to pop up the soft menus such as [Add Edit Point], [Delete Edit Point],</p>
Sweep Type <u>Cont</u> Single	
Sweep Once	
Dwell Time <u>+∞</u> Man	
Stay Time <u>Off</u> On	
Recall Antenna >	
Edit Antenna >	
Save Antenna	

	<p>[Clear All Points], [Complete Editing], [Cancel Editing], etc. It is used to edit the antenna factors.</p> <p>•[Save Antenna]: Press 【Sweep /Antenna】 →[Save Antenna] to open the antenna saving dialog box. It is used to save the antenna factor file.</p>
--	--

12.3.8 Demodulation menu

	<p>•[Off]: Press 【Demodulation】 →[Off] to turn off the demodulation mode .</p>
	<p>•[Frequency Modulation]: Press 【Demodulation】 →[Frequency Modulation], and it is used to switch demodulation to the frequency modulation mode.</p> <p>•[Amplitude Modulation]: Press 【Demodulation】 →[Amplitude Modulation], and it is used to switch demodulation to the amplitude modulation mode.</p> <p>•[Upper Sideband]: Press 【Demodulation】 →[Upper Sideband], and it is used to switch demodulation to the upper sideband mode.</p> <p>•[Lower Sideband]: Press 【Demodulation】 →[Lower Sideband], and it is used to switch demodulation to the lower sideband mode.</p> <p>•[Audio Howling Off On]: Press 【Demodulation】 → [Audio Howling <u>Off</u> On], and it is used to enable or disable the audio howling function.</p> <p>•[Special Notes]: After the audio howling switch is turned on, the demodulation modes of [Frequency Modulation], [Amplitude Modulation], [Upper Sideband], [Lower Sideband], etc. will no longer work.</p> <p>•[Volume 95]: Press 【Demodulation】 → [Volume 95] to set the demodulation volume. You can use the number keys or the 【↑】【↓】 keys or the knob to set the desired volume value.</p>

12.3.9 List edit menu

	<p>•[Edit List]: Press 【List Edit】 →[Edit List] to pop up the soft menus of [Add Edit Point], [Delete Edit Point], [Clear All Points], [Complete Editing], [Cancel Editing], etc. It is used to edit the list items.</p>
	<p>•[Save List]: Press 【List Edit】 →[Save List] to open the list file save dialog box for list file saving.</p> <p>•[Recall List]: Press 【List Edit】 →[Recall List] to pop up the soft menus such as [Header], [Footer], [Page Up], [Page Down], [Recall Immediately], [Delete], etc. You can select the saved list file and recall it.</p>

12.3.10 Measurement menu

Measure	<p>·[Point Frequency Measurement]: Press 【Measure】 → [Point Frequency Measurement], and switch the field strength measurement mode to the point frequency measurement mode.</p>
PScan	<p>·[Freq Sweep]: Press 【Measure】 → [Frequency Sweep], and switch the field strength measurement mode to the frequency sweep measurement mode.</p>
FScan	<p>·[List Sweep]: Press 【Measure】 → [List Sweep], and switch the field strength measurement mode to the list sweep measurement mode.</p>
MScan	<p>·[Special Notes]: Before switching the list sweep mode, make sure that a list file exists currently. It can be viewed through the 【List Edit】 -[Edit List] menu.</p>

13 Location analyzer mode (optional)

13.1 Introduction to typical measurements

The Location analyzer measurement mode is an extension of the spectrum measurement mode. After startup, press **【Mode】** to pop up a mode selection dialog box, select [Spectrum Analysis Mode], and press [OK] to enter the spectrum analysis mode after completing the progress bar. Then press **【System】** → [Measurement Mode] → [Location analyzer] on the touch screen to enter the Location analyzer mode.



Figure 13-1 Main Interface of Location analyzer Mode

It is mainly used for positioning interference sources or unknown signal sources, and the direction of interference signals can be quickly positioned by using external receiving antenna and electronic compass;

Notice

The Location analyzer measurement mode shall be configured with the options of the receiving antenna and the electronic compass. Since the azimuth measurement of the electronic compass used in the Location analyzer adopts the principle of geomagnetism, please try to keep a distance from the magnetic object during the test.

The Location analyzer measurement is mainly divided into three measurement modes:

13.1.1 Direct lookup

The main steps for the direct lookup measurement are as follows:

- Press **【Measure】** → [Direct Lookup] to select the direct lookup measurement mode;
- Press [Freq] → [Center Freq] to set the center frequency value;
- Press **【BW】** → [BW] to set the bandwidth value, which will be set to 150Hz, 300Hz, 600Hz, 1.5kHz, 2.4kHz, 6kHz, 9kHz, 15kHz, 30kHz, 50kHz, 120kHz, 150kHz;
- Press **【Sweep/Antenna】** → [Recall Antenna] to select the antenna factor file;
- Press **【Demodulation】** to set the demodulation type and demodulation volume.
- The schematic diagram of direct lookup measurement is as shown in the figure below (for example only)

Location analyzer mode(optional)

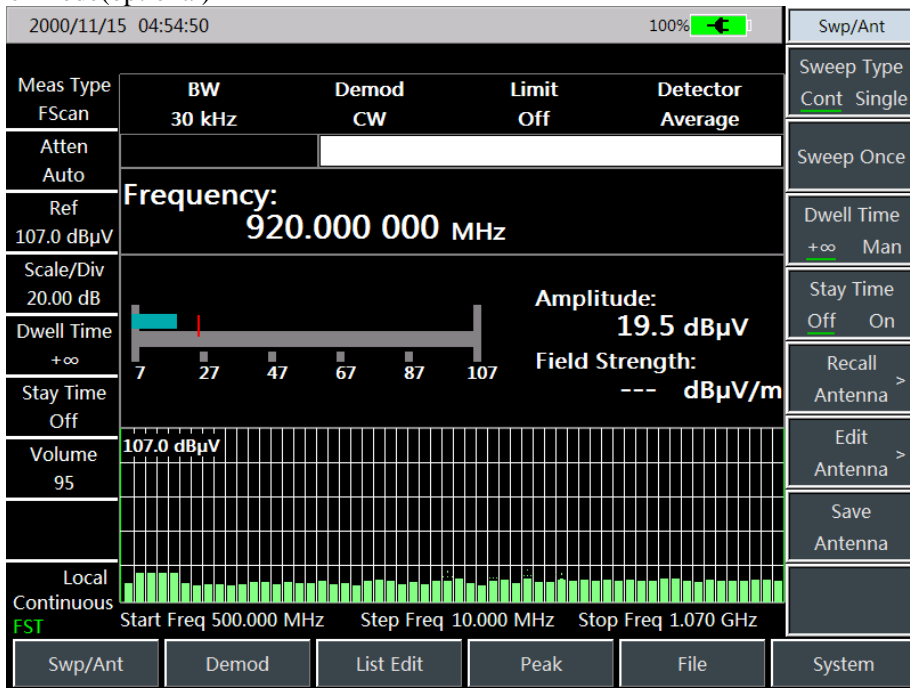


Figure 13-2 Schematic Diagram of Direct Lookup Measurement Mode

13.1.2 Horizontal sweep

Horizontal sweep is to display the measured value information after rotating one cycle of the current measurement point on a horizontal disc. The main operation steps of horizontal sweep measurement are as follows:

- a) Press **【Measure】** →[Horizontal Sweep] to select the horizontal sweep measurement mode;
- b) Press [Freq]→[Center Freq] to set the center frequency value;
- c) Press **【BW】** →[BW] to set the bandwidth value, which will be set to 150Hz, 300Hz, 600Hz, 1.5kHz, 2.4kHz, 6kHz, 9kHz, 15kHz, 30kHz, 50kHz, 120kHz, 150kHz;
- d) Press **【Sweep/Antenna】** →[Recall Antenna] to select the antenna factor file;
- e) Press **【Demodulation】** to set the demodulation type and demodulation volume.

The schematic diagram of horizontal sweep measurement is as shown in the following figure (for example only)

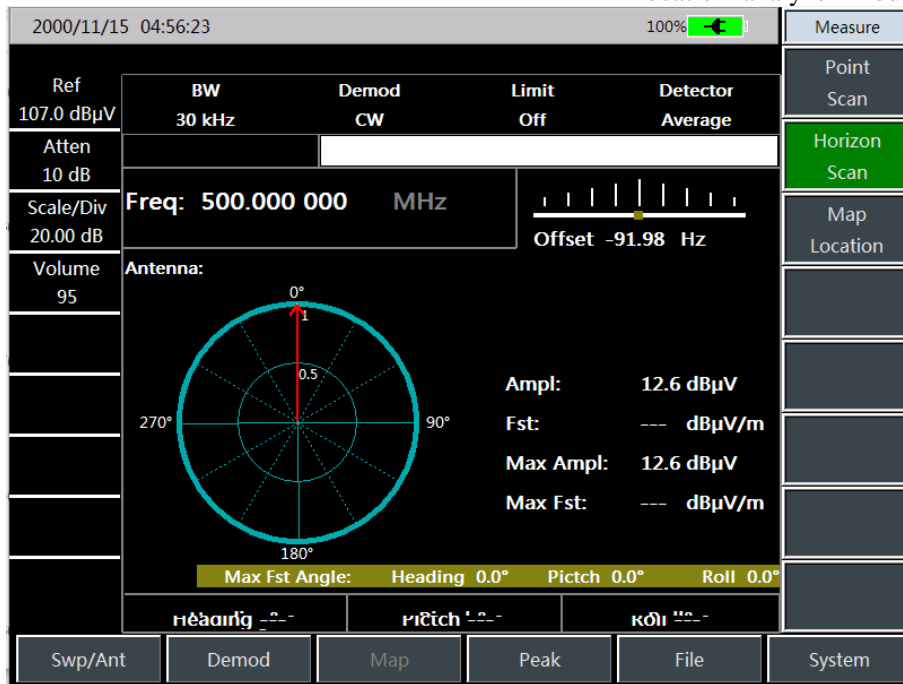


Figure 13-3 Schematic Diagram of Horizontal Sweep Measurement Mode

13.2 Menu structure of Location analyzer



Figure 12-5 Overall Menu Block Diagram of Location analyzer

13.3 Description of Location analyzer menu

13.3.1 Frequency menu

Freq	<p>·[Center Frequency]: Press 【Freq】 → [Center Frequency], through the number keys on the front panel, select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu, or use the 【↑】【↓】 keys and the knob to set.</p> <p>·[Special Notes]: When using the 【↑】【↓】 keys and the knob, the size of the frequency step is the same as the set value of the [Step Frequency]. After pressing the [Step Frequency Auto Man] to switch to [Step Frequency Auto Man], you can use the number keys or the 【↑】【↓】 keys and the knob to set the step frequency value.</p> <p>·[Frequency Step <u>Auto Man</u>]: Press 【Freq】 → [Frequency Step], through the number keys on the front panel, select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu, or use the 【↑】【↓】 keys and the knob to set.</p> <p>·[Positioning Selection 1 2 3 4 5 6]: Press 【Freq】 → [Positioning Selection], and the data saving function of 6 different location information can be realized by switching the menu mark.</p> <p>·[Positioning Save]: Press 【Freq】 → [Positioning Save], and the data saving function of current positioning information can be realized by this menu.</p> <p>·[Positioning Edit]: Press 【Freq】 → [Positioning Edit] to open the positioning data editing submenu, and you can [Edit Positioning Point], [Delete Positioning Point] and [Complete Editing].</p>
Center Freq 500.000 MHz	
Freq Step Auto Man	
Position 1 2 3 4 5 6	
Position Save	
Position Edit >	

13.3.2 Amplitude menu

Amplitude	<p>·[Reference Value 107.0 dBuV]: Press 【Amplitude】 → [Ref Level], use the number keys on the front panel, and then select [dBuV], [-dBuV], [mV] and [uV], or use the 【↑】【↓】 keys and the knob to set.</p> <p>·[Special Notes]: When using the [↑][↓] keys and the knob, the step is 10 dB.</p> <p>·[Attenuator <u>Auto Man</u>]: Press 【Amplitude】 → [Attenuator Auto Man] to switch the automatic and manual switch of the attenuator through the menu. You can use the number keys, and you can also use the 【↑】【↓】 keys and the knob to change.</p> <p>·[Special Notes]: The setting range of the attenuation value is 0 dB - 50 dB, with the step value of 10 dB.</p> <p>·[Unit dBuV]: Select the unit of the vertical axis, including [dBm], [dBmV], [dBuV], [Volt], [Watt], [A], [dBW], [dBV], [dBA], [dBmA] and [dBuA].</p> <p>·[Preamplifier <u>Off On</u>]: Press 【Amplitude】 → [Preamplifier <u>Off On</u>], you can choose whether to turn on the pre-amplifier through the menu</p>
Scale/Div 20.00 dB	
Scale Type Log Lin	
Limit Off On	
Alarm Off On	
Max Hold Off On	
More 2 of 2 >	

13.3.3 Bandwidth menu

BW	<p>·[Bandwidth 30 kHz]: Press 【BW】 →[Bandwidth 30 kHz], and set through the number keys on the front panel or the 【↑】【↓】 keys and the knob.</p> <p>·[Special Notes]: Since the resolution bandwidth is subject to the bandwidth of the intermediate frequency filter, the shape of the trace depends on the intermediate frequency filter. This instrument supports variable resolution bandwidth settings, with the range of 150Hz, 300Hz, 600Hz, 1.5kHz, 2.4kHz , 6kHz, 9kHz, 15kHz, 30kHz, 50kHz, 120kHz and 150KHz.</p> <p>·[Detection]: Press 【BW】 →[Detection], you can select the three detection modes of: [Peak], [Average], and [Real-time].</p>
BW 30 kHz	
Detector >	

13.3.4 Marker menu

Marker	<p>·[Maximum Field Strength Angle <u>Auto</u> Man]: Press 【Mkr】 →[Max Field Strength Angle <u>Auto</u> Man] to select the currently judged maximum field strength angle mode.</p> <p>·[Angle Range]: Press 【Mkr】→[Angle Range] to select the display range of the current local directional diagram.</p> <p>·[Special Notes]: The marker menu is only available in the horizontal sweep mode; and the local directional diagram pops up when you choose to manually judge the maximum field strength angle.</p>
Max Fst Angle Auto Man	
Angle Range	

13.3.5 Peak menu

Peak	· [Max Peak]: Press 【Peak】 →[Max Peak] to set the currently active marker to the maximum peak point of the field strength in the measurement directional diagram.
Peak Search	
Next Peak	· [Sub Peak]: Press 【Peak】 →[Sub Peak] to move the active marker to the next highest point that is associated with the current marker position on the directional diagram.
Next Pk Left	· [Left Peak]: Press 【Peak】 →[Left Peak] to find the next peak to the left of the current frequency marker position.
Next Pk Right	· [Right Peak]: Press 【Peak】 →[Right Peak] to find the next peak to the right of the current frequency marker position.
	· [Special Notes]: The marker menu is only available in the horizontal sweep mode.

13.3.6 Sweep/antenna menu

Swp/Ant	· [Sweep Type Continuous Single]: Press 【Sweep/Antenna】 →[Sweep Type Continuous Single]. The sweep method setting determines how the instrument sweeps and when it stops to enter into the hold state. In the interference analysis mode, it provides two sweep modes: Continuous sweep and single sweep.
Sweep Type Cont Single	
Sweep Once	· [Sweep Again]: Press 【Sweep】 →[Sweep Again] to restart the sweep.
Recall Antenna >	· [Recall Antenna]: Press 【Sweep/Antenna】 →[Recall Antenna] to pop up the soft menus such as [Header], [Footer], [Page Up], [Page Down], [Recall Immediately], [Delete], etc. You can select the saved antenna factor file and recall it .
Edit Antenna >	· [Edit Antenna]: Press 【Sweep/Antenna】 →[Recall Antenna] to pop up [Add Edit Point], [Delete Edit Point], [Clear All Points], [Complete Editing], [Cancel Editing], etc. It is used to edit the antenna factors.
Save Antenna	· [Save Antenna]: Press 【Sweep/Antenna】 →[Save Antenna] to open the antenna saving dialog box. It is used to save the antenna factor file.

