

Document No.: AV2.602.1000SSCN Version No.

Technical status identification:

Confidential: Non-confidential

3943B Monitoring Receiver Operations Manual

Prepared by:

Reviewed by:

Standardized by:

Countersigned by:

Approved by:

Ceyear Technologies Co., Ltd.

April 2021



3943B Monitoring Receiver User's Manual



Ceyear Technologies Co., Ltd.

Foreword

Thanks for choosing the 3943B monitoring receiver developed and produced by Ceyear Technologies Co., Ltd.

We will spare no efforts to meet your requirements, provide you with high-quality measuring instruments, and offer you first-class after-sales service. We've always been devoted to offering "top-quality and thoughtful service", and providing satisfactory products and services is our commitment to users.

Manual No.

AV2.602.1000SS

Version

C.2 2021.04

Ceyear Technologies Co., Ltd.

Manual Authorization

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Product Warranty

The warranty period of the product is 18 months from the date of delivery. The instrument manufacturer will repair or replace the damaged parts according to the actual situation within the warranty period. For this purpose, the user shall return the product to the manufacturer and prepay the mailing fee. The manufacturer will return the fee to the user together with the

product after maintenance.

Product Quality Certification

This product is guaranteed to meet the specifications in this manual from the date of shipment. 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. has obtained the appropriate qualifications and passed the certification of ISO 9001 and 14001 management system.

Safety Precautions

Note

"Attention" indicates important prompts and no danger. It reminds the user of certain operation process, operation method or similar situation. 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 note conditions indicated.

Tip

"Tip" only indicates prompts. It reminds the user to pay attention to the instrument or certain operation process, operation method or the like.

The purpose is to guide the instrument operator to use the instrument correctly.

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1. Manual Navigation

This chapter describes the functions, chapter composition and main contents of the User Manual of 3943B Monitoring Receiver, and the instrument-related documents for the user.

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

1.1. About the Manual

In the manual, basic functions and operating methods of the 3943B monitoring receiver are introduced, including instrument characteristics, basic operating methods, measurement configuration operating manual, menus, remote control, maintenance, specifications and test methods to help you rapidly get familiar with and understand key points of the instrument operation method and use. Please read this manual carefully before operating the instrument so that you are familiar with it, and then operate it properly according to the instructions.

This manual contains the following chapters:

➤ **Overview**

It provides an overview of main performance features and typical application of 3943B monitoring receiver and safety guidelines for instrument operations. The purpose is to provide the user with an initial understanding of the main performance features of the instrument, and guide the user in the safe operation of the instrument.

➤ **Quick Start**

In this chapter, inspections before use, instrument navigation, basic measurement methods and data management of the 3943B monitoring receiver are explained to help users get to understand the instrument itself and measurement procedure and lay foundation for subsequent detailed introduction of the instrument measurement operating manual. ### This section contains some contents consistent with the relevant sections in Quick Start.

➤ **Operation Guide**

It introduces in details operation methods of basic scan functions of the 3943B monitoring receiver, including fixed frequency receiving, panoramic scan and list scan.

➤ **Menus**

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

➤ **Remote Control**

This chapter outlines the remote control method of instrument, so that the user can rapidly get to know how to remotely control the instrument. It is divided into four sections: the program control basics describe the concepts related to program control, software configuration, program-controlled port, SCPI commands, etc.; instrument port configuration method describes the connection and software configuration methods of the program-controlled port of 3943B monitoring receiver; basic programming method of VISA interface provides an example of basic programming with text illustration and example codes, so that the user can rapidly get to know the programming method; and I/O function library describes the basic concepts of the instrument drive.

➤ **Troubleshooting and Repair**

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

➤ **Technical Indicators and Testing Methods**

This chapter describes the characteristics and main specifications of 3943B monitoring receiver and recommended test instructions for users.

➤ **Appendix**

This chapter provides the necessary reference information for 3943B monitoring receiver, including

1.2 Related Documents

terminology, remote control commands index, error messages index, etc.

1.2 Related Documents

The documents related to 3943B monitoring receiver include:

- Quick Start
- User's Manual
- Program Control Manual

Quick Start

This manual introduces the instrument configuration and the basic measurement method, with the aim to enable users to quickly understand the characteristics of the instrument, master the basic settings and basic local and remote control operation methods. Main chapters include:

- Manual Navigation
- Get Prepared
- Typical Applications
- Get Help

User's Manual

This manual introduces the functions and operation methods of the instrument in detail, including configuration, measurement, program control, and maintenance, etc.. It aims to guide the user to comprehensively understand the functional characteristics of the product and common test 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
- Annexes

Program Control Manual

This manual introduces the remote programming fundamentals, SCPI fundamentals, SCPI commands, programming examples, I/O drive function library, etc. 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
- Annexes

2 Overview

In addition to main performance features and main applications of the 3943B monitoring receiver, this chapter also describes precautions for proper operation, electrical safety, etc. of the instrument.

- Product overview3
- Safe operating manual3

2.1 Product Overview

The 3943B monitoring receiver can cover a frequency range of 9kHz to 8GHz, with the maximum analysis bandwidth of 20MHz, the overall dimensions of 182.5mm×289mm×69mm, the weight of the complete machine of less than 3.5kg, and the 10.1-inch TFT and integrated touch screen. It possesses many functions, such as radio signal search, interception, measurement, analysis, demodulation, direction finding, positioning, etc. It is applicable to emission monitoring, coverage measurement, rapid detection and positioning of illegal emission sources/ interference sources, radio support for major activities and other fields in compliance with ITU specifications. The complete machine adopts the full touch screen design, the software supports the multi-touch interactive mode, which completely applies the touch operation experience of smart phones to the monitoring receiver equipment.

2.2 Safe operating manual

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. We will not take any responsibility for any misuse or inconsistency as required, and you are liable for any risks incurred by. **Therefore, please follow the safety instructions to prevent from personal injury or property damage.** Please keep product documentation safe and delivery them to end users.

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- Maintenance6
- Battery and power supply module6
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- Waste disposal/ environment protection7

2.2.1 Safety Marks

2.2.1.1 Product-related Marks

Safety warning signs on products are shown in Table 2.1 below:

Table 2.1 Products safety marks

Symbol	Meaning	Symbol	Meaning
	Caution, reminding users of information to be paid special attention to.	○	Turn On/Off the power

2.2 Safe operating manual

	It reminds users of the operation information or instructions to be paid attention to.		
	Note, handling heavy equipment.		Standby indication
	Danger! Hazard of electric shock.		Direct current (DC)
	Warning! Hot surface.		Alternating current (AC)
	Protective conductive end		Direct/alternating current (DC/AC)
	Ground		Reinforced insulation protection of the instrument
	Ground terminal		EU symbol for batteries and cells Please refer paragraph 1 of "2.2.8 Waster Disposal/Environmental Protection" in this section for specific instructions.
	Caution, handle classical sensitive devices with care.		EU symbol for electronic devices separate collected Please refer paragraph 2 of "2.2.8 Waster Disposal/Environmental Protection" in this section for specific instructions.
	Warning! Radiation. For details, refer to Item 7 of "2.2.4 Operation Precautions" in this section.		

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.

Note

Note mark, indicating some important information which will not cause danger.

Tip

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 operating environment of 3943B monitoring receiver shall meet the following requirements: stable placement of the instrument. The instrument should be operated and transported at places with an altitude no higher than 4,600m. The actual power supply voltage is allowed to vary within $\pm 10\%$ of the specified voltage, and the power supply frequency is allowed to vary within $\pm 5\%$ of the specified frequency.
- 2) The instrument is not allowed to be placed on a wet surface, vehicle, cabinet, table and other objects which are not fixed and do not conform to the load conditions. 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 on the surface of a heat-dissipating object (e.g., a radiator). The operating 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.

2.2.3 Electrical Safety

Precautions for electrical safety of the instrument:

- 1) Before the instrument is powered on, the actual supply voltage should match the supply voltage marked on the instrument.
- 2) 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.
- 3) 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.
- 4) Keep the socket clean and tidy, and ensure the plug and the socket in good contact and reliable engagement.
- 5) Neither the socket nor the power cord can be overloaded, otherwise fire or electric shock will be caused.
- 6) In order to avoid damage to the instrument during the test in a circuit with a voltage $V_{rms} > 30\text{ V}$, appropriate protective measures shall be taken (for example: using suitable test instrument, installing fuse, limiting current value, conducting electrical isolation and insulation, etc.).
- 7) 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.
- 8) 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.
- 9) Take appropriate overload protections to prevent overload voltage (caused by lightning, for instance) from damaging the instrument or causing personal injury.
- 10) Do not place any objects other than the internal objects of the instrument in the shell when the instrument shell is opened, otherwise, it may cause short circuit, instrument damages and even personal injuries.

2.2 Safe operating manual

- 11) It is strictly forbidden to insert any objects into the instrument through the openings on the instrument shell, or shield the notches or openings on the instrument, as their function is to ventilate the instrument and prevent the instrument from overheating.
- 12) 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.
- 13) Do not place the instrument in an environment where fog is easily formed, for example, moving the instrument in a 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) Refer to the relevant requirements in “2.2.7 Transportation” in this section before handling or transporting the instrument.
- 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) Refer to relevant requirements in “2.2.8 Waste disposal/ environmental protection” of this section before removing and disposal of the instrument.
- 5) RF instruments 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.

2.2.5 Maintenance

- 1) The instrument must be opened by an authorized operator who has received special technical training. 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 and Power Modules

Please read the relevant information carefully before using batteries and power modules to avoid explosion, fire or even personal injury. The precautions regarding the use of batteries are as follows.

- 1) Do not damage the battery.
- 2) Do not expose the battery and power supply module to heat sources such as open flame; store them out of direct sunlight and keep them clean and dry; and use a clean and dry soft cotton cloth to clean the connection ports of the battery or power supply module.
- 3) Do not short-circuit the battery or power supply module. Do not store multiple batteries or power modules in a cardboard box or drawer because contact with each other or other conductors may cause a short circuit; and do not remove the original packaging before using the batteries and power modules.
- 4) The batteries and power modules shall be kept from mechanical shock.
- 5) If there are battery liquid leaks, keep your skin and eyes away from the leaks, and if it fails, please flush with plenty of water and seek medical care.
- 6) Please use the manufacturer's standard battery and power module. Any improper replacement and charging of alkaline batteries (e.g. lithium batteries) are likely to cause an explosion.

2.2 Safe operating manual

- 7) Discarded batteries and power modules shall be recycled and disposed of separately from other wastes. Because there are toxic substances inside the batteries, they shall be reasonably discarded or recycled according to local regulations.

2.2.7 Transportation

- 1) 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 Waster 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.

3.1 Get Prepared

3 Quick Start

This chapter introduces the operation precautions, description of front and rear panels and interfaces, basic measurement methods, data file management, etc. of the 3943B monitoring receiver. It is aimed to enable the user initially understand the instrument itself and the measurement process. This section contains some contents consistent with the relevant sections in Quick Start.

- Preparation before operation.....8
- Description of front and rear panels and interfaces.....18
- Basic measurement methods.....24
- Data management.....26

3.1 Get Prepared

- Preparation before operation.....8
- Precautions before power on.....11
- Battery use instructions.....13
- Startup, shutdown and screen off.....14
- Proper use of connector.....15
- Routine maintenance.....17

3.1.1 Preparations before Operation

This chapter introduces the precautions for initial setting and operation of the 3943B monitoring receiver.



Prevent personal injuries and instrument damages.

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. If the product is under warranty, we will no longer provide free maintenance.
- Carefully read the related content in "2.2 Safe use guide" of this manual, and the following operating safety precautions, and also pay attention to the specific operating environment requirements involved in the technical indicators.



Electrostatic protection

Take electrostatic protection measures at workplaces to avoid any damage caused by the instrument.

Note

Please note following condition when operating the instrument:

Improper operating or measuring position can damage the instrument or the one connected to it. Please note following conditions when the instrument is electrified:

- Keep the instrument dry.
- Reasonably arrange the instrument.
- The ambient temperature should meet the requirements in the technical indicators.
- The input signal power of the port is within the specified range.
- The signal input interface should be properly connected to avoid overload.

Tip

Influence of electromagnetic interference (EMI)

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

- Select proper shield cables. For example, to use the double-shielded RF/network connection cable;
- Always open and close the cable connection port which is not used temporarily.
- Please refer to the electromagnetic compatibility (EMC) level marking in the technical indicators.

1) Unpacking inspection

Step 1 Check whether the outer packing box and shockproof package are damaged. In case of any damage, keep the outer package for future use. Inspect continuously according to the following steps.

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

Step 3 Carefully check the above articles according to Table 3.1.

Step 4 In case of any outer package damage, or damage or problem to the instrument or articles provided in the package, never power the instrument on or start it up! Please contact our company's service consultation center through the service consultation hotline in the manual, and we will provide the repair or replacement service quickly according to the situation.

Table 3.1 List of Accompanying Articles of 3943B

Name	Quantity	Function
Main unit		
3943B	1	—
Standard configuration		
Power Adapter	1	—
3-core power cord	1	—
Built-in rechargeable lithium-ion battery	1	—
User's Manual	1	—
Program Control Manual	1	—
Packing list	1	—
Options		

3.1 Get Prepared

Depend on users' options	—	—
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2) Operating environment requirements

The 3943B monitoring receiver should be operated at places conforming to the requirements in Table 3.2:

Table 3.2 Operating Environment Requirements of 3943B

Temperature	0°C -50°C
Humidity	When the temperature is lower than 10°C, the humidity is not controlled When the temperature is 10°C~30°C, the relative humidity is (5~95)% When the temperature is 30°C~40°C, the relative humidity is (5~75)% When the temperature is above 40°C, the relative humidity is (5~45)%
Elevation	0 -4,600 m

Note

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

3) Instrument operation mode

The 3943B monitoring receiver is designed for both indoor fixed operation and outdoor hand-held operation. In any case, the instrument can be set to the best condition, and the display is in the best observation angle.

When used as a desktop instrument, the 3943B monitoring receiver can be placed on a desktop or a fixed bracket to obtain the best observation angle.



Fig. 3.1 3943B on Fixed Support

In case of the hand-held operation, it is recommended to use the accompanying hand strap for operation in front of chest, so as to obtain the optimal operation and viewing angle.



Fig. 3.2 Hand Strap of 3943B

4) 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. In order to ensure the user safety, the ground isolation resistance of anti-static components must be $1M\Omega$ at least.

Correctly take the following antistatic measures to techniques to reduce electrostatic damages:

- Ensure that all instruments are properly grounded to prevent generation of static electricity.
- Before connecting the coaxial cable to the instrument, the inner and outer conductors of the cable shall be respectively in contact with the ground for a short time.
- 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 anti-static measures shall not be adopted in situations where the voltage exceeds 500V.

3.1.2 Precautions before energization

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

1) Power supply requirements

The 3943B monitoring receiver has two power supply modes, namely, battery or power adapter.

The 3943B monitoring receiver can be powered in two ways:

a) Power adapter

When using the AC power supply, the accompanying AC-DC adapter must be adopted. The adapter input is 220V/50Hz AC. In order to prevent mutual interference of power supplies of various devices, especially the receiver hardware damage caused by spike pulse interference of high-power equipment, it is recommended to use the 220VAC stabilized power supply to power on the receiver.

Table 3.3 lists the requirements for external power supply during the normal operation of adapter

Table 3.3 Requirements of Operating Power Supply Parameters of Adapter of 3943B

3.1 Get Prepared

Power supply parameter	Applications
Input voltage	100~240VAC
Operating frequency	50-60Hz
Input current	≥1.7A

b) built-in battery

The rechargeable lithium batteries are used as the built-in battery pack. Table 3.4 lists the main performance indexes of the built-in battery pack:

Table 3.4 Performance Indexes of Batteries of 3943B

Power supply parameter	Performance index
Nominal voltage	14.8V
Nominal capacity	6200mAh
Operating time	≥3h

 **Warning**

The rechargeable battery cannot be exposed to fire or high temperature environment, and must be kept away from children. If the battery is improperly placed, it may cause an explosion. The rechargeable battery can be reused and placed in a suitable container to avoid short circuit of the battery.

If the instrument is not used for a long time, please take out the battery and place it in a cool, dry and well-ventilated area. The battery stored for more than half a year should be additionally charged.

2) Confirm and connect the power cord

The 3943B monitoring receiver adopts three-core power line interface and conforms to national safety standards. Before the monitoring receiver is energized, you must confirm that the protective earth wire in the power line of the monitoring receiver is **reliably grounded**. Floating grounding or poor grounding may cause damage to the instrument and even injury to the operator. 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.

When connecting the instrument to the power supply:

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

Step 2. Use the power line to connect the power supply plug of the instrument rear panel to a well-grounded three-core power socket.

 **Warning**

Grounding

Poor or wrong grounding may cause damage of the instrument or personal injury. Before the monitoring receiver is energized, make sure that the earth wire is in good contact with the earth 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 autotransformer is necessary, you need to connect the common terminal to the protective earth wire of the power connector.

3.1.3 Battery use instructions

1) Battery installation and replacement

The 3943B monitoring receiver is equipped with a large-capacity rechargeable lithium-ion battery, which can last for more than 3 hours. In order to facilitate long-term field test and avoid test interruption caused by insufficient battery power, users can also purchase spare batteries, and it is recommended to purchase batteries of the same type as accompanying batteries.

Note

In order to ensure the battery life, the battery should be taken out of the battery compartment during transportation and long-term storage, and the battery capacity should not be less than 5% as far as possible, otherwise the battery may not be rechargeable.

The battery insertion port of 3943B monitoring receiver is located at the lower left side of the instrument. When disassembling and assembling the battery, place the instrument stably, push up the battery cover, remove the battery cover, and then insert or remove the battery.



Fig. 3.3 Opening of Battery Cover



Fig. 3.4 Battery Installation

2) Checking battery status

The user can check the battery status in any of the following ways:

- Check the battery icon on the status bar of the system to roughly check the battery charge. When the battery icon indicates that the battery power is only 15%, please replace or charge the battery in time.
- Remove the battery, and press the green button in the middle of the batter to light up the indicator

3.1 Get Prepared

light above the button, so as to indicate the current remaining battery power. Please charge the battery in time when only one indicator light is on.

3) Battery charging

The battery can be charged when the 3943B monitoring receiver is shut down or in operation. Charging steps are as follows:

- a) First, place the battery to be charged in the instrument.
- b) Use the accompanying AC-DC adapter to connect the external power supply.
- c) If the battery is charged when the instrument is turned off, the power indicator light in the upper right corner of the front panel of the instrument is yellow and flashing, indicating that the battery is being charged, and the indicator light is yellow and normally on after charging. If the battery is charged when the instrument is turned on, the power indicator light is green and flashing, indicating that the battery is being charged, and the indicator light is green and normally on after charging. At this time, the battery icon on the right side of the system status bar of the instrument display screen shows that the battery is full.

In addition, for the battery with the battery power of >5%, it takes about 3 hours to fully charge the battery when the instrument is turned off.

4) Other precautions

- When the instrument is not used for a long time, the battery should be removed and stored separately, and the battery should be discharged and charged once every three months. Please ensure that the battery power is 60%~70% during storage to ensure the battery life.
- When the adapter is no longer in use, do not connect it to the power supply.
- Do not charge the battery with a charger that is not specified and has no safety certification. Do not charge the battery for more than 24 hours. Overcharging will shorten the battery life.
- If the battery is not used after being fully charged, it will discharge itself after a long time. The battery should be charged when needed.
- If the battery is odoriferous, discolored, deformed or abnormal during storage, charging or storage, please stop using the battery.
- Do not short-circuit the positive and negative poles of the battery, and do not damp the battery to avoid dangers.
- Do not drop the battery, cut off the battery or try to remove the battery.
- Properly recycle or dispose the battery. Do not throw the battery in the garbage dump.
- Don't throw the battery into the fire.

3.1.4 Startup, shutdown and screen off

The startup, shutdown and screen off methods and precautions of the instrument are as follows:

1) Start up

Before the initial energization, please confirm the power supply parameters and power line. For details, please refer to the "precautions before energization" in 3.1.2 of this manual.

Step 1. Connect the power supply of the adapter or install the battery with the battery power of more than 15%.

Step 2. Turn on the side power switch, as shown in Fig. 3.5. Do not connect any device to the monitoring receiver before startup. Start the instrument under normal conditions. Press and hold the power switch in the lower left corner of the side panel for about 3s, and the power indicator light will turn green. Release the switch key and the boot interface will appear. After executing a series of self-inspection procedures, start running the main measurement program.



Fig. 3.5 Power Switch on Side Panel

Tip

When the 943B monitoring receiver is started, all settings of the last shutdown will be restored.

2) Shutdown

Step 1. Press and hold the power switch key in the lower middle of the side panel for about 3s, and the shutdown interface will pop up. Select shutdown, and then the instrument will enter into the shutdown process (the software and the hardware need to be processed before power off). After more than 10s, the instrument will be shut down, and then the color of the power indicator light on the upper right of the front panel will change from green to yellow.

3) Screen off

When users do not need to operate the instrument or view the test results for a long time, they can choose to turn off the screen display, so as to reduce the power consumption of the complete machine and extend the service life of battery power. This operation is similar to devices, such as smart phone or PAD.

Step 1. Press the power switch key in the lower middle of the side panel, release it immediately, and the screen display of the instrument will be turned off. Perform the same operation again, and the screen display of the instrument will be turned on.

Note**Power cut of the instrument**

When the instrument is in normal working state, it can be shut down by the power switch on the side panel. If there is a problem with the instrument, press and hold the switch button for approximately 10s to perform a forced shutdown. In case of an emergency, in order to avoid personal injuries, you can unplug the power adapter or remove the battery to forcibly cut off power. Therefore, sufficient operating space should be reserved when operating the instrument to facilitate direct shutdown when necessary.

3.1.5 Correct Use of connectors

Connectors are commonly used in various tests of the monitoring receiver, and the precautions for the use of connector are as follows:

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:

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

3.1 Get Prepared

⚠ Caution

Check the connector to prevent damaging ports of the instrument

Any damaged connector may damage the good connector connected to it even in the first connection. In order to protect each interface of the monitoring receiver, the connector must be checked before the 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:

Step 1. As shown in Fig. 3.6, align the axes of the two interconnected devices to ensure that the pin of the male connector slide concentrically into the jack of the female connector.



Fig. 3.6 Diagram of Connector Connection

Step 2. As shown in Fig. 3.7, horizontally move two connectors to make them connected smoothly. Tighten the connector nut through rotation (do not rotate the connector). Avoid relative rotation of connectors during connection.

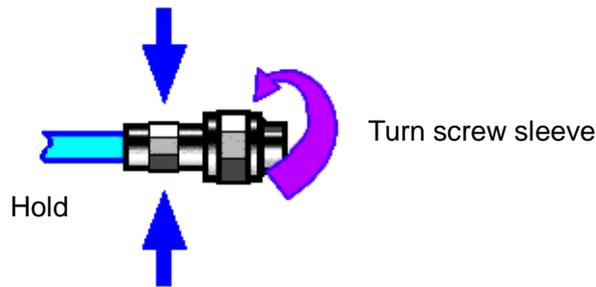


Fig. 3.7 Diagram of Connector Rotation

Step 3. As shown in Fig. 3.8, complete the final connection by tightening with the torque wrench. Note that the torque wrench must not be beyond the initial break point. Use the auxiliary wrench to prevent the connector s from rotation.

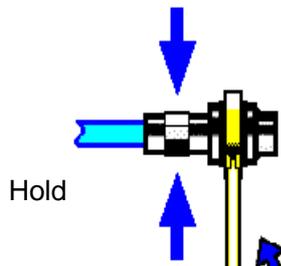


Fig. 3.8 Diagram of Wrench Operation

3) Disconnection

Step 1. Support the connectors to prevent any connector from being twisted, shaken or bent;

Step 2. An open-ended wrench can be used to prevent the connector body from rotating;

Step 3. Loosen the screw sleeve of the connector with another wrench;

Step 4. Rotate the threaded sleeve of the connector by hand to complete the final disconnection;

Step 5. Pull the two connectors straight apart.

4) Usage of a torque wrench

The use method of the torque wrench is shown in Fig. 3.9. The precautions for use are as follows:

- 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;
- Gently grasp the end of the torque wrench handle and apply force in the direction perpendicular to the handle until the bending point of the wrench is reached.

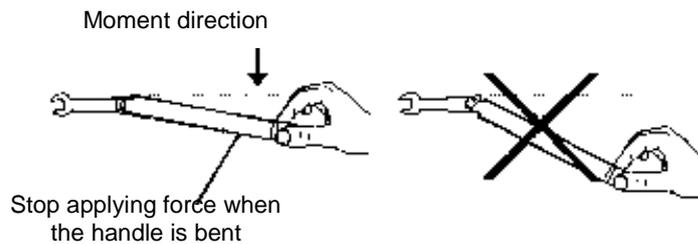


Figure 3.9. Usage of a torque wrench

3.1.6 Routine Maintenance

This section describes the routine maintenance method of the 3943B monitoring receiver.

3.1.6.1 Cleaning

1) Cleaning instrument surface

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

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

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

Step 3. Do not use chemical cleaners, such as alcohol, acetone or dilutable cleaners.

2) Cleaning LCD display

Clean the display LCD monitor after a period of use. Please follow the steps below:

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

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

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

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

Note

Display cleaning

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

3.2 Description of front and rear panels and interfaces

3.1.6.2 Test Port Maintenance

The top panel of 3943B monitoring receiver has multiple test ports. If the connection is damaged or there is dust inside it, RF band test result may be affected. Therefore, such connector should be maintained as follows:

- Keep the connector far away from dust and keep it clean.
- Do not directly contact the connector surface to prevent the electrostatic leakage (ESD).
- Do not use any damaged connector.
- Please use the air blower to clean the connector, and do not adopt the sandpaper and other tools to grind the connector surface.

Note

Port impedance matching

The radio frequency input port on the top panel of the 3943B monitoring receiver is a 50Ω connector. If the impedance connector is not matched, the test result will be affected.

3.2 Description of front and rear panels and interfaces

This section introduces the elements and functions of the front panel operation interface of 3943B monitoring receiver, and the types and functions of the interfaces.

- Description of front panel.....18
- Description of side panel interface.....21
- Description of top panel interface.....23

3.2.1 Front Panel

The 3943B monitoring receiver is designed with a 10.1-inch color touch screen. The parameter setting and information display of the instrument can be realized by one touch of a finger, which eliminates the tedious steps of setting soft and hard key menus and greatly simplifies the user's operation. The front panel of 3943B is shown in Fig. 3.10.

3.2 Description of front and rear panels and interfaces



Fig. 3.10 Front Panel of 3943B Monitoring Receiver

- | | |
|--------------------------------------|--------------------------------------|
| 1. Status information display area | 4. Measurement result display area 2 |
| 2. Menu functional area | 5. Measurement result display area 3 |
| 3. Measurement result display area 1 | 6. Function setting area |

1) Status information display area

The top information display area is on the top of the front panel. The model and name of the complete machine are displayed in the upper left corner, and the indicator light in the upper right corner indicates the current status of the instrument. When the instrument is turned off, the adapter is connected, and when there is no battery or the battery power is 100%, the indicator light is orange and normally on. When the battery is charged, the indicator light flashes orange and yellow. When the instrument is turned on, the adapter is connected, and when there is no battery or the battery power is 100%, the indicator light is green and normally on. When the battery is charged, the indicator light flashes green.

The LCD area displays the power identification, system date and time successively from left to right.

The power identification indicates different signs depending on whether there is an external power supply and the amount of battery power. The corresponding signs under different power supply conditions are described as follows:

- When the receiver is powered by an external power supply without a battery installed, it is displayed as ;
- When the receiver is installed with the battery of and the external power adapter is not connected, the icon is shown as . As the battery power decreases gradually due to consumption, the green area of the power display will gradually decrease;
- When the receiver is equipped with a battery and connected with an external power adapter, and when the battery power is less than 100%, the battery is in a charging state, and the charging icon is ;
- When the receiver is not connected to an external power supply and the power is less than 20%, the

3.2 Description of front and rear panels and interfaces

battery is in an undervoltage state, and the icon is shown as . When such an icon appears, please charge the battery in time.

Setting and modification of system date and time: set by pressing  → [setting] → [general setting] → [date/time setting] in the lower left corner.

2) Menu functional area

Menu functional area buttons are used for setting common functions, as shown in Table 3.6.

Table 3.6 Description of Menu Functional Area

Key name	Functional description
Demodulation bandwidth	Set the demodulation bandwidth, which can be set as 100Hz, 150Hz, 300Hz, 600Hz, 1kHz, 1.5kHz, 2.1kHz, 2.4kHz, 2.7kHz, 3.1kHz, 4kHz, 4.8kHz, 6kHz, 9kHz, 12kHz, 15kHz, 30kHz, 50kHz, 120kHz, 150kHz, 250kHz, 300kHz, 500kHz, 800kHz, 1MHz, 1.25MHz, 1.5MHz, 2MHz, 5MHz, 8MHz, 10MHz and 20MHz.
Demodulation mode	Set the demodulation mode, which can be set as AM, FM, I/Q, PULSE, LSB, USB, CW and ISB.
Detector Mode	Maximum peak value, mean value, power and sampling.
Attenuation control	Set the attenuator state, turn on and off or automatically control the attenuator.
Gain control	Set the gain control status, manually set the gain or automatically control the gain according to the signal.
Squelch level	Set the squelch level, which only works when squelch is turned on.
Howling	Set the howling switch. When the howling is on, you can set the level value to adjust the tone.
Audio switch	Set the demodulating sound switch.
Screen lock	Lock the screen to prevent misoperations.
Reset	Factory reset, reset before shutdown, user reset and other operations.
Screenshot	Save the screen measurement results as pictures in .png format.

3) Measurement result display area 1

In the current setting state, the measurement result of level field strength is displayed in display area 1.

4) Measurement result display area 2

In the current setting state, the intermediate frequency panoramic measurement results are displayed in display area 2.

5) Measurement result display area 3

In the current setting state, the measurement results of the intermediate frequency waterfall are displayed in display area 3.

The display contents of the above three windows can be switched among level field strength, intermediate frequency panorama, intermediate frequency waterfall, radio frequency panorama and radio frequency waterfall, or two windows can be selected for display, which can be switched by [Parameter] → [Window Selection], as shown in Fig. 3.11.

3.2 Description of front and rear panels and interfaces



Fig. 3.11 Diagram of Window Selection

6) Function setting area

Press the function button  to pop up the function menu, including scan, setting, listing, recording, and others, as shown in Fig. 3.12.

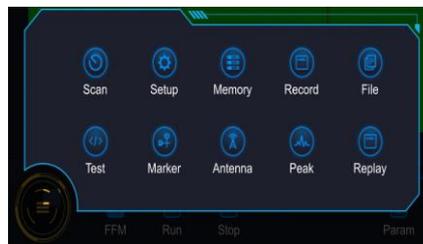


Fig. 3.12 Function Menu

Other setup buttons are mode related, such as fixed frequency receiving mode, including running, stopping, parameters, etc. Please refer to "5 Menu" in this manual for specific function description.

3.2.2 Description of side panel interfaces

This section introduces the interfaces and functions of the side panel of 3943B monitoring receiver, and the side panel is shown in Fig. 3.13.

3.2 Description of front and rear panels and interfaces

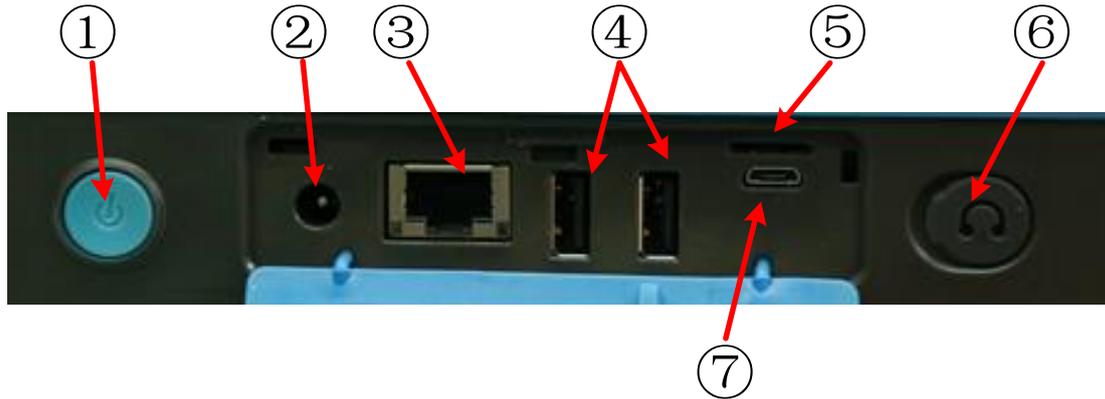


Fig. 3.13 Side Panel of 3943B

- | | | |
|--------------------|-----------------------|------------------------|
| 1. Power switch | 4. USB interface | 7. Micro USB interface |
| 2. power interface | 5. SD card interface | |
| 3. LAN interface | 6. Earphone interface | |

1) Power switch

It is used to start, close the screen and shut down the instrument. In case of startup, press and hold the switch button for a short time to realize the function of turning off the display power supply, which is used for the case of no operation for a long time and no need for measurement result observation, so as to reduce the power consumption of the complete machine and extend the standby time of battery power supply. Press and hold the switch button for a long time to prop up the shutdown/ restart menu for the user to choose.

2) Power interface

It is used for external DC power input. The DC output of AC-DC adapter or DC power supply is adopted to power the receiver. The inner conductor of the external power interface is positive and the outer conductor is grounded.

3) LAN interface

It is the RJ45, TCP/IP and 10/100/1,000M adaptive interface, which can be used for remote operations of the receiver.

4) USB interface

The 3943B monitoring receiver provides two standard A type USB2.0 interfaces, which can be used to connect peripherals of USB interface type, such as USB storage device.

5) SD card interface

The 3943B monitoring receiver provides a Micro SD card interface for storing measurement data, map data or other user setting information.

6) Earphone interface

The 3943B monitoring receiver provides a 3.5mm/3-wire standard earphone interface for analog demodulation and playback sound output. When the interface is not connected with a headphone, the sound is output by the speaker of the receiver. When the earphone is connected, the sound output is automatically switched to the earphone by the speaker.

7) Micro USB interface

The 3943B monitoring receiver provides a standard Micro USB interface, which is linked to external computer equipment.

3.2.3 Description of top panel interface

This section introduces the interfaces and functions of the top panel of 3943B monitoring receiver, and the top panel is shown in Fig. 3.14.

3.2 Description of front and rear panels and interfaces

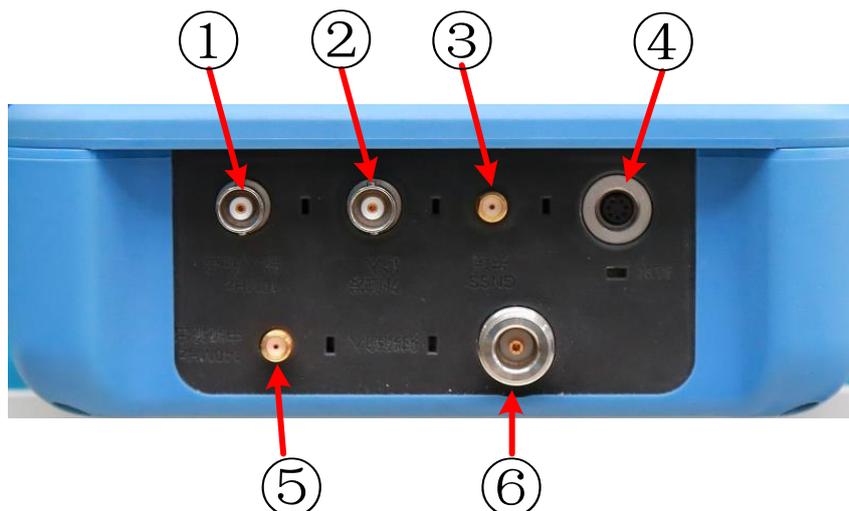


Fig. 3.14 Top Panel of 3943B

- | | | |
|---------------------------|---|-------------|
| 1. 10MHz input/output | 4. AUX interface | 6. RF input |
| 2. External trigger input | 5. 140MHz intermediate frequency output | |
| 3. GNSS antenna | | |

1) 10MHz input/output

The 10MHz signal of other equipment can be externally connected as the reference signal of the receiver. The 10MHz reference signal output function in the receiver is temporarily not supported.

2) External trigger input

The 3943B monitoring receiver can be set to the external trigger mode. The external trigger source is connected to the trigger input port of the receiver, and the output range of the source should be -5V~+5V. It can be set by the program whether it is triggered by rising edge or falling edge.

3) GNSS antenna

It is the antenna equipment connected with GNSS, which can be used to locate and time the current position of the receiver.

4) AUX interface

It is the communication interface between receiver and external devices such as antenna, and the pins of AUX interface are defined as follows.

Table 3.7 Definitions of AUX Interface Pins

Pin	1	2	3	4	5	6	7
Function	5V output Maximum 500mA	I/O	I/O	Grounding	Serial port TXD	Serial port RXD	Antenna trigger input
Direction	Output	In/out	In/out	--	Output	Input	Input

5) 140MHz intermediate frequency output

It can provide intermediate frequency signal output through software configuration for external equipment.

6) RF input

It is used for the input of the measured signal.

3.3 Basic measurement methods

3.3 Basic measurement methods

➤ Basic operation examples24

3.3.1 Basic operation examples

This section introduces details steps of common and important basic settings and functions of the 3943B monitoring receiver with examples to help the user rapidly know the characteristics of the instrument and understand basic measurement methods.