13.3.7 Demodulation menu

Demod	<p>·[Off]: Press 【Demodulation】 →[Off] to turn off the demodulation mode .</p> <p>·[Frequency Modulation]: Press 【Demodulation】 →[Frequency Modulation], and it is used to switch demodulation to the frequency modulation mode.</p> <p>·[Amplitude Modulation]: Press 【Demodulation】 →[Amplitude Modulation], and it is used to switch demodulation to the amplitude modulation mode.</p> <p>·[Upper Side band]: Press 【Demodulation】 →[Upper Sideband], and it is used to switch demodulation to the upper sideband mode.</p> <p>·[Lower Sideband]: Press 【Demodulation】 →[Lower Sideband], and it is used to switch demodulation to the lower sideband mode.</p> <p>·[Audio Howling Off On]: Press 【Demodulation】 →[Audio Howling Off On] to turn on or off the audio howling function.</p> <p>·[Special Notes]: After the audio howling switch is turned on, the demodulation methods of [Frequency Modulation], [Amplitude Modulation], [Upper Sideband], [Lower Sideband], etc. will no longer work.</p> <p>·[Volume 95]: Press 【Demodulation】 →[Volume 95], and it is used to set the demodulation volume. You can set the desired volume value through the number keys or the 【↑】【↓】 keys or the knob.</p>
CW	
FM	
AM	
USB	
LSB	
Speaker Off On	
Volume 95	

13.3.8 Measurement menu

Measure	<p>·[Direct Lookup]: Press 【Measure】 →[Direct Lookup] to select the current measurement mode as the direct lookup mode.</p> <p>·[Horizontal Sweep]: Press 【Measure】 →[Horizontal Sweep] to select the current measurement method as the horizontal sweep mode.</p> <p>·[Map Positioning]: Press 【Measure】 →[Map Positioning] to select the current measurement method as the map positioning mode.</p>
Point Scan	
Horizon Scan	
Map Location	

13.3.9 Map menu

	<p>·[Positioning Real-time Recall]: Press 【Map】 →[Positioning Real-time Recall]. The real-time positioning mode means that the current measurement is refreshed in real time with the GPS and the compass, and the calling of the positioning mode is to display the positioning data measured at different positioning points on the current map.</p> <p>·[Zoom in]: Press 【Map】 →[Zoom in] to display the currently called map in an enlarged scale.</p> <p>·[Zoom out]: Press 【Map】 →[Zoom out] to display the currently called map in a reduced scale.</p> <p>·[Marker]: Press 【Map】 →[Marker] to open the marker submenu, [Marker Current Position], [Marker Delete Marker], and [Marker Delete All]. Measurement information at different locations and in different directions can be displayed on the map via the marker submenu .</p> <p>·[Positioning Data]: Press 【Map】 →[Positioning Data] to open the positioning data sheet on the selected positioning point, and you can select [Delete], [Recall], and [Cancel].</p> <p>·[Special Notes]: The [Positioning Data] menu can only be used after calling the positioning mode.</p>
--	--

14 Signal analysis mode (optional)

14.1 Introduction to typical measurements

The signal analysis measurement mode is an extension of the spectrum measurement mode. After startup, press **【Mode】** to pop up a mode selection dialog box, select [Spectrum Analysis Mode], and press [OK] to enter the spectrum analysis mode after completing the progress bar. Then press **【System】** → [Measurement Mode] → [Signal Analysis] on the touch screen to enter the signal analysis mode.

The signal analysis measurement mode provides a rapid analysis for interference signals. With the help of waterfall charts, the display and playback of historical data can be realized. Through the shortcut menu, the parameters such as the center frequency, the sweep width, etc. can be quickly modified, and audio output and IQ capture function can also be quickly realized.

Notice

All operations in this section are based on the premise of the selected signal analysis mode, which will not be described separately later.

The main interface of the signal analysis measurement mode refers to the interference analysis waterfall chart measurement. It can be used to easily observe the periodic or hopping interference signals. A shortcut menu is specially designed for the signal analysis, so that the setting of the parameters such as the center frequency, the sweep width can be quickly realized. At the same time, audio output and IQ capture can be turned on quickly, improving the ability of quickly analyzing interference signals. The main interface of signal analysis is as shown in Figure 14-1 below:

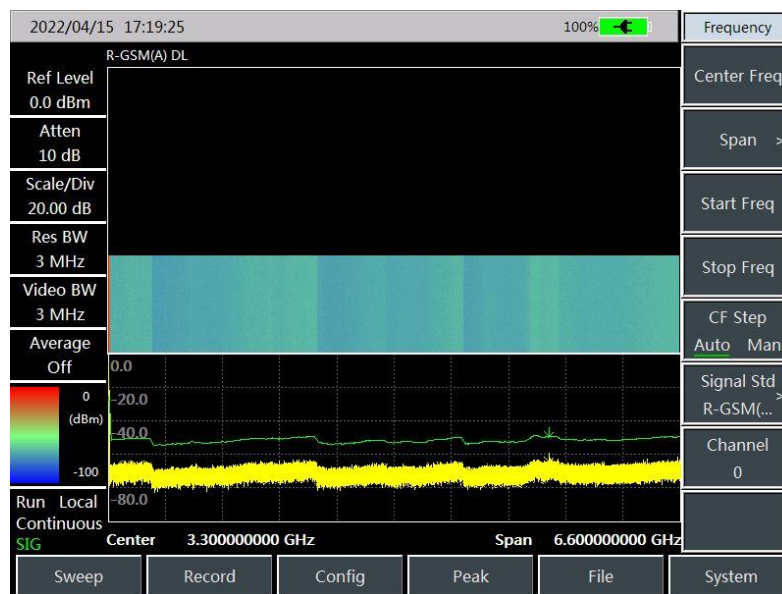


Figure 14-1 Main Display Interface of Signal Analysis Measurement Mode

Signal analysis is designed with a signal list switch menu, which can be used to easily check the parameters such as the frequency, the amplitude, the capture time, etc. of the captured interference signal. The display results are shown in Figure 14-2 below.

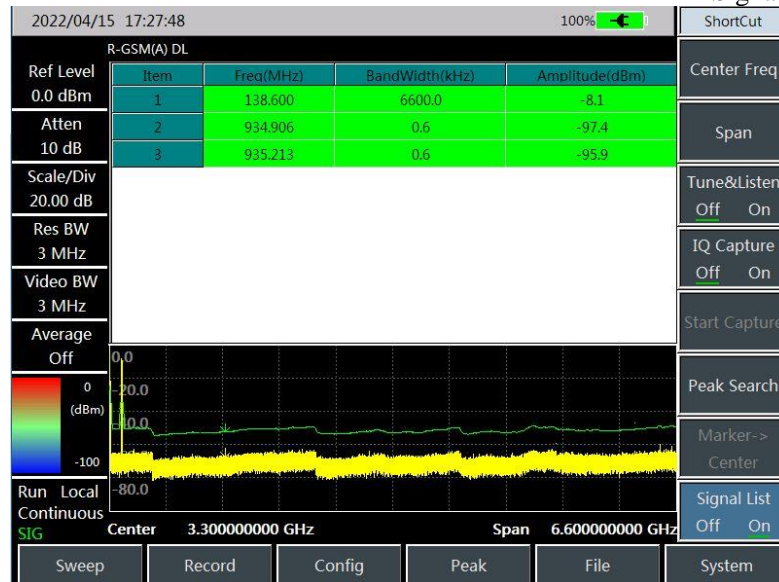


Figure 14-2 Signal List Interface

The IQ capture function can be used to directly store the IQ data of interference signals. The IQ capture interface is shown in Figure 14-3 below:

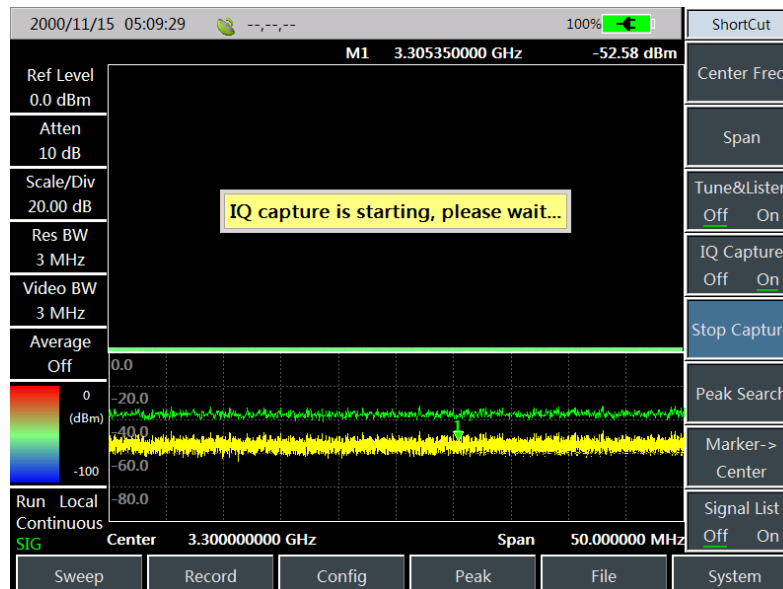


Figure 14-3 Schematic Diagram of IQ Capture Function

In the signal analysis mode, the current test task can be quickly stored, and the test task can be saved with an automatically generated file name according to the currently set intermediate frequency and sweep width and the current test time.

The signal analysis storage task is shown in Figure 14-4 below:

Signal analysis mode

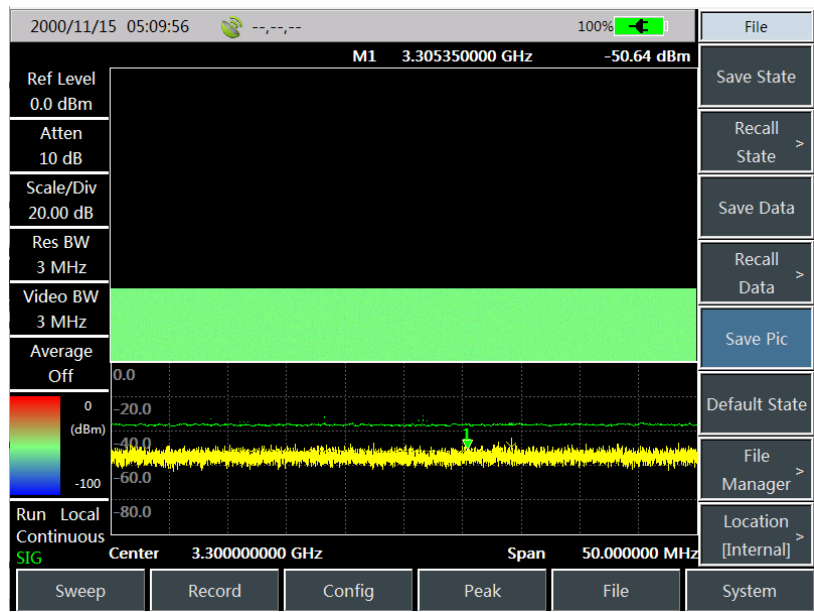


Figure 10-4 Schematic Diagram of Signal Analysis Storage Tasks

14.2 Signal analysis menu structure



Figure 14-5 Overall Menu Block Diagram of Signal Analysis

Signal analysis mode



Figure 14-6 Overall Menu Block Diagram of Signal Analysis (Continued)

14.3 Description of signal analysis menu

14.3.1 Frequency menu

	<ul style="list-style-type: none"> ·[Center Frequency]: Press 【Freq】→[Center Freq], use the numeric keys on the front panel, select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu, or use the 【↑】【↓】 keys and the knob for setting.
Frequency	
Center Freq	<ul style="list-style-type: none"> ·[Special Notes]: When using the 【↑】【↓】 keys and the knob, the size of the frequency step is the same as the set value of the [Step Frequency]. After pressing the [Step Frequency <u>A</u>uto Man] to switch to [Step Frequency <u>M</u>an], you can use the number keys or the 【↑】【↓】 keys and the knob to set the step frequency value.
Span >	<ul style="list-style-type: none"> ·[Sweep Width]: Press 【Freq】→[Span] to activate the span submenu. You can use the numeric keys, and then select the frequency unit to change. You can also use the 【↑】【↓】 keys and the knob to change the span. For the detailed information, please refer to the description of the [Span] menu.
Start Freq	<ul style="list-style-type: none"> ·[Special Notes]: Use the 【↑】【↓】 keys and the knob to change the span with a step of 1-2-5.
Stop Freq	<ul style="list-style-type: none"> ·[Start Freq]: Press 【Freq】→[Start Freq], use the numeric keys on the front panel, select the frequency unit, or use the 【↑】【↓】 keys and the knob for setting.
CF Step Auto Man	<ul style="list-style-type: none"> ·[Stop Freq]: Press 【Freq】→[Stop Freq], use the numeric keys on the front panel, select the frequency unit, or use the 【↑】【↓】 keys and the knob for setting.
Signal Std > --	<ul style="list-style-type: none"> ·[Signal Standard]: Press 【Freq】→[Signal Standard], use the 【↑】【↓】 keys and the knob to select the signal standard, and use the dialog box menu [Immediate Recall] or [OK] key for recalling. Refer to the dialog box menu for details of the dialog box menu.
Channel --	<ul style="list-style-type: none"> ·[Special Notes]: After the signal standard is loaded, the center frequency and the span are set to the center frequency and the span value defined in the signal standard.
	<ul style="list-style-type: none"> ·[Channel No.]: Press 【Freq】→[Channel No.] to pop up the channel number setting dialog box, and use the numeric keys or the 【↑】【↓】 keys and the knob to set the channel number.
	<ul style="list-style-type: none"> ·[Special Notes]: The setting of the channel number shall be carried out under the premise of loading the signal standard, otherwise a prompt that it cannot be set will pop up.

14.3.2 Sweep width menu

Span	·[Span]: Press 【Freq】 →[Span] to activate the span submenu. You can use the numeric keys, and then select the frequency unit to change. You can also use the 【↑】【↓】 keys and the knob to change the span. For the detailed information, please refer to the description of the [Span] menu.
Span	
Full Span	
Zero Span	·[Special Notes]: Use the 【↑】【↓】 keys and the knob to change the span with a step of 1-2-5.
Last Span	·[Full Span]: Press [Span]→[Full Span] to set the current span to 44.1GHz.
	·[Zero Sweep Width]: Press 【Freq】 →[Span]→[Zero Span] to set the current span to 0Hz.
	·[Last Span]: Press 【Freq】 →[Span]→[Last Span] to restore the span to the value set last time.
< Back	·[Back]: Press 【Freq】 →[Span]→[Back] to return to the 【Freq】 menu.

14.3.3 Amplitude menu

Amplitude	·[Ref Level]: Press 【Amplitude】 →[Ref Level], use the numeric keys on the front panel, and then select [dBuV], [-dBuV], [mV] and [uV], or use the 【↑】【↓】 keys and the knob to set it.
Ref Level 0.0 dBm	·[Special Notes]: When the 【↑】【↓】 keys and the knob are used, the step is 10dB.
Ref Position	·[Ref Pos]: Press 【Amplitude】 →[Ref Pos], and use the numeric keys or the 【↑】【↓】 keys and the knob to change it.
Atten Auto Man	·[Atten Auto Man]: Press 【Amplitude】 →[Atten <u>A</u> uto <u>M</u> an] to switch the automatic and manual switch of the attenuator through the menu. You can use the numeric keys or the 【↑】【↓】 keys and the knob to change it.
Scale/Div 20.00 dB	·[Special Notes]: The setting range of the attenuation value is 0 dB - 50 dB, with the step value of 10 dB.
Units dBm	·[Scale]: Press 【Amplitude】 →[Scale], and use the numeric keys or the 【↑】【↓】 keys and the knob to set the scale within the setting range of 0.1dB - 20dB.
Pre Amp Off On	·[Amp Unit]: The amplitude unit is uniformly displayed in dBm.
	·[Pre Amp <u>O</u> ff <u>O</u> n]: Press 【Amplitude】 →[Pre Amp <u>O</u> ff <u>O</u> n] to turn the preamplifier on or off.

14.3.4 Bandwidth menu

	<p>·[RBW Auto Man]: Press 【BW】 →[RBW Auto Man], and use the numeric keys on the front panel or the 【↑】【↓】 keys and the knob to set it.</p> <p>·[Special Notes]: Since the resolution bandwidth is subject to the bandwidth of the IF filter, the shape of trace depends on the IF filter. This instrument supports variable resolution bandwidth settings, ranging from 1 Hz. ~10MHz, which can be changed with a step of 1-3-10.</p>
BW	
Res BW Auto Man	<p>·[VBW Auto Man]: Press 【Amplitude】 →[VBW Auto Man], and use the numeric keys or the 【↑】【↓】 keys and the knob to change it.</p> <p>·[Special Notes]: The video bandwidth filter is used to smooth the traces, aiming to improve the ability of detecting weak signals in noise signals. This instrument supports variable resolution bandwidth settings, ranging from 1Hz~10MHz, which can be changed with a step of 1-3-10.</p>
Video BW Auto Man	
Video Type Lin Log	<p>·[Video Type Linear Logarithm]: Press 【BWh】 →[Video Type Linear Logarithm] to set the video bandwidth filter data processing.</p>
Average Off On	<p>·[Ave Off On]: Press 【BW】 →[Ave Off On], the average function can smooth the display trace without changing the video bandwidth filter, and use the numeric keys or the 【↑】【↓】 keys and the knob to change it.</p>
SPAN/RBW 100	<p>·[SPAN/RBW]: Press 【BW】 →[SPAN/RBW] to set the ratio of span to resolution bandwidth. In automatic mode, the resolution bandwidth will automatically change with the change of span. You can use numeric keys or the 【↑】【↓】 keys and the knob to change it.</p>
RBW/VBW 1	<p>·[RBW/VBW]: Press 【BW】 →[RBW/VBW]. In automatic mode, the video bandwidth will change with the change of resolution bandwidth. You can use numeric keys or the 【↑】【↓】 keys and the knob to change it.</p>
Detector Auto	<p>·[Detection]: Press 【BW】 →[Detection] to open the detection function submenu. Please refer to the [Detection] menu for details.</p>

Signal analysis mode

Detector	·[Auto]: Press 【BW】 →[Detection]→[Auto], the detection is the same as that in the spectrum analysis mode.
Auto	·[Standard]: Press 【BW】 →[Detection]→[Standard], the most commonly used detection method can see the signal and noise base at the same time without losing any signal.
Normal	·[PosPeak]: Press 【BW】 →[Detection]→[PosPeak] to ensure that no peak signal is missed and to measure the signals that are very close to the noise base.
Peak	·[NegPeak]: Press 【BW】 →[Detection]→[NegPeak], it is used in the self-inspection of the bandwidth millimeter wave RF analyzer in most cases, but it is rarely used in the test, and it can reproduce the modulation envelope of the AM signal very well.
Neg Peak	·[Sampling]: Press 【BW】 →[Detection]→[Sampling], it is beneficial to measuring the noise signal, and can measure the noise better than the standard detection.
Sample	·[Ave]: Press 【BW】 →[Detection]→[Ave] to average the data in the sampling interval.
Average	·[Rms]: Press 【BW】 →[Detection]→[Rms] to calculate the root mean square of the data in the sampling interval.
RMS	
< Back	

14.3.5 Marker menu

Marker	· 【Mkr】 →[Mkr <u>1 2 3 4 5 6</u>]: Press 【Mkr】 →[Mkr <u>1 2 3 4 5 6</u>] to switch between different marker displays, and the selected marker will be marked with an underline.
Marker 1 2 3 4 5 6	·[Normal Mode]: Press 【Mkr】 →[Normal Mode] to set the currently selected marker display mode to normal mode.
Normal	·[Difference Mode]: Press 【Mkr】 →[Difference Mode], and set the currently selected marker display mode to be the difference mode. The difference mode displays the frequency difference and the amplitude difference (it is time difference at zero sweep width) between the difference marker and the reference marker, and the displayed amplitude value is dB.
Delta	·[Noise Mkr <u>Off On</u>]: Press 【Mkr】 → [Noise Marker <u>Off On</u>], the noise marker shows the noise power near the activation marker that is normalized to the 1 Hz bandwidth. At this time, the detector is in the sample detection mode. If the noise marker is turned on, the unit of the marker reading is automatically switched to dB/Hz.
Noise Marker Off On	·[Mkr→]: Press 【Mkr】 →[Mkr→] to open the marker function submenu, which allows users to use the marker as a reference to change the instrument display. Please refer to the [Mkr→] function menu for details.
Marker->>	·[Mkr Off]: Press 【Mkr】 →[Mkr Off] to turn off the currently activated marker.
Off	·[All Off]: Press 【Mkr】 →[All Off] to turn off all markers that have been turned on.
All Off	·[Special Notes]: There is no marker function in RSSI measurement mode.

Marker->	· [Mkr→Center Freq] : Press 【Mkr】 →[Mkr→]→[Mkr→Center Freq], the marker will move to the center frequency, and the reading at the center frequency is displayed on the screen.
Marker-> Center	
Marker-> CF Step	· [Mkr→Step Freq] : Press 【Mkr】 →[Mkr→]→[Mkr→Step Freq] to set the stepping amount of the center frequency, that is, the value of the frequency step is equal to the marker frequency. If the difference marker function is activated, the frequency step value is equal to the frequency of the difference marker.
Marker-> Start	
Marker-> Stop	
	· [Mkr→Start Freq] : Press 【Mkr】 →[Mkr→]→[Mkr→Start Freq] to set the start frequency equal to the marker frequency.
	· [Mkr→Stop Freq] : Press 【Mkr】 →[Mkr→]→[Mkr→Stop Freq] to set the stop frequency equal to the marker frequency.
	· [Back] : Return to the previous menu
< Back	(not available in RSSI measurement mode)

14.3.6 Peak menu

Peak	· [Max Peak] : Press 【Peak】 →[Max Peak] to set the current active marker to the maximum peak point of the measurement trace and display the frequency and amplitude of the marker in the upper center of the screen.
Peak Search	· [Sub Peak] : Press [Peak]→[Sub Peak] to move the active marker to the next highest point on the trace that is associated with the current marker position.
Next Peak	· [Left Peak] : Press 【Peak】 →[Left Peak] to find the next peak to the left of the current frequency marker position.
Next Pk Left	· [Right Peak] : Press 【Peak】 →[Right Peak] to find the next peak to the right of the current frequency marker position.
Next Pk Right	· [Max] : Place a marker at the highest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen. Pressing this button will not change the activated functions.
Max Search	· [Min] : Press [Peak]→[Min] to place a marker at the lowest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen. Pressing this button will not change the activated functions.
Min Search	· [Mkr→Center Freq] : Press [Peak]→[Mkr → Center Freq] and set the center frequency equal to the marker frequency. This function quickly moves the signal to the center of the screen.
Marker-> Center	(not available in RSSI measurement mode)

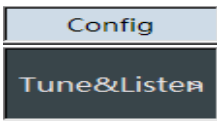
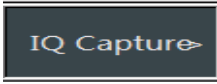
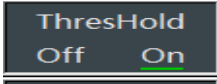
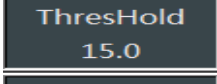
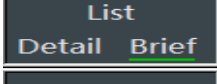


14.3.7 Sweep menu

Sweep	<p>·[Swp Time <u>Auto</u> Man]: Press 【Swp】 →[Swp Time <u>Auto</u> Man] to switch the sweep time between Auto and Manual. The underline marks the current state. If the sweep time is automatic, the RF analyzer automatically sets the sweep time to the fastest according to the current instrument status, and the screen displays the fastest sweep time under the current setting. If the sweep time is manually set, the sweep time value can be input at this time. Use the numeric keys to enter the sweep time value and select the time unit by pressing corresponding soft key to complete the setting. If the sweep time is automatic, the sweep speed may change depending on the change of RBW and VBW. The larger the values of RBW and VBW, the faster the sweeping speed and vice versa. If the sweep time of the instrument of 4957 meet the minimum sweep time limit, the maximum non-zero sweep width can be set to 800 s, and the maximum zero sweep width can be set to be 600 s.</p> <p>·[Swp Type <u>Cont</u> Single]: Press 【Swp】 →[Swp Type <u>Cont</u> Single]. The sweep type setting determines how the RF analyzer sweeps and when it stops to enter into the hold state. In the interference analysis mode, it provides two sweep modes: Continuous sweep and single sweep.</p> <p>·[Re-sweep]: Press 【Sweep】 →[Sweep Again] to restart the sweep.</p> <p>·[Number of Sweep Points]: Press 【Sweep】 →[Number of Sweep Points], you can select the number of sweep points as [201], [501], [1001], [2001] and [4001].</p>
Sweep Time Auto Man	
Sweep Cont Single	
Sweep Once	
Points 1001 >	

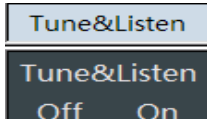
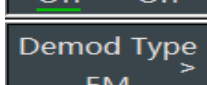
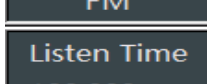
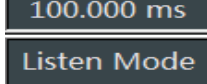
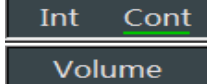
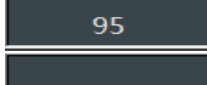


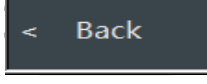
14.3.8 Automatic storage menu

Record	<p>·[Swp Interval]: Press [Auto Save]→[Swp Interval Auto] to set the sweep interval. After setting the sweep time, the trace will be switched to the maximum hold state by default to ensure that all signals measured during the sweep interval can be recorded.</p> <p>·[Span Time]: Press [Auto Save]→[Span Time Auto], and the span time is the entire sweep time. After the sweep reaches the span time, it will stop recording.</p> <p>·[Auto Save <u>Off</u> On]: Press [Auto Save]→[Auto Save <u>Off</u> On], and press the menu to switch the automatic save switch.</p> <p>·[Special Notes]: The automatic save function cannot be turned on until the span time is set.</p> <p>·[Time Mkr]: Press [Auto Save]→[Time Mkr] to view the historical data.</p> <p>·[Special Notes]: It can only be used in the waterfall chart measurement mode.</p> <p>·[Re-measure]: Press [Auto Save]→[Re-measure] to restart the sweep.</p>
Swp Interval Auto	
Sweep Span Auto	
Record Off On	
Time Cursor 0 ns	
Restart	

14.3.9 Configuration menu

	- [Audio Demodulation] : Press 【Configuration】 →[Audio Demodulation] to turn on the audio demodulation function. For the detailed introduction, you can refer to the description of the menu [Audio Demodulation].
	- [IQ Capture] : Press 【Configuration】 →[IQ Capture] to turn on the IQ capture function. For the detailed introduction, you can refer to the description of the menu [IQ Capture].
	- [Threshold Off On] : Press 【Configuration】 →[Threshold Off On], and you can choose whether to turn on the threshold function.
	- [Threshold 15.0] : Press 【Configuration】 →[Threshold 15.0], and you can set the threshold value through the number keys, the knob or the up and down keys.
	- [Signal List Detailed Concise] : Press 【Configuration】 →[Signal List Detailed Concise] to select the signal list display mode by switching the menu. In the concise display mode, only the frequency, bandwidth and amplitude information of the captured interference signal are displayed, and in the detailed display mode, the information such as the capture time, the number of capture times, etc. of the signal can also be displayed.
	
	
	

14.3.10 Audio demodulation menu

	- [Audio Demodulation Off On] : Press 【Configuration】 →[Audio Demodulation]→[Audio Demodulation Off On] to turn on or off the audio demodulation function.
	- [Demodulation type] : Press 【Configuration】 →[Audio Demodulation]→[Demodulation Type] to set the demodulation type. You can select the demodulation type of [FM], [AM], [Upper Sideband] or [Lower Sideband].
	- [Demodulation Time] : Press 【Configuration】 →[Audio Demodulation]→[Demodulation Time] to set the demodulation time.
	- [Demodulation Mode] : Press 【Configuration】 →[Audio Demodulation]→[Demodulation Mode] to set the demodulation mode. Set the demodulation mode. In intermittent mode, the data is swept for one screen and then demodulated for a period of time according to the demodulation time, and then the data is swept for one screen and then demodulated for a period of time according to the demodulation time, and that cycle repeats. In continuous mode, the data is continuously demodulated after being swept for one screen, and then the data is no longer swept.
	
	- [Volume] : Press 【Configuration】 →[Audio Demodulation]→[Volume] to set the speaker volume in the demodulation mode.
	
	
	
	

14.3.11 IQ capture menu

IQ Capture	<p>·[IQ Capture Off On]: Press 【Configuration】→[IQ Capture]→[IQ Capture Off On] to turn on or off the IQ capture function.</p>
IQ Capture Off On	<p>·[Start Capture]: Press 【Configuration】 →[IQ Capture]→[Start Capture] to start the IQ data capture and record functions.</p>
Start Capture	<p>·[Capture Time]: Press 【Configuration】→[IQ Capture]→[Capture Time] to set the IQ capture time. Note that the IQ capture time cannot exceed the sweep time.</p>
Capture Time 1.000 ms	<p>·[Capture Type]: Press 【Configuration】→[IQ Capture]→[Capture Type] to set the IQ capture type as single or continuous.</p>
Capture Mode Single Cont	<p>·[Sampling Rate]: Press 【Configuration】 →[IQ Capture]→[Sampling Rate], and press the sampling rate menu to pop up the sampling rate dialog box. The sampling rate that can be set for IQ capture will be 12.5 MHz, 5 MHz, 1.25 MHz, 500 kHz, 125 kHz and 50 kHz.</p>
Sample Rate 56.100 MHz	<p>·[Trig]: Press 【Configuration】→[IQ Capture]→[Trigger], you can choose [Free Trigger] and [External Trigger]. If you set an external trigger, you can set [Trigger Polarity] and [Trigger Delay].</p>
Triggering [Free Run]	<p>·[Save Name]: Press 【Configuration】 →[IQ Capture]→[Storage Name] to set the storage name of the IQ capture file.</p>
Save Name IQCapture	
< Back	

14.3.12 Shortcut menu

ShortCut	<p>·[Center frequency]: Press 【Shortcut】 → [Center Frequency], press 【Freq】 → [Center Frequency], and through the number keys on the front panel, select [GHz], [MHz], [kHz] and [Hz] in the frequency unit menu, or use the 【↑】【↓】 keys and the knob to set.</p>
Center Freq	<p>·[Span]: Press 【Shortcut】 → [Sweep Width], and press 【Freq】 → [Sweep Width] to activate the sweep width submenu. You can use the number keys, and then select the frequency unit to change. You can also use the 【↑】【↓】 keys and the knob to change.</p>
Span	<p>·[Audio Demodulation <u>Off On</u>]: Press 【Shortcut】 → [Audio Demodulation Off On] to turn on or off the audio demodulation function.</p>
Tune&Listen Off On	<p>·[IQ Capture <u>Off On</u>]: Press 【Shortcut】 → [IQ Capture <u>Off On</u>] to turn on or off the IQ capture function.</p>
IQ Capture Off On	<p>·[Start Capture]: Press 【Shortcut】 → [Start Capture] to start the IQ capture.</p>
Start Capture	<p>·[Max Peak]: Press 【Shortcut】 → [Max Peak], you can set the current active marker to the maximum peak point of the measurement trace and display the frequency and amplitude of the marker in the upper center of the screen.</p>
Peak Search	<p>·[Mkr -> Center Freq]: Press 【Shortcut】 → [Marker->Center Frequency], and set the center frequency to be equal to the marker frequency. This function can quickly move the signal to the center of the screen.</p>
Marker-> Center	<p>·[Signal List <u>Off On</u>]: Press 【Shortcut】 → [Signal List Off On] to open or close the signal list.</p>
Signal List Off On	

15 Technical description

15.1 Working principles

The 4957B instrument is equipped with numerous functions such as vector network analysis, spectrum analysis, cable and antenna test, vector voltmeter, power measurement, etc., and it is a multifunctional multi-parameter test instrument. In terms of the overall hardware implementation plan, this tester focuses on the design concept of modularization and platform generalization, fully utilizes the existing technical foundation and determines the block diagram of implementation plan of the final project as shown in Figure 15-1.

The system hardware can be divided into several large block pieces of a radio frequency channel board, a frequency synthesis board, an intermediate frequency channel board, a signal source board, signal separation and frequency conversion components, a CPU board, a display screen, a keyboard, a battery, etc.

Among them, the radio frequency channel board includes two parts of a program-controlled step attenuator and a switch filtering and frequency conversion. The complete machine will automatically associate the attenuation value of the program-controlled step attenuator according to the reference level settings, or the user can manually set the attenuation value to provide suitable frequency mixer level. The switch filtering and frequency conversion part will complete the sub-band filtering and frequency conversion processing of the spectrum radio frequency input signal, and it will output the intermediate frequency signal to the intermediate frequency channel board.

The intermediate frequency channel board will filter the intermediate frequency signal input by the radio frequency channel board, implement gain control for different bands to adjust the amplitude value of the AD sampled signal, and finally output the differential digital signal after AD conversion to the FPGA of the CPU board, so as to complete the functions of digital down conversion, intermediate frequency filtering, video filtering, etc.

The frequency synthesis board will provide the local oscillator signal for the frequency mixer of the radio frequency channel board. It is related to the indicators such as the hardware sweep speed, phase noise, sideband stray, etc. for the spectrum part of the complete machine. At the same time, it will also provide the local oscillator signal for the vector network part of the complete machine, and output it to the signal separation and frequency conversion components.

The signal source board will provide a 30 kHz ~ 6.5 GHz excitation signal for the vector network of the complete machine, and also provide the intermediate frequency processing function of the vector network part. It will carry out filtering and AD conversion for the intermediate frequency signal subjected to frequency conversion in the signal separation and frequency conversion components, and output the digital signal to the FPGA of the CPU board.

The signal separation and frequency conversion components are responsible for dividing the power adjustment and switching power of the 30 k ~ 6.5 GHz excitation signal into two paths. One path will reach the test port 1 via the port 1 directional coupler, and the other path will reach the port 2 via the port 2 coupler; dividing the local oscillator signal into 4 channels and sending them to the local oscillator end of the 4-way frequency mixer respectively; and carrying out frequency mixing for the excitation signal with the local oscillator signal, down converting to the intermediate frequency that can be processed by the complete machine, and sending to the signal source board.

The CPU board includes a power conversion and management circuit, an interface and display circuit, an FPGA/CPLD control and digital signal processing circuit, and an ARM core module, realizing the functions of DC/DC conversion, power work management, digital signal processing, logic circuit control, etc. for the power supply part of the complete machine, and finally outputting the test results to the LCD display.