3.3.2.1 Measurement of sinusoidal signal

The most common measurement task of the monitoring receiver is to determine level and frequency of a signal. In this section, the output signal of the synthetic signal generator is used as an input to introduce how to measure a simple sine wave signal. For example, in order to measure the sinusoidal signal at 1GHz, the following steps can be performed:

- 1) Connect the synthetic signal generator and the 3943B monitoring receiver according to Fig. 3.15.



Fig. 3.15 Schematic Diagram of Sinusoidal Signal Connection for Measurement

- 2) Set the parameters of the signal generator. Set the output frequency of the signal generator to 1GHz and the output power to -30dBm. Connect the output port of the signal generator with the input port of the test receiver by cables, and turn off the RF output of the signal generator.

- 3) Set the center frequency of the test receiver. Select the spectrogram window and set the center frequency of 1GHz, the bandwidth of 20MHz and the resolution of 12.5kHz. At this time, the level and frequency offset values can be observed in the level field strength window. If the antenna is connected and the corresponding antenna factor is introduced, the field strength value can also be obtained. The 1GHz signal spectrum should be observed in the intermediate frequency panoramic window, as shown in Fig. 3.16.

3.3 Basic measurement methods

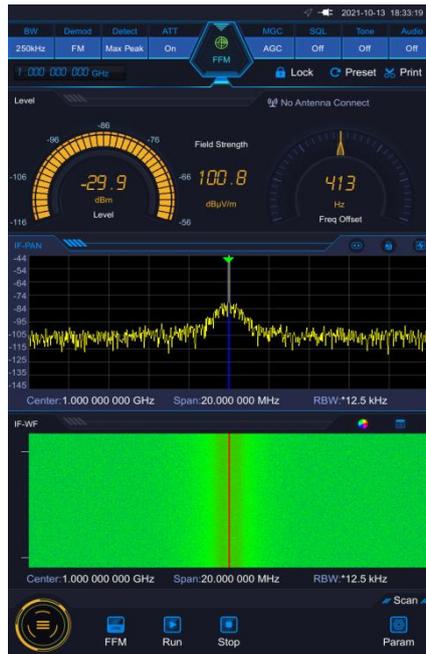


Fig. 3.16 Sinusoidal Signal Measurement Results

- 3) Press  key to pop up the function menu, and select [Peak] to activate the frequency cursor and make it jump to the peak position of the signal on the display screen. The frequency and magnitude values can be read out by the cursor and displayed in the active functional area. At this time, the cursor reading frequency is 1GHz and the magnitude is about -29.96dBm, as shown in Fig. 3.17.

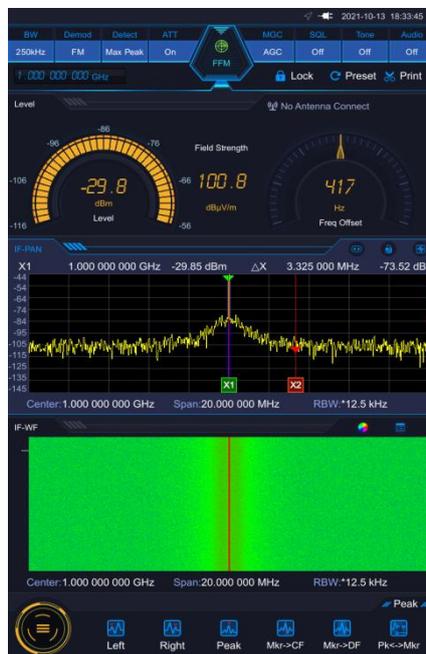


Fig. 3.17 Sinusoidal Signal Measurement Results (Activation of Frequency Cursor)

Note

For the 9 kHz~30 MHz, 20 MHz~3.6GHz and 3.6GHz~8 GHz frequency bands, the maximum input level is respectively -13dBm, +3dBm (attenuator is on) and -24dBm. If the signal level is higher than this limit, a power attenuator must be installed at the RF input end of the monitoring receiver, otherwise the

3.4 Data Management

accuracy of the test cannot be guaranteed, and the large signal level may damage the RF attenuator or input mixer, so all current signals must be considered.

3.4 Data Management

This section describes the reset state storage/ calling, measurement result data input/ output methods and screenshot storage method of the 3943B monitoring receiver.

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- Data storage/ calling28
- Screen shot storage/ calling29

3.4.1 Reset state storage/ calling

3.4.1.1 Resetting Instrument Status

The 3943B monitoring receiver uses the working state before the last shutdown by the user as the initial state during the startup measurement. If the working state before shutdown is unavailable, the factory startup state will be called by default. Usually when the measurement state of the instrument is wrong, the initial state of the instrument under normal operation can be restored by resetting the instrument state. The 3943B monitoring receiver provides five quick reset states for users to reset, including factory reset, reset before shutdown and three user reset states. Click the [Reset] shortcut menu to enter the reset dialog box, as shown in Fig. 3.18.



Fig. 3.18 Reset Dialog Box

[Factory Reset]

Return to the factory's default working state.

[Reset before Shutdown]

Return to the working state before the last shutdown.

[User Reset 1]

Return to the working state specified by the user.

[User Reset 2]

Return to the working state specified by the user.

[User Reset 3]

Return to the working state specified by the user.

3.4.1.2 Reset state saving

Click [Save Reset Status] to enter the file saving dialog box, as shown in Fig. 3.19.

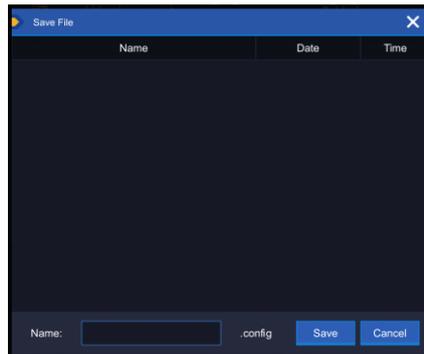


Fig. 3.19 File Saving Dialog Box

Enter the name of the user status to be saved, and click [Save] to pop up a prompt dialog box, as shown in Fig. 3.20.

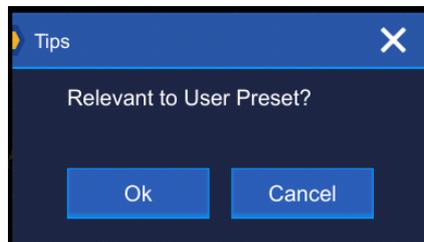


Fig. 3.20 Prompt Message Dialog Box

Click [Cancel] to save the reset status. Click [OK] to enter the reset association dialog box, select the user reset to be associated, and click [Save] to complete the association between reset status and user reset.

3.4.1.3 Associated user reset

In addition to the association of user reset during the reset state saving, the 3943B monitoring receiver also supports setting the association between user reset and saved reset state separately. Click the edit

icon [✎] behind user reset to enter the reset call dialog box, as shown in Fig. 3.21.

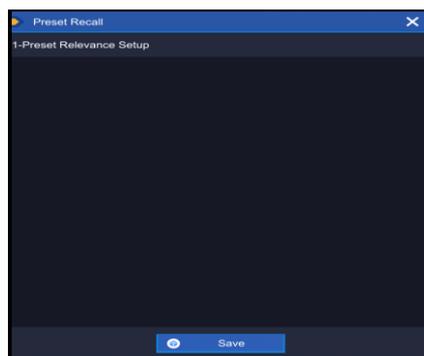


Fig. 3.21 Reset Call Dialog Box

If the user has saved multiple reset states, the user can select the reset state to be associated at this time, and click [Save] to complete the association of reset states. After the association is completed, the name of the associated reset state will be displayed at the user reset position in the reset dialog box as shown in Fig. 3.18.

3.4.2 Data storage/ calling

The 3943B monitoring receiver has file management function, which provides file saving/calling function, file browsing and directory (file) copying, cutting, pasting and deleting operations. Data files can be accessed through touch screen or remote control (refer to the program control manual of 3943B monitoring receiver for details).

3.4 Data Management**3.4.2.1 Data file type**

The types of data files related to file management are shown in Table 3.8.

Table 3.8 Data File Types

File type	Description of data storage
Startup status file	Store the measurement status of the current instrument, and call it at startup.
Reset status file	Store the measurement status of the current instrument for the user to call during resetting
Saving of trace file by user	Store the trace data of the current trace
Saving of image file by user	Store the bitmap of the current operation screen in png format
Saving of audio data by user	Store the audio file saved by users
Saving of IQ data file by user	Store the I/Q modulation data
Antenna factor file	Store the antenna factor information
Storage table file	Store the storage table information edited by the user
Suppression table file	Store the suppression table information edited by the user
Map file	Store map data

3.4.2.2 File Saving/Loading Method

The 3943B monitoring receiver provides data file saving/calling function. File saving is to store the measurement data in a file according to the agreed format (for example: *. png, *. dat). File call refers to opening the selected data file and refreshing display information, such as measurement parameters and list parameters, so as to facilitate the observation and evaluation by users.

According to different information types and management methods, the 3943B monitoring receiver provides seven kinds of file saving functions and six kinds of file calling functions. The seven types of files that can be saved are: reset status file, trace file, image, audio, storage table, suppression table and IQ data file. The file types that can be called are: reset status file, trace file, storage table, suppression table, antenna factor and audio file. Users only need to enter the corresponding menu to pop up a dialog box, and specify the file name to be saved or select the corresponding file, so as to save and call the file. Specific instructions are as follows:

For the saving and calling of reset status file, refer to 3.4.1 “Reset status storage/ calling”;

Saving and calling of trace, audio and IQ data files are introduced in the recording and playback option functions.

See 5.1.3 “List menu” for the saving and calling of storage table and suppression table files;

See 3.4.3 “Screen shot storage” for the saving and calling of image files.

3.4.2.3 File directory management

The 3943B monitoring receiver provides file directory management function. See 5.1.5 “File menu” for file browsing, copying, cutting, pasting, deleting and other operations.

3.4.2.4 File Format Description

All files are directly stored in the monitoring receiver. Except IQ data and antenna factor files, other files are in binary file format, and the file suffix is determined by the specific file type.

3.4.3 Screen shot storage

The 3943B monitoring receiver provides the function of storing screen shots in graphic files (png format). Press [Screen Shot] menu on the main interface to pop up the save screen dialog box, as shown in Fig. 3.22.

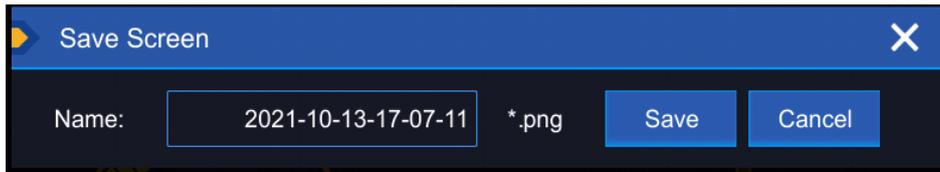


Fig. 3.22 Screen Saving Interface

Click [Save] button to save the screen shots.

4.1 Function operation guide

4 Operation Guide

In this chapter, operating methods of different measurement functions of the 3943B monitoring receiver are introduced and measurement procedures are explained in detail.

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4.1 Function operation guide

This section respectively introduces operation methods of basic scan functions of the 3943B monitoring receiver, including fixed frequency receiving, panoramic scan, frequency scan and list scan. The settings and operation steps are illustrated with examples.

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➤ Panoramic scan.....35

➤ Frequency scan.....37

➤ List scan.....40

4.1.1 Fixed frequency receiving

Fixed-frequency receiving refers to the scan mode in which the receiving frequency is fixed and the data is continuously collected and measured at this frequency. In fixed frequency measurement and analysis, the local oscillator of the instrument runs in point frequency mode, which completes the receiving of fixed frequency, completes a seamless acquisition according to sampling parameters, and saves it in memory, thus realizing one-time acquisition and omni-directional analysis. Level measurement is carried out on fixed frequency points, and the signal strength information is obtained by level measurement (field strength measurement can be carried out after the antenna is installed), so as to monitor the signal. In order to judge the signal more visually, it is usually necessary to use demodulation processing function to directly demodulate the audio signal and monitor the sound. At the same time, FFT operation is performed on the current frequency point to obtain the frequency spectrum within the intermediate frequency bandwidth, and the task of monitoring signals is assisted by the frequency spectrum diagram.

In the fixed frequency receiving mode, there are three signal processing channels: intermediate frequency spectrum processing channel, level measurement channel and demodulation channel, and the parameters of the three processing channels (such as intermediate frequency bandwidth, demodulation mode, demodulation bandwidth, etc.) can be set independently. This processing scheme has two obvious advantages. First, users can access the ultra-wide intermediate frequency spectrum and benefit from the best demodulation bandwidth (the demodulation bandwidth can be very small) at the same time. Secondly, the level measurement is mainly carried out in the level measurement channel instead of the intermediate frequency spectrum processing channel, thus ensuring that the signal level can be accurately measured even for ultrashort pulses.

4.1.1.1 Start of fixed frequency receiving

Step 1. Set the operating mode. Select [System Menu] to pop up the menu, select [Scan] icon and [Fixed Frequency Receiving] to enter the fixed frequency receiving mode, as shown in Fig. 4.1.



Fig. 4.1 Fixed Frequency Receiving Mode

Step 2: Set the frequency spectrum measurement channel parameters, including center frequency, bandwidth and resolution bandwidth (adaptive).

- Press [Center] number display area in the intermediate frequency spectrum window to pop up the numeric keyboard input area, enter the center frequency value with number keys, and select the frequency unit according to the corresponding unit area (or use a single finger to slide left and right in intermediate frequency spectrum window to modify the center frequency).
- Press [Bandwidth] number display area in the intermediate frequency spectrum window to select the bandwidth.
- Press [Resolution] number display area in the intermediate frequency spectrum window to select the corresponding resolution bandwidth. If there is no special demand, select [Auto], and the resolution bandwidth is adaptive bandwidth under this option.

Note

Demodulation frequency and center frequency can be set independently, but they must be within the same IF bandwidth. When the center frequency is changed, the demodulation frequency follows the center frequency by default.

4.1.1.2 Audio demodulation

Step 1. After the setup according to [4.1.1.1](#), set the level measurement channel parameters, including the detection mode and demodulation bandwidth:

- Press [Detection Mode] area to pop up the drop-down box for selecting detection mode, including maximum peak value, mean value, power and sampling.
- Press [Demodulation Bandwidth] area to pop up the demodulation bandwidth drop-down box to select the level and demodulation channel bandwidth.

Step 2. Set demodulation channel parameters, including demodulation mode and squelch level.

- Press [Demodulation Mode] area to pop up the demodulation mode drop-down box and select the appropriate demodulation mode.

4.1 Function operation guide

- b) Press [Squelch Level] area to pop up the squelch level digital slide bar, and select [On] to turn on the squelch level switch.
- c) Drag the middle slider to move left and right to adjust the squelch level value. The squelch level value is used to control the playback of demodulation sound. When the level of demodulated signal is greater than the squelch level, the demodulated signal is played by sound.



Fig. 4.2 Display Image of Signal Demodulation Window

4.1.1.3 Modification of reference level

The reference levels of IF and RF spectrum can be modified in two ways:

- 1) Touch operation:
 - The reference level can be modified by sliding down the corresponding window with a single finger.
 - The reference level and level range can be modified by zooming with two fingers in the corresponding window.
- 2) Set parameters:
 - a) After activating the IF spectrum window, press [Parameter] area in the bottom menu to pop up the parameter dialog box, and click [Show Related] property page.
 - b) Press [Maximum Level] number display area, and enter the upper limit value of the display level with the number keys.
 - c) Press [Minimum Level] number display area, and enter the lower limit value of the display level with the number keys.

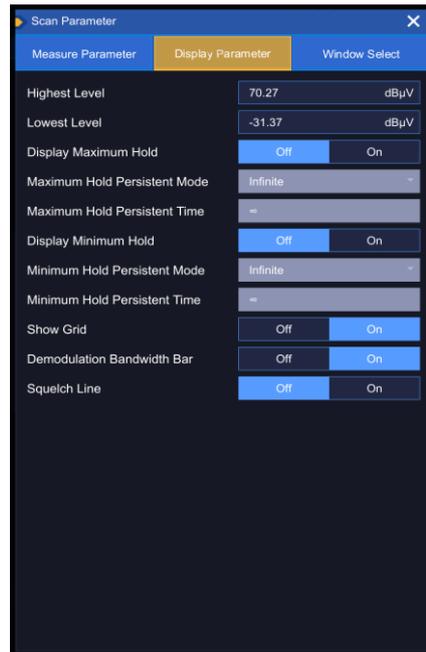


Fig. 4.3 Parameter Setting Window

4.1.1.4 Window selection

Step 1. Touch to activate any window, press [Parameter] to enter the parameter setting window, and press [Window Selection] to enter the window selection interface, as shown in Fig. 4.4.



Fig. 4.4 Window Selection

Step 2. Click the required window option to activate the option and highlight the prompt after selection, and finally click [Save].

In fixed frequency receiving mode, 2-3 windows from 3 kinds of windows can be selected for display:

- Intermediate frequency panorama: displays the frequency spectrum within the bandwidth, and can set the center frequency, frequency bandwidth and resolution bandwidth. As shown in Figure 4.5.

4.1 Function operation guide

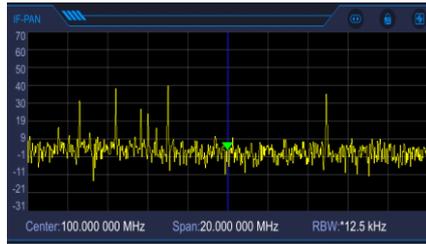


Fig. 4.5 Intermediate Frequency Spectrum

- b) Intermediate frequency waterfall plot: the spectrum information within the bandwidth is displayed through the waterfall plot. The center frequency, bandwidth and resolution bandwidth can be set, and the parameters are associated with the intermediate frequency spectrum chart. As shown in Figure 4.6.

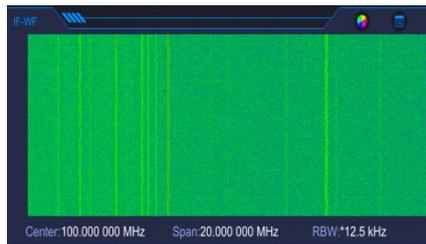


Fig. 4.6 Intermediate Frequency Waterfall Plot

- c) Level display diagram: displays the measured value of the current level channel, frequency offset, field strength (connected antenna) and other information. As shown in Figure 4.7.



Fig. 4.7 Level Display Diagram

4.1.1.5 Parameter Setting

Step 1: Touch to activate the corresponding window and press [Parameter] to enter the parameter setting window. Each window has different parameter options. Please refer to 5 Menu for detailed parameter description.

4.1.2 Panoramic scan

Traditional spectrum analysis can perform many measurement functions, which is usually enough for laboratory users. However, the execution of field tasks needs to search for signals quickly, and it is also hoped that signals can be observed from different angles or maps. Therefore, this software provides panoramic scan analysis function that can search signals quickly.

Panoramic scan refers to scanning the whole radio frequency to find the signal quickly, and only the spectrum analysis channel is analyzed during the panoramic scan. Panoramic scan can sweep the selected frequency range according to the selectable resolution bandwidth, connecting up to 20MHz intermediate frequency windows, thus covering the whole predefined scan range. Every window is calculated by FFT. Panoramic scan can sweep the spectrum quickly in a wide frequency range, so that users can find the signal quickly.

Users can customize the selection window, and choose any 2-3 windows from the four windows of IF panorama, IF waterfall, RF panorama and RF waterfall for observation, so that the signal details can be

4.1 Function operation guide

seen at a glance. During panoramic scan, RF panorama and RF waterfall are refreshed normally, while IF panorama and IF waterfall are not refreshed. When panoramic scan is stopped, the IF panorama and IF waterfall are refreshed normally, while the RF panorama and RF waterfall are not refreshed.

4.1.2.1 Start of panoramic scan

Step 1. Set the operating mode. Select [System Menu] to pop up the menu, select [Scan] icon and [Panoramic Scan] to enter the panoramic scan mode. As shown in Figure 4.8.

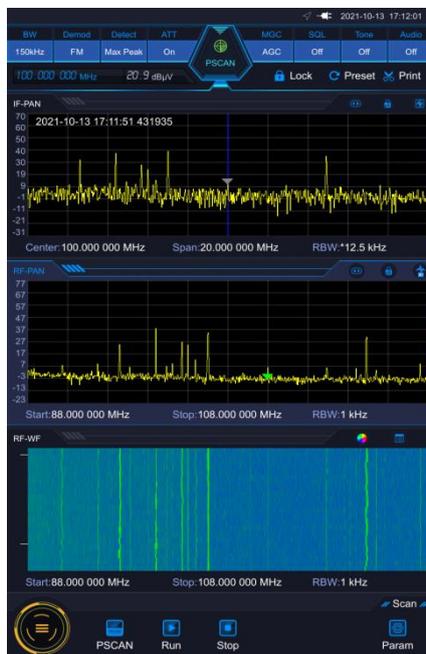


Fig. 4.8 Panoramic Scan Mode

Step 2: Set the start frequency, stop frequency and resolution bandwidth:

- Press [Start] number display area under the RF panorama to pop up the numeric keyboard input area.
- Enter the initial frequency value with the number keys, and select the frequency unit according to the corresponding unit area.
- Press [Stop] in the number display area to pop up the numeric keyboard input area. Enter the stop frequency value with the number keys, and select the frequency unit according to the corresponding unit area.
- Press [Resolution] number display area and select the corresponding resolution bandwidth.

4.1 Function operation guide

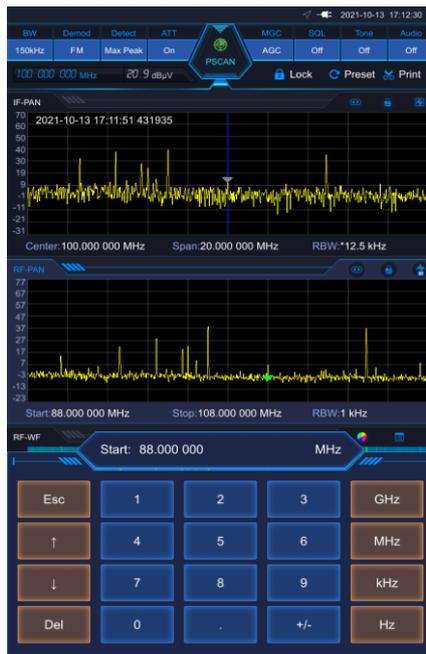


Fig. 4.9 Panorama Scan Parameter Setting Interface

Step 3. Press [Start] to start the panoramic scan mode.

4.1.2.2 Window selection

Please refer to [4.1.1.4](#) for specific operation steps.

4.1.2.3 Parameter Setting

Step 1: Enter the parameter menu. In the panoramic scan mode, touch to activate the corresponding window and press [Parameter] to enter the parameter setting window. Each window has different parameter options. See [Chapter 5-Menu](#) for detailed parameter description.

4.1.3 Frequency scan

The frequency scan takes the specified start frequency, stop frequency and step frequency as scan control data to scan and monitor point by point, and refers to the suppression table during scan. When a certain receiving frequency is in the suppression table (included in the edge of the suppression table) during scan, it gives up scan at this point and steps to the next point.

During scan, the data displayed in the RF panorama comes from the level channel, and the IF panorama data comes from the spectrum channel, which shows the IF spectrum data of the current frequency point.

At each dwell point, measurement shall be implemented once to judge whether there is a signal (when the squelch switch is turned on, the amplitude is greater than or equal to the squelch level, it is considered as a signal. When the squelch switch is turned off, it is considered that there is a signal. Otherwise, no signal is available), and further processing is performed according to the judgment result.

- If there is no signal, the instrument will step to the next point for measurement.
- If there is a signal, it will stay at this point for demodulation and other processing. The "dwell time" parameter determines the actual dwell time, and the relationship between dwell time and measurement time is as follows:
 - If the dwell time is shorter than or equal to the measurement time, only one measurement is performed, and this measurement time is the dwell time.
 - If the dwell time is longer than the measurement time, it is divided into several measurements according to the multiple of the measurement time, and the time of the last measurement is usually very short, and the total time of all measurements is equal to the dwell time. For example, if the first measurement time is 10 seconds and the dwell time is 5s, the total measurement time at the single frequency point under the frequency scan mode is 15s.

4.1 Function operation guide

For the situation that the signal exists but suddenly disappears in the measurement process, no signal time is used for judgment. When the level value of a certain frequency point is suddenly less than the squelch level after judging whether there is a signal or not, start the judgment of no signal time, and step to the next frequency point for measurement after exceeding the no signal time.

4.1.3.1 Editing suppression table

Step 1. Select [System Menu], click list to enter the list menu, and select [Suppression Table]. As shown in Figure 4.10.

Step 2. Suppress table editing:

- Select [Start Frequency] corresponding to the serial number to pop up the numeric keyboard input area.
- Enter the initial frequency value with the number keys, and select the frequency unit according to the corresponding unit area.
- Select [Stop Frequency] corresponding to the serial number to pop up the numeric keyboard input area.
- Enter the stop frequency value with the number keys, and select the frequency unit according to the corresponding unit area.

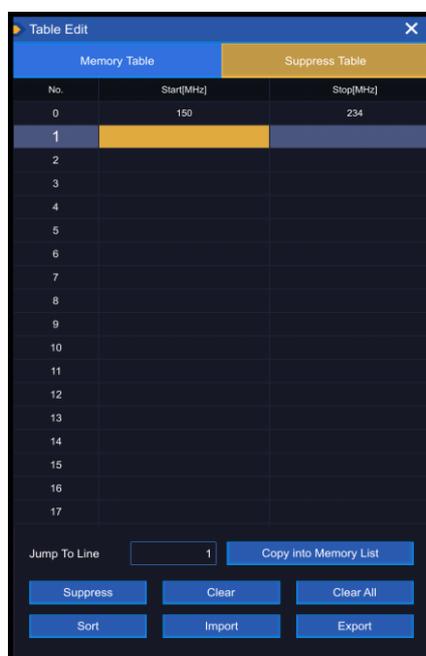


Fig. 4.10 Suppression Table Editing

4.1.3.2 Start of frequency scan

Step 1. After editing the suppression table, set the frequency scan parameters, as shown in Fig. 4.11:

- Click [Start] number display area in the RF panorama to pop up the numeric keyboard input area, enter the start frequency value with the number keys, and select the frequency unit according to the corresponding unit area.
- Click [Stop] number display area in the RF panorama to pop up the numeric keyboard input area, enter the stop frequency value with the number keys, and select the frequency unit according to the corresponding unit area.
- Click [Step] number display area in the RF panorama to pop up the numeric keyboard input area, enter the step frequency value with the number keys, and select the frequency unit according to the corresponding unit area.
- After selecting the RF panorama, click [Parameter] to enter the parameter menu and select the [Measurement Related] submenu.

4.1 Function operation guide

- Select [Dwell Time Mode], select manual from the drop-down box, select [Dwell Time] to pop up the numeric keyboard input area, enter the dwell time value with the number keys, and select the dwell time unit according of the corresponding unit area.
- Select [No Signal Time State], select [On] in the check box, select [No Signal Time] to pop up the numeric keyboard input area, enter the no signal time value with the number keys, and select the no signal time unit according to the corresponding unit area.

Step 2. Click [X] in the upper right corner to close the menu bar, and click [Run+] or [Run-] to scan the frequency:

- [Run+] means to start with the current frequency and scan sequentially from low to high.
- [Run-] means to start with the current frequency and scan in reverse order from high to low.

Step 3. Click [Stop], and then click [Restart] to restart scan.

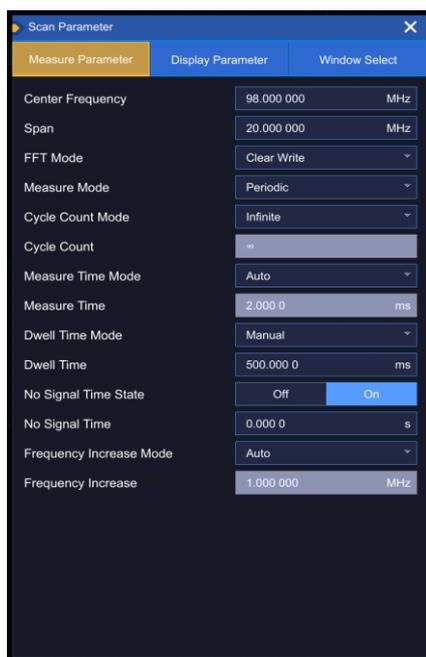


Fig. 4.11 Frequency Scan Parameter Settings

4.1.3.3 Window selection

Please refer to [4.1.1.4](#) for specific operation steps.

4.1.3.4 Parameter Setting

Step 1. Enter the parameter menu. In frequency scan mode, touch to activate the corresponding window and press [Parameter] to enter the parameter setting window. Each window has different parameter options. See Chapter 5-Menu for specific parameter description.

4.1.4 List scan

List scan refers to scan and monitoring point by point with the specified stored scan list as scan control data, so as to realize user-customized monitoring. Different from frequency scan, the detailed scan parameters of each frequency point in the stored scan list can be set separately. During scan, the data displayed in the RF panorama comes from the level channel, and the IF panorama data comes from the spectrum channel, which shows the IF spectrum data of the current frequency point. Table 4.1 lists the editable parameters of each frequency point in the list scan storage table.

Table 4.1 List Scan Storage Table Parameters

S/N	Name	S/N	Name
1	Activation	6	Squelch level
2	Freq	7	Squelch level switch

3	Demodulation bandwidth	8	Automatic frequency switch
4	Demodulation mode	9	Signal description
5	Attenuator mode		

4.1.4.1 Editing storage table

Step 1. Select [System Menu], click list to enter the list menu, and select [Storage Table], as shown in Fig. 4.12.

Step 2. Edit the storage table:

Click anywhere in the row where the serial number is located to select the row, and then perform the following operations:

- Click the corresponding [Activation] check box, and the activation status of this frequency point will be activated after being checked.
- Click the corresponding [Frequency] to pop up the numeric keyboard, enter the center frequency value, and select the frequency unit according to the corresponding unit to complete the frequency setting.
- Click [Bandwidth [kHz]] at the bottom of the list to pop up the demodulation bandwidth drop-down box and select the corresponding demodulation bandwidth.
- Click [Demodulation Mode] at the bottom of the list to pop up the demodulation mode drop-down box and select the corresponding demodulation mode.
- Click [Attenuation Mode] at the bottom of the list to pop up the attenuator mode drop-down box and select the corresponding attenuator mode.
- Click [Squelch Switch] at the bottom of the list, click [Off] to turn off the squelch switch, and click [On] to turn on the squelch switch.
- Turn on [Squelch Switch] first, then click the input box of [Squelch Value [dBm]] to pop up the numeric keypad, input the squelch level value, and select the squelch level unit according to the corresponding unit to complete the modification of the squelch value.
- Click [Automatic Frequency Control Switch] at the bottom of the list, click [Off] to turn off automatic frequency control, and click [On] to turn on automatic frequency control.
- Click the corresponding [Description] to pop up the character keyboard input area, and enter the corresponding description.

Step 3. Add new entries:

- Select a blank line and click the corresponding [Frequency]. After entering the frequency, this line will be automatically generated. Other parameters will be automatically set as default parameters, which can be modified according to Step 2. After successful setting, a new blank line will be automatically generated at the bottom.

4.1 Function operation guide

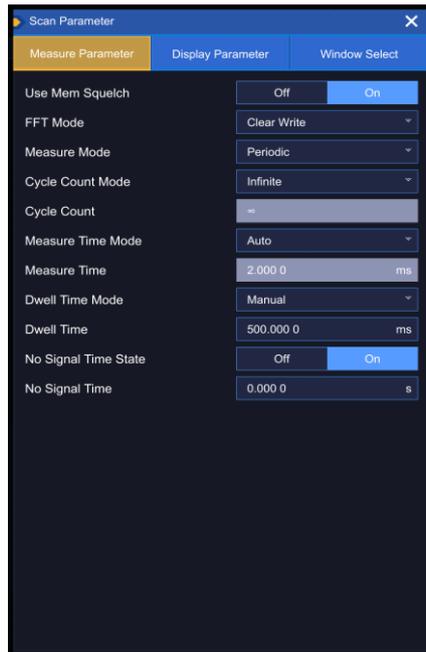


Fig. 4.12 Storage Table Editing

4.1.4.2 Start of list scan

Step 1. After editing the storage table, set the list scan parameters, as shown in Fig. 4.13:

- After selecting the RF panorama, click [Parameter] to enter the parameter menu and select the [Measurement Related] submenu.
- Select [Dwell Time Mode], select manual from the drop-down box, select [Dwell Time] to pop up the numeric keyboard input area, enter the dwell time value with the number keys, and select the dwell time unit according of the corresponding unit area.
- Select [No Signal Time State], select [On] in the check box, select [No Signal Time] to pop up the numeric keyboard input area, enter the no signal time value with the number keys, and select the no signal time unit according to the corresponding unit area.

Step 2. Click [X] in the upper right corner to close the menu bar, and click [Run+] or [Run-] to scan the frequency:

- [Run+] means to start with the current frequency and scan sequentially from low to high.
- [Run-] means to start with the current frequency and scan in reverse order from high to low.

Step 3. Click [Stop], click [Restart], and then scan sequentially from the minimum frequency.

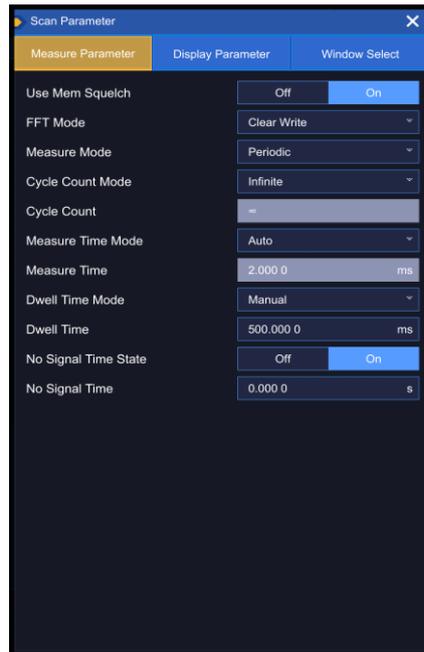


Fig. 4.13 List Scan Parameter Settings

4.1.4.3 Window selection

Please refer to [4.1.1.4](#) for specific operation steps.

4.1.4.4 Parameter Setting

Step 1. Enter the parameter menu. In list scan mode, touch to activate the corresponding window and press [Parameter] to enter the parameter setting window. Each window has different parameter options. See Chapter 5-Menu for specific parameter description.

5. Menus

5.1 General Menu

5. Menus

The general menu of 3943B monitoring receiver includes: scan, setting, list, record, file, self-inspection, frequency marker, antenna, peak value and playback, as shown in Fig. 5.1. This menu will be described in detail in Section 5.1.

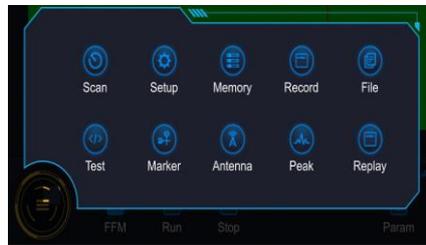


Fig. 5.1 General Menu

In addition to the general menu, the 3943B monitoring receiver corresponds to different menus in different windows of each scan mode, which will be described in detail in Section 5.2.

- General menu 44
- Window menu 65

5.1 General Menu

- Scan menu 44
- Setting menu 46
- List menu 50
- Record menu 53
- File menu 55
- Self-inspection menu 57
- Frequency marker menu 57
- Antenna menu 59
- Peak menu 60
- Playback menu 60

5.1.1 Scan menu

Scan menu is used to select scan mode and control scan status, and set relevant parameters. After clicking the scan menu, the related secondary menu is displayed in the form of menu bar at the bottom of the screen. Secondary menu items in fixed frequency receiving mode are displayed by default.

Click [Fixed Frequency Receiving] menu to pop up the mode switching menu, so as to switch the scan mode, as shown in Fig. 5.2.

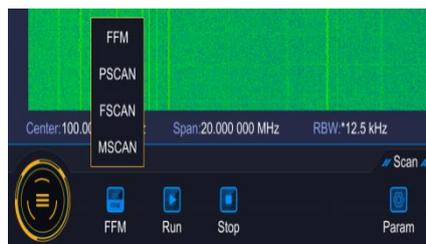


Fig. 5.2 Secondary Mode Switch Menu

When you select [Panoramic Scan], the menu items are shown in Fig. 5.3.

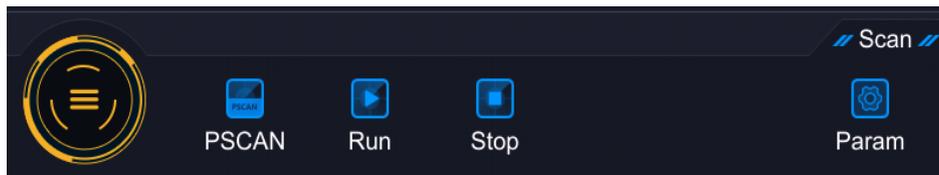


Fig. 5.3 Secondary Menu of Panoramic Scan Mode

When the menu of Fixed Frequency Receiving is selected, the menu items are shown in Fig. 5.4:

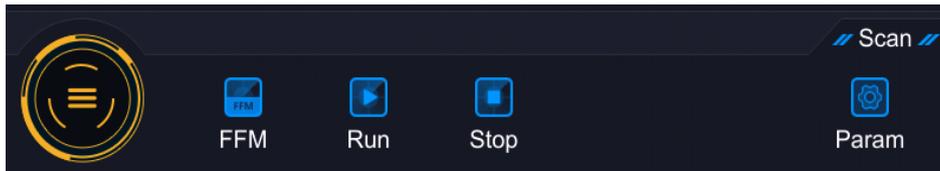


Fig. 5.4 Secondary Menu of Panoramic Scan Mode

When you select [Frequency Scan], the menu items are shown in Fig. 5.5.