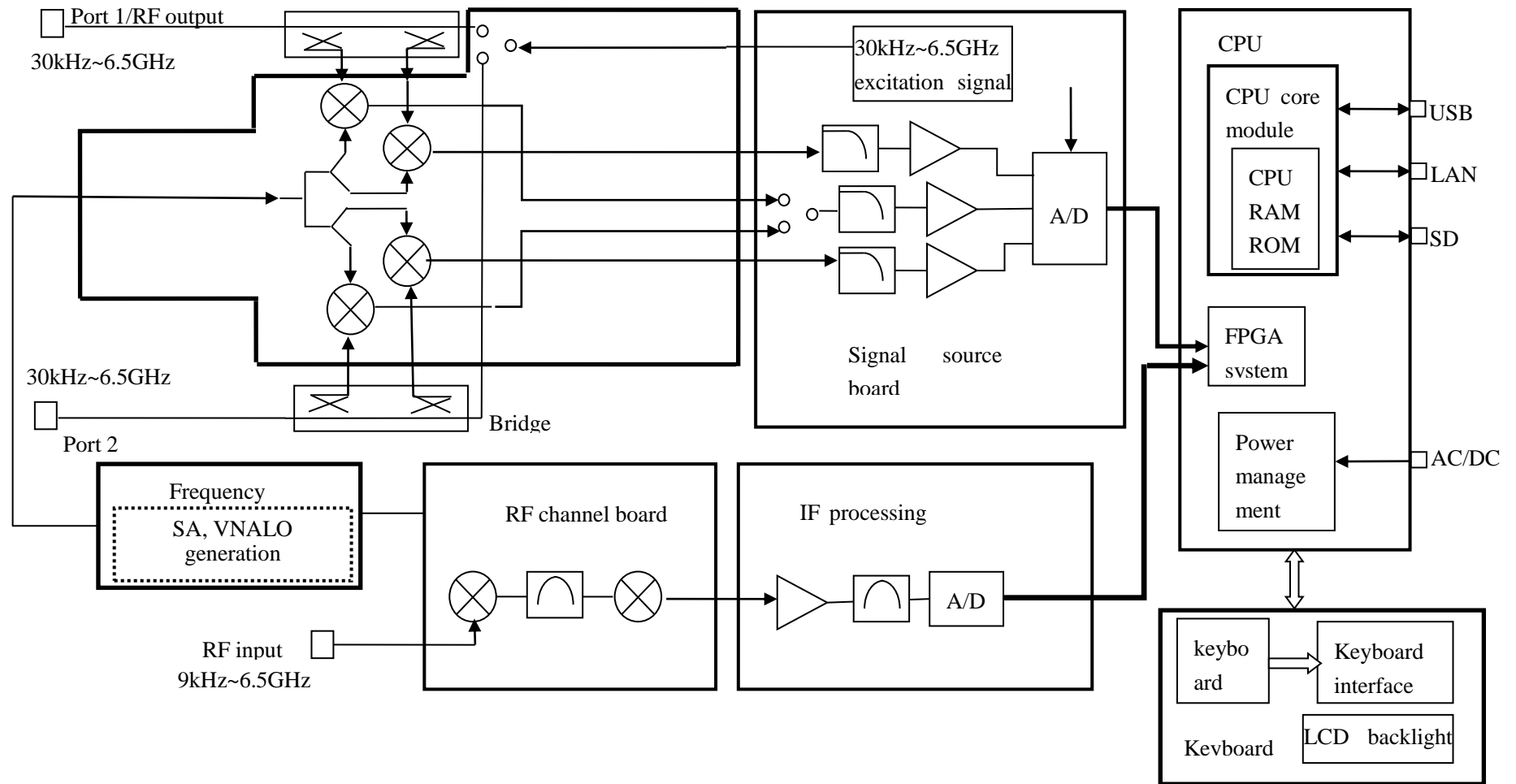


Figure 15-1 Functional Block Diagram of 4957B RF Analyzer

15.2 Description of fault information

The section introduces how to find problems and ask for after-sales services. It also includes an explanation of the error messages inside the instrument.

If you purchase a 4957B instrument and encounter some problems during operation, or you want to buy relevant parts, options or accessories of 4957B, we will provide you with complete after-sales services. Generally, causes of problems are due to hardware, software or user maloperation. In case of any problem, please contact us in time. If the 4957B you purchased is within the warranty period, we will repair it for free as per the provisions specified in the warranty bill. Even if it is beyond the warranty period, we will only charge the cost price.



Description

This section introduces the way on how to judge and handle failures (if any) of the 4957B, and feed them back to the manufacturer as accurately as possible if necessary for quick solution.

In case of any problem with 4957B you are using, you can check it by yourself according to the following tips. If the problem cannot be solved, please contact us.

If 4957B cannot be started after pressing the start button, please check whether the power supply is normal and whether the adapter indicator is on or whether the battery level is normal. If there is nothing abnormal, instrument may be faulty, please contact us for repair.

If the 4957B cannot enter the system or application program after startup, please press the **【Reset】** key to make 4957B return to a known state. If it still cannot work normally, it may be faulty, please contact us for repair.

If the performance indicators of 4957B are abnormal, please check the test tools and test environment for compliance with the requirements, the test port connectors for any damages and the calibration piece for normal performance indicators; If everything above is normal, the instrument may be faulty, please contact us for repair.

If the 4957B cannot realize communication via LAN, check the IP settings of the analyzer first, and check whether the yellow LED beside the LAN port on the top panel flashes. If no, check the LAN cable connection. If there are no problems for the above aspects, the instrument may be faulty, please contact us for repair.

15.3 Repair

In case of any failure to 4957B that is difficult to be eliminated, contact us by phone or fax. If it is confirmed that the instrument needs to be repaired, please package the instrument according to the following steps:

- 1) Write a paper document describing the instrument failure and put it in the package together with the analyzer;
- 2) Pack it with the original packing materials, so as to minimize possible damage;
- 3) Place cushions at the four corners of the outer packing carton, and place the instrument in the outer packing carton;
- 4) Seal the opening of the packing carton with adhesive tape and reinforce the packing carton with nylon tape;
- 5) Indicate "Fragile" on the box body! Do not touch! Handle with care! and so on.
- 6) ease check it as precision instrument, and keep a copy of all shipping documents.

16 Technical indicators and testing methods

This section illustrates the recommended test methods for the main technical indicators of the 4957B instrument, and these indicators can fully reflect the performance and condition of the instrument. The instrument to be tested should be stored at the operating temperature for at least 2 hours, and then started and warmed up for 30 minutes before testing the following indicators without error.

Notice

The specific operation steps for testing the following indicators are provided according to the testing instrument shown in the figure. When other testing instruments with the same performance characteristics are used for testing, please refer to the User’s Manual of such instruments for the specific operation. The reset instrument mentioned in the test step refers to the factory reset mode. If the device is in the user-defined reset state, it shall be changed to the factory reset state and reset again, ensuring that the initial state of the device is in a known state.

16.1 Vector network analysis performance indicator test

Before the indicator test of this section, first press the **【Mode】** key on the instrument to select the working mode as the vector network analysis mode, and carry out the detailed test according to the method recommended in this section.

16.1.1 Frequency range and accuracy

Description: Frequency range in this test refers to the range of the minimum frequency and the maximum frequency of the signal which can be set for the 4957B instrument (hereinafter referred to as the instrument) working at the port in the network analysis mode. Frequency accuracy refers to the difference between the measured frequency and the set frequency of the signal output at the port. Use a spectrum analyzer that is an order of magnitude higher than the frequency accuracy of the instrument to test the port 1 output frequency accuracy of the instrument.

16.1.1.1 Testing Equipment

Spectrum analyzer.....	4036
Test cable and adapter	

16.1.1.2 Test steps

- a) Set the working mode to be the vector network analysis mode, and press **【Measure】** [S11] to set the test port as Port 1.
- b) Press **【Freq】** [Start] to set the start frequency of the instrument as the minimum frequency of the corresponding model, and press [Stop] to set the stop frequency of the instrument as the maximum frequency of the corresponding model; and if they can be set to the minimum and the maximum frequencies, it indicates that the frequency range meets the requirements.

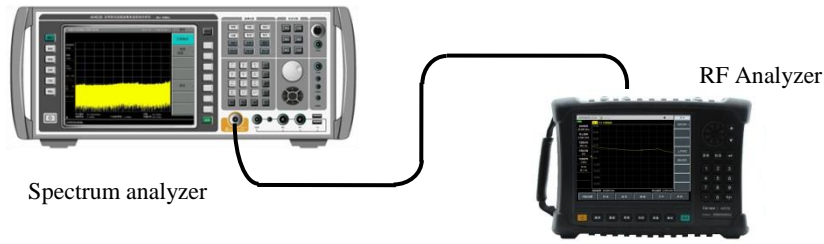


Figure 16-1 Block Diagram of Frequency Range and Frequency Accuracy Test

- c) Connect the instrument as shown in Figure 16-1; connect Port 1 (radio frequency output port) of the instrument to the RF input port of the spectrum analyzer, set the reference level of the spectrum analyzer to 10 dBm, and enable frequency counting;
- d) Press **【Freq】** [Center Frequency], 1GHz, [Sweep Width], 0Hz, and set the instrument to work at the point frequency of 1GHz;
- e) Set the center frequency of the spectrum analyzer to be the same as that of the instrument, appropriately change the sweep width of the spectrum analyzer, search the peak, and set it to the center;
- f) Read out the count value fo of the spectrum analyzer, and fill in the log sheet;

16.1.2 Frequency resolution

Description: The frequency resolution of this test refers to the minimum frequency difference between two adjacent frequency point signals output by the port of the instrument.

16.1.2.1 Testing Equipment

Spectrum analyzer.....	4036
1 piece of N(m-m) cable (100 cm)	
1 piece of BNC(m-m) cable (120 cm)	

16.1.2.2 Test steps

- a) Connect the instrument as shown in Figure 16-2. Connect Port 1 of the instrument to the RF input port of the spectrum analyzer, which provides a 10 MHz frequency reference for the instrument. On the instrument, press **【System/Local】** [Frequency Reference Internal External], and select the 10 MHz reference of the instrument as the external reference ;
- b) Set the instrument as follows (other items remain the default settings of the system at startup):

Center frequency.....	2001MHz
Sweep width	0 MHz
Output power	high power
Measurement	S11

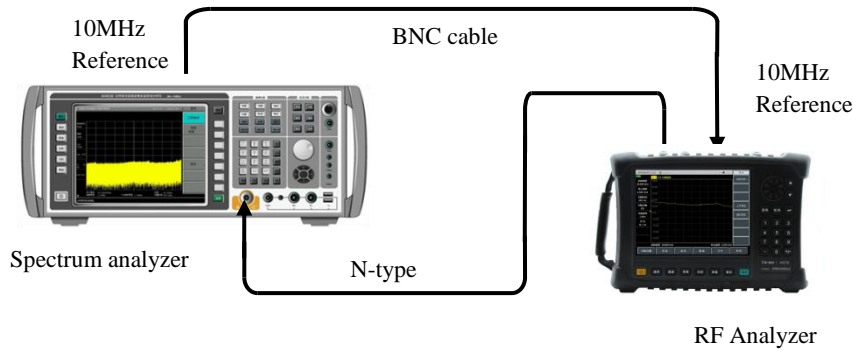


Figure 16-2 Block Diagram of Frequency Resolution Test

- c) Press the reset key on the spectrum analyzer 4036 to make the following settings:
Center frequency 2001MHz
Frequency Bandwidth 100 Hz
Reference Level 10 dBm
- d) On the spectrum analyzer4036, search the peak value, place the marker at the peak value and turn on the difference marker;
- e) Set the center frequency f_s of instrument to be 2001.00001MHz;
- f) Search the peak value on the spectrum analyzer 4036 again, read out the reading FM of the different marker, and record in the 4957B RF Analyzer Record Sheet .

16.1.3 Power level

Description: The port output power of the instrument is divided into high, low and manually set. In this test, the power level is checked and tested based on its menu.

The test steps are shown as follows:

- a) Press **【Reset】** on the instrument to set the working mode to vector network analysis mode and the test port to Port 1.
- b) Press **【Amplitude】** →[Power]→[High] to set the port output power to high.
- c) Press **【Measure】** →[Advance]→[A1], [Trace]→[Trace Math]→[Data→Mem]→[Data & Mem].
- d) Press **【Amplitude】** →[Power]→[Low] to set the port output power to low;
- e) Compare the data and the in-memory traces. If the distance is obviously about 20dB~30dB, the power range meets the requirements.
- f) Set certain output power manually within the specified range. If the test curve is below the high power output curve and relatively flat, the manually set power meets the requirements. Make a tick in corresponding place of the test log sheet if it meets the requirements; otherwise, make a cross.

16.1.4 Port output power

Description: It is to test the settable output power range for the vector network port of the instrument meeting a certain power accuracy requirement and the difference between the measured value and the actually set value of the port output power meter when the port output power is set to -15 dBm. The smaller the difference, the higher the power level accuracy.

16.1.4.1 Testing Equipment

Power meter.....	ML2437A
Power probe.....	MA2445D
One 3.5mm (f)-N(m) adapter	

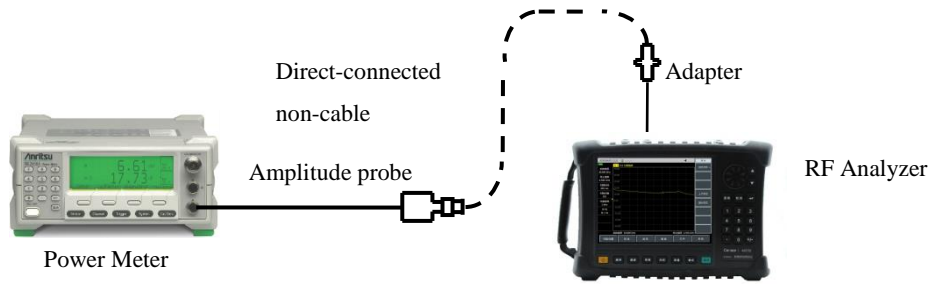


Figure 16-3 Block Diagram of Power Level Accuracy Test

16.1.4.2 Test steps

- a) Set the instrument to work in the network analysis mode, and press **【Amplitude】** [Output Power] [Manual Power]. It can be set within the range of -35dBm~-5dBm.
- b) Connect the power meter ML2437A with the power probe MA2445D for zero calibration, as shown in Figure 16-3, and connect Port 1 of the instrument to the power probe through the adapter.
- c) Set the instrument to work in network analysis mode, the test port to Port 1, the output power level to -15dBm, and the point frequency to 100MHz.
- d) Set the calibration factor frequency of the power meter to be the same as the output frequency of the RF analyzer.
- e) Read the test value of the power meter, calculate the amplitude accuracy index (-15 - power meter reading), and record the result in corresponding column of the test form;
- f) Change the test frequency based on the test log sheet, and repeat c)~e) until all tests are completed.

16.1.5 Effective directivity

Description: The direction is defined as the ratio of the power that occurs at the auxiliary end of a signal when it travels in the positive direction to the power that occurs at the auxiliary end of a signal when it travels in the reverse direction, expressed in dB. It shows how well a directional device can separate the positive and reverse traveling waves. The larger the value of the directional index is, the better its ability to separate signals is. Ideally it is infinite.

16.1.5.1 Testing Equipment

Calibration kit.....20201A/B
 N-type calibration cable

16.1.5.2 Test steps

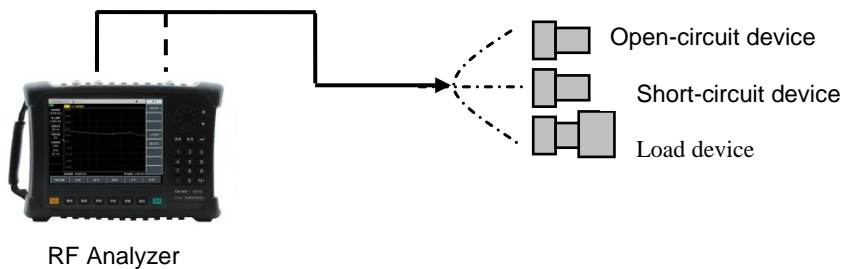


Figure 16-4 Block Diagram Of Effective Directivity, Effective Source Matching And Reflection Tracking

Test

a) Set the analyzer as follows (for the other items, keep the default settings at the startup):

Start frequency.....	300kHz
Stop frequency.....	6.5GHz
Output power.....	-10dBm
Intermediate frequency bandwidth	100Hz
Points	401

Port 1 effective directivity test

- b) Press **【Measure】** [S11] to select the test port as Port 1. Then press **【Cal】** [Cal Kit] to select the correct calibration kit, and press **【Cal】** [M Cal] [S11 Single Port], so as to complete the measurement of standard parts such as OPEN, SHORT and LOAD, and finally press [Done] to complete the calibration;
- c) Do not remove the LOAD used in the last step of calibration from the measurement port. Press [Sweep/Setup]→[Sweep Once], stop sweep after the instrument finishes the current sweep, and press **【Mkr】** [Marker search][Max] to find and test the maximum value;
- d) Fill in the *Record Sheet of 4957B RF Analyzer* with the absolute value of the maximum value as the effective directivity index of Port 1;
- e) Remove the calibration kit from Port 1, and press **【Sweep/Settings】** → [Continuous Sweep] to make the instrument in the continuous sweep state;

Port 2 Effective directivity test

- f) Press **【Measure】**[S22] to select the test port as Port 2. Then press **【Cal】**[M Cal] [S22 Single Port], so as to complete the measurement of standard parts such as OPEN, SHORT and LOAD, and finally press [Done] to complete the calibration;
- g) Repeat the step c), and fill in the Record Sheet of 4957B RF Analyzer with the absolute value of the maximum value as the effective directivity index of Port 2;

16.1.6 Effective source matching

Description: Source matching refers to the matching degree of the output impedance equivalent to the measurement port with the system standard impedance. In reflection measurement, the source matching error signal is the signal reflected by the measured part, then reflected back to the measured part by the signal source and finally reflected by the measured part. The source matching is expressed in dB. The larger the value is, the better the index is, and the smaller the measurement error is. Ideally it is infinite.

16.1.6.1 Testing Equipment

Calibration kit.....`.....20201A/B
 N-type calibration cable

16.1.6.2 Test steps

a) Set the analyzer as follows (for the other items, keep the default settings at the startup):

Start frequency.....	300kHz
Stop frequency.....	6.5GHz
Output power.....	-10dBm
Intermediate frequency bandwidth.....	100Hz
Sweep points.....	401

- b) Press **【Measure】** [S11] to select the test port as Port 1, then press **【Cal】** [Cal Kit] to select the correct calibration kit, and press **【Cal】** [M Cal] [S11 One Port], complete the measurement of the standard kits such as OPEN, LOAD, SHORT, etc., and finally press [OK] key to complete the calibration;

- c) Do not remove the SHORT used in the last step of calibration from the calibration port. Press [Sweep/Settings] → [Single Sweep], stop after the instrument finishes the current sweep, and press [Trace] → [Trace Operation] → [Data → Storage];
- d) Remove the SHORT from the test port, connect the OPEN, press [Next Page], [Source Matching] to make the instrument stop after completing the current sweep, and change the scale to make the curve easier to read;
- e) Press 【Mkr】 [Marker Search] [Max] to search for the maximum test value A_{max} on the trace at this time, take it as the source matching index of Port 1, and fill in the Record Sheet of 4957B RF Analyzer;
- f) Press 【Measure】 [S22] to select the test port as Port 2. Then press 【Cal】 [M Cal] [S22 Single Port], so as to complete the measurement of standard parts such as OPEN, SHORT and LOAD, and finally press [Done] to complete the calibration;
- g) Repeat the steps 3 to 5, and fill in the *Record Sheet of 4957B RF Analyzer* with the effective source matching index of Port 2;

16.1.7 Load matching

Description: This test is calibrated and error-corrected for load matching. The larger the value is, the better the index will be, and the smaller the measurement error will be.