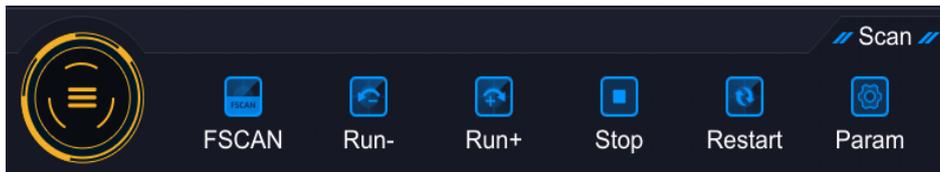


Fig. 5.5 Secondary Menu of Frequency Scan Mode

When you select [List Scan], the menu items are shown in Fig. 5.6.

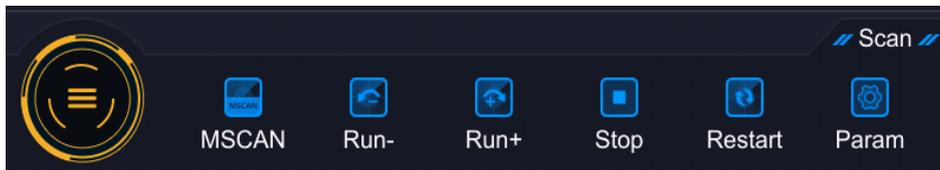


Fig. 5.6 Secondary Menu of List Scan Mode

5.1.2 Setting menu

After clicking the setting menu, the related secondary menu pops up in the form of dialog box, including four property pages: receiver setting, general setting, network setting and about equipment. Parameter settings of each property page are described one by one in the following subsections.

5.1.2.1 Settings of receiving end

The receiving end setting property page is shown in Fig. 5.7.

5.1 General Menu

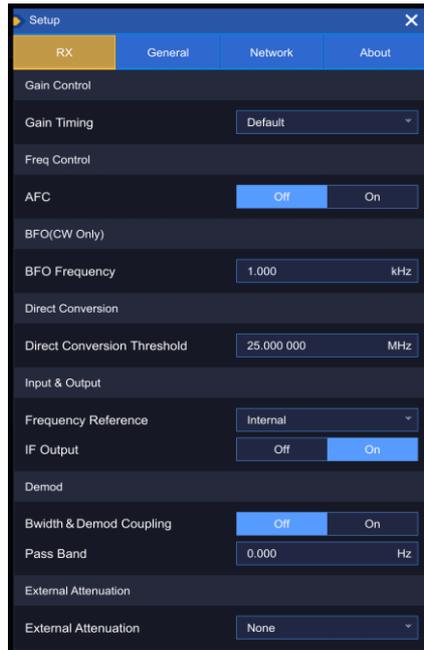


Fig. 5.7 Receiving End Setting Property Page

Parameters in the receiving end setting property page are described as follows:

[Gain Tracking Speed]

Set the gain tracking speed, including three modes: fast, normal and slow, and the default is normal mode.

[Automatic Frequency Control]

Set the automatic frequency control switch, including two modes: on/off, which is off by default.

[Beat Frequency Oscillation Frequency]

Set the beat frequency, the frequency range is -8kHz~8kHz, and the default value is 1kHz.

[Switch Point Frequency]

Set the switching point frequency of direct sampling channel, the frequency range is 20MHz-30MHz, and the default value is 20MHz.

[Frequency Reference]

Set frequency reference mode, including internal reference, external reference and GNSS reference, and the default is the internal reference.

[Intermediate Frequency Output]

Set the intermediate frequency output switch, which is off by default.

[Demodulation Bandwidth Adaptation]

Set the demodulation bandwidth adaptive switch, which is off by default.

[Channel Bandwidth]

Set the channel bandwidth in LSB/USB demodulation mode.

[External Attenuator]

Choose external attenuators, including: 10dB(71512 2w), 20dB(71512A 2w), 30dB(71512B 2w), 40dB(71512C 2w), 40dB(71512D 25w), or combination of (71512A 2w) and (71512C 2w) and combination of (71512B 2w) and (71512D 25w).

5.1.2.2 General settings

The general setting property page is shown in Fig. 5.8.

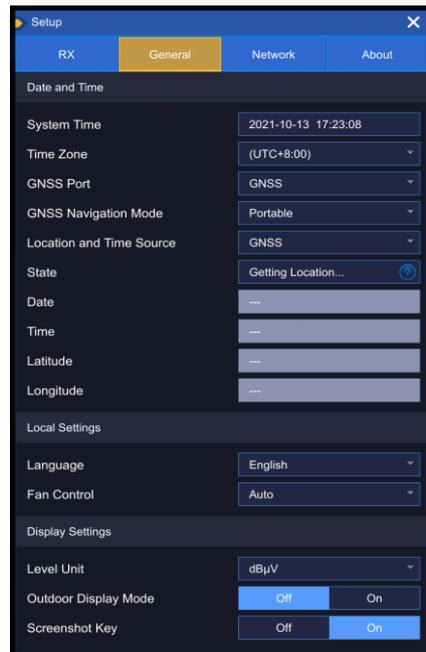


Fig. 5.8 General Setting Property Page

Parameters in the general setting property page are described as follows:

[System Time]

Set the system time in the format of yyyy-MM-dd hh:mm:ss.

[Time Zone]

Set the system time zone.

[GNSS Input Port]

Set GNSS input ports, including GNSS port and AUX port.

[GNSS Navigation Mode]

Set the GNSS navigation mode, including mobile and fixed, which can be applied to different occasions.

[Positioning and Timing Source]

Set the positioning and timing sources, including GPS, GNSS, Beidou, Beidou +GNSS and off modes, which is off by default.

[Positioning Status]

Display the current positioning status, and click the icon behind to view the specific positioning status information.

[Positioning Date]

Display the current positioning date in the format of yyyy-MM-dd.

[Positioning Time]

Display the current positioning time in the format of hh:mm:ss.

[Latitude]

Display the current latitude information.

[Longitude]

Display the current longitude information.

[Language]

Set the display language of the system menu, including Chinese and English, and the default is Chinese.

5. Menus

5.1 General Menu

[Fan Control]

Set fan control modes, including off, on and automatic control modes, which is automatic mode by default.

[Level Unit]

Set the display unit of level, including dBm and dBuV, and the default is dBuV.

[Outdoor Display Mode]

Set the switch state of outdoor display mode, which is off by default and turned on when used outdoors.

5.1.2.3 Network settings

The network setting property page is shown in Fig. 5.9.

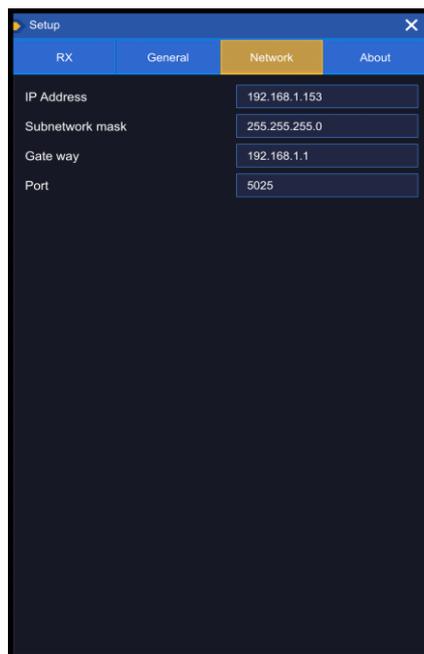


Fig. 5.9 network Setting Property Page

Parameters in the network setting property page are described as follows:

[IP Address]

Set the IP address of this machine.

[Subnet Mask]

Set the subnet mask of this machine.

[Gateway]

Set the gateway of this machine.

[LAN Port]

Set the LAN port of this machine, which is 5025 by default.

Note

Network settings

The network-related parameters can be set only after the network is connected. When the network is not connected, the parameters are gray and cannot be set.

5.1.2.4 About equipment

This about equipment property page is shown in Fig. 5.10:

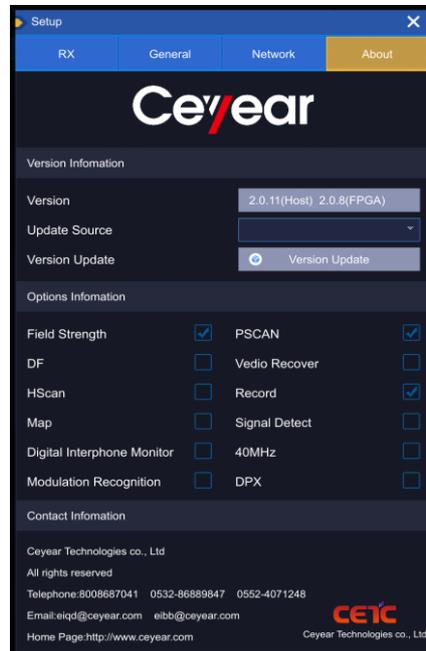


Fig. 5.10 About Equipment Property Page

Parameters in the about equipment property page are described as follows:

[Version Number]

Display the current version number of the system software.

[Update Source]

Select the source of software version update, and support using USB flash drive to update programs. When inserting USB flash drive, the version update button is available. Click the version update button to detect the version update. If there is an updateable program version in the inserted USB flash drive, the update can be executed.

5.1.3 List menu

After clicking the list menu, the related secondary menu pops up in the form of dialog box, including two property pages: storage table and suppression table.

5.1.3.1 Storage table

The property page of storage table is shown in Fig. 5.11:

5.1 General Menu

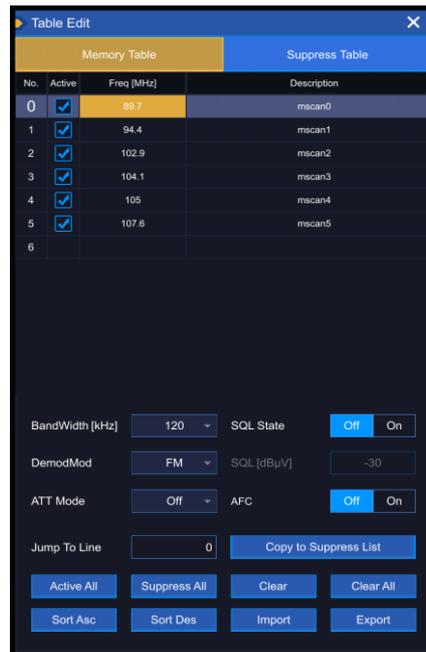


Fig. 5.11 Storage Table Property Page

The storage table is used to store the parameters of scan frequency points during list scan. Each line stores one frequency point. The parameters include: serial number, activation, frequency, bandwidth, demodulation mode, attenuation mode, squelch switch, squelch value, automatic frequency control switch and description. Each frequency point parameter can be edited independently, in which the activation, frequency and description can be modified directly in the table, and other parameters can be edited in the parameter setting area at the bottom of the table. For specific operation, see [4.1.4.1 "Editing storage table"](#).

At the bottom of the storage table, there are jump input box and some buttons to operate the storage table, which are [Copy to Suppress Table], [Activate All], [Suppress All], [Delete All], [Ascend], [Descend], [Import] and [Export]. Their functions are detailed as follows:

[Jump Input Box]

Jump to the specified storage table line number.

[Copy to Suppression Table]

Copy the storage table information of the currently active line in the storage table to the suppression table.

[Activate All]

Select the activation check box of each piece of information in the storage table, that is, select each piece of information, so that when the list is swept, every frequency point in the list will be swept.

[Suppress All]

Set the activation check box for each piece of information in the storage table to be unchecked.

[Button]

Delete the information of the currently selected storage table in the storage table.

[Delete All]

Delete all information in the storage table.

[Ascend]

Arrange each piece of information in the list from low frequency to high frequency.

[Descend]

Arrange each piece of information in the list from high frequency to low frequency.

[Import]

Import the storage table information in the external file into the current storage table.

[Export]

Export the information in the current storage table to an external file.

5.1.3.2 Suppression table

The suppression table window is shown in Fig. 5.12:

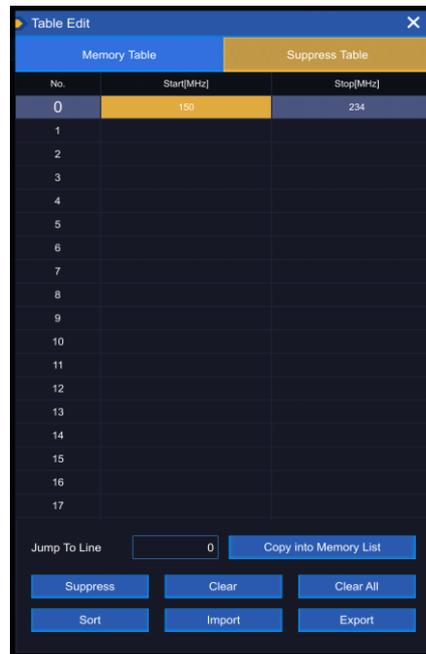


Fig. 5.12 Suppression Table Property Page

The suppression table stores the frequency bands that are not swept during frequency scan. The header of the list includes serial number, start frequency and stop frequency. Each piece of information in the list can be edited separately. For specific operation, please refer to [4.1.3.1 "Editing Suppression Table"](#).

At the bottom of the suppression table, there are jump input boxes and some buttons to operate the suppression table, including [Copy to Storage Table], [Add Suppression Table], [Delete], [Delete All], [Sort], [Import] and [Export]. Their functions are detailed as follows:

[Jump Input Box]

Jump to the specified line number.

[Copy to Storage Table]

Copy the currently selected information in the suppression table to the storage table.

[Delete]

Delete the selected suppression table information.

[Delete All]

Delete all information in the suppression table.

[Sort]

Arrange the information in the list from low frequency to high frequency.

[Import]

Import the suppression table information in the external file into the current suppression table.

[Export]

Export the information in the current suppression table to an external file.

5.1 General Menu

5.1.4 Record menu

The recording menu is related to the recording function, which is an option of this machine. When the complete machine has the recording function option, this menu is available. Click [Record Mode] menu to select [Record Mode /IQ], [Record Mode/Spectrum] and [Record Mode/Audio]. The menu included in each record mode is shown in Fig. 5.13-5.15 respectively.

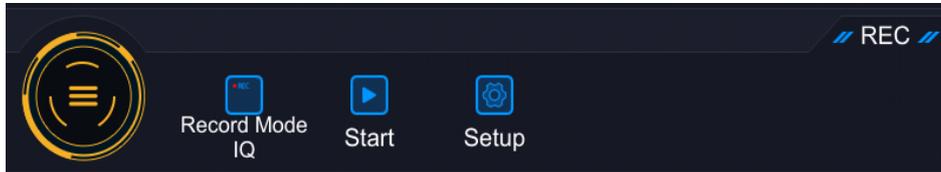


Fig. 5.13 Record Mode /IQ

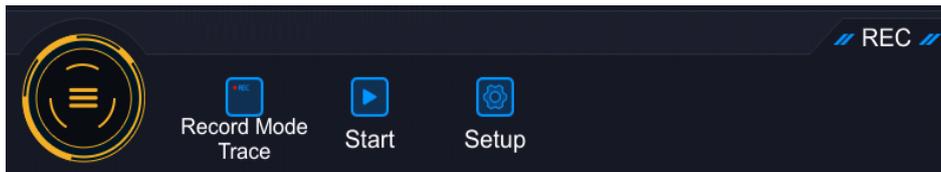


Fig. 5.14 Record Mode/Spectrum

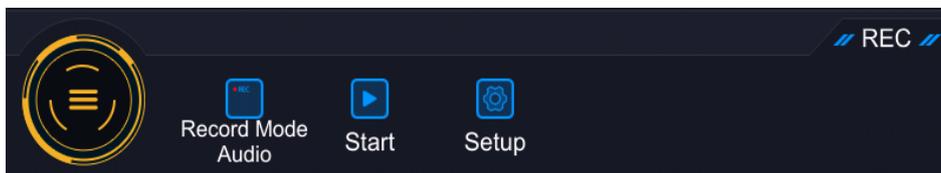


Fig. 5.15 Record Mode/Audio

5.1.4.1 IQ records

Enter the IQ record menu and click [Setting] to pop up the setting box option, as shown in Fig. 5.16:

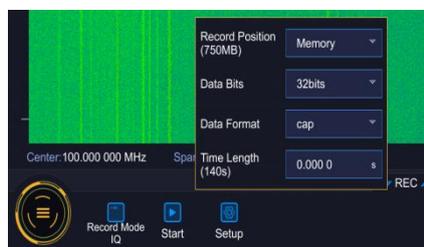


Fig. 5.16 IQ Setting Parameter Box

Parameters in IQ setting property page are described as follows:

[Storage Location]

There are two modes: internal memory and SD card. The default mode is internal memory.

[Data Bit]

It can be divided into 32-bit and 16-bit modes, and the default is 32-bit.

[Record Time]

Set the time for recorded data, which cannot exceed the maximum recordable time. The maximum recordable time is displayed in front.

Click [Start] button to start recording, as shown in Fig. 5.17:

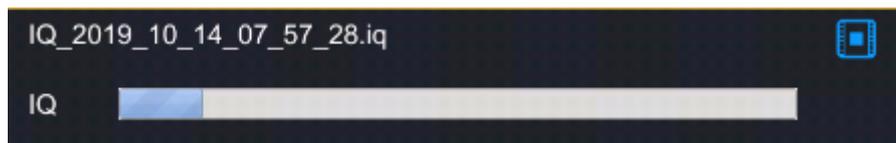


Fig. 5.17 IQ Recording Process

5.1.4.2 Spectrum record

Enter the spectrum recording menu and click [Setting] to pop up the setting box option, as shown in Fig. 5.18:

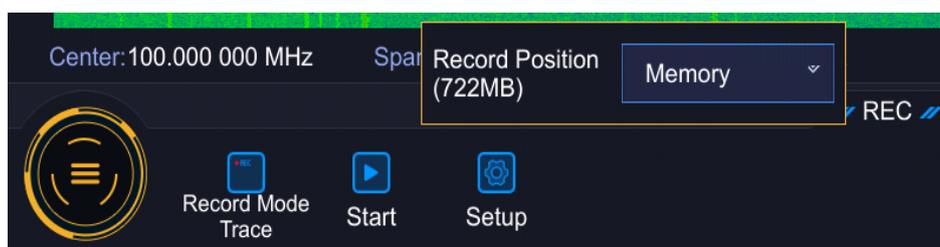


Fig. 5.18 Spectrum Record Setting Parameter Box

Parameters in spectrum setting property page are described as follows:

[Storage Location]

There are two modes: internal memory and SD card. The default mode is internal memory.

Click [Start] button to start recording, as shown in Fig. 5.19:

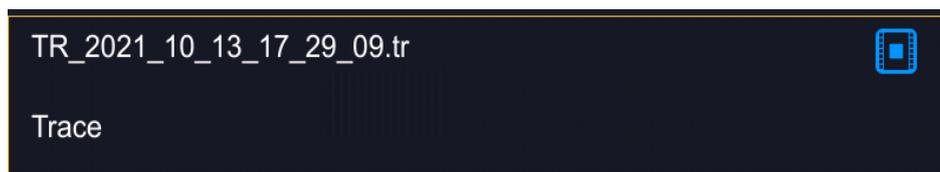


Fig. 5.19 Spectrum Recording Process

5.1.4.3 Audio record

Enter the audio recording menu and click [Setting] to pop up the setting box option, as shown in Fig. 5.20:



Fig. 5.20 Audio Record Setting Parameter Box

Parameters in audio setting property page are described as follows:

[Storage Location]

There are two modes: internal memory and SD card. The default mode is internal memory.

[Record Time]

Set the time for recorded data, which cannot exceed the maximum recordable time. The maximum recordable time is displayed in front.

Click [Start] button to start recording, as shown in Fig. 5.21:

5. Menus

5.1 General Menu

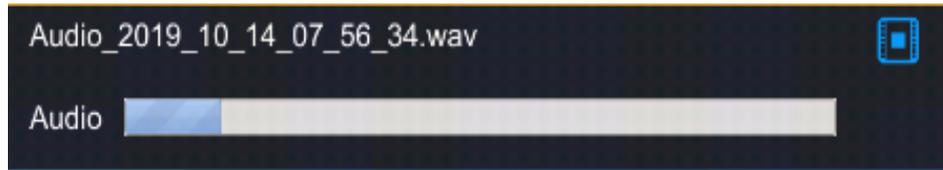


Fig. 5.21 Audio Recording Process

5.1.5 File menu

The file menu is used to display the related menu of internal storage and external storage. Click the file menu to pop up the file management dialog box. When the external storage device is not connected, only the internal storage path is displayed. As shown in Figure 5.22.

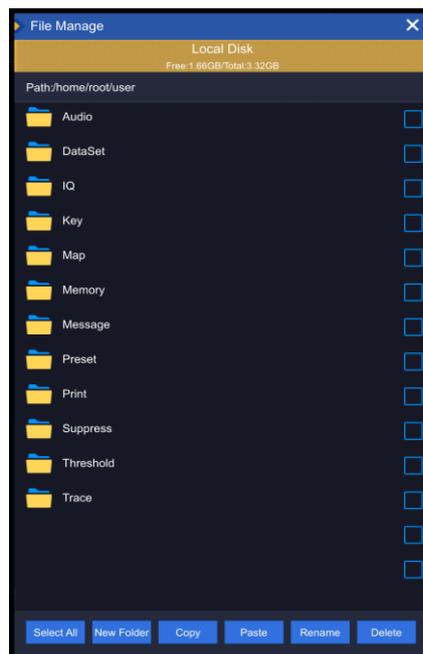


Fig. 5.22 Internal File List

There are six file operation buttons at the bottom of the file list, which are [Select All], [Create New Directory], [Copy], [Paste], [Rename] and [Delete].

[Select All]

Select all files in the current directory.

[Create New Directory]

Create a new folder.

[Copy]

Copy the selected file or folder

[Paste]

Paste the copied file or folder.

[Rename]

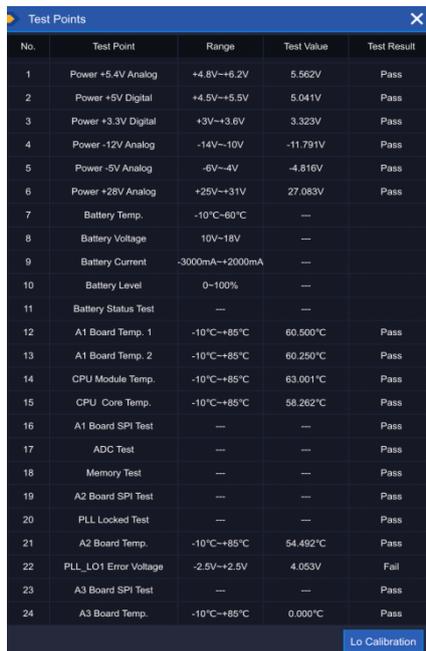
Rename the selected file or folder.

[Delete]

Delete the selected file or folder.

5.1.6 Self-test menu

The self-test menu is used to complete the self-test of the instrument. Click on the self-test menu to complete the instrument self-test, and the test results are shown in Figure 5.23.



No.	Test Point	Range	Test Value	Test Result
1	Power +5.4V Analog	+4.8V~+6.2V	5.562V	Pass
2	Power +5V Digital	+4.5V~+5.5V	5.041V	Pass
3	Power +3.3V Digital	+3V~+3.6V	3.323V	Pass
4	Power -12V Analog	-14V~-10V	-11.791V	Pass
5	Power -5V Analog	-6V~-4V	-4.816V	Pass
6	Power +28V Analog	+25V~+31V	27.083V	Pass
7	Battery Temp.	-10°C~60°C	---	---
8	Battery Voltage	10V~18V	---	---
9	Battery Current	-3000mA~+2000mA	---	---
10	Battery Level	0~100%	---	---
11	Battery Status Test	---	---	---
12	A1 Board Temp. 1	-10°C~+85°C	60.500°C	Pass
13	A1 Board Temp. 2	-10°C~+85°C	60.250°C	Pass
14	CPU Module Temp.	-10°C~+85°C	63.001°C	Pass
15	CPU Core Temp.	-10°C~+85°C	58.262°C	Pass
16	A1 Board SPI Test	---	---	Pass
17	ADC Test	---	---	Pass
18	Memory Test	---	---	Pass
19	A2 Board SPI Test	---	---	Pass
20	PLL Locked Test	---	---	Pass
21	A2 Board Temp.	-10°C~+85°C	54.492°C	Pass
22	PLL_LO1 Error Voltage	-2.5V~+2.5V	4.053V	Fail
23	A3 Board SPI Test	---	---	Pass
24	A3 Board Temp.	-10°C~+85°C	0.000°C	Pass

Figure 5.23 Self-test results of the machine

5.1.7 Frequency scale menu

Frequency scale can be enabled through the frequency scale menu. If the current activation window does not support the frequency marker function, the menu is grayed out. Click on the frequency scale menu, the bottom of the screen displays the secondary menu related to the frequency scale, as shown in Figure 5.24.

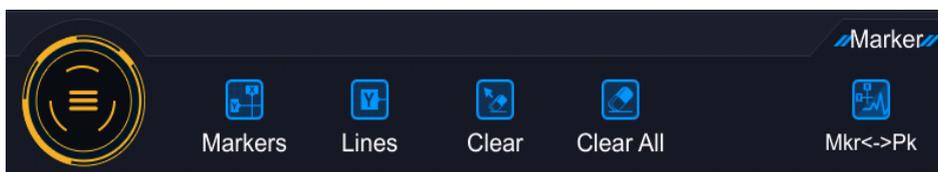


Figure 5.24 Frequency scale menu

Frequency scale menu is described as follows:

[Frequency Scale]

Activate the IF panorama window (take the IF panorama window as an example, other windows are the same), click on the frequency scale, two horizontal frequency scale X1 and X2 will be displayed on the window, as shown in Figure 5.25, both X1 and X2 frequency scale can be moved, the frequency point and magnitude of X1, the difference between X2 and X1 frequencies and the difference of magnitude are displayed in the top column of the panorama spectrum, and as X1 and X2 frequency scales are moved, these values will change.



Fig. 5.25 Frequency scale diagram of IF panoramic window

5. Menus

5.1 General Menu

[Magnitude marker]

Click the magnitude marker, two longitudinal frequency scales Y1 and Y2 will be displayed on the IF panoramic spectrum, as shown in Fig. 5.25. Both the Y1 and Y2 scales can be moved, and the magnitudes of Y1 and Y2, and the difference between the magnitudes of Y1 and Y2 will be displayed in the top column of the panoramic spectrum, and these values will change as the Y1 and Y2's longitudinal frequency scales are moved.

[Clear]

The function of this menu is to clear the frequency scales on the horizontal axis and the frequency scales on the vertical axis, but only two frequency scales or two magnitude markers can be cleared at one time. The method to clear the horizontal frequency scales X1 and X2 is: click and select one of X1 or X2, and then click Clear menu, then the two horizontal frequency scales X1 and X2 will be cleared and not displayed, the method to clear the vertical frequency scales Y1 and Y2 is the same as clearing the horizontal frequency scales.

[Clear All]

The function of this menu is to clear the frequency scales on the horizontal axis and the frequency scales on the vertical axis, and you can clear both frequency scales and both magnitude markers at once, i.e., just click Clear All.

[Frequency scale<->Peak]

The function of this menu is to switch the display of the frequency scale and peak menu. If the current is under the frequency scale menu, click on this menu to switch to the peak menu, the peak menu includes left adjacent peak, right adjacent peak, peak, frequency scale-> center, frequency scale -> demodulation several menus, as shown in Fig. 5.26.

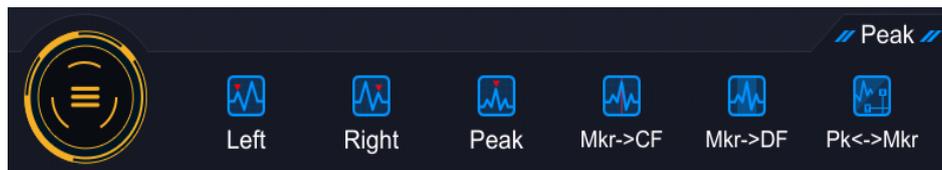


Fig. 5.26 Peak menu

The specific functions are described below.

[Left Adjacent Peak]

The function of this menu is mainly to position the currently selected frequency scale to its left adjacent peak point, click the left adjacent peak menu, the selected horizontal axis frequency scale will be positioned to the left adjacent peak point of the current one.

[Right Adjacent Peak]

The function of this menu is mainly to position the currently selected frequency scale to its right adjacent peak point. Clicking on the right adjacent peak menu, the selected horizontal axis frequency scale will be positioned to the right adjacent peak point of the current frequency point.

[Peak]

The function of this menu is mainly to position the currently selected frequency scale to one corresponding to the maximum value of the current frequency band trace. Click on the peak menu, and the selected horizontal frequency scale will be positioned to the frequency point where the maximum value of the current frequency band trace is located.

[Frequency Scale->Center]

The function of this menu is mainly to set the frequency point corresponding to the currently selected frequency scale as the center frequency. Click frequency scale->Center menu, and the frequency corresponding to the selected horizontal frequency scale is set as the center frequency.

[Frequency Scale->Demodulation]

The function of this menu is to set the frequency point corresponding to the currently selected frequency

5.1 General Menu

scale as the demodulation frequency. Click frequency scale -> Demodulation menu, the frequency corresponding to the selected horizontal frequency scale is set as the demodulation frequency.

5.1.8 Antenna menu

Antenna menu is used to set the antenna connected to this machine, click the antenna menu to bring up the antenna setting dialog, as shown in Fig. 5.27.

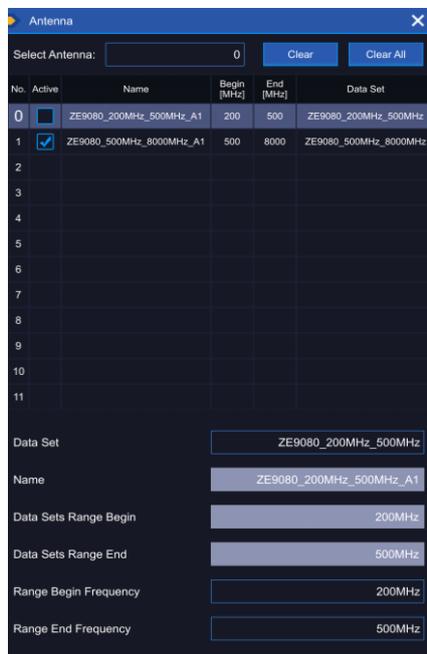


Fig. 5.27 Antenna setup parameters

The antenna factor of some common antennas are configured in the data source, therefore, you should select the antenna factor of the corresponding antenna before use. Click the input box corresponding to the data source, select the antenna factor corresponding to the antenna, the antenna information for the selected data source will appear in the edit box below the antenna list, these information mainly include the antenna name, the starting and ending frequencies of the antenna, the starting and ending frequencies of the antenna used and termination frequency, where the antenna name, starting frequency and termination frequency can be modified as needed.

After the antenna is activated, the level field strength window in the main interface displays the name of the selected antenna and enables the current field strength to be calculated based on the antenna factor, as shown in Fig. 5.28:

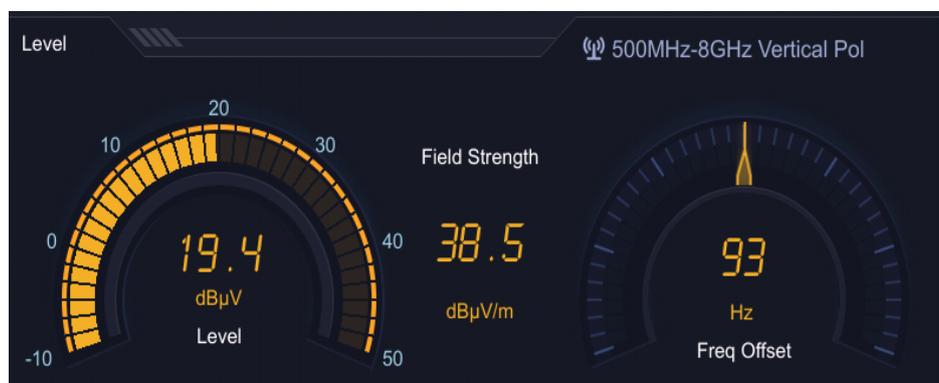


Fig. 5.28 Display of antenna name and field strength in the level field strength window

5.1.9 Peak menu

If the peak search is available in the currently active window, click on the peak icon and perform peak search in the window, and the peak menu is displayed at the bottom of the screen, as shown in Fig. 5.25.

For the function descriptions of the secondary menus contained in the Peak menu, please refer to the

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5.1 General Menu

detailed description of the Peak menu in 5.1.7 Frequency scale menu.

5.1.10 Playback menu

The function of this menu is to set the playback, the playback function is an option of the machine, when the whole machine has the playback function option, the menu is available. The playback function supports playback of the spectrum and audio data files recorded by this machine. The playback menu is shown in Fig. 2.9:



Fig. 5.29 Playback menu

5.1.10.1 Spectrum playback

Click [Playback Mode] menu to select [Playback Mode/Spectrum] or [Playback Mode/Audio]. When selecting a spectrum, the menu is shown as the Fig. 5.30:

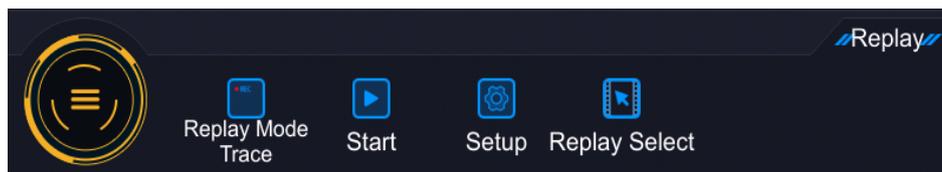


Fig. 5.30 Playback mode/spectrum

Enter the Spectrum Playback menu, click [Settings], and a settings box option appears, where you can select the playback speed, as shown in Fig. 5.31:

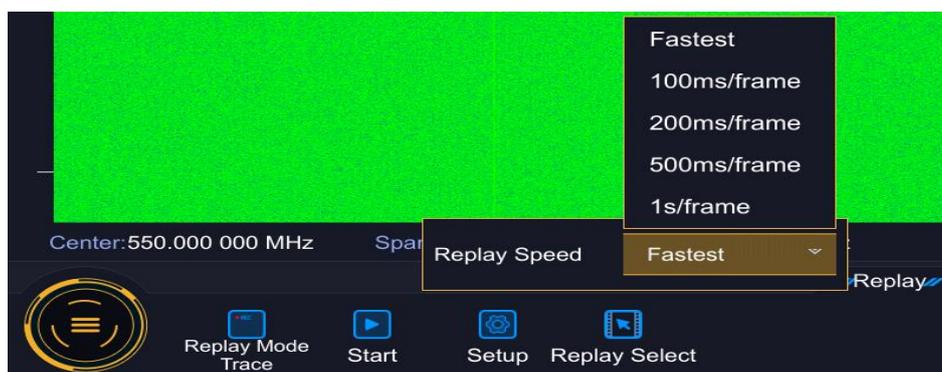


Fig. 5.31 Spectrum playback settings

5.1 General Menu

Click [Playback Selection] to bring up the file options, and you can select any file you want to play back, as shown in Fig. 5.32:

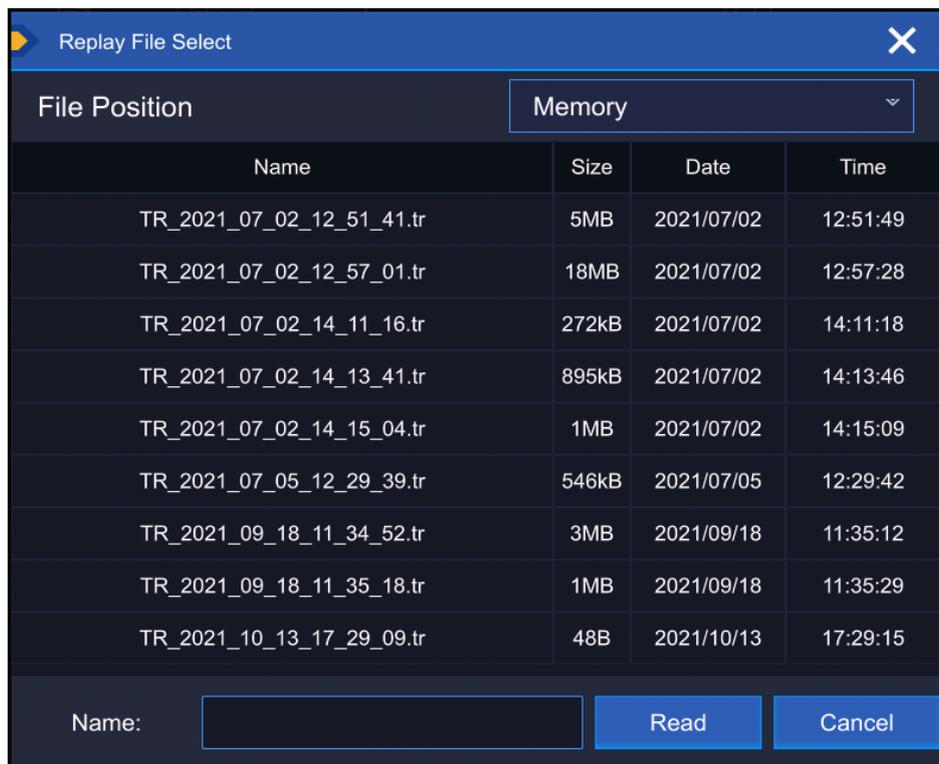


Fig. 5.32 Spectrum file selection

Select the file and click [Read] to enter the spectrum playback status, as shown in Fig. 5.33:



Fig. 5.33 Spectrum playback

5.1.10.1 Audio playback

Click the [Playback Mode] menu and select [Playback Mode/Audio]. As shown in Fig. 5.34:

5.1 General Menu

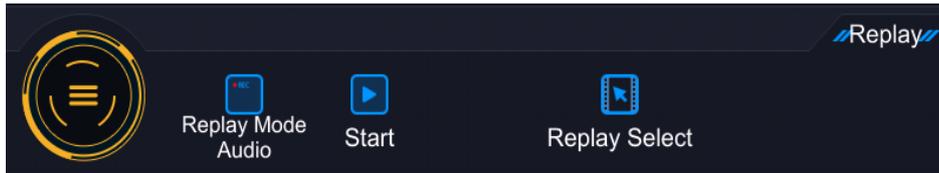


Fig. 5.34 Playback mode/audio

Click [Playback Selection] to bring up the file options, and you can select any file you want to play back, as shown in Fig. 5.35:

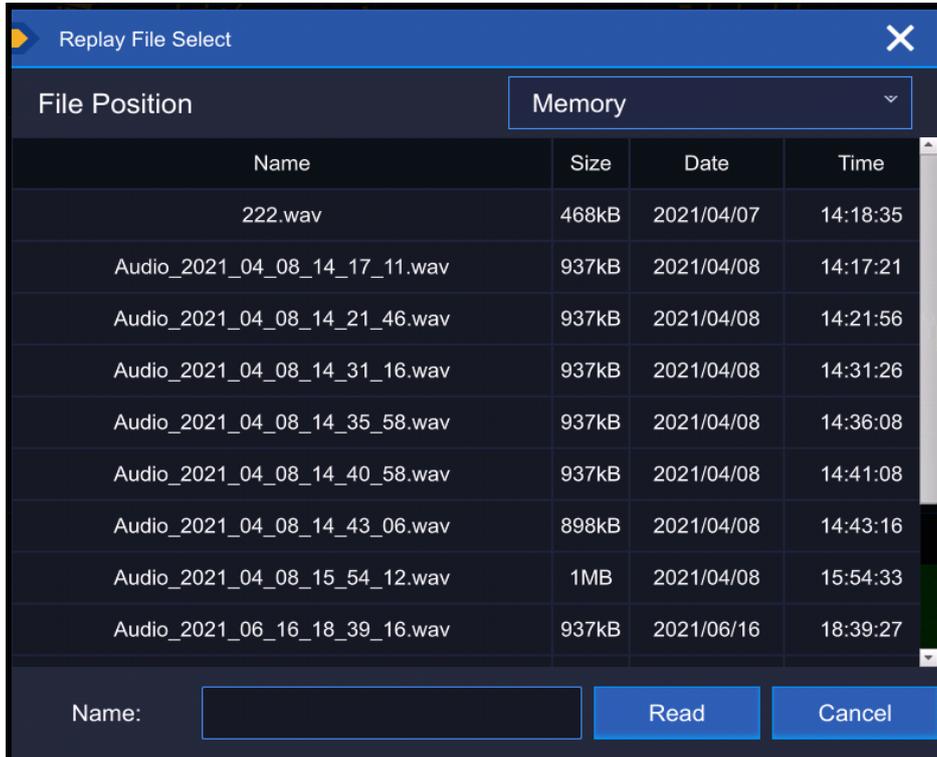


Fig. 5.35 Audio file selection

Select the file and click [Read] to enter the audio playback status, as shown in Fig. 5.36.

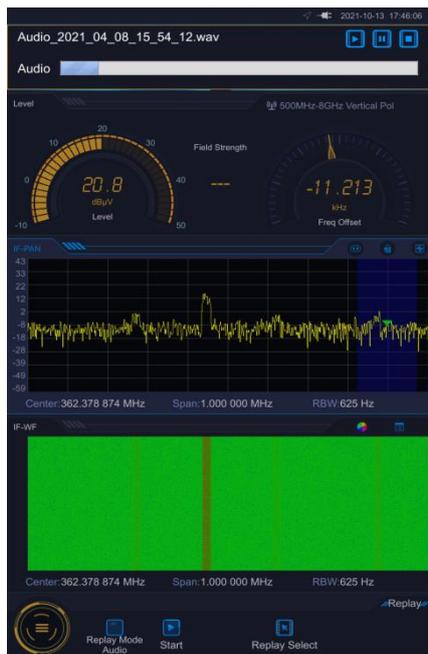


Fig. 5.36 Audio playback

5.2 Window menu

The 3943B monitoring receiver has different menus under different windows of different scan modes. This section details the menu information contained in each window of each scan mode, in the order of fixed frequency reception, panoramic scan, frequency scan, and list scan, respectively.

- Fixed frequency receiving.....66
- Panoramic scan.....71
- Frequency scan.....78
- List scan.....80

5.2.1 Fixed frequency receiving

Click [System Menu] under the [Scan] menu, select [Fixed Frequency Receive] menu. The menu items as shown in Fig. 5.37, mainly includes run, stop and parameter settings several menus, where the run and stop menu are mainly used to control the scanning state; press [Parameters] menu, the parameter settings dialog box pops up, where there are different windows correspond to different parameter settings to be introduced separately.

The fixed-frequency reception mode consists of three main windows: the level field strength window, the IF panorama window and the IF waterfall window.

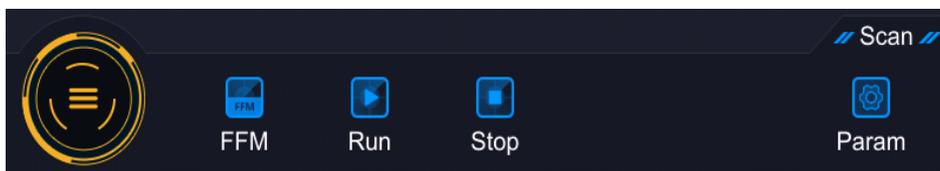


Fig. 5.37 Secondary Menu of Panoramic Scan Mode

5.2.1.1 Level field strength window

The Parameter Settings dialog box corresponding to the Level Field Intensity window contains two property pages for parameter settings and window selection.

1) Parameter setting

The parameter setting property page is shown in Fig. 5.38:

5.2 Window menu

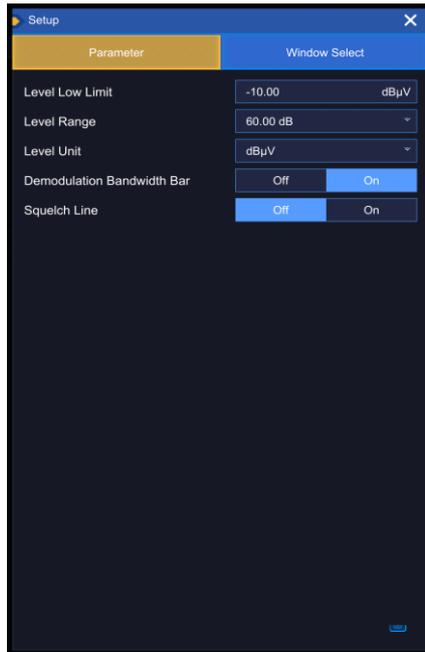


Fig. 5.38 Level field strength window parameter setting property page

The relevant parameters on the Parameter Settings property page are described as follows:

[Level Display Lower Limit]

Set the lower limit of the level display, the default value is -10dBuV.

[Level Display Range]

Set the level display range, default select 60.00dB.

[Level Unit]

Set the level unit, including dBm, dBuV.

[Demodulation Bandwidth Histogram]

Set the demodulation bandwidth histogram switch state.

[Squelch Line]

Set the squelch line switch.

2) Window selection

The window selection property page under the Level Field Strength window is shown in Fig. 5.39.



Fig. 5.39 Level field strength window selection property page

Select the combination of windows to be displayed, you can only choose to display 2-3 windows, if the number of windows selected does not meet the requirements, a dialog box will pop up to prompt: the number of windows selected is incorrect, please choose again!

5.2.1.2 IF panoramic window

The parameter setting dialog box corresponding to the IF panorama window contains three property pages for the measurement, display and window selection.

1) Measurement

The measurement-related property pages under the IF Panorama window are shown in Fig. 5.40.

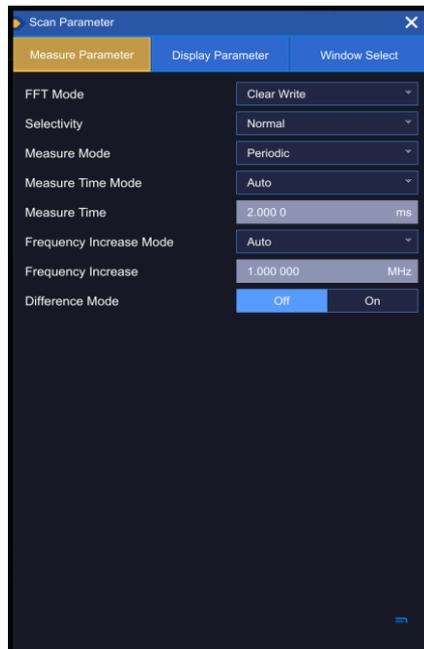


Fig. 5.40 Measurement-related property page under the IF panorama window

The measurement-related parameters are described below:

[Wave Detection Type]

5. Menus

5.2 Window menu

Set the detection type, including dynamic refresh, minimum value, maximum value, and average four trace types, and the default is dynamic refresh.

[Filter Selectivity]

Set the filter type, including auto, regular, narrow, and sharp four selection types, and the default is regular.

[Measurement Mode]

Set the measurement mode, including two modes: periodical and continuous, and the default is periodical mode.

[Measurement Time Mode]

Set the type of measurement time, including automatic and manual modes. Auto mode is selected by default (in the auto mode the measurement time is automatically calculated by the receiver).

[Measurement Time]

Set the measurement time, the range is 500 μ s-900s. The default value is set to 500 μ s and valid when the measurement time mode is manual.

[Frequency Step Mode]

Set the frequency step mode including the automatic and manual modes, and the automatic mode is selected by default.

[Frequency Step Interval]

Set the frequency step interval which is valid when the frequency step mode is manual. The range is 1Hz~1GHz and the default value is set to 1MHz.

[Differential Mode]

Set the differential display of the spectrum. Differential mode will display when it is on, and it is in normal display when it is off.

2) Display

The display-related property pages under the IF Panorama window are shown in Fig. 5.41.

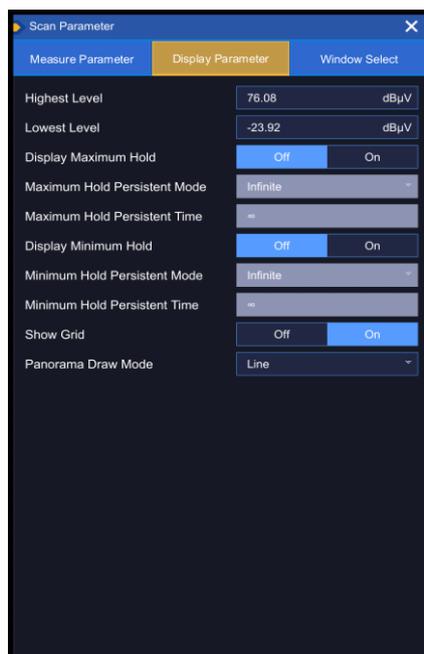


Fig. 5.41 The display-related property pages under the IF Panorama window

The parameters for the display-related property pages are described below:

[Highest Level]

5.2 Window menu

Set the maximum display level of the window. The range is -30dBuV~110dBuV, and the default value is set to 76.99dBuV.

[Lowest Level]

Set the minimum display level of the window. The range is -230dBuV~100dBuV, and the default value is set to -23.01dBuV.

[Max Hold Display]

Sets the maximum hold display switch, which is turned off by default.

[Max Hold Continuous Mode]

Set the maximum hold continuous mode which is valid when the maximum hold display status is on. It includes wireless and manual states, and the unlimited mode is set by default.

[Maximum Hold Duration]

Set the maximum hold duration which is valid when the maximum hold mode is set in manual mode. The range is 500ms~60s, and the default value is set to 2s.

[Min Hold Display]

Set the minimum hold display switch, which is off by default.

[Min Hold Continuous Mode]

Set the minimum hold duration mode which is valid when the minimum hold display is on, including unlimited and manual two modes, the default selection is set in unlimited mode.

[Minimum Hold Duration]

Set the minimum hold duration which valid when the minimum hold mode is manual. Range: 500ms~60s, the default value is set to 2s.

[Grid]

Set whether the grid of the spectrum window is displayed or not, it is displayed when it is on and the display goes off when it is off. It is turned on by default.

[Demodulation Bandwidth Histogram]

Set whether the demodulation bandwidth histogram in the Spectrum window is displayed or not, when it is on, or not when it is off, the default is on.

[Squelch Line]

Set whether the squelch line in the spectrum window is displayed or not, it will display when it is on, the default state is off.

3) Window selection

Select the property page in the window under the IF Panorama window the same as the window under the Level Field Strength window.

5.2.1.3 IF waterfall window

The parameter setting dialog corresponding to the IF waterfall window contains three property pages for measurement, display, and window selection.

1) Measurement

The measurement property page corresponding to the IF Waterfall window is the same as the measurement property page under the IF Panorama window.

2) Display

The display property pages under the IF Waterfall window are shown in Fig. 5.42.

5.2 Window menu

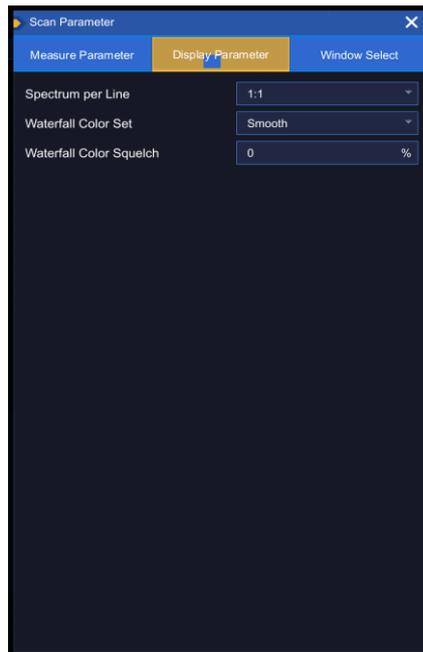


Fig. 5.42 Display property pages under IF waterfall window

The display parameters are described below:

[Spectrum/Line]

Set the compression ratio of spectrogram and waterfall map, including 1:1, 2:1, 5:1, 10:1, 20:1, 50:1, 100:1, where the larger the compression ratio the slower the waterfall map. The default compression ratio is set to 1:1;

[Waterfall Chart Color]

Set the color of the waterfall chart, including smooth, rainbow, rainbow extended, cool, grayscale five color modes. The smooth color is set by default.

[Waterfall Chart Color Display Threshold]

Set the waterfall chart color display threshold, the range is 0~100%. The default value is set to 0.

3) Window selection

The window selection property page under the IF waterfall chart is the same as the window selection property page under the IF panorama window.

5.2.2 Panoramic scan

Click the [Scan] menu under [System Menu] and select the [Panorama Scan] menu. The menu items mainly include several menus for running, stopping, and parameter setting.

In the panoramic scan mode you can choose any 2-3 windows in the four windows of IF panorama, IF waterfall, RF panorama, RF waterfall for combined display. The default display is set to IF panorama, RF waterfall and RF panorama three windows, and the run and stop menus are mainly used to control the scanning state of the panoramic scan.

Click [Run] menu, the panoramic scan starts working, the corresponding RF panoramic window and RF waterfall window start running, while the IF panoramic window stops running.

Click [Stop] menu, the panoramic scan stops working, the corresponding RF panoramic window and RF waterfall window stop running, and the IF panoramic window starts running.

Click the [Parameter] menu to bring up the parameter setting dialog box. Different windows correspond to different parameter settings, which will be described in detail in subsections 5.2.2.1~5.2.2.5.

5.2.2.1 IF panoramic window

The parameter setting dialog corresponding to the IF panorama window in panorama scanning mode

5.2 Window menu

contains three property pages, including measurement, display and window selection, which is the same as 5.2.1.2 IF panorama window in fixed frequency reception mode.

5.2.2.2 IF waterfall window

The parameter setting dialog corresponding to the IF waterfall window in panoramic scan mode contains three property pages, including measurement, display and window selection, which is the same as 5.2.1.3 IF waterfall window in fixed frequency reception mode.

5.2.2.3 RF panorama window

The parameter setting dialog corresponding to the RF panorama window in panorama scanning mode contains three property pages: measurement, display and window selection.

1) Measurement

The measurement property pages under the RF Panorama window are shown in Fig. 5.43.

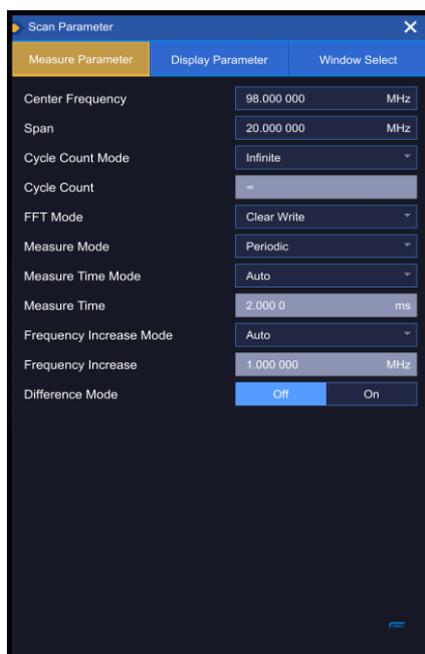


Fig. 5.43 Measurement property pages under the RF Panorama window

The measurement-related parameters are described below:

[Center Freq]

Set the center frequency with the range of 13.5kHz~7.999995GHz, the default value is 98MHz, if the set center frequency and the current bandwidth are not coordinated, the bandwidth will be automatically adjusted to the best value that is compatible with the desired frequency.

[Span]

Set the frequency width with the range of 9kHz~7.999991GHz, the default value is 20MHz.

[Scan Count Mode]

Set the scan count mode, including unlimited and manual modes. The unlimited mode is set by default.

[Scan Count]

Set the scan count which is valid when the scan count mode is set to manual. The setting range is 1-1000, and the default scan count is 1.

[Wave Detection Type]

Set the detection type, including dynamic refresh, minimum value, maximum value, and average four trace types, and the default is dynamic refresh.

[Measurement Mode]

5. Menus

5.2 Window menu

Set the measurement mode, including two modes: periodical and continuous, and the default is periodical mode.

[Measurement Time Mode]

Set the type of measurement time, including automatic and manual modes. Auto mode is selected by default (in the auto mode the measurement time is automatically calculated by the receiver).

[Measurement Time]

Set the measurement time, the range is 500 μ s-900s. The default value is set to 500 μ s and valid when the measurement time mode is manual.

[Frequency Step Mode]

Set the frequency step mode including the automatic and manual modes, and the automatic mode is selected by default.

[Frequency Step Interval]

Set the frequency step interval which is valid when the frequency step mode is manual, the range is 1Hz~1GHz, the default value is 1MHz.

[Differential Mode]

Set the differential display of the spectrum. Differential mode will display when it is on, and it is in normal display when it is off.

2) Display

The display property page under the panorama scan mode RF panorama window is shown in Fig. 5.44.

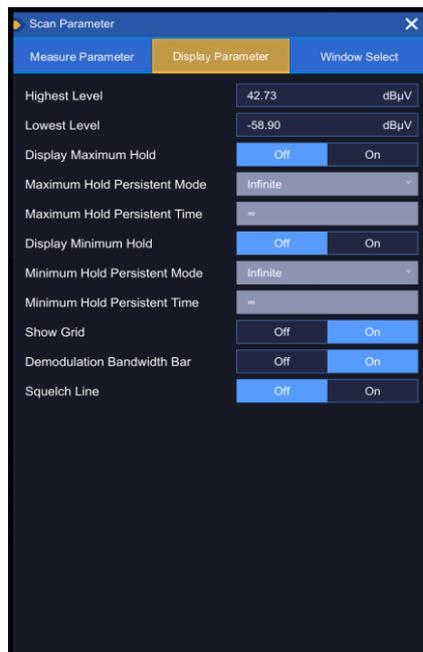


Fig. 5.44 Display property pages under the RF Panorama window

The parameters for the display-related property pages are described below:

[Highest Level]

Set the maximum display level of the window. The range is -30dBuV~110dBuV, and the default value is set to 76.99dBuV.

[Lowest Level]

Set the minimum display level of the window. The range is -230dBuV~100dBuV, and the default value is set to -23.01dBuV.

[Max Hold Display]

Sets the maximum hold display switch, which is turned off by default.

[Max Hold Continuous Mode]

Set the maximum hold continuous mode which is valid when the maximum hold display status is on. It includes wireless and manual states, and the unlimited mode is set by default.

[Maximum Hold Duration]

Set the maximum hold continues time which is valid when the maximum hold mode is set to manual. The range is 500ms~60s, and the default value is 2s.

[Min Hold Display]

Set the minimum hold display switch, which is off by default.

[Min Hold Continuous Mode]

Set the minimum hold duration mode which is valid when the minimum hold display is on, including unlimited and manual two modes, the default selection is set in unlimited mode.

[Minimum Hold Duration]

Set the minimum hold continues time which valid when the minimum hold mode is set to manual. The range is 500ms~60s, and the default value is 2s.

[Grid]

Set whether the grid of the spectrum window is displayed or not, it is displayed when it is on and the display goes off when it is off. It is turned on by default.

[Spectrum Plotting Mode]

Set the spectrum plotting mode, including both comb and line modes, and the line mode chosen by default.

3) Window selection

The window selection property page corresponding to the RF panorama window in panorama scan mode is the same as the IF panorama window window selection property page.

5.2.2.4 RF waterfall window

The parameter setting dialog corresponding to the RF waterfall window in panoramic scan mode contains three property pages: measurement, display and window selection.

1) Measurement

The measurement property pages under the Panorama Scan Mode RF Waterfall window are shown in Fig. 5.45.

5.2 Window menu

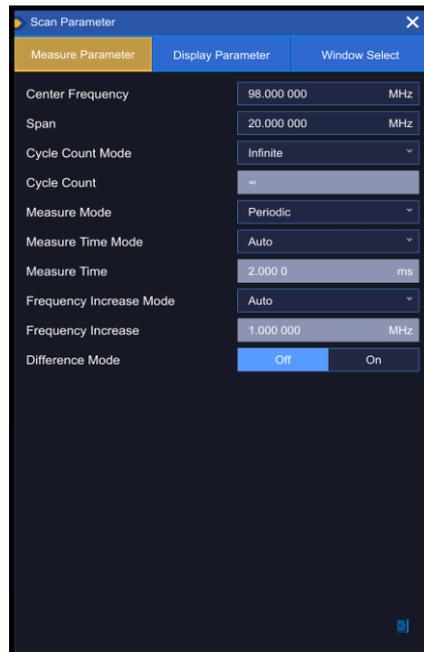


Fig. 5.45 Measurement property page under the RF Waterfall window

The measurement-related parameters are described below:

[Center Freq]

Set the center frequency with the range of 13.5kHz~7.999995GHz, the default value is 98MHz, if the set center frequency and the current bandwidth are not coordinated, the bandwidth will be automatically adjusted to the best value that is compatible with the desired frequency.

[Span]

Set the frequency width with the range of 9kHz~7.999991GHz, the default value is 20MHz.

[Scan Count Mode]

Set the scan count mode, including unlimited and manual modes. The unlimited mode is set by default.

[Scan Count]

Set the scan count which is valid when the scan count mode is set to manual. The setting range is 1-1000, and the default scan count is 1.

[Measurement Mode]

Set the measurement mode, including two modes: periodical and continuous, and the default is periodical mode.

[Measurement Time Mode]

Set the type of measurement time, including automatic and manual modes. Auto mode is selected by default (in the auto mode the measurement time is automatically calculated by the receiver).

[Measurement Time]

Set the measurement time, the range is 500 μ s-900s. The default value is set to 500 μ s and valid when the measurement time mode is manual.

[Frequency Step Mode]

Set the frequency step mode including the automatic and manual modes, and the automatic mode is selected by default.

[Frequency Step Interval]

Set the frequency step interval which is valid when the frequency step mode is manual. The range is 1Hz~1GHz and the default value is set to 1MHz.

[Differential Mode]

Set the differential display of the spectrum. Differential mode will display when it is on, and it is in normal display when it is off.

2) Display

The corresponding display property pages of the RF waterfall window in panoramic scan mode are shown in Fig. 5.46.

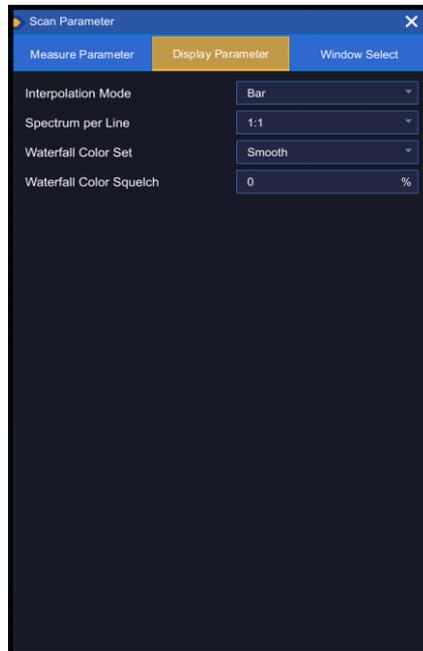


Fig. 5.46 Display property pages under RF Waterfall window

The display parameters are described below:

[Interpolation Mode]

Set the interpolation mode, including both the bar and comb modes. The bar mode is chosen by default.

[Spectrum/Line]

Set the compression ratio of spectrogram and waterfall, including 1:1, 2:1, 5:1, 10:1, 20:1, 50:1, 100:1. The larger the compression ratio the slower the speed of the waterfall, the default compression ratio is set to 1:1;

[Waterfall Chart Color]

Set the color of the waterfall map, including smooth, rainbow, rainbow extended, cool, grayscale five color modes, the smooth color mode is chosen by default.

[Waterfall Chart Color Display Threshold]

Set the waterfall chart color display threshold, the range is 0~100%. The default value is set to 0.

3) Window selection

The window selection property page corresponding to the RF waterfall window in panoramic scan mode is the same as the window selection property page corresponding to the IF panoramic window in panoramic scan mode.

5.2.3 Frequency scan

Click [Scan] menu under [System Menu], select [Frequency Scan] menu, the menu items mainly include parameter setting, restart, run-, run+, stop several menus.

Click [Run+] menu, in the RF panorama window the trace is scanned backward in every step starting from the starting frequency.

5. Menus

5.2 Window menu

Click [Run-] menu, in the RF panorama window the trace is scanned forward in every step starting from the termination frequency.

Click the [Stop] menu to stop the step scan in the RF Panorama window and RF Waterfall window.

Click the [Restart] menu to restart the step scan.

Click the [Parameter] menu to bring up the parameter setting dialog box. Different windows correspond to different parameter settings, such as the level field strength window contains two property pages for parameter setting and window selection, while the spectrum graph window and waterfall graph window include three property pages: measurement, display and window combination, which will be described in detail in subsections 5.2.3.1~5.2.3.5.

5.2.3.1 Level field strength window

The corresponding parameter setting pair box of the level field intensity window in frequency sweep mode contains two property pages for parameter setting and window selection, the same as the level field intensity window in 5.2.1.1 fixed frequency reception mode.

5.2.3.2 IF panoramic window

The parameter setting dialog box corresponding to the IF panorama window in frequency scan mode contains three property pages: measurement, display and window selection, the same as the IF panorama window in 5.2.1.2 fixed frequency reception mode.

5.2.3.3 IF waterfall window

The parameter setting dialog box corresponding to the IF waterfall window in frequency scan mode contains three property pages of measurement, display and window selection, the same as the IF panorama window in 5.2.1.3 fixed frequency reception mode.

5.2.3.4 RF panorama window

The parameter setting dialog corresponding to the RF panorama window in frequency scan mode contains three property pages for measurement, display and window selection.

1) Measurement

The measurement property page under the RF Panorama window in frequency scan mode is shown in Fig. 5.47.

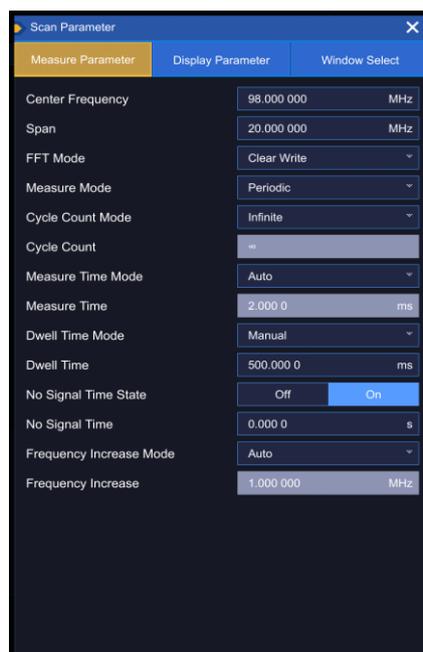


Fig. 5.47 Measurement property page under RF panorama window

The measurement-related parameters are described below:

[Center Freq]

5.2 Window menu

Set the center frequency with the range of 13.5kHz~7.999995GHz, the default value is 98MHz, if the set center frequency and the current bandwidth are not coordinated, the bandwidth will be automatically adjusted to the best value that is compatible with the desired frequency.

[Span]

Set the frequency width with the range of 9kHz~7.999991GHz, the default value is 20MHz.

[Wave Detection Type]

Set the detection type, including dynamic refresh, minimum value, maximum value, and average four trace types, and the default is dynamic refresh.

[Scan Count Mode]

Set the scan count mode, including unlimited and manual two modes, the default is unlimited mode.

[Scan Count]

Set the scan count which is valid when the scan count mode is set to manual. The setting range is 1-1000, and the default scan count is 1.

[Measurement Mode]

Set the measurement mode, including two modes: periodical and continuous, and the default is periodical mode.

[Measurement Time Mode]

Set the type of measurement time, including automatic and manual modes. Auto mode is selected by default (in the auto mode the measurement time is automatically calculated by the receiver).

[Measurement Time]

Set the measurement time, the range is 500 μ s-900s. The default value is set to 500 μ s and valid when the measurement time mode is manual.

[Dwell Time Mode]

Set the dwell time mode, including unlimited and manual modes, the default is manual mode.

[Dwell time]

Set the dwell time with the range of 0~60s. The default setting is 500ms, and the dwell time mode is valid when set to manual.

[No Signal Time State]

Set the no-signal time state, including on and off. The default setting is on.

[No Signal State Dwell Time]

Set the no-signal state dwell time. The range is 0~60s, and the default is set to 0s. No-signal time state is valid when open.

[Frequency Step Mode]

Set the frequency step mode including the automatic and manual modes, and the automatic mode is selected by default.

[Frequency Step Interval]

Set the frequency step interval which is valid when the frequency step mode is manual. The range is 1Hz~1GHz and the default value is set to 1MHz.

[Differential Mode]

Set the differential display of the spectrum. Differential mode will display when it is on, and it is in normal display when it is off.

2) Display

The display property pages corresponding to the RF Panorama window in Frequency Scan mode are the same as the display property pages of the RF Waterfall window in Section 5.2.2.3.

5.2 Window menu

3) Window selection

The window selection property sheet corresponding to the RF panorama window in frequency scan mode is the same as the window selection property sheet under 5.2.1.2 IF panorama window.

5.2.3.5 RF waterfall window

The parameter setting dialog corresponding to the RF waterfall window in frequency scan mode contains three property pages: measurement, display, and window selection.

1) Measurement

The measurement property page corresponding to the RF waterfall window in frequency scan mode is the same as the measurement-related property page corresponding to the RF panorama window.

2) Display

The display property pages corresponding to the RF Waterfall window in Frequency Scan mode are the same as the display-related property pages in Section 5.2.2.4.

3) Window selection

The window selection property page corresponding to the RF waterfall window in frequency scan mode is the same as the window under 5.2.1.2 IF panorama window

Select the property page.

5.2.4 Scan the list

Click [Scan] menu under [System Menu], select [Scan the List] menu, the menu items mainly include parameter setting, restart, run-, run+, stop several menus.

Click the [Run+] menu, and in the RF Panorama window, and cycle backward for the frequency points saved in the list from the starting frequency.

Click the [Run-] menu, and in the RF Panorama window, and perform a cyclic scan forward for the frequency points saved in the list from the termination frequency.

Click [Stop] menu to stop the scanning of RF Panorama window and RF Waterfall window.

Click the [Restart] menu to resume scanning the list.

Click the [Parameter] menu to bring up the parameter setting dialog box. Different windows correspond to different parameter settings, such as the level field strength window contains two property pages for parameter setting and window selection, while the spectrum graph window and waterfall graph window include three property pages: measurement, display and window combination, which will be described in detail in subsections 5.2.3.1~5.2.3.5.

5.2.4.1 Level field strength window

The parameter setting dialog box corresponding to the level field intensity window in list scan mode contains two property pages: parameter setting and window selection, the same as 5.2.1.1 Level field strength window.

5.2.4.2 IF panoramic window

The parameter setting dialog box corresponding to the IF panorama window in list scan mode contains three property pages: measurement , display and window selection, same as 5.2.1.2 IF panorama window.

5.2.4.3 IF waterfall window

The parameter setting dialog corresponding to the IF waterfall window in list scan mode contains three property pages for measurement, display and window selection, as in 5.2.1.3 IF waterfall window.

5.2.4.4 RF panorama window

The parameter setting dialog corresponding to the RF panorama window in list scanning mode contains three property pages: measurement, display and window selection.

1) Measurement

5.2 Window menu

The measurement property pages corresponding to the RF panorama window in list scan mode are shown in Fig. 5.48.

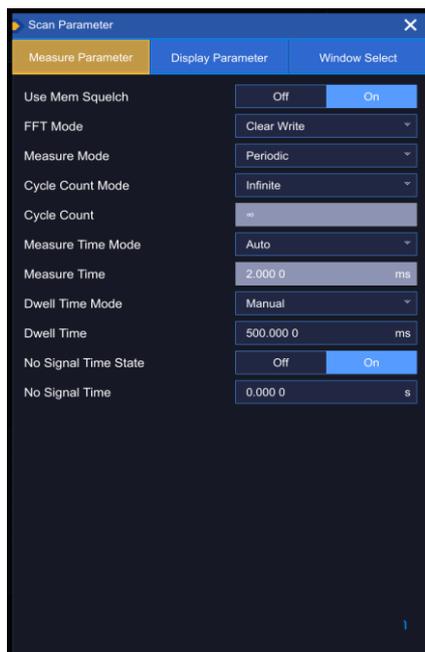


Fig. 5.48 Measurement property pages corresponding to the RF panorama window in list scan mode

The measurement-related parameters are described below:

[Memory Table Squelch Level]

Set the state of the memory table squelch level, including the open and close states, the default is open. All frequencies in the memory table use their own squelch level value when turned on, and the same squelch level (squelch level value on the main screen) when turned off.

[Wave Detection Type]

Set the detection type, including dynamic refresh, minimum value, maximum value, and average four trace types, and the default is dynamic refresh Type.

[Scan Count Mode]

Set the scan count mode, including unlimited and manual modes. The unlimited mode is set by default.

[Scan Count]

Set the scan count which is valid when the scan count mode is set to manual. The setting range is 1-1000, and the default scan count is 1.

[Measurement Mode]

Set the measurement mode, including two modes: periodical and continuous, and the default is periodical mode.

[Measurement Time Mode]

Set the type of measurement time, including automatic and manual modes. Auto mode is selected by default (in the auto mode the measurement time is automatically calculated by the receiver).

[Measurement Time]

Set the measurement time, the range is 500 μ s-900s. The default value is set to 500 μ s and valid when the measurement time mode is manual.

[Dwell Time Mode]

Set the dwell time mode, including unlimited and manual modes, the default is manual mode.

[Dwell time]

5.2 Window menu

Set the dwell time with the range of 0~60s. The default setting is 500ms, and the dwell time mode is valid when set to manual.

[No Signal Time State]

Set the no-signal time state, including on and off. The default setting is on.

[No Signal State Dwell Time]

Set the no-signal state dwell time. The range is 0~60s, and the default is set to 0s. No-signal time state is valid when open.

[Differential Mode]

Set the differential display of the spectrum. Differential mode will display when it is on, and it is in normal display when it is off.

2) Display

The corresponding display property pages of the RF panorama window in frequency scan mode are the same as those in Section 5.2.2.3, Panorama Scan Mode.

3) Window selection

The window selection property page corresponding to the RF panorama window in list scan mode is the same as the window selection property page under 5.2.1.2 IF panorama window.