16.1.7.1 Testing Equipment

Calibration kit.....`.....20201A/B
N-type calibration cable

16.1.7.2 Test steps

- a) Set the RF analyzer as follows (for the other items, keep the default settings at the startup):

Start frequency 300 kHz
Stop frequency 6.5 GHz
Output power -10dBm
Intermediate frequency bandwidth 100Hz
Points 401

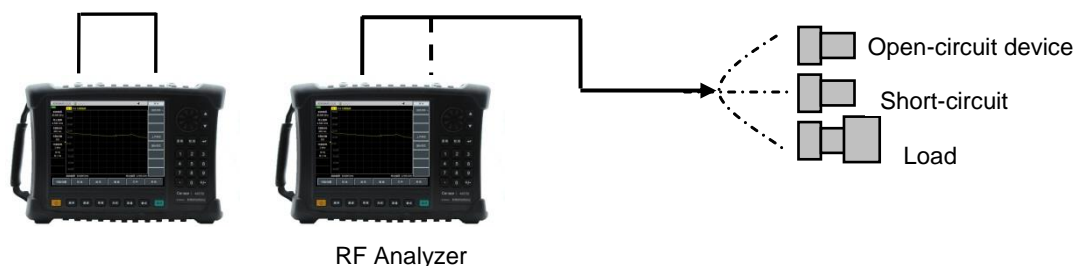


Figure 16-5 Block Diagram of Load Matching Test

- b) Press 【Cal】 [Cal Kit] to select the correct calibration kit, then press 【Cal】 [M Cal] [Full 2 Ports] [Reflection], connect the N-type calibration cable at the test Port 1 as shown in Figure 16-5, connect the OPEN, SHORT and LOAD at the end of the cable successively to complete the measurement of the standard kits such as the OPEN, SHORT and LOAD of the port P1; connect the OPEN, SHORT and LOAD successively at the test Port 2, and complete the measurement of the standard kits such as the OPEN, SHORT and LOAD of the port P2; and finally, press the [OK] key to complete the reflection calibration of full 2 ports;
- c) Directly connect the test Port 1 and test Port 2 with an N-type calibration cable, press [Transmit] [Auto] to transmit the calibration, press [Back] [ISO] [Ignore Iso] to omit isolation calibration, and

Technical indicators and testing methods

finally press the [Back] [OK] key to complete the calibration of full 2 ports;

Port 1 Effective load matching test

- d) Press **【Measure】** [S11], press [Sweep/Settings] →[Single Sweep], and stop after the instrument finishes the current sweep;
- e) Press **【Mkr】** [Marker Search] [Max] to record the read out the maximum return loss value R1;
- f) Record the absolute value of R1 as the effective load matching index of Port 1 into the Record Sheet of 4957B RF Analyzer;

Port 2 Effective load matching test

- g) Press **【Measure】** [S22], press [Sweep/Settings] →[Single Sweep], and stop after the instrument finishes the current sweep;
- h) Press **【Mkr】**[Marker Search] [Max] , and record the absolute value of the maximum as the effective load matching index of Port 2 into the Record Sheet of 4957B RF Analyzer.

16.1.8 Reflection tracking

Description: Reflection tracking reflects the difference between the reflection test channel and the reference channel. For the reflection tracking error after calibration and error correction in this test, the smaller the value, the better the index, and the smaller the measurement error caused.

16.1.8.1 Testing Equipment

Calibration kit.....`.....20201A/B
 N-type calibration cable

16.1.8.2 Test steps

- a) Set the RF analyzer as follows (for the other items, keep the default settings at the startup):

Start frequency.....300kHz
 Stop frequency..... 6.5GHz
 Output power.....-10dBm
 Intermediate frequency bandwidth..... 100Hz
 Sweep points..... 401

Port 1 Reflection tracking test

- b) Press **【Measure】** [S11] to select the test port as Port 1, then press **【Cal】** [Cal Kit] to select the correct calibration kit, and press **【Cal】** [M Cal] [S11 One Port], complete the measurement of the standard kits such as OPEN, LOAD, SHORT, etc., and finally press [OK] key to complete the calibration;
- c) Do not remove the SHORT used in the last step of calibration from the calibration port. Press [Sweep/Settings] →[Single Sweep], and stop after the instrument finishes the current sweep;
- d) Press **【Mkr】**[Marker Search][Max], record the read out maximum return loss value R1, press [Min], record the read out minimum return loss value R2, and compare |R1| and |R2|;
- e) e) Fill in the Record Sheet of 4957B RF Analyzer with the value for which the absolute value is larger as the reflection tracking index of Port 1;
- f) Press **【Sweep】** [Trigger] [Continuous Sweep] to make the instrument in the continuous sweep state;

Port 2 Reflection tracking test

- g) Press **【Measure】**[S22] to select the test port as Port 2, then press **【Cal】**[M Cal] [S22 Single Port], complete the measurement of the standard kits such as OPEN, LOAD, SHORT, etc., and finally press the [OK] key to complete the calibration;
- h) Repeat the steps c) to d), and fill in the Record Sheet of 4957B RF Analyzer with the value for which the absolute value is larger as the reflection tracking index of Port 2.

16.1.9 transmission tracking

Description: Transmission tracking reflects the difference between the transmission test channel and the reference channel. For the transmission tracking error after calibration and error correction in this test, the smaller the value, the better the index, and the smaller the measurement error caused.

16.1.9.1 Testing Equipment

Calibration kit.....`.....20201A/B
N-type calibration cable

16.1.9.2 Test steps



Figure 16-6 Block Diagram of Dynamic Range and Transmission Tracking Test

- f) Set the instrument as follows (other items remain the default settings of the system when it is started):

Start frequency 300 kHz
Ending frequency 6 GHz
Output power -10dBm
Intermediate frequency bandwidth 100Hz
Points..... 401

- g) Press **【Cal】** →[Cal Kit] to select the correct calibration kit, then press [M Cal]→[Response & Isolation S12]→[Isolation], as shown in Figure 16-6, connect the test cable to Port 1 or Port 2, connect the LOAD at the end of the cable to the other port, and finally press [Isolation] to complete isolation calibration.
h) Remove the LOAD, directly connect the test Port 1 and the test Port 2. and press [Through] to complete S12 through measurement;

Port 1 Transmission tracking test

- i) After the calibration is completed, wait for the end of single sweep, press **【Mkr】** , [Marker Search], [Max], and record the read out maximum value R1;
j) Press [Minimum Value] to record the read out the minimum value R2;
k) Compare |R1| and |R2|, and record the value for which the absolute value is larger as the transmission tracking index of Port 1 into the Record Sheet of 4957B RF Analyzer;

Port 2 Transmission tracking test

- l) Press **【Measure】** , [S21], repeat the steps 2 to 6, carry out S21 transmission and isolation calibration, and complete the test and record of transmission tracking indicators for Port 2.

16.1.10 Dynamic range

Description: Dynamic range refers to the difference between the maximum power output from the port of the instrument and the measurement sensitivity of the port. The unit of the dynamic range index for the port after calibration and error correction in the test is dB. The larger the value is, the better the index is.

16.1.10.1 Testing Equipment

Calibration kit.....20201A/B
 N-type calibration cable

16.1.10.2 Test steps

a) Set the analyzer as follows (for the other items, keep the default settings at the startup):

Start frequency 300kHz
 Stop frequency 6.5GHz
 Output power high power
 Intermediate frequency bandwidth 10 Hz
 Points..... 401

- b) Press **【Cal】** →[Cal Kit] to select the correct calibration kit, then press [M Cal]→[Response & Isolation S12], as shown in Figure 6, use the cable to directly connect the test Port 1 with Port 2, and press [Trough] to complete the through measurement;
- c) Remove the cable from one of the ports, connect the load on the calibration end face, and press [Isolation] to complete the S12 isolation measurement;

Port 1 Dynamic range test

- d) After the calibration is completed, wait for the end of single sweep, press **【Mkr】** , [Marker Search], [Max], and record the read out maximum value;
- e) Fill in the *Record Sheet of 4957B RF Analyzer* with the absolute value of the maximum value as the dynamic range index of Port 1;

Port 2 Dynamic range test

- e) Press **【Measure】** , [S21], repeat the steps 2 to 5, carry out S21 transmission and isolation calibration, and complete the dynamic range test for Port 2.

16.2 Spectrum analysis performance indicator test

Before the indicator test in this section, first press the **【Mode】** key on the instrument, select the working mode as the spectrum analysis mode, and carry out the detailed test according to the method recommended in this section.

16.2.1 Frequency range

Description: Test the frequency measurement range of the comprehensive by using a 9 kHz signal and a 6.5 GHz signal. Use a signal generator of high-frequency stability to produce signals within the nominal upper and lower limits of the 4957B instrument to check whether the spectrum frequency measurement capability of the 4957B is adequate.

16.2.1.1 Testing Equipment

Composite Signal Generator..... 1464A/1461
 Several test cables and adapters

16.2.1.2 Test steps

- a) Connect the test equipment by following the dotted line in Figure 16-7. The instrument is used to provide reference frequencies for the 1464C composite signal generator. The low-frequency output port of the composite signal generator is connected to the radio frequency input of the instrument.
- b) Set the Composite signal generator as follows: **【Freq】** [Set Low Frequency Generator] [Set

Frequency] 9 kHz, [Set Amplitude] -10 dBm, [Return], [Low Frequency Output On Off].

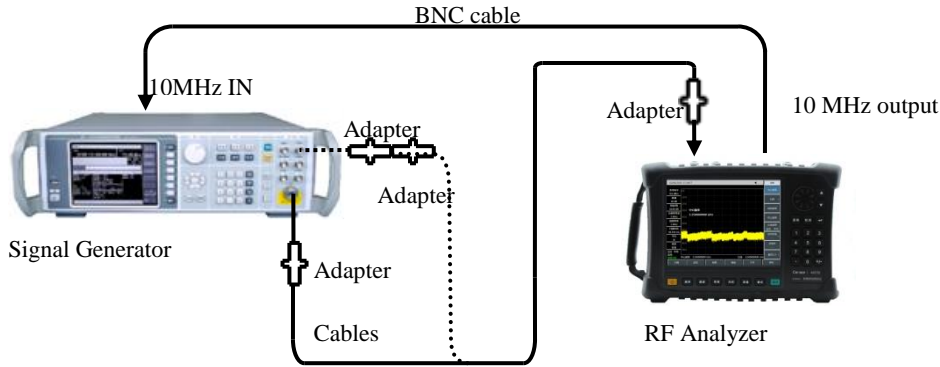


Figure 16-7 Frequency Range Test

- c) Set the instrument to be the spectrum analysis mode, and set the center frequency of the spectrum analyzer to 9 kHz, sweep width to 1 kHz, reference level to 0 dBm, and resolution bandwidth to 10 Hz. For the other items, set them to be automatic. On the instrument, press Peak Value. At this time, the cursor points to the maximum signal response; the marker amplitude value has no obvious jitter; the signal can be clearly distinguished. Then, record the center frequency as the lower-limit measured value of the frequency span; otherwise, record Fail to meet the requirements.
- d) As shown in the solid line of Figure 16-7, connect the radio frequency output of the composite signal generator 1461 to the radio frequency input of the instrument with adapters and cables . Set the output frequency of the signal generator to 6.5 GHz, the modulation function to off, and the output power to -10 dBm.
- e) Set the center frequency of the instrument to the highest frequency of the corresponding model, sweep width to 1 kHz, reference level to 0 dBm, resolution bandwidth to 10 Hz, and other items automatic. On the instrument, press Peak Value. At this time, the marker points to the maximum signal response, the marker amplitude value has no obvious jitter; the signal can be clearly distinguished. Then, record the center frequency as the lower-limit measured value of the frequency range; otherwise, record Fail to meet the requirements.
- f) Record measurement results in corresponding test items of the *Record Sheet of 4957B RF Analyzer*.

16.2.2 Frequency reading accuracy

Description: This index is used to represent the proximity between the indicated value of frequency measurement on the instrument and the corresponding true value. The frequency measurement indicator value of the instrument is subject to the influence of some factors such as frequency reference, span and RBW. Use an input signal with known frequency to test the accuracy of the frequency read out from the instrument, which represents the degree of difference between the test indicator value and the true value. The smaller the difference, the higher the accuracy.

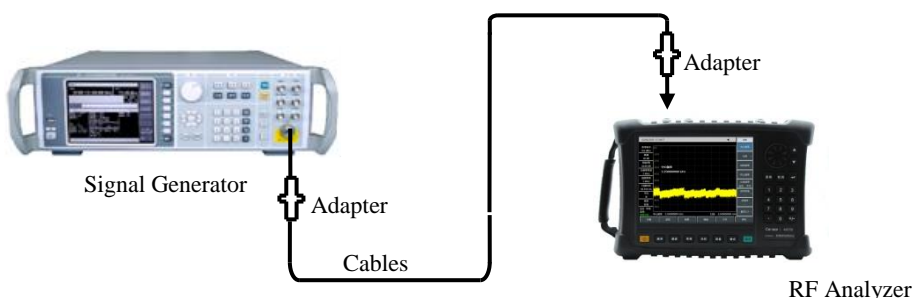
16.2.2.1 Testing Equipment

Composite Signal Generator 1464A/1461

Several test cables and adapters

16.2.2.2 Test steps

Figure 16-8 Block Diagram of Frequency Readout Accuracy Test



Technical indicators and testing methods

- a) Connect the test equipment according to Figure 16-8, in which the RF output of the signal generator is connected to the RF input of the spectrum analyzer.
- b) Press the Reset key on the signal generator; set the output frequency f_0 of the signal generator according to the item of “frequency readout accuracy” in the *Record Sheet of 4957B RF Analyzer*; set the power level to -10 dBm, and turn on the radio frequency output switch.
- c) Set the center frequency of the instrument to f_0 for spectrum analysis, sweep width to 500 kHz, reference level to 0 dBm, and the resolution bandwidth and sweep time to automatic.
- d) Press **【Peak】** on the instrument, and read out the peak signal frequency f_s through the marker.
- e) Calculate the error of frequency reading (Δf) by formula (1):

$$\Delta f = f_s - f_0 \tag{1}$$
- f) Record Δf as the test result in the corresponding test item of *Record Sheet of 4957B RF Analyzer*.
- g) Repeat steps b) through f) to test all combinations of frequencies and sweep widths listed in the corresponding test items of the *Record Sheet of 4957B RF Analyzer*.

16.2.3 Sweep width accuracy

Description: Use two composite signal generators to send two signals of known frequency as the input of the instrument. Set the center frequency of the instrument to the middle value of the two frequencies. Measure the frequency difference between the two signals by using the marker. Calculate and record the percentage of the error between the measured difference marker and the span. Enable the two signal generators to share a reference frequency with the instrument.

Note: You can also use one signal generator to perform the test. Firstly set the center frequency and the sweep width of the instrument, enable the frequency value of the first signal generator on the instrument, and set the difference marker on the instrument; then enable the frequency value of the second signal generator on the instrument. Read the difference marker of the two signals on the instrument and record it as the measured value. Enable the signal generator to share a reference frequency with the instrument.

16.2.3.1 Testing Equipment

- Composite Signal Generator 1464A/1461
- Several test cables and adapters

16.2.3.2 Test steps

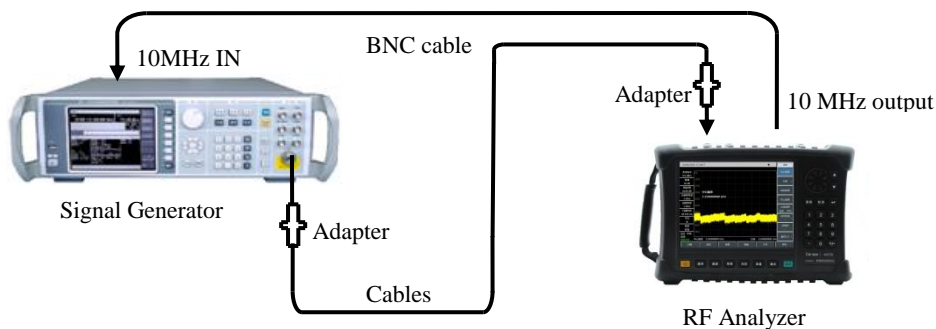


Figure 16-9 Block Diagram of Sweep Width Accuracy and Sweep Time Test

- a) Connect the test equipment as shown in Figure 16-9, and the instrument is used to provide reference frequencies for the composite signal generator.
- b) Set the center frequency f_0 of the instrument for spectrum analysis to 3.25 GHz, and reference level to 0 dBm; set the sweep width according to the item column of “Sweep Width Accuracy” in the *Record Sheet of 4957B RF Analyzer*.
- c) Firstly set the output frequency of the signal generator to f_1 ($f_1 = f_0 - 0.4 \times \text{sweep width}$, the sweep width is the setting value of the instrument), the power to -10 dBm, and the state of radio frequency output

to on.