5.2.4.5 RF waterfall window

The parameter setting dialog corresponding to the RF waterfall window in list scan mode contains three property pages: measurement, display and window selection.

1) Measurement

The measurement property page corresponding to the RF waterfall window in list-scan mode is the same as the measurement-related property page corresponding to the RF panorama window in 5.2.4.4 Scan the list mode.

2) Display

The display property pages corresponding to the RF waterfall window in list scan mode are the same as the display-related property pages corresponding to the RF waterfall window in 5.2.2.4 panorama scan mode.

3) Window selection

The window selection property page corresponding to the RF waterfall window in list scan mode is the same as the window under 5.2.1.2 IF panorama window

Select the property page.

6 Remote control

This chapter provides the basic information for operating the 3943B monitoring receiver by remote control to facilitate remote control operation. Specifically it includes:

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- Instrument program control port and configuration.....96
- VISA interface basic programming method.....98
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- Remote control interface.....84
- Message.....86
- SCPI command.....86
- Command sequence and synchronization.....93
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- Programming considerations.....96

6.1.1 Program control interface

The 3943B monitoring receiver supports LAN remote control interface as described in the following table:

Table 6.1 Remote control interface types and VISA addressing strings

Remote control interface	VISA address string (Note 1)	Description
LAN (Local Area Network)	Raw socket protocol: TCPIP::host_address::port::SOCKET	The controller is connected to the instrument through the instrument's rear panel network port for remote control. For details of the protocol, please refer to: 6.1.1.1 LAN interface

Note 1: VISA (Virtual Instrumentation Software Architecture), is a set of standard software interface function library, by which the user can use the function library through the GPIB, RS232, LAN, USB and other interfaces to control the instrument. Users shall first install the VISA library on the control computer and use the VISA library to achieve remote instrument control. Please refer to the user manual of the installed VISA library for details.

6.1.1.1 LAN interface

The monitoring receiver can be connected to 10Mbps/100Mbps/1000Mbps Ethernet using RJ45 communication cable (shielded or unshielded Cat. 5 twisted pair) for remote control via a control computer in the LAN. The monitoring receiver has been installed with an interface adapter and TCP/IP network protocol for remote control within the LAN, and configured with the corresponding TCP protocol-based network services.

The network interface adapter installed in the 3943B monitoring receiver has three operating modes, which are:

- 10 Mbps Ethernet (IEEE802.3);
- 100 Mbps Ethernet (IEEE802.3u);
- 1000Mbps Ethernet (IEEE802.3ab);

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The interface adapter automatically matches the appropriate network speed to the link condition. Normally, the length of the cable connecting the monitoring receiver shall not exceed 100 meters. For more information about Ethernet, please refer to: <http://www.ieee.org>

LAN interface introduction:

1) IP address

When remote control of the monitoring receiver is performed via LAN, the physical connection to the network shall be ensured to be smooth. Set the address to the subnet where the master computer is located through "IP address" under the Setup->Network Setup interface of the monitoring receiver, for example: the IP address of the master computer is 192.168.12.0, then the IP address of the monitoring receiver shall be set to 192.168.12.XXX, where XXX is a value between 1 ~ 255.

Only the IP address is required to establish a network connection, and the VISA addressing string takes the following form:

TCPIP: : host address: port: : SOCKET

Where:

- TCPIP indicates the network protocol used;
- The "host address" indicates the IP address or host name of the instrument, which is used to identify and manage the controlled instrument.
- The port identifies the socket port number. For the 3943B monitoring receiver it is 5025;
- The SOCKET represents the raw network socket resource class.

Example:

When establishing an original socket connection, the following IP is allowed:

TCPIP::192.1.2.3::5025::SOCKET

Tip

Methods of identification of multiple instruments in programmable system

If multiple instruments are connected in the network, the individual IP addresses of the instruments and the associated resource strings will be used to distinguish them. Host computers identifies the instruments through their respective VISA resource strings.

2) Socket communication

The TCP/IP protocol connects monitoring receivers in a network via LAN sockets. Sockets are a basic method used in computer network programming that allows applications using different hardware and operating systems to communicate in a network. This method enables bi-directional communication between the monitoring receiver and the computer through a port.

A socket is a specially written software category that defines information necessary for network communication such as IP addresses and device port numbers, integrating some basic operations in network programming. Sockets can be used after installing packaged libraries in the operating system. Two commonly used socket libraries are the Berkeley socket library for UNIX the Winsock library for Windows.

The sockets in the monitoring receiver are compatible with Berkeley sockets and Winsock through the Application Program Interface (API). In addition, it is also compatible with other standard socket APIs. When monitoring the receiver through SCPI command control, the socket program established in the program issues commands. The socket port number of the monitoring receiver is fixed to 5025.

6.1.2 Message

The messages transmitted on the data cable are separated into the following two categories:

1) Interface message

During communication between the instrument and the host computer, the "attention" cable shall be pulled down first before the interface messages can be transmitted to the instrument via the data cable. Only the instruments with GPIB bus function can send interface messages.

2) Instrument message

For the structure and syntax of instrument messages, refer to Section "5.1.4 SCPI Commands". Depending on the transmission direction, instrument messages can be divided into commands and instrument responses. Unless otherwise stated, all remote control interfaces apply instrument message in the same way.

a) Commands:

Commands (programming messages) are messages sent by the host computer to the instrument for remote control of instrument functions and query of status information. Commands are divided into the following two categories:

➤ Based on the impact on the instrument:

-- setting commands: change the set state of the instrument, such as reset or setting frequency.

-- query commands: query and return data, for example: identify the instrument or query the parameter value. Query commands end with the suffix question mark.

➤ Based on the definition in the standard:

- Generic commands: function and syntax defined by IEEE 488.2, applicable to all types of instruments (if implemented)

The purpose is for management of standard status register, reset and self-detection, etc.

-- instrument control commands: instrument characteristic commands, used to realize instrument functions, such as setting frequency.

The syntax also follows the SCPI specification.

b) Instrument responses:

Instrument responses (response message and service request) are the query result information sent by the instrument to the computer. Such information includes measurement results, instrument status, etc.

6.1.3 SCPI commands

6.1.3.1 Introduction to the SCPI command

SCPI (Standard Commands for Programmable Instruments) is a command set built on the standard IEEE488.2 and suitable for all instruments. The main purpose is to make the same function have the same program command to achieve the universality of program control commands.

The SCPI command consists of a command header and one or more parameters, which are separated by a space, and the command header contains one or more key fields. The command is directly suffixed with a question mark as the query command. Commands are divided into common commands and instrument commands that have different syntactic structures. The SCPI command has the following characteristics:

1) The remote control commands are oriented towards the test function and do not describe the instrument operation.

2) The remote control commands reduce the repetition of the process of implementing similar test functions and ensure the compatibility of programming.

3) The remote control messages are defined in layers that are hardware independent of the communication physical layer.

4) The remote control commands are independent of the programming method and language, and the SCPI test program is easily portable.

5) The remote control commands are scalable and can adapt to different scale of measurement

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6) The scalability of SCPI makes it a "live" standard.

For those interested in learning more about SCPI, please refer to:

- IEEE Standard 488.1-1987, IEEE Standard Digital Interface for Programmable Instrumentation. New York, NY, 1998.
- IEEE Standard 488.2-1987, IEEE Standard Codes, Formats, Protocols and Comment Commands for Use with ANSI/IEEE Std488.1-1987. New York, NY, 1998.
- Standard Commands for Programmable Instruments(SCPI) VERSION 1999.0.

For the collection, classification and description of remote control commands for 3943B monitoring receivers, please refer to:

- 1) Appendix B SCPI command quick reference table.
- 2) Remote Control Manual 3. Remote Control Commands section.
- 3) Program Control Manual 6.2 Appendix B SCPI Commands Quick Reference Table (by Subsystem).

6.1.3.2 SCPI command description

1) General terms

The following terms apply to this section. To better understand the chapters, you shall understand the exact definitions of the terms.

a) Controller

The controller is a computer that is used to communicate with the SCPI device. The controller may be a personal computer, a minicomputer, or a plug-in card on a card cage. Some AI devices can also be used as controllers.

b) Device

The device is a SCPI-enabled device. Most of the devices are electronic measurement or excitation devices and communicate using the GPIB interface.

c) Program message

A programmed message is a combination of one or more properly formatted SCPI commands. Program messages tell the devices how to measure and output the signals.

d) Response message

The response message is a collection of data in the specified SCPI format. The response message is always from the device to the controller or listening device. Response messages tell the controllers about the internal state or measured values of the devices.

e) Command

Commands are those that satisfy the SCPI standard. The combination of commands controlling the devices forms a message. In general, a command includes keywords, parameters, and punctuation.

f) Event command

Event-type program control commands cannot be queried. An event command generally has no corresponding front panel key setting, and its function is to trigger an event at a specific time.

g) Query

A query is a special type of command. When a control device is queried, a response message appropriate to the controller syntax requirements is returned. A query statement always ends with a question mark.

2) Command type

There are two types of SCPI commands: general-purpose commands and instrument-specific commands. The generic commands are defined by IEEE 488.2 and are used to manage macros, status registers, synchronization, and data storage. Since the generic orders are all headed by an asterisk, they

6.1 Remote control principals

are easily identifiable. For example *IDN? , *OPC, *RST are all general commands. Common commands are not part of any instrument commands, and the instrument interprets them in the same way regardless of the current path setting of the commands.

Instrument commands are easy to be recognized because they contain a colon (:). The colon is used at the beginning of the command expression and in the middle of the keyword, e.g., FREQUency[:CW|FIXed]. According to the internal functional modules of the instrument, the instrument-specific commands are divided into subsets of corresponding subsystem commands. For example, the trigger subsystem (TRIGger) contains trigger commands, while the status subsystem (:STATus) contains commands for the status control registers.

3) Instrument command syntax

Table 6.2 Special characters in command syntax

Symbol	Meaning	Example
	The vertical bar between the keyword and the parameter represents multiple options.	CW and FIXed are options in [SENSe:]FREQUency[:CW FIXed]
[]	A square bracket indicates that the contained keyword or parameter is optional when forming a command. The command will be executed even when such implied keyword or parameter is ignored.	SENSe and FUNCtion are optional in [SENSe:]DETECTOR[:FUNCtion].
<>	The part in angle brackets indicates that the command is not used. Meaning use. They represent the part that must be contained.	In [SENSe:]FREQUency:SPAN <range>, <range> must be replaced with the actual frequency and unit. Example: FREQUency:SPAN 10MHz
{ }	The part in braces indicates that the parameter is optional.	TRACe:UDP:TAG<ip_address>,<port_number>,<tag_list> in <tag_list> is equivalent to <tag>{,<tag>} for example: TRACe:UDP:TAG "192.168.1.10",5025,IFP

Table 6.3 Command syntax

Characters, keywords, and syntax	Example
Uppercase characters represent the minimum set of characters required to execute a command.	[SENSe:]FREQUency[:CW FIXed], FREQ is the short-form part of the command.
The lowercase character part of the command is optional; this flexible format is called "listen flexibly". For more information, please refer to the "Command Parameters and Responses" section.	:FREQUency, :FREQ, :frequency or :FREQUENCY, either one of which is correct.
When a colon is between the two command mnemonics, it moves the current path in the command tree down by one level. For more information, please refer to the command path part in section "Command Tree".	TRIGger[:SEQUence]:SCOPE? TRIGger is the top-level keyword for the command.
If the command contains more than one parameter, the adjacent parameters are separated by commas. Parameter is not part of the command path section, so it does not affect the path layer.	TRACe:UDP:TAG<ip_address>,<port_number>,<tag_list>
Semicolon separates 2 adjacent commands, but does not affect the current command path.	FREQ 2.5GHz; DET AVG
Blank characters, such as <space> or <tab>, are	FREQUency :STEP1MHz is not allowed.

6.1 Remote control principals

usually ignored as long as they do not appear between keywords or in keywords. However, you must use blank characters to separate commands and parameters without affecting the current path.	STEP and 1MHz must be separated by a space. That is: FREQUency :STEP 1MHz
---	---

A typical command consists of a keyword prefixed with a colon. The keyword is followed by parameters. Here is an example of a syntax statement.

```
[SENSe:]FREQUency[:CW|FIXed] <receive_frequency>
```

In the above example, the [SENSe:] part of the command follows the FREQUency with no space in between. The section immediately following the FREQUency: <receive_frequency> is the parameter section. There is a space between the command and its parameter. Conventions of other parts of the syntax expression are shown in Tables 6.2 and 6.3.

4) Command tree

Most remote control programming will adopt the instrument-specific command. When parsing this type of command, SCPI uses a file system-like structure, which is called a command tree.

The command on the top is the root command, which is called the "root" for short. When a command is parsed, follow a specific path to the next level of command according to the tree structure. For example: :POWer:ALC:SOURce? , where :POWer stands for AA, :ALC stands for BB, and :SOURce stands for GG, and the whole command path is (:AA:BB:GG).

A software module in the instrument software, the Command Interpreter, is dedicated to parsing each incoming SCPI command. The command interpreter uses a set of rules for distinguishing command tree paths to separate commands into individual command elements. After parsing the current command, keep the current command path unchanged. The advantage of this is to parse subsequent commands more quickly and efficiently since that the same command keyword may appear in different paths. Reset the current command path to root after powering on or *RST (reset) the instrument.

5) Command parameters and responses

Table 6.4 SCPI command parameters and response types

Parameter type	Response data type
Numerical	Real number or integer
Extended numerical	Integer
Discrete	Discrete
Boolean	Digital boolean
String	String
Blocks	Finite-length blocks
	Infinite-length blocks
Non-decimal numeric types	Hexadecimal
	Octal
	Binary

SCPI defines different data formats in the use of programmed and response messages to comply with the principles of "listen flexibly" and "speak precisely". For more information, please refer to IEEE 488.2. "Listen flexibly" means that the format of commands and parameters is flexible.

For example, the automatic switching status command CALCulate:IFPan:STEP:AUTO ON|OFF|1|0, which monitors the receiver to set the IF panorama step value.

The following command formats all set the automatic switching status function on for the IF panoramic stepping values.

```
CALCulate:IFPan:STEP:AUTO ON, CALCulate:IFPan:STEP:AUTO 1,
```

```
CALC:IFP:STEP:AUTO ON, CALC:IFP:STEP:AUTO 1
```

6.1 Remote control principals

Different parameter types have one or more corresponding response data types. During a query, a data type will be returned for a numerical parameter, and the response data is precise and strict, known as "Speak precisely"

For example, when querying the automatic switching status of the IF panorama step value (CALCulate:IFPan:STEP:AUTO?), the response data returned when querying is always 1, regardless of which of the above four setting commands was previously sent.

a) Numerical parameters

Numerical parameters can be used in both instrument commands and common commands. A numeric parameter receives all the usual decimal counting methods, including signs, decimals, and scientific notation. If a device only accepts a specified numeric type, such as an integer, it will automatically round up the received numeric parameters.

Examples of numeric parameters:

0	No decimal point
100	Optional decimal point
1.23	Signed bit
4.56e<space>3	Index mark e can be followed by a space
-7.89E-01	The exponent token e which can be upper or lower case
+256	Positive lookahead allowed
5	Decimal points can be used first

b) Extended numerical parameters

Most measurements related to instrument commands use extended numeric parameters to specify physical quantities. Extended numerical parameters receive all numeric parameters and additional special values. All the extended numeric parameters receive MAXimum and MINimum as parameter values. Whether other special values, such as UP and DOWN, are received is determined by the instrument's resolution capability, and all valid parameters are listed in its SCPI command table.

Note: The extended value parameter does not apply to general purpose commands or STATus subsystem commands.

Examples of extended numeric parameters:

101	Numeric parameter
1.2GHz	GHz can be used as an index (E009)
200MHz	MHz can be used as an index (E006)
-100mV	-100 mV
10DEG	10 degrees
MAXimum	Maximum effective setting
MINimum	Minimum effective setting
UP	Increase by a step
DOWN	Decrease by a step

c) Discrete parameters

When the number of parameter values to be set are finite, they are identified by discrete parameters. Discrete parameters use mnemonics to represent each valid setting. Like remote control command mnemonics, discrete parameter mnemonics have two formats, long and short, and allow for mixture of upper and lower cases.

In the following examples, discrete parameters and commands are used together.

[SENSe:]DETEctor[:FUNction] AVG|FAST|PEAK|RMS

6.1 Remote control principals

- AVG Average value wave detection
- FAST Fast wave detection
- PEAK Peak wave detection
- RMS Power wave detection

d) Boolean parameters

A Boolean parameter represents a true or false binary condition, which can only have four possible values.

Boolean parameter examples:

ON	Logical true
OFF	Logical false
1	Logically true
0	Logically false

e) String parameters

String-type parameters allow ASCII strings to be sent as parameters. Single quotes and double quotes are used as separators.

Examples of string parameters:

'This is Valid' "This is also Valid" 'SO IS THIS'

f) Real response data

Most of the test data are of real number type, and their formats can be basic decimal notation or scientific notation, which are supported by most advanced programming languages.

Examples of real number response data:

- 1.23E+0
- 1.0E+2
- +1.0E+2
- 0.5E+0
- 0.23
- 100.0
- +100.0
- 0.5

g) Integer response data

An integer response data is a decimal expression of an integer value containing signed bit. When querying the status register, most of the response data returned are of integer type.

Examples of integer response data:

- 0 Sign bit optional
- +100 Positive lookahead allowed
- 100 Negative lookahead allowed
- 256 No decimal point

h) Discrete response data

Discrete response data are basically the same as discrete parameters, only that the return format of discrete response data is only a short form in uppercase.

Examples of discrete response data:

PERiodic	measurement mode is periodic
CONTinuous	measurement mode is continuous

i) Digital Boolean response data

A binary value 1 or 0 is returned as Boolean response data.

j) String response data

String response data and string parameters are alike. The main difference is that the separators of string response data are double quotes instead of single quotes. Double quotes can also be embedded in string response data, and there may be no characters between the double quotes. Here are some examples of string response data:

"This is a string"

"one double quote inside brackets: ("")"

6) Number system of commands

The value of the command can be entered in binary, decimal, hexadecimal or octal format. When using binary, hexadecimal or octal format, a proper identifier is required before the value. The decimal format (the default format) does not require an identifier. When a value is entered without an identifier in front of it, the device will ensure it to be in decimal format. The following list shows the identifiers required for different formats:

- #B indicates that the number is a binary value;
- #H indicates that the number is a hexadecimal value;
- #Q indicates that the number is an octal number.

The following are the various presentations of the decimal number 45 in the SCPI command:

#B101101

#H2D

#Q55

The following example uses the hexadecimal value 000A to set the squelch level threshold to 10 dBuV.

OUTP:SQU:THR #H000A

When using a non-decimal format, a measurement unit, such as dBuV or dBm, is not used along with the value.

7) Command line structure

A command line may contain more than one SCPI command. To indicate the end of the current command line, the following method may be used:

- Enter;
- Enter with EOI;
- EOI with the last data byte.

Commands in the command line are separated by semicolons, and commands belonging to different subsystems start with a colon. For example:

MMEM:COPY "Test1", "MeasurementXY";HCOP:ITEM ALL

This command line contains two commands, the first command belongs to the MMEM subsystem and the second command belongs to the HCOP subsystem. If the adjacent commands belong to the same subsystem, the command paths are partially repeated and the commands can be abbreviated. For example:

HCOP:ITEM ALL;HCOP:IMM

This command line contains two commands, both of which belong to the HCOP subsystem and have the same level. So the second command can start from the lower level of HCOP and can omit the colon at

6.1 Remote control principals

the beginning of the command. It can be abbreviated to the following command line:

```
HCOP:ITEM ALL;IMM
```

6.1.4 Command Sequence and Synchronization

IEEE 488.2 defines the difference between an interleaved command and a sequential command:

- Sequential commands are sequences of commands that are executed continuously. Each command is usually executed faster.
- An overlapping command is one that is not executed automatically before the next command is executed. It usually takes longer to process overlapping commands, and programs are allowed to process other events synchronously during the period.

Even if there are multiple setting commands on a command line, they may not be executed in the order they were received. To ensure that commands are executed in a certain order, each command must be sent on a separate command line.

Example: the command line contains setting and query commands

If multiple commands on a command line contain query commands, the query results are unpredictable. A fixed value is returned for the following command:

```
:FREQ:STAR 1GHZ;SPAN 100;:FREQ:STAR?
```

Return value: 1000000000 (1GHz)

The following command returns an unfixed value:

```
:FREQ:STAR 1GHZ;STAR?;SPAN 1000000
```

The returned result can be current initial frequency value of the instrument before such command is sent, since the host program will not execute the commands one by one until all command messages are received. If the host program receives the command and executes it, the return result may also be 1GHz.

Tip

The setting command and query command are sent separately.

General rules: The setting command and query command shall be sent in different program control messages, so as to ensure the returned result of the query command is correct.

6.1.5 Status reporting system

The status report system stores all operation status information and error information of current instrument. They are stored in the status register and the error queue, respectively, and can be queried via the remote control interface.

6.1.5.1 Structure of status register

The register classification is described below:

- 1) STB, SRE

The status byte (STB) register and its related mask register - service request enable register (SRE), comprise the top register of the status reporting system. STB saves the general working state of the instrument by collecting the information of lower registers.

- 2) ESR, SCPI Status Register

STB receives information from the following registers:

- The value of the event status register (ESR) and the event status enable (ESE) mask register.

6.1 Remote control principals

➤ SCPI status register includes: STATus:OPERation, STATus:QUEStionable registers (SCPI definition),

STATus:TRACe and STATus: EXTension registers (SCPI definition), which contain instrument specific operation information. All SCPI status registers have the same internal structure (please refer to section 2.1.5.2 "SCPI Status Register Structure" in the remote control manual).

3) IST, PPE

Similar to SRQ, as an individual bit of IST symbol ("Individual SStatus"), it is composed of all the statuses of the instrument. Related parallel poll enable register (PPE) determines which bits of the STB act on the IST symbol.

4) Output buffer

The message returned by the instrument to the controller is stored. It does not belong to the status report system, but determines the MAV position value of the STB.

Please refer to the section "2.1.5 Status Reporting System" in the program control manual for the specific description of the above registers.

Please refer to the Fig.6.1 for hierarchical structure of status register.

Tip**SRE, ESE**

The service request enabling register (SRE) can be used for STB enabling. Similarly, the ESE can be used for ESR enabling.

6.1 Remote control principals

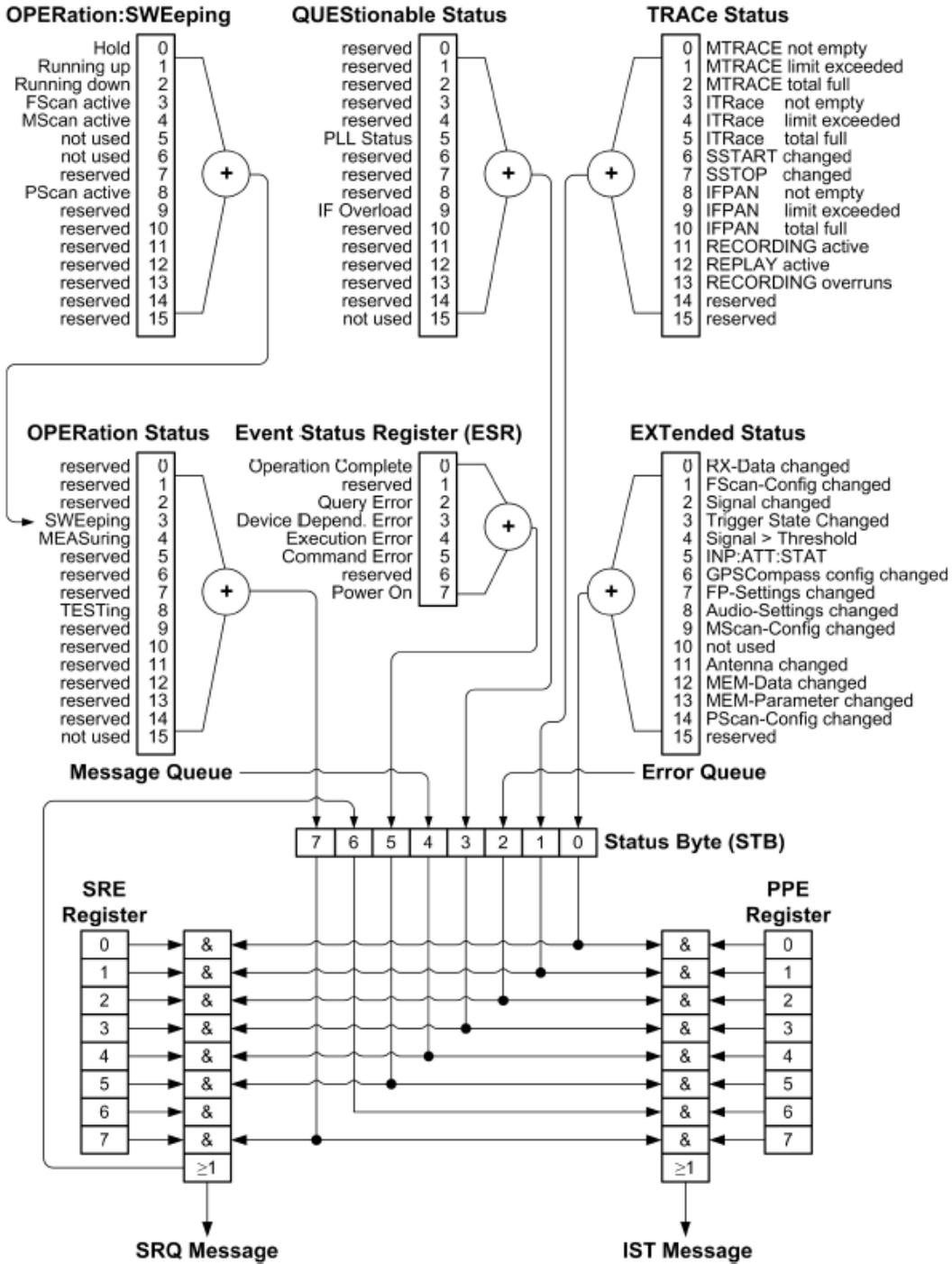


Fig. 6.1 Hierarchical structure of the status register

6.1.5.2 Application of status reporting system

The status report system is used to monitor the status of one or more instruments in the test system. The master computer in the test system must receive and assess all instrument information with the following standard methods, so as to realize functions of the status report system properly:

- 1) Service request (SRQ) initiated by the instrument;
- 2) All instruments in the serial query bus system initiated by the master computer in the system, aiming to find the service request originator and reasons.
- 3) Parallel query of all instruments;
- 4) Program command to query the status of specific instruments;

6.2 Instrument program control port and configuration

6.1.6 Programming considerations

1) Please initialize the instrument status first before changing the setting.

When setting the instrument remotely, first initialize the instrument status (for example, send "*RST"), and then implement the required status setting.

2) Command sequence

Generally, the setting command and query command must be sent separately. Otherwise, the returned value of query commands will change with the current order of instrument operation.

3) Fault response

Service requests can only be initiated by the instrument. The controller program in the test system should guide the instrument to initiate service request actively when there is an error, and then enter corresponding interrupt service program for processing.

4) Error Queue

When handling the service request each time, the master program shall query the instrument error queue rather than the status register, so as to obtain the error cause with higher accuracy. Especially in the test phase of the controller program, the error queue should be frequently queried to obtain the error command sent by the controller to the instrument.

6.2 Instrument program control port and configuration

➤ LAN 96

6.2.1 LAN

SICL-LAN is used to control 3943B monitoring receiver in Local Area Network (LAN).

Note

Application of the connector at the master control port of Side USB

The Type-A connector on the side panel is the USB master port connector, which in the 3943B monitoring receiver can be used to connect a USB flash drive for instrument resident software upgrades. It is not allowed to make the instrument programmed through this port.

6.2.1.1 Connection establishment

Use a network cable to connect the 3943B monitoring receiver to an external controller (computer) to a local area network. It is especially important to note that the IP address setting may cause address conflicts, so please check with your network administrator before setting to prevent conflicts.

6.2.1.2 Interface configuration

When remote control of the monitoring receiver is performed via LAN, the physical connection to the network shall be ensured to be smooth. Since DHCP, domain name access, and wide area network connections are not supported, the network program control settings for monitoring receivers are relatively simple by clicking on the [Main Menu Button] and selecting [Settings] in the main menu, as shown in Fig. 6.2.

6.3 Basic VISA interface programming method



Fig. 6.2 Main menu buttons and main menu

In the [Settings] dialog box shown in Fig. 6.3, select [Network Settings] and set the "IP Address", "Subnet Mask" and "Gateway" to the subnet where the main controller is located. The subnet in which the main controller is located can be set.

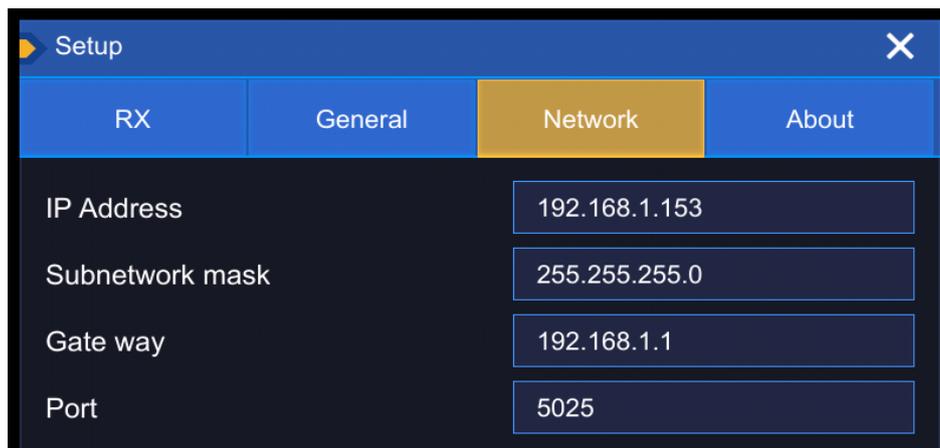


Figure 6.3 LAN interface setting

Note

Ensure that monitoring receiver is physically connected properly via 10Base-T LAN or 100Base-T LAN cable

Since the monitoring receiver only supports the construction of a single local area network control system, and only supports the setting of static IP addresses, not DHCP, and does not support access to hosts through DNS and domain name servers, it does not require the user to modify the subnet mask, which is fixed to: 255.255.255.0 within the instrument.

6.3 Basic VISA interface programming method

The following is an example of how to use the VISA library to implement the basic method of instrument programming. Take the C++ language as an example.

- [Installing the VISA library.....98](#)
- [Initializing the controller.....98](#)
- [Initialize the instrument.....98](#)
- [Send setting command.....99](#)
- [Read the state of measuring instrument.....99](#)
- [Read frequency scale.....99](#)

6.3.1 Installing the VISA Library

It is necessary to install VISA library to realize remote control. Among them, the VISA library encapsulates the lower-level transfer functions of the VXI, GPIB, LAN and USB interfaces, which can be

6.3 Basic VISA interface programming method

called directly by the user. The programming interfaces supported by the monitoring receiver is: LAN Interface These interfaces can be used in conjunction with the VISA library and programming language to remotely control monitoring receivers.

6.3.2 Initialize the controller

```
/*******/
```

The following example illustrates how to open and establish a communication connection between the VISA library and the instrument (specified by the instrument descriptor).

```
//Initialize the controller: opens the default explorer and returns the instrument handle monitor
```

```
/*******/
```

```
void InitController()
```

```
{
```

```
ViStatus status;
```

```
status = viOpenDefaultRM(&defaultRM);
```

```
status = viOpen(defaultRM, monitorString, VI_NULL, VI_NULL, &monitor);
```

```
}
```

6.3.3 Initialize the instrument

```
/*******/
```

The following examples show how to initialize the default state of the instrument and empty the status register.

```
/*******/
```

```
void InitDevice()
```

```
{
```

```
ViStatus status;
```

```
long retCnt;
```

```
status = viWrite(monitor, "*CLS", 4, &retCnt); //reset the status register
```

```
status = viWrite(monitor, "*RST", 4, &retCnt); //reset the instrument
```

```
status = viWrite(monitor, "FREQ:MODE FFM", 13, &retCnt); //Set the instrument operating mode (here the monitor receiver command is used as an example)
```

```
}
```

6.3.4 Send Setting Command

```
/*******/
```

The following example illustrates how to set the 3943B to monitor the receive frequency.

```
/*******/
```

```
void SimpleSettings()
```

```
{
```

```
ViStatus status;
```

```
long retCnt;
```

```
// Set the receive frequency 200MHz
```

```
status = viWrite(monitor, "FREQ 200MHz", 11, &retCnt);
```

```
}
```

6.4 I/O library**6.3.5 Read the State of Measuring Instrument**

```
/******
```

The following examples show how to read the set state of the instrument.

```
/******
```

void ReadSettings()

```
{
    ViStatus status;
    long retCnt;
    char rd_Buf_CW[VI_READ_BUFLEN]; // #define VI_READ_BUFLEN 40

    // Query center frequency
    status = viWrite(monitor, "FREQ?", 5, &retCnt);
    status = viRead(monitor, rd_Buf_CW, VI_READ_BUFLEN, &retCnt);
    // Print debugging information
    sprintf("Freq is %s", rd_Buf_CW);
}
```

6.3.6 Read the frequency scale

```
/******
```

The following example illustrates how to read the frequency scale measurements.

```
/******
```

void ReadMarker ()

```
{
    ViStatus status;
    long retCnt;
    char rd_Buf_Marker[VI_READ_BUFLEN]; // #define VI_READ_BUFLEN 20

    // Open IF panoramic frequency scale pairs and query frequency scale peaks
    status = viWrite(monitor, "CALC:IFP:MARK:MMA", 18, &retCnt);
    status = viWrite(monitor, "CALC:IFP:MARK:MY?", 17, &retCnt);
    status = viRead(monitor, rd_Buf_Marker, VI_READ_BUFLEN, &retCnt);
    // Print debugging information
    sprintf("Marker is %s", rd_Buf_Marker);
}
```

6.4 I/O library

- [I/O library overview.....100](#)
- [I/O Library installation and configuration.....101](#)

6.4.1 Overview of I/O Library

I/O library is a pre-written software library for instruments, known as instrument driver. As a software between the computer and the instrument hardware, it consists of the function library, utility program, tool kit, etc. It is a combination of a series of software code modules and corresponds to operation of a

6.4 I/O library

plan, such as configuring the instrument, reading from the instrument, writing to the instrument and triggering the instrument, etc. Residing in the computer, it is the bridge and link between the computer and the instrument. By providing a high-level modular library for convenient programming, users no longer need to learn the complex low-level programming protocol for a specific instrument. Application of instrument driver is the key to develop test and measurement applications quickly.

Functionally, a universal instrument driver generally consists of five parts: functor, interactive developer interface, programmer interface, subprogram interface and I/O interface, as shown in Figure 6.4.

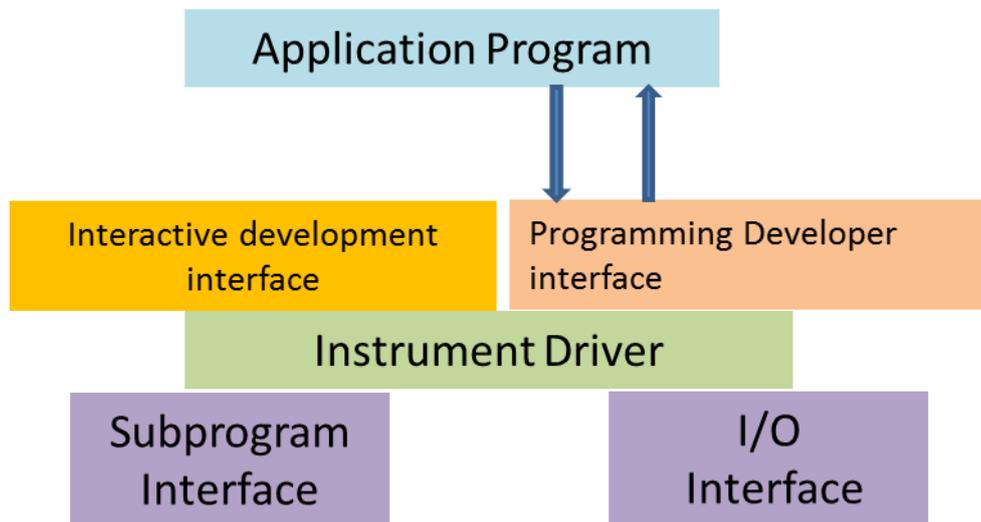


Figure 6.4 Structure model of instrument driver

The details are as follows:

- 1) Functor. As the main function part of the instrument driver, it may be understood as its framework program.
- 2) Interactive developer interface. The application development environment supporting instrument driver development always provides graphical interactive developer interface for user convenience. For example, in Labwindows/CVI, the function panel is an interactive developer interface. In the function panel, each parameter of the instrument driver function is represented as a graphical control.
- 3) Programmer interface. It is a software interface for the application to call instrument driver function, such as dynamic link library file.dll of instrument driver in Windows system.
- 4) I/O interface. It is used to realize actual communication between the instrument driver and instrument. The bus specific I/O software, such as GPIB and RS-232, or the common standard I/O software used across multiple buses, VISA I/O, may be used.
- 5) Subprogram interface. It is the software interface for the instrument driver to access some other support libraries, such as databases, FFT functions, etc. The instrument driver will use the subroutine interface to call other software module, operating system, program control code library and analysis function library, so as to complete relevant functions.

6.4.2 Installation and Configuration of I/O Library

Along with the application in test field, it has gone through different development stages from traditional instrument to virtual instrument. In order to solve the interchangeability of instruments and reusability of test program in automatic test system, instrument driver has gone through different development processes. IVI (Interchangeable Virtual Instruments) driver is relative popular and common at present. Based on IVI specification, it defines a new instrument programming interface, inserts the class driver and VPP architecture onto the VISA to make the test application and instrument hardware completely independent, adds such unique functions as instrument simulation, range sensing and status cache, improves the operation efficiency of the system, and realizes instrument exchange.

There are two types of IVI driver: IVI-C and IVI-COM, where the latter adopts the form of COM API based on the component object model (COM) of Microsoft, and the former adopts the form of C API based on ANSI C. Both types are designed according to the instrument class defined in the IVI

6.4 I/O library

specification and have the same application development environment, including Visual Studio, Visual Basic, Agilent VEE, LabVIEW, CVI/LabWindows, etc.

Two types of driver should be provided at present to meet the needs of different users in different development environments. The IVI driver for the monitoring receiver is developed using Nimbus Driver Studio, which directly generates the IVI-COM and IVI-C driver and program installation packages.

The installed IVI driver is divided into the inherent IVI function group and instrument function group (namely, the basic function group and extended function group). For specific function classification, function and property description, see the built-in file of the driver.

Tip

Port configuration and IO library installation

Before using the PC to control the monitoring receiver, make sure you have the necessary ports and I/O banks properly installed and configured.

7 Troubleshooting and after-sales services

The section introduces how to find problems and ask for after-sales services. and state the monitoring receiver error message.

If you encounter any problem when operating the 3943 monitoring receiver or want to buy relevant components or accessories, we can 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 monitoring receiver you have purchased is under warranty, we will repair your instrument free of charge as promised in the warranty statement; if the warranty period is exceeded, we will only charge the cost.

- [Working principles.....](#)102
- [Troubleshooting and debugging.....](#)104
- [Error messages.....](#)105
- [Method to Obtain After-sales Services.....](#)107

7.1 Working principles

In order to facilitate the user to understand the function of the 3943B monitoring receiver and better solve the problems encountered in the operation process, this section introduces the basic working principle of the monitoring receiver and the hardware block diagram.

- [Overall working principle and hardware function block diagram.....](#)102

7.1.1 Overall working principle and hardware function block diagram

The 3943B monitoring receiver is controlled by an industrial control computer, the operating system is Linux, and the design is based on a super outlier signal reception system. The design follows the modularization option design concept, dividing the whole hardware and software into several modules with relatively independent functions. The whole machine is composed of pre-selected frequency module, local vibration module, acquisition and processing module, display module and other parts. The block diagram of the whole machine is shown in Fig. 7.1.

7.1 Working principles

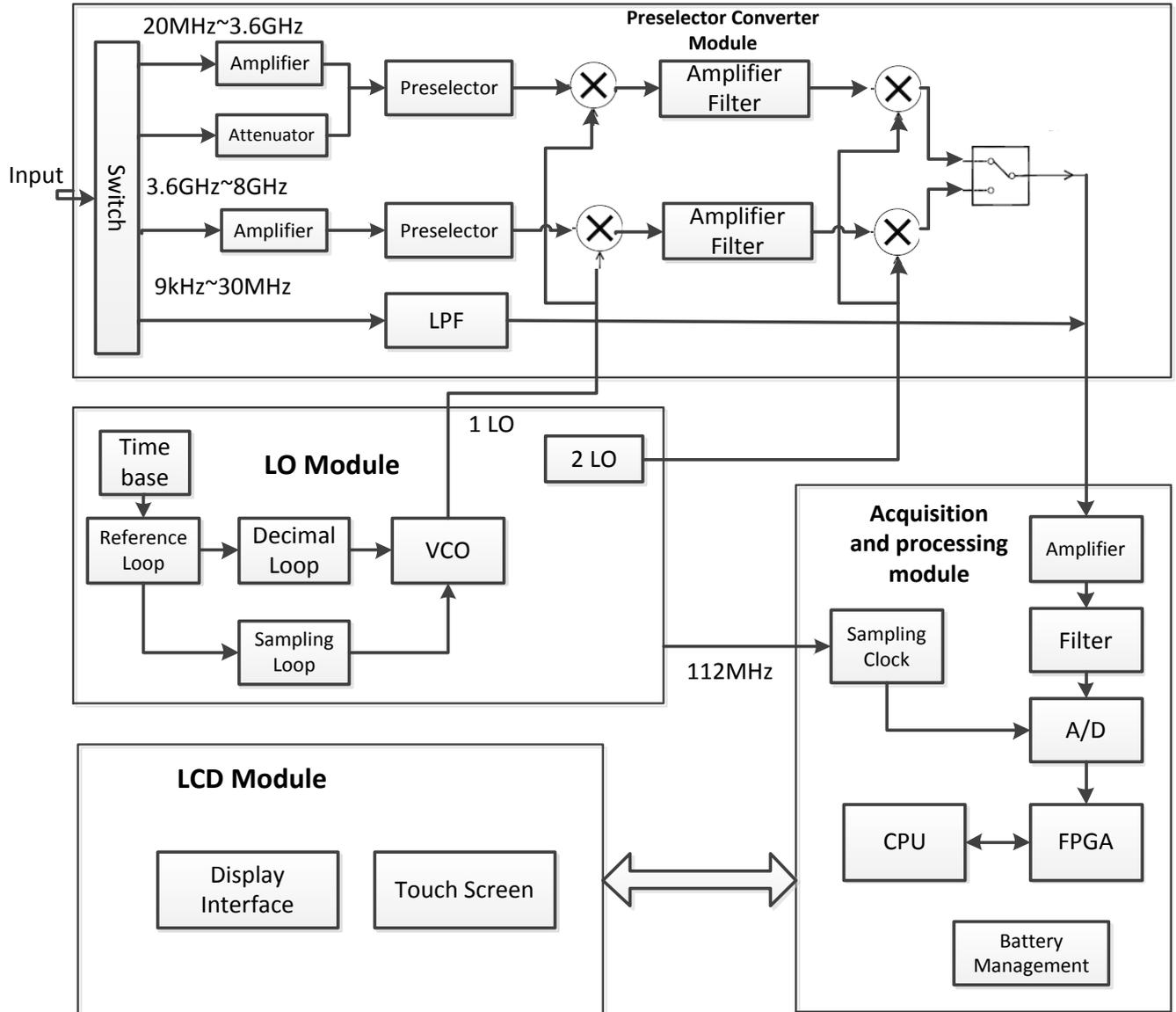


Fig. 7.1 Block diagram of the 3943B monitoring receiver

➤ **Optional inverter module**

After the antenna sends the received RF signal to the pre-selected frequency conversion module, it is switched by the microwave switch to 3 bands: 0-band (9 kHz to 30 MHz), 1-band (20 MHz to 3.6 GHz) and 2-band (3.6 GHz to 8 GHz). Among them, the 0-band low-pass filter is directly output to the acquisition and processing module, and the 1-band signal is amplified or attenuated and mixed with a local oscillator from 5245MHz to 8825MHz to obtain a 5225MHz IF signal, which is amplified and filtered and mixed with a second local oscillator with a fixed frequency of 5085MHz to produce a 140MHz second IF. After amplification and filtering, the 2-band signal is mixed with the local oscillator from 1625MHz to 6025MHz to obtain the first IF signal of 1975MHz, and after amplification and filtering, it is mixed with the second local oscillator of fixed frequency 1835MHz to produce the second IF of 140MHz. The two IF signals are selected by a switch and output to the acquisition and processing module.

➤ **Local oscillator module**

The main function of the local oscillator module is to provide the required local oscillator signal for the pre-selected inverter module, including the 1st and 2nd local oscillators. In this project, the 1st oscillator is obtained by fast digital sweep technique, which can improve the detection speed of electromagnetic signals, and at any frequency point. The 1st oscillator is a frequency synthesized local oscillation signal. The synthesized local oscillation signal is obtained by the phase-locked sweep method, which consists of several phase-locked rings, such as the reference ring, the fractional ring, the sampling ring and the

7.2 Troubleshooting and debugging

1st local oscillation VCO ring. The 2nd local oscillator frequency is fixed at 5085MHz and 1835MHz.

➤ **Signal acquisition and processing module**

The signal acquisition and processing module has two main parts: signal acquisition and signal processing. The signal acquisition part is mainly composed of amplifier, anti-alias filter, high-speed ADC, sampling clock generation circuit and other parts, which completes the functions of amplification, filtering and high-speed sampling of 140MHz IF signal. The signal processing part is mainly composed of FPGA, CPU and other parts. FPGA is responsible for digital signal extraction and filtering, real-time FFT calculation, real-time demodulation, etc. CPU is responsible for level and spectrum calculation, display processing, and process control of the whole machine.

➤ **Display module**

The display module contains two parts: touchscreen and LCD, with a large 10.1-inch display and support for full touch operation.

7.2 Troubleshooting and debugging

Under normal circumstances, the problem with the instrument is due to hardware, software, or improper use of users. Once a problem occurs, first observe the error message and save it. Then, analyze the possible causes and refer to the methods provided in section 7.2.1 "Basic Troubleshooting Process" and section 7.2.2 "Common Fault Symptoms and Debugging Methods" to check and solve the problem in advance. You can also contact our service center and provide the error messages you've collected, and we will coordinate with you to solve the problem as soon as possible. For details, please refer to the contact information provided in this manual, or check online at www.ceyear.com for the nearest technical support service point.

Tip

Troubleshooting and instructions

This section introduces the way on how to judge and handle failures (if any) of the 3943B monitoring receiver, and feed them back to the manufacturer as accurately as possible if necessary for quick solution.

- [Basic troubleshooting process.....](#)104
- [Common fault phenomena and troubleshooting methods.....](#)104

7.2.1 Basic troubleshooting process

When there is a problem with the instrument, first check the following:

- ✧ If the 3943B monitoring receiver 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, please check whether the test tool and test environment meet the requirements, whether the test port connector is damaged and whether the calibration parts performance indicators are normal.
- ✧ In case of any other instrument, cable or connector connected with the monitoring receiver properly and run normally.
- ✧ If the monitoring receiver cannot communicate over the LAN, check the yellow LED next to the LAN connector on the side panel, if the light does not blink, check the LAN cable and connections.
- ✧ Does the instrument display an error message? If there are error messages, please refer to section "7.3 Error Messages" in this manual.

7.2.2 Common fault phenomena and troubleshooting methods

The following lists the common faults and troubleshooting methods as per function types.

7.3 Error message

7.2.2.1 Problems During Startup

If the 3943 monitoring receiver fails during startup, it may involve multiple aspects such as the power supply, processor hardware, and instrument setup. This section helps to analyze the possible failures in the startup process and the causes according to the power-on startup steps of the 3943B monitoring receiver.

1) Orange standby light not on

When the adapter is connected, the power indicator in the upper right corner of the front panel will turn orange. If the orange standby light is not on, check whether the adapter indicator is lit, and if available, use a multimeter to measure whether the output voltage of the adapter is about 18V. If the adapter indicator lights up or the output voltage of the adapter is 18V, the instrument power supply may be faulty. Please contact the customer service center according to the contact information provided in this manual and provide the collected error information, we will assist you to solve the problem as soon as possible.

2) No screen display

When 3943B monitoring receiver is powered on, the power indicator in the upper right corner of the front panel from orange to green, while the screen does not light up, connect the network cable, if the network port light blinks, and the network can be connected. It indicates that the instrument is powered on and the CPU is working normally, and it may be that the LCD is malfunctioning; if the net port light is not on, it may be that the power supply is abnormal. Please contact the customer service center according to the contact information provided in this manual and provide the collected error information, we will assist you to solve the problem as soon as possible.

7.2.2.2 Instrument Setup Problems

When the 3943B monitoring receiver enters the normal scanning state, a continuously refreshed trace can be seen on the interface. However, if some parameters of the instrument are not set properly, the user may not be able to see the desired track or signal. If the refresh of the track or the signal display is malfunctioning, please check the following settings first.

1) The track is not refreshed or refreshed abnormally

If the track on the interface does not refresh, or does not refresh properly, please refer to the following steps:

- a) Check if the machine is in running state, if the setting is correct and the track still does not refresh, please proceed to the next step.
- b) Turn on the frequency scale and see if the X1 and X2 readings change. If there is a reading change, it may be due to the setting reason, for example, the instrument reference level is too high and so on, which causes the traces to be below the screen, thus the traces cannot be seen, in this case, you can slide the spectrum window up and down, beat the reference level smaller, and observe the traces again. If the marker reading stays still, it may be a trackback error, please try to reboot the machine, and if the fault still can't be eliminated, please contact the customer service center according to the contact information provided in this manual and provide the collected error information, we will assist you to solve the problem as fast as possible.

7.3 Error message

The monitoring receiver uses two ways to record errors that occur during measurements: a front panel display error message queue and an SCPI (remote control mode) error message queue, both of which are stored and managed separately.

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- [Error description.....106](#)

7.3.1 Error message file

The random CD stores the file `errormessage.pdf`, which records the complete error message. The error list consists of the error number and the error description. For multiple error messages corresponding to the same error serial number, alphabetical order is used to distinguish different error messages.

7.4 Method to obtain after-sales services**7.3.2 Error message description****Table 7.3.2.1 Local error message****1) Error message view**

View via interface:

If an error message is displayed in the upper left corner of the monitoring receiver during use, it indicates a problem with the software operation or hardware of the monitoring receiver. You can basically judge the error type as per the error code, and take corresponding measures for troubleshooting.

Only one error message can be displayed at a time in the error display area of the monitoring receiver. Since multiple errors can occur to the instrument, perform a drop-down in the top area of the front panel to see all error messages.

2) Error description

If an error is detected during the measurement of the monitoring receiver, an alarm or error message will be displayed on the upper left side of the status indication area, and you can see all the error indication messages by pulling down the operation.

For specific local error message descriptions, refer to Exhibit C.1 Local Error Message Table in the "Appendix [C Error Message](#) Quick Check Table" section.

7.3.2.2 Remote control error information**1) Error format and description**

In remote control mode, errors are recorded in the error/event queue of the status reporting system, and can be queried with the command "SYSTem:ERRor?". The format is as follows:

"<Error code>, "<Error in error queue>; "<Detailed error description>"

Example:

"-100, "Command error; keyword error."

The program control error message includes two types:

- Negative error codes as defined by the SCPI standard; this type of error message is not specified here;
- For the instrument characteristics positive error codes, please refer to the [Appendix C Error Messages Quick Check Table](#) section of Table C.2 Programmable Error Messages Table" for specific error message descriptions.

2) Error message type

The error event corresponds only to one type of error message, and the error message types are introduced in details below:

- **System error (0- 99):** control platform, OS, file system, etc.
- **Hardware errors (100- 199):** lock detection, status detection, temperature detection, battery detection, etc..
- **Communication interfaces (200 - 299):** network, I2C, SPI, etc.
- **Measurement error (300 - 399):** Overload detection, etc.

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7.4.1 Contact us

In case of any failure to the 3943B monitoring receiver, check and save the error message, analyze possible causes, and refer to the methods provided in "7.2 Troubleshooting and debugging" for preliminary troubleshooting. You can also contact our service center and provide the error messages

7 Troubleshooting and after-sales services

7.4 Method to obtain after-sales services

you've collected, and we will coordinate with you to solve the problem as soon as possible. Online website: www.ceyear.com for the nearest technical support station.

Contact information:

Service Consultation: 0532-86889847 800-868-7041

Technical support: 0532-86888026 0532-86880165

Email: eiqd@ceyear.com

Postal code: 266555

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

7.4.2 Package and mailing

In case of any failure to the monitoring receiver that is difficult to be eliminated, contact us by phone or fax. If it is confirmed that the monitoring receiver has to be returned for repairing, pack it with the original packing materials and case by following the steps below:

- 1) Prepare a detailed description of the failure of the monitoring receiver and put it into the package along with it.
- 2) Pack the monitoring receiver with the original packaging material 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) Specify text like "Fragile! Do not touch! Handel with care!" and so on.
- 6) Please check by precision instrument.
- 7) Keep a copy of all shipping documents.

8 Technical indicators and testing methods

This chapter describes the technical specifications and main test methods of the 3943B monitoring receiver.

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➤ Product Features.....	108
➤ Technical indicators.....	109
➤ Additional information.....	113
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8.1 Statement

Unless otherwise stated, all index test conditions are: Temperature range is: $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ after half an hour of power on. The additional instrument information is to facilitate users to understand more clearly the instrument performance that is not contained in the technical indicator range. Key word descriptions are shown below:

Technical specifications (spec): Unless otherwise stated, performance is guaranteed for calibrated instruments after a minimum of two hours in the operating temperature range of 0 to 40°C , followed by a 30-minute warm-up; this includes errors in measurement. All data in the document are technical specifications, unless otherwise specified.

Typical value (Typ): It indicates 80% of the instruments can reach typical performance, which is not a guarantee, and excludes uncertainty factors during the measurement. It is valid only at the room temperature (about 25°C).

Nominal value (nom): It indicates such performances as the expected average performance, designed performance features or those that cannot be tested by limited means, for example, the $50\ \Omega$ connector. The measured values are not guaranteed data and are measured at room temperature (approx. 25°C).

Measured value (meas): It indicates the performance feature measured during the design phase for comparing with the expected performance, for example, amplitude drifting change with time. This data is not guaranteed and is measured at room temperature (approx. 25°C).

8.2 Product features

Table 8.1 Product features

General Technical Indicators	
Temperature range	Working time: $0 \sim +50^{\circ}\text{C}$ Storage time: $-40 \sim +70^{\circ}\text{C}$
Elevation	4,600 meters
Electromagnetic compatibility	Meet the following requirements as specified in GJB 3947A-2009, 3.9.1: a) Harassment from power supply: in accordance with the provisions of GB 4842-2004, in which the frequency of 150 kHz ~ 30 MHz, in line with the requirements of the voltage limit of Group 1 Class B equipment. b) RF field induction conducted harassment immunity: in accordance with the provisions of GB/T 17626.6-1998, where the test level is 2, the effective value of 3V, frequency 150kHz ~ 80MHz, 1kHz sine wave 80% modulation magnitude. c) Electrical fast transient pulse group immunity: according to GB/T 17626.4-1998, where the test level is 3, 2kV peak for AC line, 1kV for signal, control and DC lines, rise time $T_r=5\text{ns}$, hold time $T_h=50\text{ns}$, repetition frequency (5~100) kHz. d) Electromagnetic radiation harassment: in accordance with the provisions of GB 4842-2004, the frequency of 30MHz ~ 1000MHz, in line with the requirements of the limit value of electromagnetic radiation harassment of

8.3 Technical Indicators

	<p>Group 1 Class B equipment.</p> <p>e) Electromagnetic radiation immunity: in accordance with the provisions of GB/T 17626.3-2006, test level 2, field strength 3V/m, frequency range 80MHz ~ 1000MHz, 1kHz sine wave 80% modulation magnitude.</p> <p>f) Electrostatic discharge immunity: According to GB/T 17626.2-2006, the test level is 3, 6kV contact discharge and 8kV air discharge.</p>
--	--

Table 8.1 Product characteristics (continued)

General Technical Indicators		
Safety	<p>Comply with the safety certification requirements of 3.10 in GJB 3947A-2009.</p> <p>(a) When the power switch is on, the insulation resistance between the power input end of the equipment power adapter and the insulation resistance of the casing should not be less than 100MΩ under standard atmospheric conditions for testing, and that should not be less than 2MΩ in humid environment.</p> <p>(b) When a 1500V AC voltage is applied between the power input end of the equipment power adapter and the casing, there should be no breakdown, flashover or flicker.</p> <p>(c) During the operation of the equipment, the current leaked between the power input end of the power adapter and the ground shall be no more than 3.5 mA.</p>	
Power supply requirement	Power supply method	Power adapters and batteries
	Voltage and frequency (rated value)	100 ~ 240 V, 50 ~ 60 Hz
	Battery power time	3h~4h
	Power consumption	Maximum power consumption: less than 30W
Display screen	1280×800 10.1" TFT with integrated touchscreen	
Data/Memory	Supports USB 2.0 compliant memory devices, TF cards	
Weight	Net weight: less than 3.5 kg	
Size	Width × height × depth (mm) = (182.5±1.2) × (289±1.2) × (69±0.8) (Hand strap and bracket not included)	
Warranty	Standard warranty cycle of 18 months	
Reliability	MTBF (θ_0) ≥ 5000 h	
Calibration cycle	The recommended calibration cycle is one year and the calibration service is provided by a professional calibration institution.	

8.3 Technical Indicators**1) Frequency range**

9kHz to 8GHz.

2) Maximum linear operating input level

-13dBm, 9kHz to 30MHz;

+3dBm, 20MHz to 3.6GHz (low distortion mode);

-24dBm, 20MHz to 3.6GHz (low noise mode);

-24dBm, 3.6GHz to 8GHz.

3) RF input port voltage standing wave ratio

<2.5, 9 kHz to 5.8 GHz;

<4.0, 5.8GHz to 8GHz.

4) Display average noise level (spectrum channel)

≤-125dBm, 9kHz to 100kHz;

≤-151dBm, 100kHz to 1MHz;

≤-155dBm, 1MHz to 20MHz;

≤-154dBm, 20MHz to 80MHz (low noise mode);

≤-160dBm, 80MHz to 1.5GHz (low noise mode);

≤-155dBm, 1.5GHz to 3.6GHz (low noise mode);

≤-128dBm, 20MHz to 3.6GHz (low distortion mode);

≤-158dBm, 3.6GHz to 5.8GHz;

≤-154dBm, 5.8GHz to 7.5GHz;

≤-151dBm, 7.5GHz to 8GHz.

5) Noise factor (level channel)

≤21dB at 100kHz test frequency;

≤17dB at 1MHz test frequency;

≤17dB at 11MHz test frequency;

≤17dB at 19MHz test frequency;

≤10.5dB at 50MHz test frequency;

≤9.5dB at 140MHz test frequency;

≤10.5dB at 430MHz test frequency;

≤11dB at 1.1GHz test frequency;

≤11dB at 1.5GHz test frequency;

≤14.5dB at 3.4GHz test frequency;

≤17dB at 3.6GHz test frequency;

≤13dB at 5.5GHz test frequency;

≤19dB at 7.499GHz test frequency;

≤21dB, test frequency 8GHz.

6) Phase noise

Carrier 11MHz,

<-115dBc/Hz, 10kHz frequency deviation,

<-117dBc/Hz, 100kHz frequency deviation;

Carrier 21MHz,

<-115dBc/Hz, 10kHz frequency deviation,

<-117dBc/Hz, 100kHz frequency deviation;

8.3 Technical Indicators

Carrier 500MHz,

<-95dBc/Hz, 10kHz frequency deviation,

<-95dBc/Hz, 100kHz frequency deviation;

Carrier 3.4GHz,

<-92dBc/Hz, 10kHz frequency deviation,

<-92dBc/Hz, 100kHz frequency deviation;

Carrier 7.499GHz,

<-92dBc/Hz, 10kHz frequency deviation,

<-92dBc/Hz, 100kHz frequency deviation;

Carrier 8GHz,

<-92dBc/Hz, 10kHz frequency deviation,

<-92dBc/Hz, 100kHz frequency deviation.

7) AM demodulation sensitivity

\leq -105.5dBm, 9kHz to 30MHz;

\leq -110dBm, 20MHz to 1.5GHz;

\leq -106dBm, 1.5GHz to 3.6GHz;

\leq -102dBm, 3.6GHz to 8GHz.

8) FM demodulation sensitivity

\leq -103dBm, 9kHz to 30MHz;

\leq -111dBm, 20MHz to 1.5GHz;

\leq -107dBm, 1.5GHz to 3.6GHz;

\leq -102dBm, 3.6GHz to 8GHz.

9) Third-order intercept points

$>$ + 18dBm, 9kHz to 30MHz;

$>$ -10dBm, 20MHz to 650MHz (low noise mode);

$>$ -11.5dBm, 650MHz to 2.5GHz (low noise mode);

$>$ -8dBm, 2.5GHz to 3.6GHz (low noise mode);

$>$ +15dBm, 20MHz to 1.5GHz (low distortion mode);

$>$ +15dBm, 1.5GHz to 3.6GHz (low distortion mode);

$>$ -8dBm, 3.6GHz to 4.7GHz;

$>$ -6dBm, 4.7GHz to 8GHz.

10) Secondary interception point

$>$ + 30dBm, 9kHz to 30MHz;

$>$ +30dBm, 20MHz to 1.5GHz (low noise mode);

$>$ +60dBm, 1.5GHz to 3.6GHz (low noise mode);

$>$ + 55dBm, 3.6GHz to 5.8GHz;

$>$ +50dBm, 5.8GHz to 8GHz.

11) Mirror frequency suppression (1 IF)

8.4 Additional information

- > 90dB, 20MHz to 3.6GHz (low noise mode);
- > 80dB, 20MHz to 3.6GHz (low distortion mode);
- > 70dB, 3.6GHz to 8GHz.

12) Mirror frequency suppression (2 IF)

- > 60dB, 20MHz to 3.6GHz (low noise mode);
- > 60dB, 20MHz to 3.6GHz (low distortion mode);
- > 70dB, 3.6GHz to 8GHz.

13) IF suppression

- > 80dB, 20MHz to 3.6GHz (low noise mode);
- > 65dB, 20MHz to 3.6GHz (low distortion mode);
- > 90dB, 3.6GHz to 8GHz.

14) Local oscillator re-radiation

- > -89dBm.

15) Residual response

- < -100dBm, 9kHz to 3.6GHz;
- < -90dBm, 3.6GHz to 7GHz;
- < -80dBm, 7GHz to 8GHz.

16) Panoramic scanning speed

- ≥ 2 GHz/s

17) Amplitude accuracy

- Better than ± 1.5 dB ($+15^{\circ}\text{C} \sim +35^{\circ}\text{C}$);
- Better than ± 3 dB ($0^{\circ}\text{C} \sim +50^{\circ}\text{C}$).

8.4 Additional information**1) Top port**

Table 8.2 Top port

Front panel port	
RF Input Interface	N type female head
IF output port	SMA female head for 140MHz IF output, 3dB bandwidth 20MHz
External reference input port	BNC female head for 10MHz external reference input, external reference signal magnitude range: 0dBm ~ 10dBm
GNSS antenna port	SMA female connector for connecting active GPS/BeiDou antenna, port output voltage: $3.3\text{V} \pm 5\%$
AUX port	Aerial plug connector for connecting the supplied antenna

2) Right port

Table 8.3 Right port

Rear panel port	
Earphone interface	Micro audio jack (3.5 mm)

8.5 Performance characteristics test

USB2.0 interface	For connecting external memory
TF card interface	For connecting TF card for system software upgrade and backup data
LAN interface	RJ45 interface, TCP/IP interface, 10/100/1000M adaptive, for remote analyzer operation
Power input connector	DC power socket (φ2.0mm) for connecting power adapter output plug

8.5 Performance characteristics test

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- [Performance test log sheet.....129](#)
- [Performance test auxiliary table.....132](#)
- [Recommended instruments for performance characteristics testing.....146](#)

8.5.1 Recommended testing method

8.5.1.1 Frequency range

a) Description of the test items

The frequency range indicates the range between the highest and lowest frequency signals that can be correctly measured by the device.

Use a synthesis signal generator to generate the signal in the range of the upper and lower measurement frequencies calibrated by the equipment to be tested, to check whether the frequency measurement capability of the equipment is adequate.

b) Test equipment

Synthetic Signal Generator Recommend 1464/E8257D

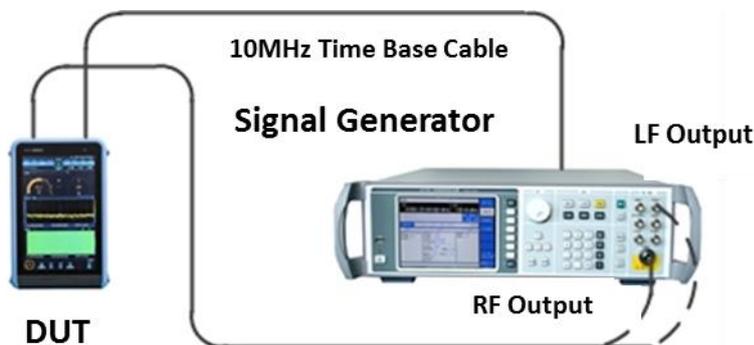


Figure 8.1 Diagram of the frequency span test

c) Test procedure

- 1) Connect the test equipment according to Fig. 8.1, the equipment to be tested and wait for the synthesized signal generator sharing a common time base, and connect the synthesized signal generator's low frequency output to the signal input of the equipment to be tested.
- 2) Set the low frequency generator output waveform of the synthesized signal generator as a sine wave with the output frequency of 9kHz and output power of -30dBm (10mV peak, 50Ω impedance).
- 3) Reset the device to be tested. Set the device to be tested as fixed frequency reception mode (FFM) and set the frequency reference as external reference. Set the center frequency at 9 kHz and the frequency width at 10 kHz. Use the peak frequency scale to read out the signal frequencies and record the measurements in the 3943B Monitoring Receiver Functional Performance Test Auxiliary Table (hereinafter referred to as the "Auxiliary Table") B.1.
- 4) Connect the RF output of the synthesized signal generator to the RF input of the device to be tested, and the device to be tested and the synthesized signal generator share a common time base. Set the output frequency of the synthesized signal generator to 8GHz, and the output power -30dBm.

8.5 Performance characteristics test

5) Set the center frequency at 8GHz and the frequency width at 500kHz. Use the peak frequency scale to read the signal frequency and record the measurement in the auxiliary table B.1.

d) Recording and data processing

The records in Auxiliary Form B.1 are summarized in 3943B Monitoring Receiver Functional Performance Test Record Form (hereinafter referred to as the "Functional Performance Test Record Form") A.1.

8.5.1.2 Maximum linear operating input level

a) Description of the test items

This test verifies the maximum operating level that the device to be tested can accurately measure, and a number of frequency points can be selected to test in the following way.

b) Test diagram and test instruments and equipment

Synthetic Signal Generator Recommend 1464/E8257D

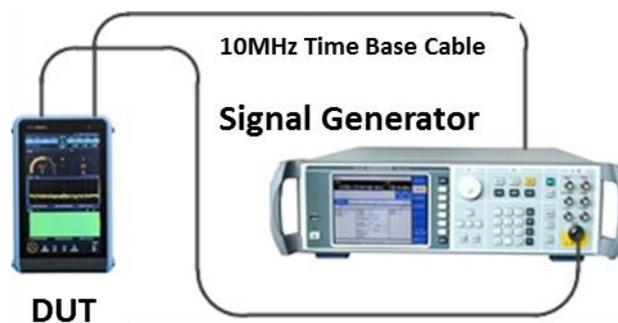


Fig. 8.2 Schematic diagram of the maximum linear operating level test

c) Test procedure

1) Connect the test equipment as shown in Figure 8.2.

2) Reset the device to be measured, select "Settings" menu in the main menu, select "Frequency Reference" as the external reference under the "Receiver Settings" tab, and select "Level Unit" as dBm in the Select "Level Unit" as dBm in the "Display Settings" tab. Set the device to be tested to fixed frequency reception mode (FFM), and set the center frequency according to auxiliary table B.2.

3) Set the synthesized signal generator frequency according to the auxiliary table B.2 and set the output power -30dBm. Gradually increase the output power in 1dB steps until the overload mark appears on the device to be tested, at which point the output power is reduced by 1dB.

4) Activate the peak frequency scale in the spectrum window of the device to be measured, measure the signal power at this point, and record the results in the auxiliary table B.2.

5) Repeat steps 2) to 4) according to auxiliary table B.2 to complete all frequency point tests.

d) Recording and data processing

The minimum value of the test data of each band in the auxiliary table B.2 is taken as the test result of the band and summarized in the functional performance test record table A.1.

8.5.1.3 RF input port voltage SWR

a) Description of the test items

The voltage SWR is used to measure the effective propagation power of the signal into the RF input port. It is usually expressed as the ratio of the highest voltage to the lowest voltage on the transmission line. Use a vector network analyzer to test the voltage VSWR of the input port of the device under test.

b) Test diagram and test instruments and equipment

Vector Network Analyzer Recommend AV3629A/E5071C

8.5 Performance characteristics test

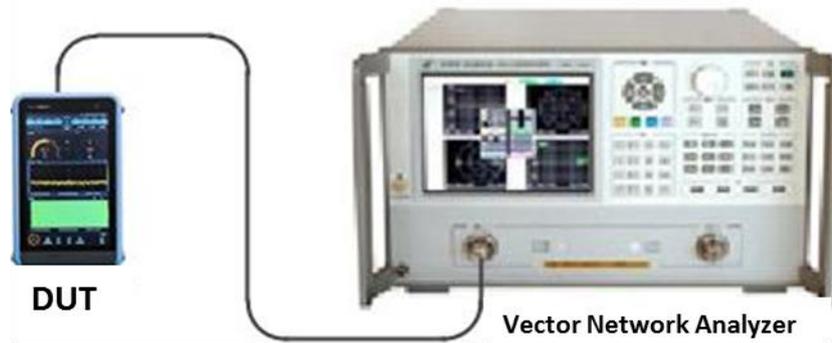


Fig. 8.3 Schematic diagram of input port SWR test

c) Test procedure

- 1) Set the frequency range and output power of the vector network analyzer as appropriate parameters and select the SWR display.
- 2) Single-port reflection measurement calibration (including open-circuit, short-circuit, and load calibration) for vector network analyzers.
- 3) After completing the calibration, remove the calibration piece from the vector network analyzer. Connect the test equipment according to Fig. 8.3 and connect the test port to the input port of the device to be tested.
- 4) Reset the device to be tested. Set the device to be tested to fixed frequency reception mode (FFM). Set the center frequency in order according to the auxiliary table B.3 and set the attenuator off.
- 5) In the frequency band from 9 kHz to 1.5 GHz, the voltage standing wave ratio (VSWR) of the corresponding frequency point of the device to be tested is read out using the frequency scale function of the vector network analyzer and recorded in the auxiliary table B.3.
- 6) In the 1.5GHz to 8GHz band, use the frequency scale function of the vector network analyzer to read out the maximum voltage VSWR in the band corresponding to the frequency point of the corresponding equipment to be tested and record it in the auxiliary table B.3.

d) Recording and data processing

The maximum value of the voltage SWR of the corresponding frequency band in the auxiliary table B.3 is summarized and recorded in the functional performance test record table A.1.

8.5.1.4 Display average noise level (spectrum channel)

a) Description of the test items

Measure the reception sensitivity of the spectrum channel of the device to be measured in different frequency bands. Use the frequency scale function to locate the frequency point with the worst reception sensitivity in each band, then read out the noise level value at that frequency point and normalize it to the 1Hz resolution bandwidth. In the measurement, if there is a residual response frequency point, the residual response frequency point should be removed.

b) Test equipment

50Ω load

3.5mm(f)-N type(m) connector

8.5 Performance characteristics test

Fig. 8.4 Display average noise level test schematic diagram

c) Test procedure

- 1) Connect a 50Ω load to the RF input port of the device to be tested in accordance with Fig. 8.4.
- 2) Reset the device to be tested. Set the device to be tested to panoramic scan mode (PSCAN). Set the level unit to dBm. Set the start frequency, end frequency, attenuator state and resolution bandwidth of each band in the RF Panorama window according to the auxiliary table B.4. Set the maximum level -60dBm.
- 3) Set the detection type to average, measurement time mode manual, and set the measurement time according to auxiliary table B.4. Set the filter selectivity to narrow. Use the peak frequency scale to search for the maximum frequency point of the noise level and record the level reading of that frequency point in the auxiliary table B.4. If there are remaining response frequencies, the remaining response frequencies should be removed.

d) Test record and data processing

Process the data in Auxiliary Table B.4 according to the following formula, and record the calculation results in Auxiliary Table B.4 and summarize them in Functional Performance Test Record Table A.1.

$$DANL = P - 10 \times \log(RBW \times 0.8) \dots\dots\dots (1)$$

Where:

DANL - is the detection sensitivity;

P - is the peak frequency scale magnitude;

RBW - is the resolution bandwidth.

8.5.1.5 Noise factor (level channel)

a) Description of the test items

The noise factor (NF) is a parameter that measures the receiver's ability to receive weak signals. The ITU recommends three methods for measuring this parameter, of which this device uses the "gain" method for measurement. The physical gain of the level channel of this device is compensated in the measurement result, which is equivalent to the full channel gain of 0. Therefore, $NF=174+P_{out}$ in dB, and P_{out} is the noise floor power density.

b) Test equipment

50Ω load

3.5mm(f)-N type(m) connector



Fig. 8.5 Schematic diagram of the noise factor test

c) Test procedure

8.5 Performance characteristics test

- 1) Connect a 50Ω load to the RF input port of the device to be tested in accordance with Fig. 8.5.
- 2) Reset the device to be tested. Set the device to be tested to fixed frequency reception mode (FFM). Set the level unit to dBm. Set the demodulation bandwidth to 1 kHz and the detection method to average. In the IF panorama window, set the measurement time mode to manual and the measurement time to 2s.
- 3) Set the test frequency and attenuator status according to auxiliary table B.5. The noise level values are read in the Level Field Intensity window and recorded in the auxiliary table B.5. If the remaining response frequency point is encountered, the test frequency should be fine-tuned to deviate from the remaining response frequency point.
- d) Test record and data processing

Process the data in Table B.5 according to the following formula, and record the calculation results in the auxiliary Table B.5 and summarize them in the functional performance test record Table A.1.

$$NF = 174 + P - 10 \log(BW) \dots\dots\dots (2)$$

Where:

NF - is the noise factor.