- d) Press **【Peak】** , **【Mkr】** , [Delta Mode] on the instrument.
- e) Set the output frequency of the signal generator to f_2 ($f_2=f_0+0.4\times$ Sweep width), and the output power to -10 dBm;
- f) Press the **【Peak】** key on the instrument and move the difference marker to f_2 . After sweep is completed, read out the frequency difference Δf of the two signals through the instrument.
- g) Record the frequency difference Δf and calculate the sweep width accuracy by the following formula:

$$\text{Span accuracy} = 100 \times [\Delta f - (0.8 \times \text{span})] / (0.8 \times \text{span})\% \quad (2)$$
- h) Record the results in the corresponding test items of the *Record Sheet of 4957B RF Analyzer*.
- i) Turn off all frequency markers and set the sweep width of the instrument and the frequency of the signal generator respectively according to the sweep widths of the instrument in the record sheet. Repeat the steps c) to h) until all sweep width tests are completed.

16.2.4 Sweep time

Description: Display the amplitude modulation signal on the instrument at the zero sweep width, and adjust the frequency of the modulation signal, enabling the peak intervals to be evenly distributed on the screen. Count the frequency of the modulation signal, calculate the actual sweep time, and then compare it with the specified time to obtain the sweep time accuracy. The sweep time accuracy is guaranteed by design. In order to reduce the test time, select a typical sweep time to test and verify.

16.2.4.1 Testing Equipment

Composite Signal Generator 1464A/1461

Several test cables and adapters

16.2.4.2 Test steps

- a) Connect the test equipment as shown in Figure 16-9, connect the radio frequency output of the signal generator to the radio frequency input of the instrument, which is used to provide reference frequencies for the composite signal generator.
- b) Set the center frequency of the instrument to 3 GHz, the sweep width to 0 Hz, the resolution bandwidth and the video bandwidth to 10 MHz respectively, and the number of sweep points to 201, then the minimum settable sweep time is not higher than 10 μ s, and the maximum settable sweep time is 600 s. If the above settings meet the requirements of the "Sweep Time Range (Zero Sweep Width)" item in the Record Sheet of 4957B RF Analyzer, it would be recorded as " \sqrt ", otherwise it would be recorded as " \times ."
- c) After resetting the signal generator, set the frequency to 3 GHz, the power to -5 dBm, **【Modulation】** [Amplitude Modulation] [Amplitude Modulation Input], [Internal], **【Back】**, [Amplitude Modulation On], [Modulation Rate], 10 kHz, [Modulation Depth], 100%, [Internal Modulation Waveform Selection], [Sawtooth Wave], [Modulation Type Linear], and turn on the amplitude modulation switch and the radio frequency output switch.
- d) Set the scale type of the instrument to linear, the peak detection method, set the number of sweep points to the default 1001 points, the resolution bandwidth to 3 MHz, and the video bandwidth to 3 MHz.
- e) Set the instrument[Sweep Time], 1ms, [Sweep Type Continuous Single].
- f) Set the instrument, press [Peak], and use [Left Peak] or [Right Peak] to place the marker on the first peak from the left. Press **【Mkr】** [Delta Mode], press **【Peak】** , and use [Left Peak] or [Right Peak] to place the marker on the ninth peak from the left. To read out the difference marker reading,

Technical indicators and testing methods

calculate as follows:

$$\text{Sweep time error} = 100 \times ((\text{Marker difference reading} \times 1.25 - \text{set sweep time}) / \text{set sweep time}) \% \quad (3)$$

Record the results at the 1 ms sweep time in the corresponding test items of the Record Sheet of 4957B RF Analyzer.

- g) Turn off the marker, and repeat the steps f) ~ g) for other sweep time listed in the table. Set the modulation rate (Frequency) in step f) according to the following formula: Modulation rate = 10/sweep time settings

16.2.5 Resolution bandwidth

Description: Resolution bandwidth is used to represent the capability of the instrument to clearly separate two input signals. It is subject to the influence of some factors such as IF filter bandwidth, phase noise, and sweep time. Most spectrum analyzers can be used to test different resolution bandwidths by using the LC filter, crystal filter, SAW, digital filter, etc.

Connect the output of the signal generator to the radio frequency input of the instrument. Set the bandwidth of the 4957B to approximately 2~3 times the current resolution bandwidth (facilitate the measurement of -3 dB bandwidth). Reduce the signal source output amplitude by 3 dB to determine the actual -3 dB point. After the marker reference is set, the output value of the signal source is increased by 3 dB and is returned back to the previous level. Then sweep is started. The difference marker is taken as the measured value of 3 dB bandwidth.

The reading value in the 4957B usable for 3 dB bandwidth test can be taken as the test value. The span error of Analyzer may cause an error to the resolution bandwidth accuracy. Compared with the error of resolution bandwidth, the span error can be neglected.

16.2.5.1 Testing Equipment

- Composite Signal Generator 1464A/1461
- Several test cables and adapters

16.2.5.2 Test steps

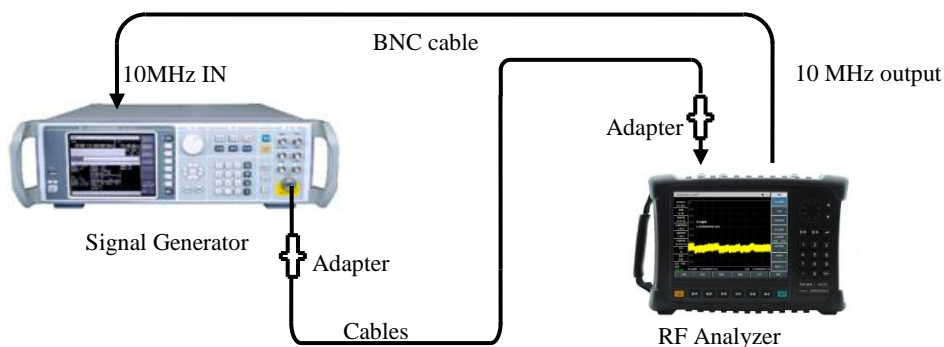


Figure 16-10 Settings for Resolution Bandwidth Accuracy Test

- a) Connect the test equipment as shown in Figure 16-10. The instrument is used to provide reference frequencies for the signal generator.
- b) Set the composite signal generator as follows: frequency is 100 MHz; power is -2 dBm; power step is 1 dB.
- c) Reset the instrument, press the **【 Mode 】** , [Frequency Analysis], [Measure] and [Occupied

Bandwidth] keys to open the function of measuring occupied bandwidths; select the measurement method XdB, and change X to -3.01 dB.

- d) Set the center frequency of the instrument to 100 MHz, sweep width to 30 MHz, amplitude scale to 1 dB/graduation, and resolution bandwidth to 10 MHz. For the other items, keep the default values of system.
- e) Adjust the output power of the composite signal generator to make the signal be 2 to 3 scales below the reference level.
- f) Use the instrument to search the peak value, record the 3 dB bandwidth marker difference Δf_{-3dB} that is read out at this time; calculate the resolution bandwidth accuracy δ by the following formula, and fill the calculation results in the corresponding test item of the Record Sheet of 4957B RF Analyzer.

$$\delta = \frac{\Delta f_{-3dB} - RBW}{RBW} \times 100\% \quad (5)$$

- g) Set the instrument according to the item column of “ Resolution Bandwidth Accuracy ” in the Record Sheet of 4957B RF Analyzer, with the frequency bandwidth close to three times of the resolution bandwidth. Repeat the steps f)~g) until all resolution bandwidth tests are completed.

16.2.6 Noise sideband

Description: Sideband noise is an indicator to represent the short-term stability of the local oscillator signal frequency of the instrument.

Measure the sideband noises of the 1.0 GHz and 0 dBm reference signals at deviation points of 10 kHz, 100 kHz, 1 MHz and 10 MHz of the carrier wave. Average the sideband noise at each frequency deviation point by using the noise marker and video averaging function. If there is a spurious response at the set frequency deviation point, deviate the cursor from the spurious response to ensure the measurement accuracy.

16.2.6.1 Testing Equipment

Composite Signal Generator 1464A/1461

Test cable and adapter

16.2.6.2 Test steps

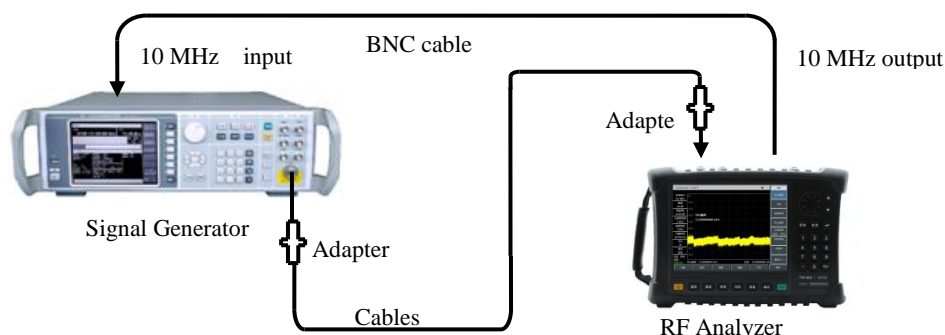


Figure 16-11 Schematic Diagram of Sideband Noise Test

- a) Connect the test equipment as shown in Figure 16-11, and the instrument is used to provide reference frequencies for the composite signal generator.
- b) Set the output frequency of the signal generator to 1GHz and the output power to 0dBm;
- c) On the instrument, set **【Freq】** to 1 GHz, **[Sweep Width]** to 30 kHz, and **【Amplitude】** (Ref Level)

to 0 dBm.

- d) Press **【Mkr】** , [Peak], [Delta Mode] on the instrument to set the difference marker to 10 kHz, and turn on the noise marker.
- e) Set the resolution bandwidth and video bandwidth according to Table 4; enable the averaging function; and perform 10 times of averaging.
- f) Record the difference marker amplitude value as the sideband noise at +10 kHz deviation point in the corresponding measured value item of the Record Sheet of 4957B RF Analyzer.
- g) Press **【Mkr】** - 10 kHz] on the instrument and record the difference marker amplitude value as the sideband noise at the -10 kHz deviation point.
- h) Set the instrument according to Table 4; test the single sideband noise at the deviation points of ± 100 kHz, ± 1 MHz and ± 10 MHz successively; record the difference marker amplitude value in the corresponding test item of the Record Sheet of 4957B RF Analyzer. If there is a spurious response at the frequency deviation point under test, keep away from the spurious response when reading the cursor value in the test.

Table 16-1 Sideband Noise Measurement Settings

Offset frequency Δf	Span	RBW	Video bandwidth and averaging
± 10 kHz	30 kHz	300 Hz	Video bandwidth is 30Hz; averaging is On
± 100 kHz	300 kHz	3 kHz	Video Bandwidth 300 Hz Average On
± 1 MHz	2.2 MHz	10kHz	Video Bandwidth 1 kHz Average On
± 10 MHz	25 MHz	100 kHz	Video Bandwidth 10 kHz Average On

16.2.7 Explicit average noise level

Description: The explicit average noise level refers to the background noise observed by the instrument when there is no additional noise or signal. The input port of the instrument is connected to a 50Ω matcher. The normalized noise value observed when the input attenuation value is set to 0 dB is the measured value of the average noise level.

16.2.7.1 Testing Equipment

50Ω matcher

16.2.7.2 Test steps

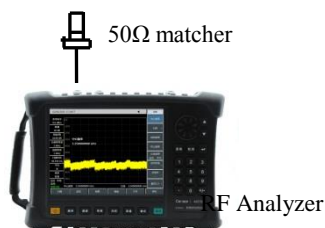


Figure 16-12 Settings for Test of Explicit Average Noise Level

- a) Connect the 50Ω matcher to the radio frequency input port of the instrument according to Figure 16-12.

Explicit average noise; the preamplifier is on (2 MHz-10 MHz)

- b) Set the instrument as follows:

Starting frequency 2MHz
 Ending frequency 10MHz
 Reference level -50 dBm
 Mkr all marker Off
 Resolution Bandwidth 100kHz
 Video Bandwidth 30 kHz
 Video type Logarithm
 Preamplifier On
 Detection type Mean

- c) Press [Cursor] -> [Noise cursor off on] -> [Peak] -> [Maximum].
 d) Press [Bandwidth] -> [Averaging on off] -> "5" -> [Confirm]; wait until "averaging 5/5" is shown on the left side of the screen.
 e) Read the peak value of the marker as the explicit average noise level of the 2 MHz to 10 MHz frequency band in the case that the preamplifier is on, and record it in the corresponding test item of the Record Sheet of 4957B RF Analyzer. Turn off the noise cursor and the averaging function.

Explicit average noise, the preamplifier is on (10 MHz-3 GHz)

- f) Set the start frequency of the instrument to 10 MHz, the stop frequency to 3 GHz, and make the others unchanged.
 g) Repeat the steps c) to d).
 h) Read the peak value of the marker as the explicit average noise level of the 10 MHz to 3 GHz frequency band in the case that the preamplifier is on, and record it in the corresponding test item of the Record Sheet of 4957B RF Analyzer. Turn off the noise cursor and the averaging function.

Explicit average noise; the preamplifier is on (3 GHz ~ 6.5 GHz)

- i) Set the start frequency of the instrument to 3 GHz, the stop frequency to 6.5 GHz; and make the others unchanged.
 j) Repeat the steps c) to d).
 k) Read the peak value of the marker as the explicit average noise level of the 3 GHz to 6.5 GHz frequency band in the case that the preamplifier is on, and record it in the corresponding test item of the Record Sheet of 4957B RF RF Analyzer. Turn off the noise cursor and the averaging function.

Explicit average noise; the preamplifier is off (2 MHz-10 MHz)

- l) Set the start frequency of the instrument to 2 MHz, the stop frequency to 10 MHz, the reference level to -20dBm, the preamplifier to be off; and make the others unchanged.
 m) Repeat the steps c) to d).
 n) Read the peak value of the marker as the explicit average noise level of the 2 MHz to 10 MHz frequency band in the case that the preamplifier is off; record the value in the corresponding test item of the Record Sheet of 4957B RF Analyzer. Turn off the noise cursor and the averaging function.

Explicit average noise; the preamplifier is off (10 MHz ~ 3 GHz)

- o) Set the start frequency of the instrument to 10 MHz, the stop frequency to 3 GHz, the reference level to -20dBm, the preamplifier to be off; and make the others unchanged.
 p) Repeat the steps c) to d).

- q) Read the peak value of the marker as the explicit average noise level of the 10 MHz to 3 GHz frequency band in the case that the preamplifier is off; record the value in the corresponding test item of the Record Sheet of 4957B RF Analyzer. Turn off the noise cursor and the averaging function.

Explicit average noise; the preamplifier is off (3 GHz ~ 6.5 GHz)

- r) Set the start frequency of the instrument to 3 GHz, the stop frequency to 6.5 GHz, the reference level to -20dBm, the preamplifier to be off; and make the others unchanged.
- s) Repeat the steps c) to d).
- t) Read the peak value of the marker as the explicit average noise level of the 3 GHz to 6.5 GHz frequency band in the case that the preamplifier is off; record the value in the corresponding test item of the Record Sheet of 4957B RF Analyzer. Turn off the noise cursor and the averaging function.

16.2.8 Second harmonic distortion

Description: When a signal is input to a nonlinear device (such as a mixer and amplifier, etc.), the nonlinear device will generate the harmonics of the input signal, and the unwanted second harmonic component attached to the signal is called For second harmonic distortion.

The composite signal generator provides a signal to the instrument to measure the second harmonic distortion via a low-pass filter. The low pass filter removes any harmonic distortion from the signal source. The composite signal generator is locked to the 10 MHz reference of the instrument.

16.2.8.1 Testing Equipment

- Composite Signal Generator 1464A/1461
- One 1.0 GHz low-pass filter
- One 3.0 GHz low-pass filter
- One 3.5 mm (f)-3.5 mm (f) adapter
- One BNC (m-m) cable
- 1 piece of 3.5 mm(m-m) cable

16.2.8.2 Test steps

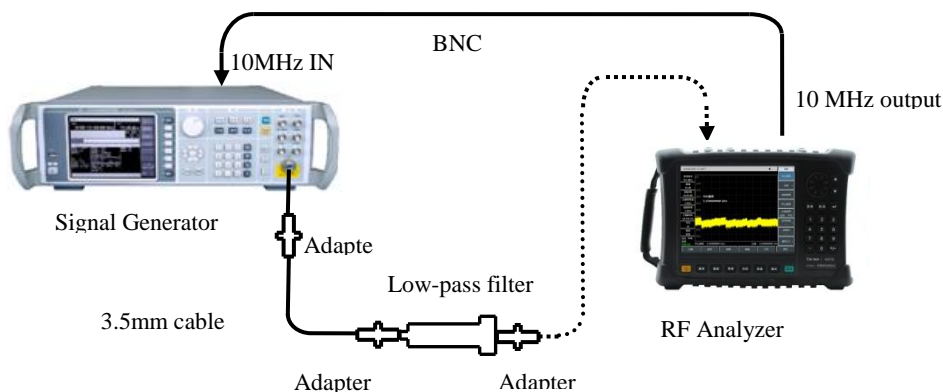


Figure 16-13 Settings of Second Harmonic Distortion Test

- a) Connect the test instrument as shown in Figure 16-13. The instrument provides a 10 MHz frequency reference for the composite signal generator and selects a 1 GHz low-pass filter.
- b) Set the frequency of the signal generator to 900 MHz, the amplitude to -30dBm, and the radio

frequency output is on.