P - is the noise level value.

BW - is the demodulation bandwidth.

8.5.1.6 Phase noise

- a) Description of the test items

Measure the reference sine signals at +10kHz, -10kHz, +100kHz, and -100kHz off the carrier. The phase noise index at each frequency deviation of the reference sinusoidal signal is at least 6 dB higher than that of the device to be tested. During the test, if there is a parasitic response at the set frequency offset, the parasitic response should be rejected and measured near the frequency offset.

- b) Test diagram and test instruments and equipment

Synthetic Signal Generator Recommend 1464/E8257D

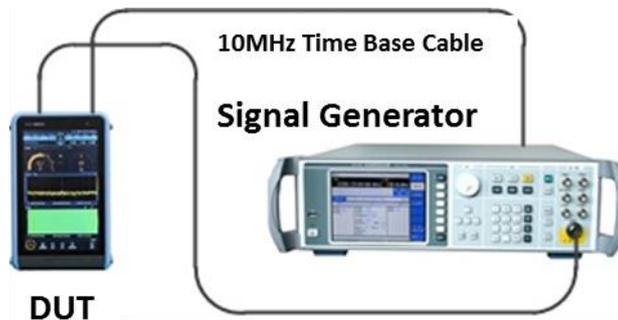


Fig. 8.6 Schematic diagram of phase noise test

- c) Test procedure

- 1) Connect the test equipment according to Fig. 8.6, the device to be tested and the synthesized signal generator common time base.
- 2) According to the auxiliary table B.6 set the output frequency of the synthesized signal generator in turn, power -30dBm.
- 3) Reset the device to be tested. Set the equipment to be measured as fixed frequency reception mode (FFM); set the external reference; set the center frequency, frequency width, resolution bandwidth in order according to auxiliary table B.6; set the detection type average, filter selectivity for narrow; set the measurement time mode to manual, measurement time 2s; open the peak frequency scale function, open the relative frequency scale function, and set the relative frequency scale to +10kHz, -10kHz, -100kHz, -100kHz in order. +100kHz, -100kHz. The relative frequency scale values are read and

8.5 Performance characteristics test

recorded in the auxiliary Table B.6.

d) Recording and data processing

The data in Auxiliary Table B.6 are processed according to the following formula, and the calculation results are recorded in Auxiliary Table B.6 and the values of positive and negative frequency deviation phase noise difference at each frequency point are summarized and recorded in Functional Performance Test Record Table A.1.

$$L(f_m) = P_{\Delta} - 10 \times \log(RBW \times 0.8) \dots\dots\dots (3)$$

Where:

$L(f_m)$ - is the sideband noise.

P_{Δ} - is the relative frequency scale magnitude.

RBW - is the resolution bandwidth.

8.5.1.7 AM demodulation sensitivity

a) Description of the test items

This test is to examine the AM audio demodulation sensitivity of the device to be tested, using the ITU-R SM.1840 proposal method. The device to be tested has AM demodulation function, providing a total of 34 demodulation bandwidths in the range of 100Hz to 20MHz. This test uses a synthesized signal generator to generate an AM signal, the device to be tested performs AM demodulation of the signal, and then tests the demodulated signal output from the headphone interface of the device to be tested.

b) Test diagram and test instruments and equipment

Synthetic Signal Generator Recommend 1464/E8257D

Audio analyzer Recommend U8903A/U8903B

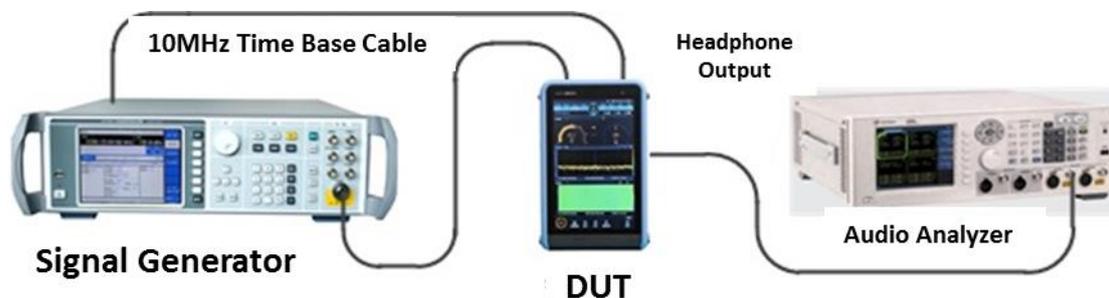


Fig. 8.7 Schematic diagram of AM demodulation sensitivity test

c) Test procedure

1) Connect the test equipment according to Fig. 8.7, the equipment to be tested and the synthesized signal generator common time base; the headphone interface of the equipment to be tested is connected to the input channel interface of the audio analyzer.

2) According to the auxiliary table B.7 of the test frequency set synthetic signal generator frequency, power -70dBm, select AM modulation, set the modulation rate of 1kHz, modulation depth of 50%.

3) Reset the device to be tested. Set the device to be tested to fixed frequency reception mode (FFM), set the center frequency according to the test frequency of auxiliary table B.7, set the frequency width to 50kHz, demodulation mode to AM, demodulation bandwidth to 6kHz, attenuator off, gain control select AGC, audio output on.

4) Select the analysis channel of the audio analyzer, set the measurement function of Function1 to frequency, set the measurement function of Function2 to "SINAD" mode, set the weighting option of the filter function (Filter) in the measurement configuration (Meas. Weighting) option in the filter function (Filter) of the measurement configuration (Meas. Config) is set to "CCITT", adjust the output power of the

8.5 Performance characteristics test

signal generator until the audio analyzer shows a stable SINAD value of about 30 dB, reduce the signal power until the SINAD value drops to 12 dB, and record the corresponding power value read out from the signal generator at this time in the auxiliary table B.7. power value read on the signal generator at this time.

d) Recording and data processing

The test results recorded in the auxiliary table B.7 are recorded in the functional performance test record table A.1 as a summary of AM demodulation sensitivity for the corresponding band.

8.5.1.8 FM demodulation sensitivity

a) Description of the test items

This test is to examine the FM audio demodulation sensitivity of the device to be tested, using the ITU-R SM.1840 proposal method. The device to be tested has FM demodulation function, providing a total of 34 demodulation bandwidths in the range of 100Hz to 20MHz. This test uses a synthesized signal generator to generate an FM signal, the device to be tested performs FM demodulation of the signal, and then tests the demodulated signal output from the headphone interface of the device to be tested.

b) Test diagram and test instruments and equipment

Synthetic Signal Generator Recommend 1464/E8257D

Audio analyzer Recommend U8903A/U8903B

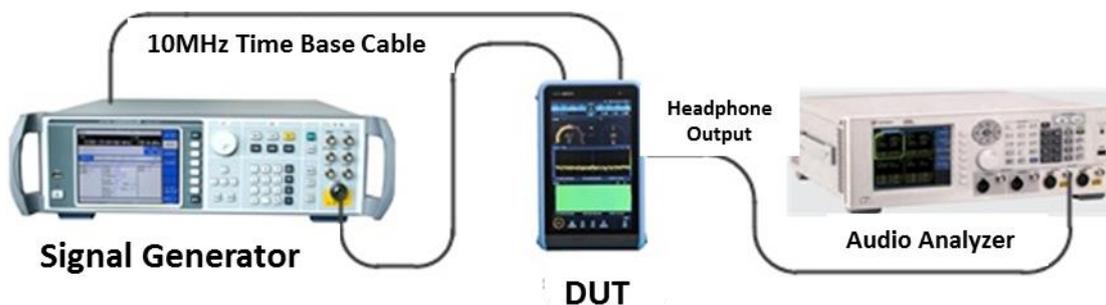


Fig. 8.8 Schematic diagram of FM demodulation sensitivity test

c) Test procedure

1) Connect the test equipment according to Fig. 8.8, the equipment to be tested and the synthesized signal generator common time base; the headphone interface of the equipment to be tested is connected to the input channel interface of the audio analyzer.

2) According to the performance test auxiliary table B.8 performance test form of the test frequency set synthetic signal generator frequency, power -70dBm, select FM modulation, set the modulation rate 1kHz, frequency bias 5kHz, when the demodulation frequency is not greater than 30MHz, set the frequency bias 3kHz.

3) Reset the device to be tested. Set the device to be tested as fixed frequency reception mode (FFM), set the center frequency according to the test frequency of auxiliary table B.8, set the frequency width to 50kHz, demodulation mode to FM, demodulation bandwidth to 15kHz, when the demodulation frequency is not greater than 30MHz, set the demodulation bandwidth to 9kHz, attenuator off and audio output on.

4) Select the analysis channel of the audio analyzer, set the measurement function of Function1 to frequency, set the measurement function of Function2 to "SINAD" mode, set the weighting option of the filter function (Filter) in the measurement configuration (Meas. Weighting) option in the filter function (Filter) of the measurement configuration (Meas. Config) is set to "CCITT", adjust the output power of the signal generator until the audio analyzer shows a stable SINAD value of about 30 dB, reduce the signal power until the SINAD value drops to 20 dB, and record the corresponding power value read out from the signal generator at this time in the auxiliary table B.8. power value read on the signal generator at this time.

d) Recording and data processing

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The test results recorded in the auxiliary table B.8 are recorded in the functional performance test record table A.1 as a summary of FM demodulation sensitivity for the corresponding band.

8.5.1.9 Third-order intercept points

a) Description of the test items

The third-order intercept point (IP3) is a measure of the ability of the device under test to suppress intermodulation interference signals generated at the receiving front-end at frequencies $2f_1-f_2$ and $2f_2-f_1$ by two strong input signals with frequencies $f_1=f+\Delta f$ and $f_2=f_2=f+2\Delta f$, expressed as $IP_3=P_{in}+\alpha/2$, where Δf is the frequency interval of the two input signals; IP_3 is the third-order intercept point value, expressed in dBm as a unit; P_{in} is the input signal level of the device to be measured, expressed in dBm; α is the difference between the input signal level of the device to be measured and the level of the third-order intermodulation product, that is, $\alpha=P_{in}-P_t$, expressed in dB, where P_t is the level of the third-order intermodulation product, expressed in dBm as a unit.

b) Test diagram and test instruments and equipment

Synthetic Signal Generator1..... Recommend 1464/E8257D

Synthetic Signal Generator2..... Recommend 1464/E8257D

Directional Coupler Recommended AV70604

Directional Coupler Recommended AV70607

1.6GHz low-pass filter

2.9GHz low-pass filter

4.1GHz low-pass filter

6.8GHz low-pass filter

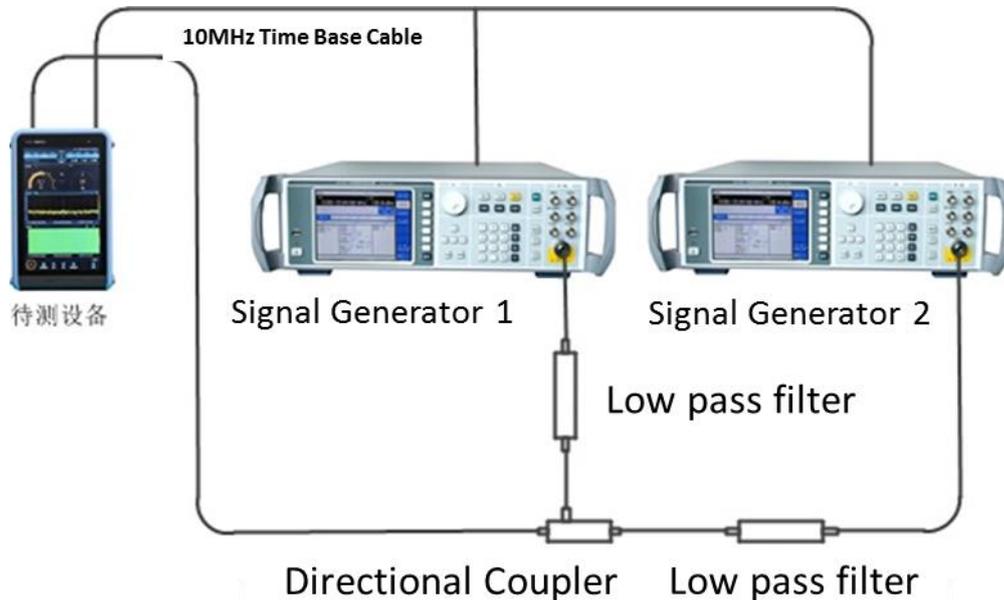


Fig. 8.9 Schematic diagram of the third-order intercept point test

c) Test procedure

1) Connect the test equipment as shown in Figure 8.9.

2) Reset the device to be tested. Set the device to be tested as fixed frequency reception mode (FFM), and set the frequency reference as the reference. Set the center frequency and attenuator status according to auxiliary table B.9. Set the frequency width 2MHz and set the level unit dBm. Set the highest level displayed in the IF panorama window according to the output power of the synthesized signal generator in auxiliary table B.9, so that the highest level is greater than the value by more than

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3dB, and set the lowest level less than the highest level by 100dB.

- 3) Set the measurement time of the device to be measured manually, 350ms, and set the detection type to average.
- 4) Set the frequency of synthesized signal generator 1 and synthesized signal generator 2 according to auxiliary table B.9, adjust the power of the two synthesized signal generators so that they arrive at the input port of the equipment to be tested with equal power and equal to the table power value, allowing the magnitude error $\pm 0.5\text{dB}$.
- 5) The level difference between the third-order intermodulation products on both sides and the input signal is measured using the difference frequency scale, and the absolute value of the difference (α) is recorded in the auxiliary table B.9.

d) Recording and data processing

Calculate the third-order intercept points according to the following formula, and record the smaller value of each test frequency point calculation in the auxiliary table B.9. The calculated IP_3 values are summarized as the corresponding band third-order intercept point values and recorded in the functional performance test record table A.1.

$$IP_3 = P_{in} + \alpha/2 \quad \dots\dots\dots (4)$$

Where:

IP_3 - third-order intercept point value;

P_{in} - the input signal level value;

α - the absolute value of the level difference between the third-order intermodulation product and the input signal.

8.5.1.10 Second-order intercept points

a) Description of the test items

The second-order intercept point (IP_2) is a measure of the ability of the device under test to suppress intermodulation interference signals generated at the receiving front-end at frequencies f_1+f_2 and f_1-f_2 by two strong input signals with frequencies $f_1=f/2+\Delta f$ and $f_2=f/2-\Delta f$, expressed as $IP_2=P_{in}+\alpha$, where $2\Delta f$ is the frequency interval of the two input signals; IP_2 is the third-order intercept point value, expressed in dBm as a unit; P_{in} is the input signal level of the device to be measured, expressed in dBm; α is the difference between the input signal level of the device to be measured and the level of the third-order intermodulation product, that is, $\alpha=P_{in}-P_t$, expressed in dB, where P_t is the level of the third-order intermodulation product, expressed in dBm as a unit.

b) Test diagram and test instruments and equipment

- Synthetic Signal Generator1..... Recommend 1464/E8257D
- Synthetic Signal Generator2..... Recommend 1464/E8257D
- Directional Coupler Recommended AV70604
- Directional Coupler Recommended AV70607

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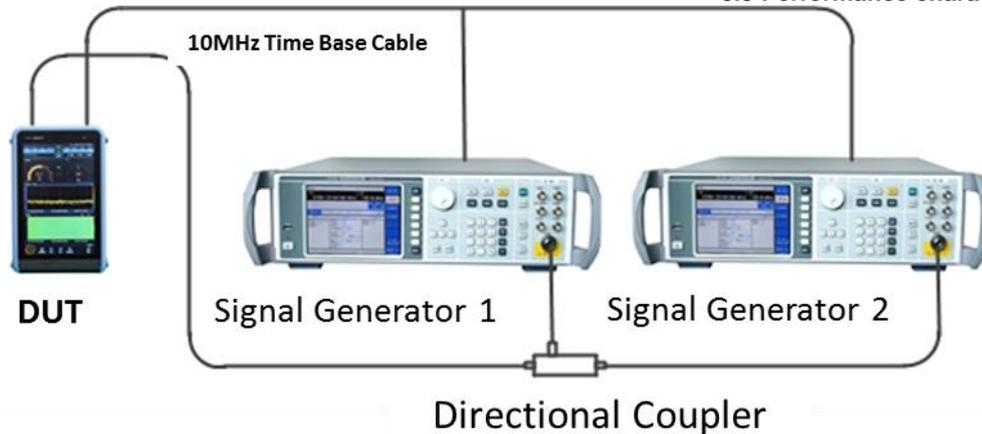


Fig. 8.10 Schematic diagram of the second-order intercept point test

c) Test procedure

1) Connect the test equipment as shown in Figure 8.10.

2) Reset the device to be tested. Set the device to be tested as fixed frequency reception mode (FFM) and set the frequency reference as external reference. Set the center frequency and attenuator status according to auxiliary table B.10. Set the frequency width 2MHz and set the level unit dBm. Set the highest level displayed in the IF panorama window according to the output power of the synthesized signal generator in auxiliary table B.10, so that the highest level is greater than the value by more than 3dB, and set the lowest level less than the highest level by 100dB.

3) Set the measurement time of the device to be measured manually, 350ms, and set the detection type to average.

4) Set the frequency of synthesized signal generator 1 and synthesized signal generator 2 according to auxiliary table B.10, adjust the power of the two synthesized signal generators so that they arrive at the input port of the equipment to be tested with equal power and equal to the table power value, allowing the magnitude error $\pm 0.5\text{dB}$.

5) Set the center frequency of the equipment to be measured as the intermodulation product frequency according to the auxiliary table B.10, and measure the level value (P_t) of the intermodulation product using the peak frequency scale and record it in the auxiliary table B.10.

d) Recording and data processing

The intercept points of the second-order intermodulation low end product and high end product are calculated according to the following equation, and the smaller value of the calculation result is used as the second-order intercept point value (IP_2) for each test frequency point and recorded in the auxiliary table B.10. The minimum value of the calculated IP_2 value in each test band is summarized as the second-order intercept point value of the corresponding band and recorded in the functional performance test record table A.1.

$$IP_2 = P_{in} + (P_{in} - P_t) = 2P_{in} - P_t \quad \dots\dots\dots (5)$$

Where:

IP_2 - second-order intercept point value;

P_{in} - the input signal level value;

P_t - the value of the second-order intermodulation product level.

8.5.1.11 Mirror frequency suppression (1 IF)

a) Description of the test items

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

8.5 Performance characteristics test

other. Each frequency of the LO has a mirror frequency of corresponding input signal, with the difference of two IFs between the signal and the mirror frequency. This test is to measure the ability of the equipment to be tested to suppress the interference signal whose input frequency is its mirror frequency rate.

b) Test diagram and test instruments and equipment

Synthetic Signal Generator1..... Recommend 1464/E8257D

Power Meters Recommend AV2436/E4419

Power Probes Recommend AV71710/9304A

Power Divider Recommend 11667C

3.5mm(f)-N type(m) connector

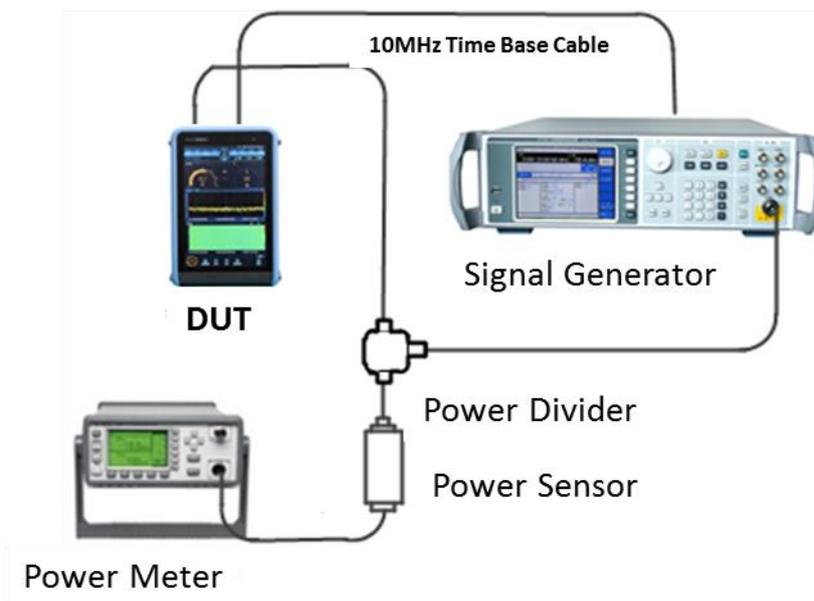


Fig. 8.11 Schematic diagram of the test for mirror frequency suppression

c) Test procedure

1) Connect the test equipment as shown in Figure 8.11.

2) Reset the device to be tested. The device to be tested shares a common time base with the synthesized signal generator, and the frequency reference of the device to be tested is set as the external reference. Set the device to be tested to fixed frequency reception mode (FFM mode). In the IF Panorama window, set the bandwidth to 100 kHz and the resolution bandwidth (RBW) to auto. Set the center frequency and attenuator status according to auxiliary table B.11. Set the level unit to dBm. Set the display maximum level according to the output power of the synthesized signal generator, so that the maximum level is greater than the value by 3dB or more, and set the minimum level less than the maximum level by 100dB.

3) Set the detection type to average, the measurement time mode to manual, and the measurement time to 350ms.

4) Set the output frequency and power of the synthesized signal generator according to the auxiliary table B.11, the frequency is the mirror frequency rate of the center frequency of the equipment to be tested.

5) Use a power meter to measure the input power of the mirror frequency signal and record the value in the auxiliary table B.11.

6) In the IF panoramic window of the device to be tested, the level value of the mirror frequency interference signal is measured using the frequency scale and the value is recorded in the auxiliary table B.11. If the mirror frequency interference signal level does not exceed the background noise by 10 dB, the center frequency position level value is recorded in the auxiliary table B.11.

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d) Recording and data processing

Process the test data according to the following formula and record the calculation results in the auxiliary table B.11. The minimum value of the calculated mirror frequency rejection ratio in each band is recorded as the summary of the mirror frequency rejection ratio in this band in the functional performance test record table A.1.

$$R_{\text{image}} = P_{\text{in}} - P_{\text{image}} \dots\dots\dots (6)$$

Where:

R_{image} : Mirror frequency rejection ratio.

P_{in} : Mirror frequency signal input power.

P_{image} : The mirror frequency interference signal level value.

8.5.1.12 Mirror frequency suppression (2 IF)

a) Description of the test items

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 the mirror frequency. This test is to measure the ability of the equipment to be tested to suppress the interference signal whose input frequency is the second IF mirror frequency rate of the equipment.

b) Test diagram and test instruments and equipment

Synthetic Signal Generator Recommend 1464/E8257D

Power Meters Recommend AV2436/E4419

Power Probes Recommend AV71710/9304A

Power Divider Recommend 11667C

3.5mm(f)-N type(m) connector

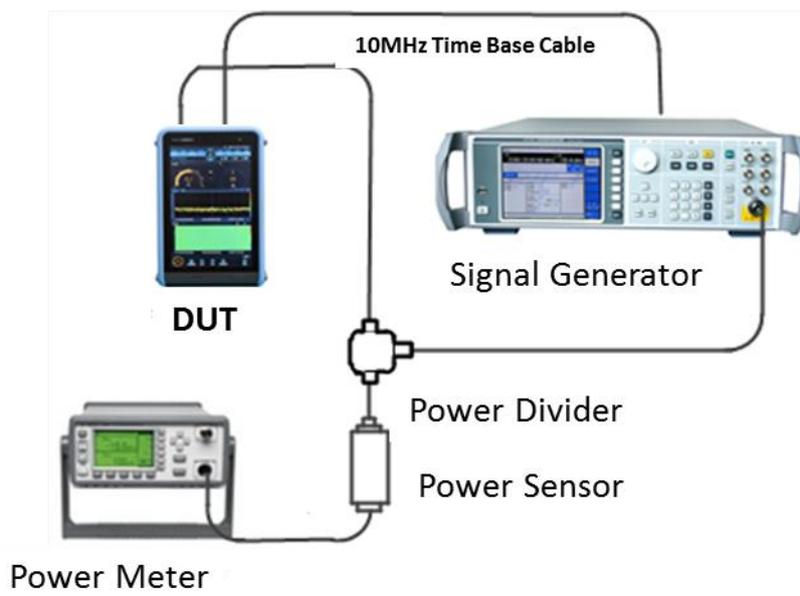


Fig. 8.12 Schematic diagram of the test for mirror frequency suppression (2 IF)

c) Test procedure

1) Connect the test equipment as shown in Figure 8.12.

2) Reset the device to be tested. The device to be tested shares a common time base with the

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synthesized signal generator, and the frequency reference of the device to be tested is set as the external reference. Set the device to be tested to fixed frequency reception mode (FFM mode). In the IF Panorama window, set the bandwidth to 100 kHz and the resolution bandwidth (RBW) to auto. Set the center frequency and attenuator status according to auxiliary table B.12. Set the level unit to dBm. Set the display maximum level according to the output power of the synthesized signal generator, so that the maximum level is greater than the value by 3dB or more, and set the minimum level less than the maximum level by 100dB.

- 3) Set the detection type to average, the measurement time mode to manual, and the measurement time to 350ms.
- 4) Set the output frequency and power of the synthesized signal generator according to the auxiliary table B.12, the frequency is the mirror frequency rate of the center frequency of the equipment to be tested.
- 5) Use a power meter to measure the input power of the mirror frequency signal and record the value in the auxiliary table B.12.

1) In the IF panoramic window of the device to be tested, the level value of the mirror frequency interference signal is measured using the frequency scale and the value is recorded in the auxiliary table B.12. If the mirror frequency interference signal level does not exceed the background noise by 10 dB, the center frequency position level value is recorded in the auxiliary table B.12.

d) Recording and data processing

Process the test data according to the following formula and record the calculation results in the auxiliary table B.12. The minimum value of the calculated mirror frequency rejection ratio in each band is recorded as the summary of the mirror frequency rejection ratio in this band in the functional performance test record table A.1.

$$R_{\text{image}} = P_{\text{in}} - P_{\text{image}} \dots\dots\dots (7)$$

Where:

- R_{image} : Mirror frequency rejection ratio.
- P_{in} : Mirror frequency signal input power.
- P_{image} : The mirror frequency interference signal level value.

8.5.1.13 IF suppression

a) Description of the test items

IF suppression is a measure of the ability of the equipment to be tested to suppress interfering signals whose input frequency is its IF frequency rate.

b) Test diagram and test instruments and equipment

- Synthetic Signal Generator Recommend 1464/E8257D
- Power Meters Recommend AV2436/E4419
- Power Probes Recommend AV71710/9304A
- Power Divider Recommend 11667C
- 3.5mm(f)-N type(m) connector

8.5 Performance characteristics test

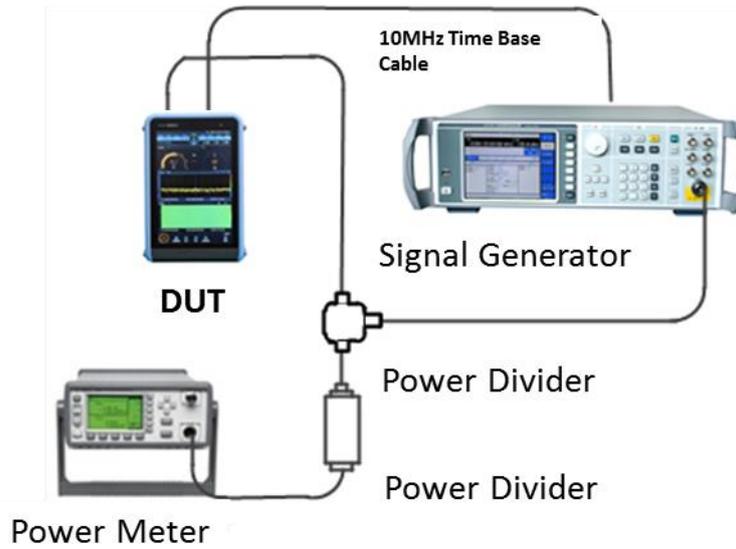


Fig. 8.13 Schematic diagram of IF suppression test

c) Test procedure

- 1) Connect the test equipment as shown in Figure 8.13.
- 2) Reset the device to be tested. The device to be tested shares a common time base with the synthesized signal generator, and the frequency reference of the device to be tested is set as the external reference. Set the device to be tested to fixed frequency reception mode (FFM mode). In the IF Panorama window, set the bandwidth to 100 kHz and the resolution bandwidth (RBW) to auto. Set the center frequency and attenuator status according to auxiliary table B.13. Set the level unit to dBm. Set the display maximum level according to the output power of the synthesized signal generator, so that the maximum level is greater than the value by 3dB or more, and set the minimum level less than the maximum level by 100dB.
 - 1) Set the detection type to average, the measurement time mode to manual, and the measurement time to 350ms.
 - 2) Set the output frequency and power of the synthesized signal generator according to the auxiliary table B.13, which is the IF frequency of the equipment to be tested.
 - 3) Use a power meter to measure the input power of the IF signal and record the value in the auxiliary table B.13.
 - 4) In the IF panorama window of the device to be tested, the level value of the IF interference signal is measured using the frequency scale and the value is recorded in the auxiliary table B.13. If the IF interference signal level does not exceed the background noise by 10 dB, the center frequency position level value is recorded in the auxiliary table B.13.

d) Recording and data processing

Process the test data according to the following formula and record the calculation results in the auxiliary table B.13. The minimum value of the calculated IF suppression ratio in each band is recorded as the summary of IF rejection ratio in this band in the functional performance test record table A.1.

$$R_{IF} = P_{in} - P_{IF} \dots\dots\dots (8)$$

Where:

R_{IF} : IF suppression ratio.

P_{in} : iF signal input power.

P_{IF} : IF interference signal level value.

8.5.1.14 Re-radiation of the local oscillation

a) Description of the test items

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The local oscillation re-radiation is a measure of the ability of the device to be tested to suppress the level of internal leakage from various local oscillation sources to the RF input port. Through the signal / spectrum analyzer test to be tested device RF input port radiation signal maximum, that is, the local oscillation re-radiation value.

b) Test diagram and test instruments and equipment

Signal/Spectrum Analyzer Recommended FSVR/4051

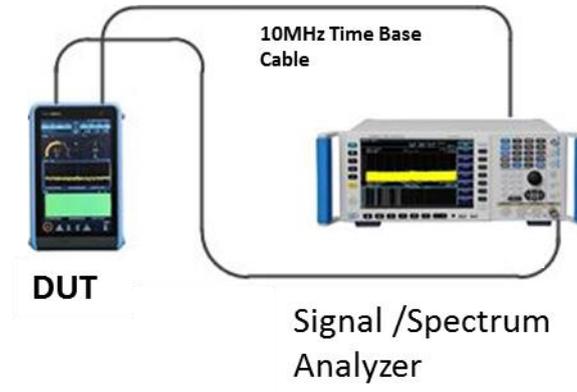


Fig. 8.14 Schematic diagram of the local oscillation re-radiation test

c) Test procedure

- 1) Connect the test equipment as in Fig. 8.14, the RF output of the device to be tested is connected to the input of the signal/spectrum analyzer, and the device to be tested shares a common time base with the signal/spectrum analyzer.
- 2) Reset the device to be tested. Set the frequency reference of the device to be tested as the external reference. Set the scan mode to fixed frequency scan (FFM). Set the center frequency and attenuator status according to auxiliary table B.14.
- 3) Set the center frequency of the signal/spectrum analyzer according to the auxiliary table B.14. Set the bandwidth so that the resolution bandwidth is less than or equal to 10 kHz. Set the reference level -30dBm and display the dynamic range 100dB. Set preamplifier on, track average, and average times 8 times.
- 4) On the signal/spectrum analyzer, the center frequency position leakage signal power is measured using the frequency scale function and recorded in the auxiliary Table B.14. If the leakage signal is smaller than the background noise, the noise power is recorded in the auxiliary table B.14.

d) Test record and data processing

Record the maximum value of the leakage signal power in the functional performance test record table A.1.

8.5.1.15 Residual response

a) Description of the test items

The RF input port of the device to be tested is connected to a 50Ω load to examine the frequency response of the device to be tested in the absence of signal input.

b) Test diagram and test instruments and equipment

50Ω load

3.5(f)-N type (m) connectors

8.5 Performance characteristics test

Fig. 8.15 Schematic diagram of the residual response test

c) Test procedure

- 1) Connect a 50Ω load to the RF input port of the device to be tested according to Fig. 8.15.
- 2) Reset the device to be tested. Set the device to be tested to fixed frequency reception mode (FFM). Set the center frequency 20MHz, the frequency width 20MHz, the reference level -70dBm, the resolution bandwidth 12.5kHz.
- 3) Observe for false response signals exceeding -90dBm. If available, record the frequency value and power value in the auxiliary table B.15.
- 4) Set the center frequency in steps of 20MHz and repeat step 3 until the upper frequency limit of the device to be tested is covered. During the test, if the background noise of the device to be tested is close to -100dBm, the resolution bandwidth measurement of the device to be tested can be reduced.

d) Recording and data processing

Collect the test data, record the maximum power value in the auxiliary table B.13 as the residual response value and record it in the functional performance test record table A.1.

8.5.1.16 Panoramic scan speed

a) Description of the test items

Panoramic scan speed refers to the continuous band width of the device in the panoramic scan state, under the specified frequency resolution, to complete the scan search in unit time.

b) Test diagram and test instruments and equipment

Synthetic Signal Generator Recommend 1464/E8257D

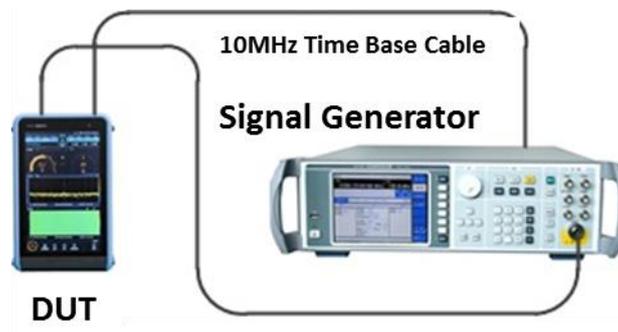


Fig. 8.16 Schematic diagram of the panoramic scan speed test

c) Test procedure

- 1) Connect the instrument according to Figure 8.16. Synthetic signal generator and the device to be tested share a common time base.
- 2) Reset the device to be measured; set the scan mode to panoramic scan (PSCAN), start frequency 10MHz, end frequency 8GHz, resolution 100kHz, measurement time 500us, window type select IF panoramic and RF panoramic, attenuation off, maximum hold display on; run panoramic scan.
- 3) Set the scanning mode of the synthesized signal generator as "Frequency", the scanning type as "List", the repetition mode as "Single", and conFig. the frequency points of the list scanning as 20MHz, 60MHz, 120MHz, 240MHz, 500MHz, 700MHz, 1GHz, 1.2GHz, 1.6GHz, 2GHz, 2.5GHz, 3GHz, 3.5GHz, 4GHz, 4.5GHz. 60MHz, 120MHz, 240MHz, 500MHz, 700MHz, 1GHz, 1.2GHz, 1.6GHz, 2GHz, 2.5GHz,

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3GHz, 3.5GHz, 4GHz, 4.5GHz, 5GHz, 5.5GHz, 6GHz, 6.5GHz, 7GHz, 7.5GHz, 7.9 GHz total 22 points, output power -30dBm, dwell time T₀ is 3.9s, start single scan.

4) After the end of a single scan, observe whether the device under test can display all burst signals, use the maximum hold frequency scale to measure the frequency and magnitude of all burst signals to meet the level error less than 5dB and frequency error less than 1 resolution bandwidth.

5) If the requirements of step 4) cannot be met, adjust the dwell time T₀ and repeat the process from 3) to 4) until the requirements are met, and the dwell time T₀ will be recorded in the auxiliary table B.16.

d) Test record and data processing

Calculate the scan speed according to the following formula and record the test results in the Functional Performance Test Record Table A.1.

$$\text{扫描速度} = \frac{\text{终止频率} - \text{起始频率}}{T_0} \dots\dots\dots (9)$$

8.5.1.17 Magnitude accuracy

a) Description of the test items

This test verifies the accuracy of the magnitude measurement of the input signal in the operating frequency range of the device to be tested.

b) Test diagram and test instruments and equipment

- Synthetic Signal Generator Recommend E8257D/1464
- Power Meters Recommend 2436/E4419
- Power Probes Recommend AV71710/9304A
- Power Divider Recommend 11667C

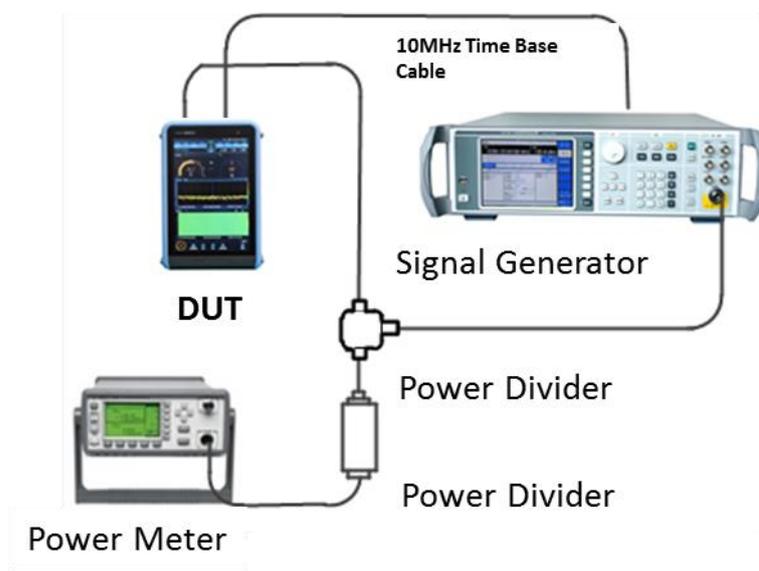


Fig. 8.17 Schematic diagram of the magnitude measurement accuracy test

c) Test procedure

1) Connect the test instrument as shown in Fig. 8.17, synthesize the signal generator and the common time base of the device to be tested. The signal output of the synthesized signal generator is input to the device to be measured and the power meter respectively after power division.