- c) Set the RF analyzer as follows (other items remain the default settings of the system):
- Center frequency 900 MHz
 Span 10kHz
 Reference Level -30 dBm
- d) Press **【Peak】** on the instrument. Adjust the power level of the signal generator so that the reading of the RF analyzer is $-30\text{dBm} \pm 0.1\text{dB}$.
- e) Press **【Mkr】** [Delta Mode] to set the center frequency to 1.8 GHz.
- f) Press **【Peak】** after the instrument has completed a new sweep. Record the difference marker reading in the item of 0.9 GHz second harmonic distortion of the Record Sheet of 4957B RF Analyzer.
- g) Connect the test instrument as shown in Figure 14, and use the 3.0 GHz low-pass filter.
- h) Set the frequency of the signal generator to 2.5 GHz, and the amplitude to -30dBm.
- i) Set the instrument as follows (other items remain the default settings of the system):
- Center frequency 3 GHz
 Span 10kHz
 Amplitude -30dBm
 Mkr.....all marker Off
- j) Press **【Peak】** on the instrument. Adjust the power level of the signal generator so that the reading of the RF analyzer is $-30\text{dBm} \pm 0.1\text{dB}$.
- k) Press **【Mkr】** [Delta Mode] to set the center frequency to 5 GHz.
- l) Wait for the new sweep to complete, then Press **【Peak】** . Record the difference marker reading in the item of 2.5 GHz second harmonic distortion of the Record Sheet of 4957B RF Analyzer.

16.2.9 Mirror, multiple and out-of-band responses

Description: During frequency mixing, two input signals can generate the same IF signal with that of the LO signal with the same frequency, with one signal frequency one IF lower than the LO and another signal frequency one IF higher than the LO. In this case, one of the signal is called the mirror frequency of the other. Each frequency of the LO has a mirror frequency of corresponding input signal, with the difference of two IFs between the signal and frequency of the mirror frequency.

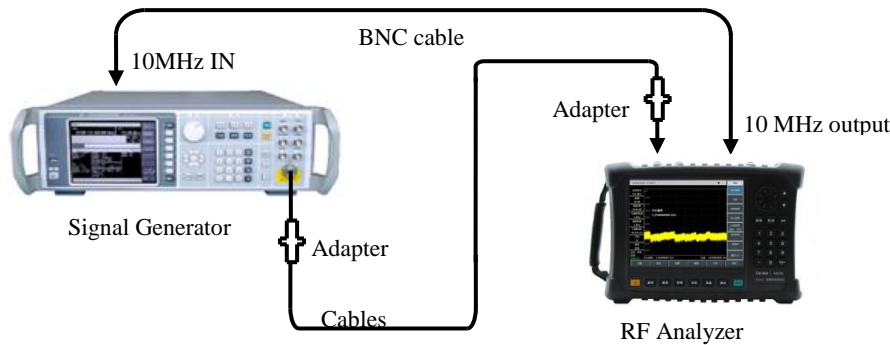
Test image, multiple and out-of-band responses on all frequency bands. The signal is applied to the input port of the instrument for reference amplitude measurement. Then tune composite signal generator to a frequency that causes a mirror, multiple or out-of-band response, and measure and record the amplitude displayed on the instrument.

16.2.9.1 Testing Equipment

Composite Signal Generator 1464A/1461
 Test cable and adapter

16.2.9.2 Test steps

Figure 16-14 Settings of Mirror, Multiple and Out-of-band Responses



- a) Connect the test equipment as shown in Figure 16-14. The instrument is used to provide reference frequencies for the composite signal generator.
- b) Set the frequency of the signal generator to 2 GHz and the power to -10dBm.
- c) Set the instrument as follows:

Center frequency	2GHz
Span	10kHz
Reference Level	-10 dBm
Resolution Bandwidth.....	10 Hz
Video bandwidth	10 Hz
- d) Adjust the output power level of the composite signal generator, enabling the signal peak to be close to the reference level of the instrument.
- e) On the instrument, press **【Peak】 【Mkr】** [Delta mode].
- f) Set the signal generator to each frequency point of mirror, multiple and out-of-band response corresponding to 2 GHz listed in the test item of the Record Sheet of 4957B RF Analyzer. Set the reference level of the instrument to -40dBm, press **【Peak】**, and record the difference marker amplitude value as the response amplitude in the corresponding test item of the Record Sheet of 4957B RF Analyzer.

16.2.10 Residual response

Description: It refers to the discrete response displayed on the display when the instrument is not connected to the input signal.

16.2.10.1 Testing Equipment

50Ω load matching

16.2.10.2 Test steps

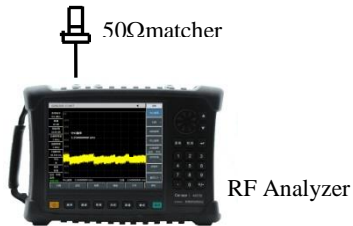


Figure 16-15 Setting of Residual Response Test

Residual response, 10 MHz~6.5 GHz (Preamplifier On)

- a) Connect the 50 Ω matcher on the spectrum input port of the instrument according to Figure 16-15, and set the instrument as follows:

Center frequency	65MHz
Frequency Stepping	100MHz.
Span	110MHz
Reference level.....	-50 dBm
Preamplifier	On
Resolution bandwidth	10kHz
Video bandwidth.....	3kHz

- b) Turn on the limit line function, and set the upper limit line to -95dBm, and the noise level shall be at least 5dB below the limit line. If not, it is necessary to decrease the resolution bandwidth and video bandwidth so as to decrease the noise level.
- c) Observe whether there is residual response on the noise baseline of the instrument. If yes, use the marker to read out the residual response amplitude and record the measurement result. The test should be such that the amplitude of the residual response signal is greater than the display average noise level by more than 10 dB. If the residual response signal amplitude is small, the resolution bandwidth should be further reduced to minimize the display average noise level.
- d) Press **【Freq】** [Center Frequency] **【↑】** to change the center frequency. Repeat step 3 to check the residual response of the frequency up to 6.5 GHz, record the measured maximum value in the corresponding test item with the preamplifier on of the Record Sheet of 4957B RF Analyzer.

Residual response, 10 MHz~6.5 GHz (Preamplifier Off)

- e) Set the instrument as follows:

Center frequency	65MHz
Frequency Stepping	100MHz.
Span	110MHz
Reference Level	-20 dBm
Preamplifier	Off
Resolution bandwidth	10kHz
Video bandwidth.....	3kHz

- f) Turn on the limit line function, and set to -82dBm, and the noise level shall be at least 5dB below the

limit line. If not, it is necessary to decrease the resolution bandwidth and video bandwidth so as to decrease the noise level.

- g) Observe whether there is residual response on the noise baseline of the instrument. If yes, use the marker to read out the residual response amplitude and record the measurement result. The test should be such that the amplitude of the residual response signal is greater than the display average noise level by more than 10 dB. If the residual response signal amplitude is small, the resolution bandwidth should be further reduced to minimize the display average noise level.
- h) Press **【Freq】** [Center Frequency] **【↑】** to change the center frequency. Repeat step h) to check the residual response of the frequency up to 6.5 GHz, record the measured maximum value in the corresponding test item with the preamplifier off of the Record Sheet of 4957B RF Analyzer.

16.2.11 Reference level

Description: The vertical scale position that has been calibrated on the instrument screen is used as the reference of amplitude measurement. The reference level usually refers to the top scale line. Reference level switching may cause a linkage of gain/attenuation. The error of reference level conversion is used to assess the switching gain error of the instrument.

Note: If the error is large when the power meter performs a measurement at -60 dBm, you can directly reduce the test result of -50 dBm by 10 dB, or connect a 10 dB attenuator that has been calibrated to the input port of the instrument for test.

16.2.11.1 Testing Equipment

Signal generator	1464A/1461
Power meter	ML2437A
Power probe	MA2445D
Power splitter.....	81313
Test cable and adapter	

16.2.11.2 Test steps

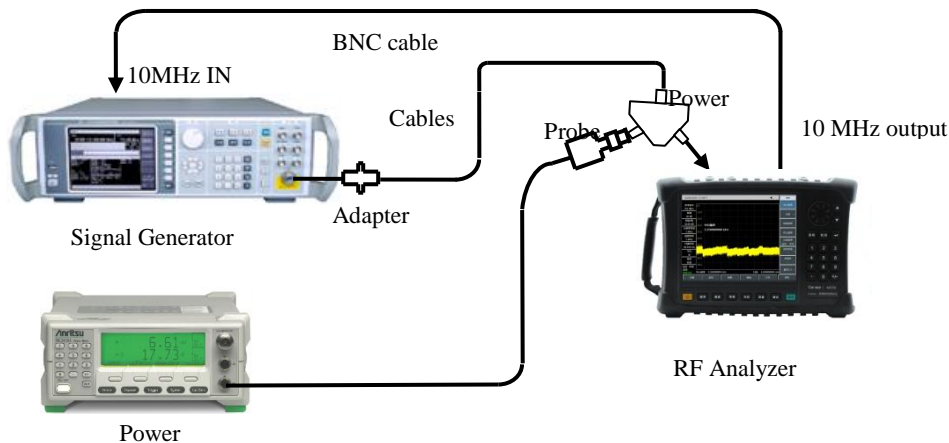


Figure 16-16 Settings for Test of Reference Level Uncertainty and Scale Fidelity

- a) Connect the power meter ML2437A to the power probe MA2445D, conduct zero calibration on them, and set the calibration factor frequency to 50 MHz.
- b) Connect the test equipment according to Figure 16-16. The instrument is used to provide

reference frequencies for the composite signal generator. The output ends of the signal generator are respectively connected to the instrument and the power probe via a power splitter.

- c) Set **【Amplitude】**[Ref Level] on the instrument with the knob or the step key **【↑】****【↓】**. If the maximum and minimum reference levels can be set to +30 dBm and -120 dBm respectively, the indicator of reference level range meets the requirement, and mark in the corresponding result of the Record Sheet of 4957B RF Analyzer as “√”, otherwise mark as “x”.
- d) Set the output frequency of the composite signal generator to 50 MHz and adjust the output power to make the power meter reading be -3 dBm ±0.05dB.
- e) Set the instrument as follows:

Center frequency 50 MHz
 Reference level 0 dBm
 Sweep width 1 kHz
 Logarithmic scale dB/div 1 dB
 Resolution Bandwidth 10 Hz

- f) On the instrument, press **【Peak】** **【Mkr】** [Delta mode].
- g) Adjust the output power of the signal generator to reduce the power meter reading by 10dB ±0.02dB.
- h) Set the reference level of the instrument to the reference level listed in the Record Sheet of 4957B RF Analyzer, wait until the sweep is completed and then press **【Peak】** .
- i) Record the difference marker amplitude reading of the instrument , make the following calculations (difference marker amplitude reading of the instrument – currently set reference level, and record the calculated value as the uncertainty of current reference level in the corresponding test item of the Record Sheet of 4957B RF Analyzer.
- j) Repeat steps g) through i) to set the residual reference levels listed in the corresponding test items of the Record Sheet of 4957B RF Analyzer.

16.2.12 Scale fidelity

Description: Scale fidelity is the error between the vertical scale and the theoretical value of the instrument screen, which is used to assess the linearity of the analog-to-digital converter of the instrument.

Test the fidelity at 10 dB/div, for which the resolution bandwidth is set to 10 Hz, and the initial amplitude of the input signal is set at the 0 dBm reference level. When the signal amplitude is reduced, compare the displayed signal amplitude with the reference level. The instrument provides a 10 MHz reference for the signal generator.

Note: If the error is large when the power meter performs a measurement at -60 dBm, you can directly reduce the test result of -50 dBm by 10dB, or connect a 10 dB attenuator that has been calibrated to the input port of the instrument for test.

16.2.12.1 Testing Equipment

Signal generator 1464A/1461
 Power meter ML2437A
 Power probe MA2445D
 Power splitter 81313

16.2.12.2 Test steps

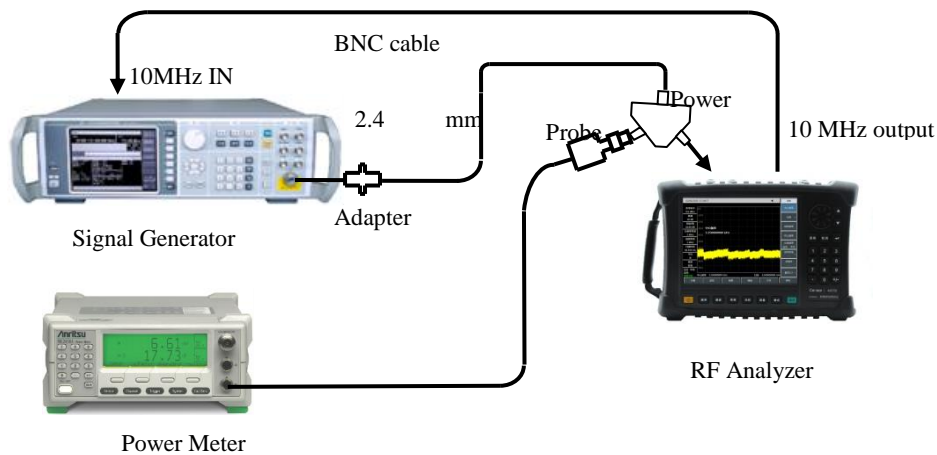


Figure 16-17 Scale fidelity

- a) Connect the power meter to the power probe and perform zero calibration; set the calibration factor frequency to 50 MHz.
- b) Connect the test equipment as shown in Figure 16-17. The instrument is used to provide reference frequencies for the composite signal generator. The output ends of the signal source are respectively connected to the instrument and the power probe via a power splitter.
- c) Set the RF analyzer as follows (other items remain the default settings of the system):

Center frequency.....	50 MHz
Reference level.....	0 dBm
Mkr	Off
Sweep width	1 kHz
Resolution Bandwidth.....	10 Hz

- d) Set the frequency of the signal generator to 50 MHz, the amplitude to 6 dBm, and the amplitude step to 0.05 dB.
- e) Press **【Peak】** on the instrument.
- f) Adjust the output amplitude of the signal generator until the power meter reads 0 dBm ± 0.05 dB.
- g) On the instrument, press **【Peak】 【Mkr】 [Delta Mode]**.
- h) Adjust the output signal amplitude of the signal emitter to reduce the power meter reading by 10 dB ± 0.05 dB.
- i) Make the following calculations (difference marker amplitude reading of the instrument - power variation value of the signal source), record the calculation data in the corresponding test item of the Record Sheet of 4957B RF Analyzer, and repeat steps h) to i).

16.2.13 Overall level uncertainty

Description: The overall level uncertainty means the difference between the power reading of the composite signal generator tested on the power meter and the reading of the signal generator tested on the instrument. Being affected by the front-end program-controlled step attenuator, this index is used to respectively test the amplitude accuracy index of each frequency point when the attenuation is set to different values and when the attenuation is 0 dB, so as to ensure the test comprehensiveness.

16.2.13.1 Testing Equipment

Composite Signal Generator.....	1464A/1461
Power meter	ML2437A
Power probe	MA2445D
Power splitter.....	81313
Test cable and adapter	

16.2.13.2 Test steps

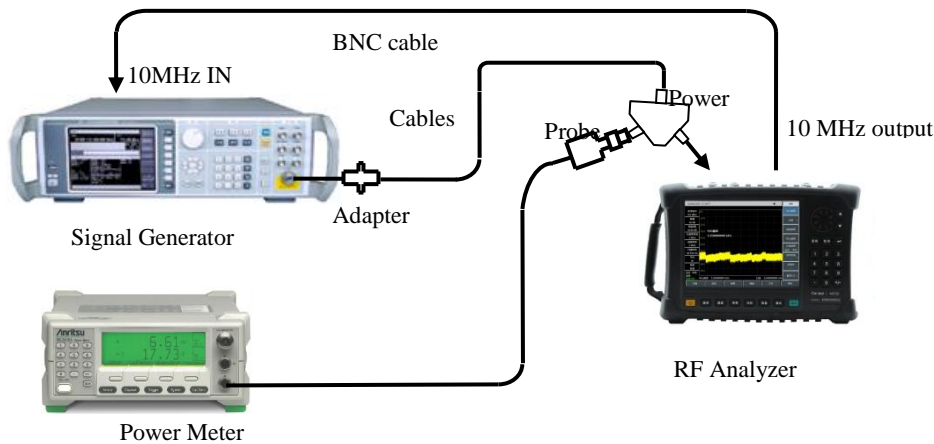


Figure 16-18 Test Settings for Overall Level Uncertainty

- Connect the power meter to the power probe, and conduct zero calibration on them.
- Connect the testing equipment as shown in Figure 16-18, and connect the SUM port of the power splitter, the port PORT1 and the port PORT2 to the radio frequency input port of the instrument and the power probe respectively.
- After resetting the signal generator, set the frequency to 10 MHz and amplitude to -15dBm.
- Set the instrument as follows:

Center frequency	10 MHz
Sweep width	100 KHz
Reference Level	-10 dBm
Attenuation	0 dB
Resolution bandwidth	1 kHz
Video bandwidth	100 Hz

- Adjust the output amplitude of the signal generator to make the power meter reading -25dBm.
- Set the marker of the instrument to the peak value, read the level value L indicated by the marker of the instrument and the test reading $L_{\text{功率计}}$ of the power meter, and calculate the overall level uncertainty ΔL as follows:

$$\Delta L = L - L_{\text{功率计}} \quad (8)$$

- Record the calculated ΔL in the Record Sheet of 4957B RF Analyzer as the test results of the overall level uncertainty.

- h) Repeat step f) to test the overall level uncertainty index when the attenuation value of the internal attenuator for the instrument is 10 dB and 20 dB.
- i) Set the reference level of the instrument to 20dBm, and change the output power level of the signal generator to make the power meter reading -5dBm.
- j) Repeat step f) to test the overall level uncertainty index when the attenuation value of the attenuator is 30 dB.
- k) Change the frequency settings of the signal generator, the power meter and the instrument according to the Record Sheet of 4957B RF Analyzer, and repeat steps e) to i) until the test for all attenuations at all frequency points is completed.

Overall level uncertainty (frequency response test)

- l) For the signal generator, set the frequency to 500 MHz and output power to -15dBm.
- m) Set the calibration factor frequency of the power meter to be the same as that of the signal generator, and adjust the output power level of the signal generator to make the power meter reading close to -25dBm.
- n) Set the center frequency of the instrument to 500 MHz, reference level to -10dBm, and attenuation to 0dB, and repeat step f).
- o) Change the frequency settings of the signal generator, the power meter, and the instrument according to the Record Sheet of 4957B RF Analyzer, and repeat steps k) ~ m) for the test of all frequency points with attenuation being reduced to 0dB.

16.2.14 Input attenuator

Description: The test switches uncertainty between the measured attenuations of the input attenuator range within all bands. The reference input to the composite signal generator is provided by the 10 MHz reference of the instrument. Switch the uncertainty by referring to the settings of the 0 dB attenuator.

16.2.14.1 Testing Equipment

Composite Signal Generator 1464A/1461
 Test cable and adapter

16.2.14.2 Test steps

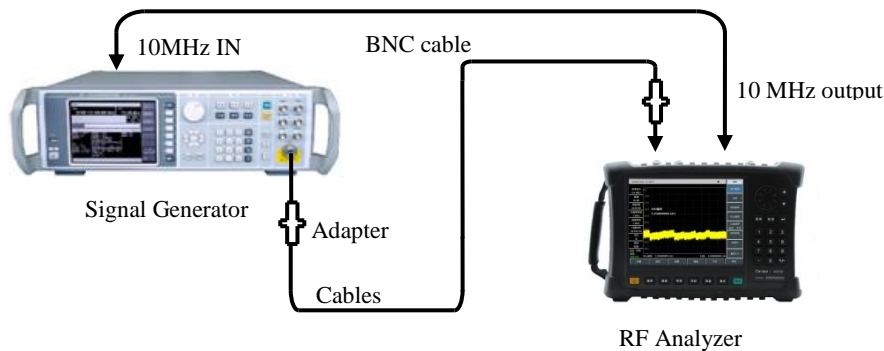


Figure 16-19 Settings for Test of Input Attenuator Conversion Uncertainty

- a) Connect the test equipment according to Figure 16-19, and the instrument is used to provide reference frequencies for the composite signal generator.
- b) Set the output power level of the signal generator to -13dBm and the output frequency to 50 MHz.

c) Press **【Reset】** on the instrument to set as the spectrum analysis mode, and set it as follows:

Center frequency..... 50 MHz
 Sweep width 1 kHz
 Reference Level -10 dBm
 Attenuation 0 dB
 Resolution Bandwidth..... 10 Hz

Wait for the new sweep to complete, press **【Mkr】**, [Peak], [Delta Mode], and take the attenuation value of 0dB for the attenuator as a reference.

d) Set the instrument, press **【Amplitude】** [Attenuation Auto Man], and set the attenuation value of the attenuator according to the test table.

e) After the sweep is completed, press **【Peak】**, the amplitude value of the current difference marker is the attenuator switching error.

f) Repeat steps e) ~ f) until the attenuation values of all the attenuators in the table have been tested, and record the test results in the Record Sheet of 4957B RF Analyzer.

16.2.15 Input voltage standing wave ratio test

Description: The radio frequency input voltage standing wave ratio reflects the impedance matching degree of the radio frequency receiving front end of the instrument. This indicator is mainly affected by adapters, cables, attenuators, etc. The attenuation value of the attenuator is required to be greater than or equal to 10dB during the test. The 4957B adopts the scheme of the sub-band switch combined with electronic attenuator. Different electronic attenuators are used in the frequency bands of 9 kHz ~ 5.2 GHz and 5.2 GHz ~ 6.5 GHz. In order to avoid influence between each other, the instrument shall be set to work in a suitable frequency range when testing the voltage standing wave ratio, so that only one attenuator works in the test frequency band.

16.2.15.1 Testing Equipment

Handheld antenna feeder tester 3680B

A set of 20201A calibration kit (including OPEN, SHORT and LOAD)

One piece of N-type calibration cable

16.2.15.2 Test steps

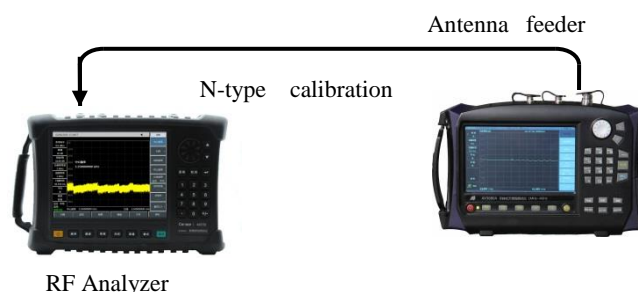


Figure 16-20 Input Port Voltage Standing Wave Test

a) Set the appropriate parameters such as the frequency range, the source output power, etc. of the antenna feeder tester, and select the VSWR display mode.

Perform single-port measurement calibration (including OPEN, SHORT and LOAD calibration) on the antenna feeder tester at the end of the calibration cable.

4957B RF Analyzer User Manuals

Technical indicators and testing methods

- b) After completing the calibration, remove the calibration kit from the end of the calibration cable and connect it to the spectrum radio frequency input port of the instrument, as shown in Figure 20.
- c) Press the **【Reset】** key on the instrument, wait for restart and enter the spectrum analysis and measurement interface, and set the frequency range of the complete machine to 10 MHz ~ 5.2 GHz and 5.2 GHz ~ 6.5 GHz respectively.
- d) Use the marker function to read out the maximum voltage standing wave ratio (VSWR) on the antenna feeder tester.
- e) Record the test result in the corresponding test item of *Record Sheet of 4957B RF Analyzer*.

Appendix A Performance and Property Inspection Results

Appendix A Record Sheet of 4957B RF Analyzer

Instrument No.: _____

Test Personnel: _____

Test Date: _____

Test Condition: _____

Record Sheet of 4957B RF Analyzer

No.	Item	Unit	Standard Requirement	Results
	Design and Structure		Structure: Handheld	
			Appearance color: Black	
			The complete machine features neat and beautiful appearance, clear text display on the panel, flexible key and knob operation, and convenient and reliable connection of the connectors, and free of obvious mechanical damage and stains	
	Function		Spectrum measurement function	
			Measurement function of power kit	
			Audio frequency demodulation function	
			IQ capture function	
			Vector network analysis and measurement function	
	Options		Cable and Antenna Analyzer	
			Vector voltmeter	
			USB Power Meter	
			IA	
			Analog demodulation analysis	
			Channel sweep	
			Field Strength Meter	
			GPS function	
			Safety option	
			Directional analysis	
			Signal analysis	
			Signal generation	
Vector network analysis performance indicator				
	Frequency range and accuracy		30kHz~6.5GHz	
			1GHz: 1GHz±1000Hz	
	Frequency resolution		2001MHz: 10	
	Power level	/	Large, small and manual setting	
	Port output power	dBm	Power range: -35 dBm ~ -5dBm(10 MHz~6.5 GHz)	
	Power level accuracy		100MHz	±2.5
			500MHz	±2.5
			1.5GHz	±2.5
			2.5GHz	±2.5
			3.5GHz	±2.5
			4.5GHz	±2.5
			5.5GHz	±2.5
			6.5GHz	±2.5

Record Sheet of 4957B RF Analyzer (continued 1)

No.	Item	Unit	Standard Requirement		Results
	Effective directivity		≥40	300kHz~6.5GHz	Test port 1
					Test port 2
	Effective source matching		≥33	300kHz~6.5GHz	Test port 1
					Test port 2
	Load matching		≥37	300kHz~6.5GHz	Test port 1
					Test port 2
	Reflected tracking		±0.06	300kHz~6.5GHz	Test port 1
					Test port 2
	Transmission tracking		±0.08	300kHz~6.5GHz	Test port 1
					Test port 2
	Dynamic range		≥95dB	300kHz~6.5GHz	Test port 1
					Test port 2
Spectrum analysis performance indicator					
	Frequency range		9kHz	9kHz±21Hz	
			6.5GHz	6.5GHz±21Hz	
	Frequency reading accuracy		1.0GHz(bandwidth 500kHz):	±11.10	
			1.0 GHz (bandwidth 50 MHz):	±1.03	
			1.0 GHz(bandwidth 500 MHz):	±10.30	
			3.0 GHz (bandwidth 500 kHz):	±12.70	
			3.0 GHz (bandwidth 50 MHz):	±1.03	
			3.0 GHz(bandwidth 500 MHz):	±10.30	
			4.5 GHz (bandwidth 500 kHz):	±13.90	
			4.5 GHz (bandwidth 50 MHz):	±1.03	
			4.5 GHz(bandwidth 500 MHz):	±10.30	
			6.0 GHz (bandwidth 500 kHz):	±15.10	
			6.0 GHz (bandwidth 50 MHz):	±1.03	
			6.0 GHz(bandwidth 500 MHz):	±10.30	
	Sweep width accuracy		1kHz	±2.0%	
			10kHz	±2.0%	
			100kHz	±2.0%	
			1MHz	±2.0%	
			10MHz	±2.0%	
			100MHz	±2.0%	
			1GHz	±2.0%	
	Swp Time	Range	10 μs ~ 600 s (zero sweep width)		
		Accuracy	1ms	±2.0%	
			10ms	±2.0%	
			100ms	±2.0%	
			1s	±2.0%	
			1s	±2.0%	

Record Sheet of 4957B RF Analyzer (continued 2)

Appendix A Performance and Property Inspection Results

No.	Item		Unit	Standard Requirement	Results
	RBW Accuracy		/	10MHz ±10.0%	
			/	3MHz ±10.0%	
			/	1MHz ±10.0%	
			/	300kHz ±10.0%	
			/	100kHz ±10.0%	
			/	30kHz ±10.0%	
			/	10kHz ±10.0%	
			/	3kHz ±10.0%	
			/	1kHz ±10.0%	
	Sideband noise (carrier frequency 1GHz)		dBc/Hz	+10kHz ≤-108	
				-10kHz ≤-108	
				+100kHz ≤-112	
				-100kHz ≤-112	
				+1MHz ≤-118	
				-1MHz ≤-118	
				+10MHz ≤-129	
				-10MHz ≤-129	
	Explicit average noise level		dBm	2 MHz ~ 10 MHz (Preamplifier On) ≤-150	
				10 MHz ~ 3 GHz (Preamplifier On) ≤-160	
				3 GHz ~ 6.5 GHz (Preamplifier On) ≤-157	
				2 MHz ~ 10 MHz (Preamplifier Off) ≤-135	
				10 MHz ~ 3 GHz (Preamplifier Off) ≤-140	
				3 GHz ~ 6.5 GHz (Preamplifier Off) ≤-138	
	Second harmonic distortion		dBc	0.9GHz <-65	
				2.5GHz <-65	
	Mirror, multiple and out-of-band responses	2GHz	dBc	Image frequency 2280.5 MHz <-65	
		3.5 GHz		Image frequency 3780.5 MHz <-65	
		5 GHz		Image frequency 5280.5 MHz <-65	
	Residual response		dBm	10 MHz ~ 6.5 GHz (Preamplifier On) ≤-95	
				10 MHz ~ 6.5 GHz (Preamplifier Off) ≤-82	
	Ref Level	Range	/	Logarithm scale: -120 dBm ~ +30 dBm, with step of 1 dB	
		Conversion error	/	0 dBm Reference	
			dB	-10 dBm ±1.20	
			dB	-20dBm ±1.20	
			dB	-30 dBm ±1.20	
			dB	-40 dBm ±1.20	
			dB	-50 dBm ±1.20	
			dB	-60 dBm ±1.20	

Record Sheet of 4957B RF Analyzer (continued 3)

No.	Item	Unit	Standard Requirement	Results	
	Scale fidelity	dB	-10dBm	±1.00	
			-20dBm	±1.00	
			-30dBm	±1.00	
			-40dBm	±1.00	
			-50dBm	±1.00	
			-60dBm	±1.00	
	Overall level uncertainty	dB	50 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			50 MHz (Attenuation 10 dB, input -25 dBm):	±1.80	
			50 MHz (Attenuation 20 dB, input -25 dBm):	±1.80	
			50 MHz (Attenuation 30 dB, input -5 dBm):	±1.80	
			2000 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			2000 MHz (Attenuation 10 dB, input -25 dBm):	±1.80	
			2000 MHz (Attenuation 20 dB, input -25 dBm):	±1.80	
			2000 MHz (Attenuation 30 dB, input -5 dBm):	±1.80	
			3000 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			3000 MHz (Attenuation 10 dB, input -25 dBm):	±1.80	
			3000 MHz (Attenuation 20 dB, input -25 dBm):	±1.80	
			3000 MHz (Attenuation 30 dB, input -5 dBm):	±1.80	
			4000 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			4000 MHz (Attenuation 10 dB, input -25 dBm):	±1.80	
			4000 MHz (Attenuation 20 dB, input -25 dBm):	±1.80	
			4000 MHz (Attenuation 30 dB, input -5 dBm):	±1.80	
			5000 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			5000 MHz (Attenuation 10 dB, input -25 dBm):	±1.80	
			5000 MHz (Attenuation 20 dB, input -25 dBm):	±1.80	
			5000 MHz (Attenuation 30 dB, input -5 dBm):	±1.80	
			6000 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			6000 MHz (Attenuation 10 dB, input -25 dBm):	±1.80	
			6000 MHz (Attenuation 20 dB, input -25 dBm):	±1.80	
			6000 MHz (Attenuation 30 dB, input -5 dBm):	±1.80	
			350 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			650 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			950 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			1250 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			1550 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			1850 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			2150 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
			2450 MHz (Attenuation 0 dB, input -25 dBm):	±1.80	
2750 MHz (Attenuation 0 dB, input -25 dBm):	±1.80				
3050 MHz (Attenuation 0 dB, input -25 dBm):	±1.80				
3350 MHz (Attenuation 0 dB, input -25 dBm):	±1.80				

Record Sheet of 4957B RF Analyzer (continued 4)

No.	Item	Unit	Standard Requirement	Results	
	Overall level uncertainty	dB	3650 MHz (Attenuation0 dB, input -25	±1.80	
			3850 MHz (Attenuation0 dB, input -25	±1.80	
			4150 MHz (Attenuation0 dB, input -25	±1.80	
			4450 MHz (Attenuation0 dB, input -25	±1.80	
			4750 MHz (Attenuation0 dB, input -25	±1.80	
			5050 MHz (Attenuation0 dB, input -25	±1.80	
			5350 MHz (Attenuation0 dB, input -25	±1.80	
			5650 MHz (Attenuation0 dB, input -25	±1.80	
			5850 MHz (Attenuation0 dB, input -25	±1.80	
			6150 MHz (Attenuation0 dB, input -25	±1.80	
			6450 MHz (Attenuation0 dB, input -25	±1.80	
Attenuator	Range	/	0 ~ 30 dB, with step of 5 dB		
			Attenuation0 dB	Reference	/
	Conversion uncertainty (50 MHz)	dB	Attenuation 5dB	±1.20	
		dB	Attenuation 10dB	±1.20	
		dB	Attenuation 15dB	±1.20	
		dB	Attenuation 20dB	±1.20	
		dB	Attenuation 25dB	±1.20	
		dB	Attenuation 30dB	±1.20	
	Conversion uncertainty (6 GHz)	/	Attenuation0 dB	Reference	/
		dB	Attenuation 5dB	±1.20	
		dB	Attenuation 10dB	±1.20	
		dB	Attenuation 15dB	±1.20	
		dB	Attenuation 20dB	±1.20	
		dB	Attenuation 25dB	±1.20	
		dB	Attenuation 30dB	±1.20	
	Input port voltage standing wave ratio	/	10 MHz ~ 6.5 GHz	≤2.00: 1	
	Maximum safe input level	/	+27dBm (continuous wave, input attenuator is		
	Scale display	/	0.1 ~ 10 dB per graduation, with minimum step of		
	VBW	/	Bandwidth range: 1 Hz~10 MHz (with step of 1-3)		
interface	RF interface	/	N type adapter (female)		
	Communication Interface	/	USB interface: Type A, two		
		/	USB interface: mini type, one		
		/	LAN Interface: RJ45 type		
	Frequency	/	Reference input/output, BNC		
	Other interface	/	GPS antenna interface: BNC		
/		External trigger input interface:			

4957B RF Analyzer User Manuals

Appendix A Performance and Property Inspection Results

Record Sheet of 4957B RF Analyzer (continued 5)

No.	Item	Unit	Standard Requirement	Results
	Safety	/	Dielectric Strength requires AC	
		/	Voltage 242 V, leakage current: ≤ 3.5 mA, 1min.	
			The insulation resistance between the power input end and the casing should not be less than 100 M Ω under	
		/	The insulation resistance between the power input end and the casing should not be less than 2 M Ω in humid environment.	
Remarks	1. “√” indicates normal function or meet the requirements; “X” indicates that the function is abnormal or does not meet the requirements; 2. “/” indicates that there is no such test item on this device.			
	Comprehensive judgment: Pass <input type="checkbox"/> Fail <input type="checkbox"/>			