2) Set the output signal frequency and power of the synthesized signal generator according to the auxiliary table B.17.

3) Reset the device to be tested and set the scan mode to fixed frequency reception (FFM) with a frequency width of 100 kHz. Set the center frequency and attenuator status according to auxiliary table

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B.17.

- 4) The signal power was measured using the peak frequency scale and recorded in the auxiliary table B.17.
- 5) The same signal power is measured using a power meter and recorded in the auxiliary table B.17.
- 6) Set the test frequencies in sequence to complete the test.
- d) Test record and data processing

The magnitude error ΔA of the corresponding frequency point is calculated according to Equation (10) and recorded in the auxiliary Table B.17. The largest absolute value of the calculated value, ΔA , is recorded as the magnitude accuracy in the functional performance test record table A.1.

$$\Delta A = L_2 - L_1 \dots\dots\dots (10)$$

Where:

Wherein, L_1 indicates the power meter reading (dBm);

L_2 - the peak frequency scale reading of the device to be measured, dBm.

8.5 Performance characteristics test
8.5.2 Performance test log sheet

Instrument No.: _____

Test Personnel: _____

Test Condition: _____

Test Date: _____

S/N	Item	Unit	Standard Requirement	Results
1	Design and Structure	/	The appearance of the instrument is neat and beautiful, the panel markings are clearly written, the keys are flexible, and the connectors are convenient and in place.	
2	Function	/	Panoramic scan, frequency scan, memory scan and other multi-mode signal scan detection function	
			Level field strength measurement function	
			Whistling tone assisted test function	
			Remote control function	
			Record playback function (option)	
			Horizontal scanning function (option)	
			Direction finding function (option)	
			Map function (option)	
3	Frequency range	/	Lower frequency limit: 9kHz	
			Upper frequency limit: 8GHz	
4	Maximum linear operating input level	dBm	-13dBm, 9kHz to 30MHz;	
			+3dBm, 20MHz ~ 3.6GHz (low distortion mode)	
			-24dBm, 20MHz ~ 3.6GHz (low noise mode)	
			-24dBm, 3.6GHz to 8GHz;	
5	RF input port voltage standing wave ratio	/	<2.5, 9 kHz to 5.8 GHz;	
			<4.0, 5.8 GHz to 8 GHz;	
6	Display average noise level (spectrum channel)	dBm	≤-125dBm, 9kHz to 100kHz;	
			≤-151dBm, 100kHz to 1MHz;	
			≤-155dBm, 1MHz to 20MHz;	
			≤-154dBm, 20MHz to 80MHz (low noise mode)	
			≤-160dBm, 80MHz to 1.5GHz (low noise mode)	
			≤-155dBm, 1.5GHz to 3.6GHz (low noise mode)	
			≤-128dBm, 20MHz ~ 3.6GHz (low distortion mode)	
			≤-158dBm, 3.6GHz to 5.8GHz;	
			≤-154dBm, 5.8GHz to 7.5GHz;	
			≤-151dBm, 7.5GHz to 8GHz;	
7	Noise factor (level channel)	dB	≤21dB, test frequency 100kHz	
			≤17dB, test frequency 1MHz	
			≤17dB, test frequency 11MHz	
			≤17dB, test frequency 19MHz	

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			$\leq 10.5\text{dB}$, test frequency 50MHz					
			$\leq 9.5\text{dB}$, test frequency 140MHz					
			$\leq 10.5\text{dB}$, test frequency 430MHz					
S/N	Item	Unit	Standard Requirement		Results			
7	Noise factor (level channel)	dB	$\leq 11\text{dB}$, test frequency 1.1GHz					
			$\leq 11\text{dB}$, test frequency 1.5GHz					
			$\leq 14.5\text{dB}$, test frequency 3.4GHz					
			$\leq 17\text{dB}$, test frequency 3.6GHz					
			$\leq 13\text{dB}$, test frequency 5.5GHz					
			$\leq 19\text{dB}$, test frequency 7.499GHz					
			$\leq 21\text{dB}$, test frequency 8GHz					
8	Phase noise	dBc/Hz	Carrier 11MHz	$< -115\text{dBc/Hz}$, 10kHz frequency deviation				
				$< -117\text{dBc/Hz}$, 100kHz frequency deviation				
			Carrier 21MHz	$< -115\text{dBc/Hz}$, 10kHz frequency deviation				
				$< -117\text{dBc/Hz}$, 100kHz frequency deviation				
			Carrier 500MHz	$< -95\text{dBc/Hz}$, 10kHz frequency deviation				
				$< -95\text{dBc/Hz}$, 100kHz frequency deviation				
			Carrier 3.4GHz	$< -92\text{dBc/Hz}$, 10kHz frequency deviation				
				$< -92\text{dBc/Hz}$, 100kHz frequency deviation				
			Carrier 7.499GHz	$< -92\text{dBc/Hz}$, 10kHz frequency deviation				
				$< -92\text{dBc/Hz}$, 100kHz frequency deviation				
			Carrier 8GHz	$< -92\text{dBc/Hz}$, 10kHz frequency deviation				
				$< -92\text{dBc/Hz}$, 100kHz frequency deviation				
			9	AM demodulation sensitivity	dBm	$\leq -105.5\text{dBm}$, 9kHz to 30MHz;		
						$\leq -110\text{dBm}$, 20MHz to 1.5GHz;		
$\leq -106\text{dBm}$, 1.5GHz to 3.6GHz;								
$\leq -102\text{dBm}$, 3.6GHz to 8GHz;								
10	FM demodulation sensitivity	dBm	$\leq -103\text{dBm}$, 9kHz to 30MHz;					
			$\leq -111\text{dBm}$, 20MHz to 1.5GHz;					
			$\leq -107\text{dBm}$, 1.5GHz to 3.6GHz;					
			$\leq -102\text{dBm}$, 3.6GHz to 8GHz;					

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11	Third-order intercept points	dBm	>+18dBm, 9kHz to 30MHz		
			>-10dBm, 20MHz to 650MHz (low noise mode)		
			>-11.5dBm, 650MHz to 2.5GHz (low noise mode)		
			>-8dBm, 2.5GHz to 3.6GHz (low noise mode)		
			>+15dBm, 20MHz to 1.5GHz (low distortion mode)		
			>+15dBm, 1.5GHz to 3.6GHz (low distortion mode)		
			>-8dBm, 3.6GHz to 4.7GHz		
			>-6dBm, 4.7GHz to 8GHz		
12	Second-order intercept points	dBm	>+30dBm, 9kHz to 30MHz		
			>+30dBm, 20MHz to 1.5GHz (low noise mode)		
			>+60dBm, 1.5GHz to 3.6GHz (low noise mode)		
			>+55dBm, 3.6GHz to 5.8GHz		
			>+50dBm, 5.8GHz to 8GHz		
S/N	Item	Unit	Standard Requirement		Results
13	Mirror frequency suppression (1 IF)	dB	>90dB, 20MHz to 3.6GHz (low noise mode)		
			>80dB, 20MHz to 3.6GHz (low distortion mode)		
			>70dB, 3.6GHz to 8GHz		
14	Mirror frequency suppression (2 IF)	dB	>60dB, 20MHz to 3.6GHz (low noise mode)		
			>60dB, 20MHz to 3.6GHz (low distortion mode)		
			>70dB, 3.6GHz to 8GHz		
15	IF suppression	dB	>80dB, 20MHz to 3.6GHz (low noise mode)		
			>65dB, 20MHz to 3.6GHz (low distortion mode)		
			>90dB, 3.6GHz to 8GHz		
16	Local oscillator re-radiation	dBm	>-89dBm		
17	Residual response	dBm	<-100dBm, 9kHz to 3.6GHz;		
			<-90dBm, 3.6GHz to 7GHz;		
			<-80dBm, 7GHz to 8GHz;		
18	Panoramic scanning speed	GHz/s	>2 GHz/s		
19	Amplitude accuracy	dB	Better than ± 1.5 dB ($+15^{\circ}\text{C} \sim +35^{\circ}\text{C}$)		
			Better than ± 3 dB ($0^{\circ}\text{C} \sim +50^{\circ}\text{C}$)		
20	interface	/	Signal input and output interface	RF input interface: N-type female connector	
				IF output interface: SMA female connector	
				GNSS input interface: SMA female connector	
			Communication	LAN interface: standard RJ-45 type	

8.5 Performance characteristics test

				interface	USB interface: Type A, two	
					TF card interface: standard interface	
				Auxiliary input and output interfaces	Headphone jack: standard 3.5mm	
					Audio output interface: built-in amplifier	
				AUX interface: 7-core aerial plug, female connector		
Frequency Reference Interface	10MHz reference input interface					
21	Safety	Insulation resistance	MΩ	The insulation resistance between the power input of the equipment and the housing should be not less than 100 MΩ under standard atmospheric conditions for testing		
				The insulation resistance between the power input of the equipment and the housing should be not less than 2MΩ under humid environmental conditions		
		Dielectric strength	/	AC 1.5Kv/10mA/1min no arc, no breakdown.		
		Leakage current	mA	Voltage 242V, leakage current≤3.5mA, 1min.		
Blank below.						
Compliance determination						
Note: " # " means meet the requirements; "%" means do not meet the requirements; hit "/" means there is no content in this cell or the machine does not have this test item.						

8.5.3 Performance test auxiliary tables

Instrument No.: _____

Test Personnel: _____

Test Condition: _____

Test Date: _____

Table B.1 (Test of frequency range)

Item	Signal source output frequency	Test results
Frequency range	9kHz	kHz
	8GHz	(GHz)

Table B.2 (Test of maximum linear operating level)

Item	Signal source output frequency	3943B attenuation control	Test results
Maximum linear operating level	11MHz	--	dBm
	75MHz	On	dBm
	160MHz	On	dBm
	500MHz	On	dBm
	1GHz	On	dBm

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Item	Signal source output frequency	3943B attenuation control	Test results
	2GHz	On	dBm
	3GHz	On	dBm
	75MHz	Off	dBm
	160MHz	Off	dBm
	500MHz	Off	dBm
	1GHz	Off	dBm
	2GHz	Off	dBm
	3GHz	Off	dBm
	4.1GHz	--	dBm
	5.2GHz	--	dBm
	6.3GHz	--	dBm
	7.5GHz	--	dBm

Table B.3 (RF input port voltage SWR test)

Item	Setting frequency of the device to be tested	Vector network analyzer test frequency point / frequency band	Test results
Voltage SWR	11MHz	11MHz	
	30MHz	30MHz	
	75MHz	75MHz	
	90MHz	90MHz	
	160MHz	160MHz	
	220MHz	220MHz	
	500MHz	500MHz	
	660MHz	660MHz	
	1.45GHz	1.45GHz	
	2GHz	1.5GHz~2.5GHz	
	3GHz	2.5GHz~3.6GHz	
	4.1GHz	3.6GHz~4.7GHz	
	5.2GHz	4.7GHz~5.8GHz	
	6.3GHz	5.8GHz~6.9GHz	
7.5GHz	6.9GHz~8GHz		

Table B.4 (Display average noise level test)

Inspection Item	Frequency range		Attenuation control	Resolution	Measurement time	Frequency scale readings	Test results
	Start Freq	Stop Freq					

8.5 Performance characteristics test

Explicit average noise level	9kHz	100kHz	--	100Hz	1s	dBm	dBm/Hz
	100kHz	1MHz	--	100Hz	1s	dBm	dBm/Hz
	1MHz	20MHz	--	10kHz	50ms	dBm	dBm/Hz
	20MHz	80MHz	Off	10kHz	50ms	dBm	dBm/Hz
	80MHz	1.5GHz	Off	1MHz	50ms	dBm	dBm/Hz
	1.5GHz	3.6GHz	Off	1MHz	50ms	dBm	dBm/Hz
	20MHz	3.6GHz	On	1MHz	50ms	dBm	dBm/Hz
	3.6GHz	5.8GHz	--	1MHz	50ms	dBm	dBm/Hz
	5.8GHz	7.5GHz	--	1MHz	50ms	dBm	dBm/Hz
	7.5GHz	8GHz	--	1MHz	50ms	dBm	dBm/Hz

Table B.5 (Test of noise coefficient)

Item	Test frequency	Attenuation control	Level reading	Test results
Noise Figure	100kHz	--	dBm	dB
	1MHz	--	dBm	dB
	11MHz	--	dBm	dB
	19MHz	--	dBm	dB
	50MHz	Off	dBm	dB
	140MHz	Off	dBm	dB
	430MHz	Off	dBm	dB
	1.1GHz	Off	dBm	dB
	1.5GHz	Off	dBm	dB
	3.4GHz	Off	dBm	dB
	3.6GHz	--	dBm	dB
	5.5GHz	--	dBm	dB
	7.499GHz	--	dBm	dB
	8GHz	--	dBm	dB

Table B.6 (Test of phase noise)

Item	Test frequency	RBW	Freq Offset	Frequency scale readings	Test results
Phase noise	11MHz	31.25Hz	+10kHz	dB	dBc/Hz
			-10kHz	dB	dBc/Hz
		312.5Hz	+100kHz	dB	dBc/Hz
			-100kHz	dB	dBc/Hz
	21MHz	31.25Hz	+10kHz	dB	dBc/Hz
			-10kHz	dB	dBc/Hz
		312.5Hz	+100kHz	dB	dBc/Hz
			-100kHz	dB	dBc/Hz
	500MHz	31.25Hz	+10kHz	dB	dBc/Hz
			-10kHz	dB	dBc/Hz

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Item	Test frequency	RBW	Freq Offset	Frequency scale readings	Test results
		312.5Hz	+100kHz	dB	dBc/Hz
			-100kHz	dB	dBc/Hz
	3.4GHz	31.25Hz	+10kHz	dB	dBc/Hz
			-10kHz	dB	dBc/Hz
		312.5Hz	+100kHz	dB	dBc/Hz
			-100kHz	dB	dBc/Hz
	7.499GHz	31.25Hz	+10kHz	dB	dBc/Hz
			-10kHz	dB	dBc/Hz
		312.5Hz	+100kHz	dB	dBc/Hz
			-100kHz	dB	dBc/Hz
	8GHz	31.25Hz	+10kHz	dB	dBc/Hz
			-10kHz	dB	dBc/Hz
312.5Hz		+100kHz	dB	dBc/Hz	
		-100kHz	dB	dBc/Hz	

Table B.7 (Test of AM demodulation sensitivity)

Item	Test point frequency	Test results
AM demodulation sensitivity	11MHz	
	1GHz	
	2GHz	
	4GHz	

Table B.8 (Test of FM demodulation sensitivity)

Item	Test point frequency	Test results
FM demodulation sensitivity	11MHz	
	1GHz	
	2GHz	
	4GHz	

Table B.9 (Test of third-order intercept points)

Item	Center Freq	Att Control	Signal generator 1 frequency	Signal generator 1 power	Signal generator 2 frequency	Signal generator 2 power	Intermodulation of low end product level difference	Intermodulation of high end product level difference	Third-order intercept points IP ₃
Third-order intercept points	11MHz	--	10.85MHz	-17dBm	11.15MHz	-17dBm	dB	dB	dBm
	75MHz	Off	74.85MHz	-30dBm	75.15MHz	-30dBm	dB	dB	dBm
	90MHz	Off	89.85MHz	-30dBm	90.15MHz	-30dBm	dB	dB	dBm
	160MHz	Off	159.85MHz	-30dBm	160.15MHz	-30dBm	dB	dB	dBm
	220MHz	Off	219.85MHz	-30dBm	220.15MHz	-30dBm	dB	dB	dBm

8.5 Performance characteristics test

Item	Center Freq	Att Control	Signal generator 1 frequency	Signal generator 1 power	Signal generator 2 frequency	Signal generator 2 power	Intermodulation of low end product level difference	Intermodulation of high end product level difference	Third-order intercept points IP ₃
	z		z		z				
	500MHz z	Off	499.85MHz z	-30dBm	500.15MHz z	-30dBm	dB	dB	dBm
	660MHz z	Off	659.85MHz z	-30dBm	660.15MHz z	-30dBm	dB	dB	dBm
	1GHz	Off	0.99985G Hz	-30dBm	1.00015G Hz	-30dBm	dB	dB	dBm
	1.45G Hz	Off	1.44985G Hz	-30dBm	1.45015G Hz	-30dBm	dB	dB	dBm
	1.55G Hz	Off	1.54985G Hz	-30dBm	1.55015G Hz	-30dBm	dB	dB	dBm
	2GHz	Off	1.99985G Hz	-30dBm	2.00015G Hz	-30dBm	dB	dB	dBm
	2.4GHz	Off	2.39985G Hz	-30dBm	2.40015G Hz	-30dBm	dB	dB	dBm
	2.6GHz	Off	2.59985G Hz	-30dBm	2.60015G Hz	-30dBm	dB	dB	dBm
	3GHz	Off	2.99985G Hz	-30dBm	3.00015G Hz	-30dBm	dB	dB	dBm
	3.5GHz	Off	3.49985G Hz	-30dBm	3.50015G Hz	-30dBm	dB	dB	dBm
	75MHz	On	74.85MHz	-10dBm	75.15MHz	-10dBm	dB	dB	dBm
	90MHz	On	89.85MHz	-10dBm	90.15MHz	-10dBm	dB	dB	dBm
	160MHz z	On	159.85MHz z	-10dBm	160.15MHz z	-10dBm	dB	dB	dBm
	220MHz z	On	219.85MHz z	-10dBm	220.15MHz z	-10dBm	dB	dB	dBm
	500MHz z	On	499.85MHz z	-10dBm	500.15MHz z	-10dBm	dB	dB	dBm
	660MHz z	On	659.85MHz z	-10dBm	660.15MHz z	-10dBm	dB	dB	dBm
	1GHz	On	0.99985G Hz	-10dBm	1.00015G Hz	-10dBm	dB	dB	dBm
	1.45G Hz	On	1.44985G Hz	-10dBm	1.45015G Hz	-10dBm	dB	dB	dBm
	1.55G Hz	On	1.54985G Hz	-10dBm	1.55015G Hz	-10dBm	dB	dB	dBm
	2GHz	On	1.99985G Hz	-10dBm	2.00015G Hz	-10dBm	dB	dB	dBm

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Item	Center Freq	Att Control	Signal generator 1 frequency	Signal generator or 1 power	Signal generator 2 frequency	Signal generator or 2 power	Intermodulation of low end product level difference	Intermodulation of high end product level difference	Third-order intercept points IP ₃
			Hz		Hz				
	2.4GHz	On	2.39985G Hz	-10dBm	2.40015G Hz	-10dBm	dB	dB	dBm
	2.6GHz	On	2.59985G Hz	-10dBm	2.60015G Hz	-10dBm	dB	dB	dBm
	3GHz	On	2.99985G Hz	-10dBm	3.00015G Hz	-10dBm	dB	dB	dBm
	3.5GHz	On	3.49985G Hz	-10dBm	3.50015G Hz	-10dBm	dB	dB	dBm
	3.601 (GHz)	--	3.60085G Hz	-30dBm	3.60115G Hz	-30dBm	dB	dB	dBm
	4.1GHz	--	4.09985G Hz	-30dBm	4.10015G Hz	-30dBm	dB	dB	dBm
	4.6GHz	--	4.59985G Hz	-30dBm	4.60015G Hz	-30dBm	dB	dB	dBm
	4.75G Hz	--	4.74985G Hz	-30dBm	4.75015G Hz	-30dBm	dB	dB	dBm
	5.2GHz	--	5.19985G Hz	-30dBm	5.20015G Hz	-30dBm	dB	dB	dBm
	5.7GHz	--	5.69985G Hz	-30dBm	5.70015G Hz	-30dBm	dB	dB	dBm
	5.85G Hz	--	5.84985G Hz	-30dBm	5.85015G Hz	-30dBm	dB	dB	dBm
	6.3GHz	--	6.29985G Hz	-30dBm	6.30015G Hz	-30dBm	dB	dB	dBm
	6.8GHz	--	6.79985G Hz	-30dBm	6.80015G Hz	-30dBm	dB	dB	dBm
	6.95G Hz	--	6.94985G Hz	-30dBm	6.95015G Hz	-30dBm	dB	dB	dBm
	7.5GHz	--	7.49985G Hz	-30dBm	7.50015G Hz	-30dBm	dB	dB	dBm
	8GHz	--	7.99985G Hz	-30dBm	8.00015G Hz	-30dBm	dB	dB	dBm

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Table B.10 (Test of second-order intercept points)

Item	Center Freq	Att Control	Signal generator or 1 frequency	Signal generator 1 power	Signal generator or 2 frequency	Signal generator 2 power	Mutual adjustment of low-end product frequency	Intermodulation of low end product levels	Mutual tuning of high-end products frequency	Intermodulation of high-end product levels	Second-order intercept points IP ₂
Second-order intercept points	11MHz	--	10.85MHz	-17dBm	11.15MHz	-17dBm	300kHz	dBm	22MHz	dBm	dBm
	75MHz	Off	74.85MHz	-30dBm	75.15MHz	-30dBm	300kHz	dBm	150MHz	dBm	dBm
	90MHz	Off	89.85MHz	-30dBm	90.15MHz	-30dBm	300kHz	dBm	180MHz	dBm	dBm
	160MHz	Off	159.85MHz	-30dBm	160.15MHz	-30dBm	300kHz	dBm	320MHz	dBm	dBm
	220MHz	Off	219.85MHz	-30dBm	220.15MHz	-30dBm	300kHz	dBm	440MHz	dBm	dBm
	500MHz	Off	499.85MHz	-30dBm	500.15MHz	-30dBm	300kHz	dBm	1GHz	dBm	dBm
	660MHz	Off	659.85MHz	-30dBm	660.15MHz	-30dBm	300kHz	dBm	1.32GHz	dBm	dBm
	1GHz	Off	0.99985GHz	-30dBm	1.00015GHz	-30dBm	300kHz	dBm	2GHz	dBm	dBm
	1.45GHz	Off	1.44985GHz	-30dBm	1.45015GHz	-30dBm	300kHz	dBm	2.9GHz	dBm	dBm
	1.55GHz	Off	1.54985GHz	-30dBm	1.55015GHz	-30dBm	300kHz	dBm	3.1GHz	dBm	dBm
	2GHz	Off	1.99985GHz	-30dBm	2.00015GHz	-30dBm	300kHz	dBm	4GHz	dBm	dBm
	2.4GHz	Off	2.39985GHz	-30dBm	2.40015GHz	-30dBm	300kHz	dBm	4.8GHz	dBm	dBm
	2.6GHz	Off	2.59985GHz	-30dBm	2.60015GHz	-30dBm	300kHz	dBm	5.2GHz	dBm	dBm
	3GHz	Off	2.99985GHz	-30dBm	3.00015GHz	-30dBm	300kHz	dBm	6GHz	dBm	dBm
	3.5GHz	Off	3.49985GHz	-30dBm	3.50015GHz	-30dBm	300kHz	dBm	7GHz	dBm	dBm
	3.601 (GHz)	--	3.60085GHz	-30dBm	3.60115GHz	-30dBm	300kHz	dBm	7.202 (GHz)	dBm	dBm
	4.1GHz	--	4.09985GHz	-30dBm	4.10015GHz	-30dBm	300kHz	dBm	--	dBm	dBm
	4.6GHz	--	4.59985GHz	-30dBm	4.60015GHz	-30dBm	300kHz	dBm	--	dBm	dBm

8.5 Performance characteristics test

Item	Center Freq	Att Control	Signal generator or 1 frequency	Signal generator 1 power	Signal generator or 2 frequency	Signal generator 2 power	Mutual adjustment of low-end product frequency	Intermodulation of low end product levels	Mutual tuning of high-end products frequency	Intermodulation of high-end product levels	Second-order intercept points IP ₂
	Hz		GHz	m	GHz	m	z				
	4.75G Hz	--	4.74985 GHz	-30dBm	4.75015 GHz	-30dBm	300kHz	dBm	--	dBm	dBm
	5.2G Hz	--	5.19985 GHz	-30dBm	5.20015 GHz	-30dBm	300kHz	dBm	--	dBm	dBm
	5.7G Hz	--	5.69985 GHz	-30dBm	5.70015 GHz	-30dBm	300kHz	dBm	--	dBm	dBm
	5.85G Hz	--	5.84985 GHz	-30dBm	5.85015 GHz	-30dBm	300kHz	dBm	--	dBm	dBm
	6.3G Hz	--	6.29985 GHz	-30dBm	6.30015 GHz	-30dBm	300kHz	dBm	--	dBm	dBm
	6.8G Hz	--	6.79985 GHz	-30dBm	6.80015 GHz	-30dBm	300kHz	dBm	--	dBm	dBm
	6.95G Hz	--	6.94985 GHz	-30dBm	6.95015 GHz	-30dBm	300kHz	dBm	--	dBm	dBm
	7.5G Hz	--	7.49985 GHz	-30dBm	7.50015 GHz	-30dBm	300kHz	dBm	--	dBm	dBm
	8GHz	--	7.99985 GHz	-30dBm	8.00015 GHz	-30dBm	300kHz	dBm	--	dBm	dBm

Table B.11 (Tests for mirror frequency rejection (1 IF))

Item	Center frequency	Att Control	Mirror Frequency Rate	Signal generator setting power	Mirror frequency signal input power	Mirror frequency interference output power	Test results
Mirror frequency Suppression (1 IF)	30MHz	Off	10.48GHz	-25dBm	dBm	dBm	dB
	75MHz	Off	10.525GHz	-25dBm	dBm	dBm	dB
	90MHz	Off	10.54GHz	-25dBm	dBm	dBm	dB
	160MHz	Off	10.61GHz	-25dBm	dBm	dBm	dB
	220MHz	Off	10.67GHz	-25dBm	dBm	dBm	dB
	500MHz	Off	10.95GHz	-25dBm	dBm	dBm	dB
	660MHz	Off	11.11GHz	-25dBm	dBm	dBm	dB
	1GHz	Off	11.45GHz	-25dBm	dBm	dBm	dB
	1.45GHz	Off	11.9GHz	-25dBm	dBm	dBm	dB
	1.55GHz	Off	12GHz	-25dBm	dBm	dBm	dB
	2GHz	Off	12.45GHz	-25dBm	dBm	dBm	dB
2.4GHz	Off	12.85GHz	-25dBm	dBm	dBm	dB	

8.5 Performance characteristics test

Item	Center frequency	Att Control	Mirror Frequency Rate	Signal generator setting power	Mirror frequency signal input power	Mirror frequency interference output power	Test results	
	2.6GHz	Off	13.05GHz	-25dBm	dBm	dBm	dB	
	3GHz	Off	13.45GHz	-25dBm	dBm	dBm	dB	
	3.5GHz	Off	13.95GHz	-25dBm	dBm	dBm	dB	
	30MHz	On	10.48GHz	-10dBm	dBm	dBm	dB	
	75MHz	On	10.525GHz	-10dBm	dBm	dBm	dB	
	90MHz	On	10.54GHz	-10dBm	dBm	dBm	dB	
	160MHz	On	10.61GHz	-10dBm	dBm	dBm	dB	
	220MHz	On	10.67GHz	-10dBm	dBm	dBm	dB	
	500MHz	On	10.95GHz	-10dBm	dBm	dBm	dB	
	660MHz	On	11.11GHz	-10dBm	dBm	dBm	dB	
	1GHz	On	11.45GHz	-10dBm	dBm	dBm	dB	
	1.45GHz	On	11.9GHz	-10dBm	dBm	dBm	dB	
	1.55GHz	On	12GHz	-10dBm	dBm	dBm	dB	
	2GHz	On	12.45GHz	-10dBm	dBm	dBm	dB	
	2.4GHz	On	12.85GHz	-10dBm	dBm	dBm	dB	
	2.6GHz	On	13.05GHz	-10dBm	dBm	dBm	dB	
	3GHz	On	13.45GHz	-10dBm	dBm	dBm	dB	
	3.5GHz	On	13.95GHz	-10dBm	dBm	dBm	dB	
	3.601GHz	--	7.551GHz	-25dBm	dBm	dBm	dBm	dB
	4.1GHz	--	8.05GHz	-25dBm	dBm	dBm	dBm	dB
			150MHz	-25dBm	dBm	dBm	dBm	dB
	4.6GHz	--	8.55GHz	-25dBm	dBm	dBm	dBm	dB
			650MHz	-25dBm	dBm	dBm	dBm	dB
	4.75GHz	--	8.7GHz	-25dBm	dBm	dBm	dBm	dB
			800MHz	-25dBm	dBm	dBm	dBm	dB
	5.2GHz	--	9.15GHz	-25dBm	dBm	dBm	dBm	dB
			1.25GHz	-25dBm	dBm	dBm	dBm	dB
	5.7GHz	--	9.65GHz	-25dBm	dBm	dBm	dBm	dB
1.75GHz			-25dBm	dBm	dBm	dBm	dB	
5.85GHz	--	9.8GHz	-25dBm	dBm	dBm	dBm	dB	
		1.9GHz	-25dBm	dBm	dBm	dBm	dB	
6.3GHz	--	10.25GHz	-25dBm	dBm	dBm	dBm	dB	
		2.35GHz	-25dBm	dBm	dBm	dBm	dB	
6.8GHz	--	10.75GHz	-25dBm	dBm	dBm	dBm	dB	
		2.85GHz	-25dBm	dBm	dBm	dBm	dB	

8.5 Performance characteristics test

Item	Center frequency	Att Control	Mirror Frequency Rate	Signal generator setting power	Mirror frequency signal input power	Mirror frequency interference output power	Test results
	6.95GHz	--	10.9GHz	-25dBm	dBm	dBm	dB
			3GHz	-25dBm	dBm	dBm	dB
	7.5GHz	--	11.45GHz	-25dBm	dBm	dBm	dB
			3.55GHz	-25dBm	dBm	dBm	dB
	8GHz	--	11.95GHz	-25dBm	dBm	dBm	dB
			4.05GHz	-25dBm	dBm	dBm	dB

Table B.12 (Tests for mirror frequency rejection (2 IF))

Item	Center frequency	Att Control	Mirror Frequency Rate	Signal generator setting power	Mirror frequency signal input power	Mirror frequency interference output power	Test results	
Mirror frequency Suppression (2 IF)	30MHz	Off	310MHz	-25dBm	dBm	dBm	dB	
	75MHz	Off	355MHz	-25dBm	dBm	dBm	dB	
	90MHz	Off	370MHz	-25dBm	dBm	dBm	dB	
	160MHz	Off	440MHz	-25dBm	dBm	dBm	dB	
	220MHz	Off	500MHz	-25dBm	dBm	dBm	dB	
	500MHz	Off	780MHz	-25dBm	dBm	dBm	dBm	dB
			220MHz	-25dBm	dBm	dBm	dBm	dB
	660MHz	Off	940MHz	-25dBm	dBm	dBm	dBm	dB
			380MHz	-25dBm	dBm	dBm	dBm	dB
	1GHz	Off	1.28GHz	-25dBm	dBm	dBm	dBm	dB
			720MHz	-25dBm	dBm	dBm	dBm	dB
	1.45GHz	Off	1.73GHz	-25dBm	dBm	dBm	dBm	dB
			1.17GHz	-25dBm	dBm	dBm	dBm	dB
	1.55GHz	Off	1.83GHz	-25dBm	dBm	dBm	dBm	dB
			1.27GHz	-25dBm	dBm	dBm	dBm	dB
	2GHz	Off	2.28GHz	-25dBm	dBm	dBm	dBm	dB
			1.72GHz	-25dBm	dBm	dBm	dBm	dB
	2.4GHz	Off	2.68GHz	-25dBm	dBm	dBm	dBm	dB
			2.12GHz	-25dBm	dBm	dBm	dBm	dB
	2.6GHz	Off	2.88GHz	-25dBm	dBm	dBm	dBm	dB
2.32GHz			-25dBm	dBm	dBm	dBm	dB	
3GHz	Off	3.28GHz	-25dBm	dBm	dBm	dBm	dB	
		2.72GHz	-25dBm	dBm	dBm	dBm	dB	
3.5GHz	Off	3.78GHz	-25dBm	dBm	dBm	dBm	dB	

8.5 Performance characteristics test

Item	Center frequency	Att Control	Mirror Frequency Rate	Signal generator setting power	Mirror frequency signal input power	Mirror frequency interference output power	Test results
			3.22GHz	-25dBm	dBm	dBm	dB
	30MHz	On	310MHz	-10dBm	dBm	dBm	dB
	75MHz	On	355MHz	-10dBm	dBm	dBm	dB
	90MHz	On	370MHz	-10dBm	dBm	dBm	dB
	160MHz	On	440MHz	-10dBm	dBm	dBm	dB
	220MHz	On	500MHz	-10dBm	dBm	dBm	dB
	500MHz	On	780MHz	-10dBm	dBm	dBm	dB
			220MHz	-10dBm	dBm	dBm	dB
	660MHz	On	940MHz	-10dBm	dBm	dBm	dB
			380MHz	-10dBm	dBm	dBm	dB
	1GHz	On	1.28GHz	-10dBm	dBm	dBm	dB
			720MHz	-10dBm	dBm	dBm	dB
	1.45GHz	On	1.73GHz	-10dBm	dBm	dBm	dB
			1.17GHz	-10dBm	dBm	dBm	dB
	1.55GHz	On	1.83GHz	-10dBm	dBm	dBm	dB
			1.27GHz	-10dBm	dBm	dBm	dB
	2GHz	On	2.28GHz	-10dBm	dBm	dBm	dB
			1.72GHz	-10dBm	dBm	dBm	dB
	2.4GHz	On	2.68GHz	-10dBm	dBm	dBm	dB
			2.12GHz	-10dBm	dBm	dBm	dB
	2.6GHz	On	2.88GHz	-10dBm	dBm	dBm	dB
			2.32GHz	-10dBm	dBm	dBm	dB
	3GHz	On	3.28GHz	-10dBm	dBm	dBm	dB
			2.72GHz	-10dBm	dBm	dBm	dB
	3.5GHz	On	3.78GHz	-10dBm	dBm	dBm	dB
			3.22GHz	-10dBm	dBm	dBm	dB
	3.601GHz	--	3.881GHz	-25dBm	dBm	dBm	dB
			3.321GHz	-25dBm	dBm	dBm	dB
	4.1GHz	--	4.38GHz	-25dBm	dBm	dBm	dB
			3.82GHz	-25dBm	dBm	dBm	dB
	4.6GHz	--	4.88GHz	-25dBm	dBm	dBm	dB
			4.32GHz	-25dBm	dBm	dBm	dB
	4.75GHz	--	5.03GHz	-25dBm	dBm	dBm	dB
			4.47GHz	-25dBm	dBm	dBm	dB
	5.2GHz	--	5.48GHz	-25dBm	dBm	dBm	dB

8.5 Performance characteristics test

Item	Center frequency	Att Control	Mirror Frequency Rate	Signal generator setting power	Mirror frequency signal input power	Mirror frequency interference output power	Test results	
	5.7GHz	--	4.92GHz	-25dBm	dBm	dBm	dB	
			5.98GHz	-25dBm	dBm	dBm	dB	
	5.85GHz	--	5.42GHz	-25dBm	dBm	dBm	dB	
			6.13GHz	-25dBm	dBm	dBm	dB	
	6.3GHz	--	5.57GHz	-25dBm	dBm	dBm	dB	
			6.58GHz	-25dBm	dBm	dBm	dB	
	6.8GHz	--	6.02GHz	-25dBm	dBm	dBm	dB	
			7.08GHz	-25dBm	dBm	dBm	dB	
	6.95GHz	--	6.52GHz	-25dBm	dBm	dBm	dB	
			7.23GHz	-25dBm	dBm	dBm	dB	
	7.5GHz	--	6.67GHz	-25dBm	dBm	dBm	dB	
			7.78GHz	-25dBm	dBm	dBm	dB	
	8GHz	--	7.22GHz	-25dBm	dBm	dBm	dB	
			8.28GHz	-25dBm	dBm	dBm	dB	
				7.72GHz	-25dBm	dBm	dBm	dB

Table B.13 (Test of IF suppression)

Item	Center frequency	Att Control	IF frequency	Signal generator setting power	IF signal input power	IF interference output power	Test results
IF Suppression	30MHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	75MHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	90MHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	160MHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	220MHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	500MHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	660MHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	1GHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	1.45GHz	Off	5225MHz	-25dBm	dBm	dBm	dB

8.5 Performance characteristics test

Item	Center frequency	Att Control	IF frequency	Signal generator setting power	IF signal input power	IF interference output power	Test results
			140MHz	-25dBm	dBm	dBm	dB
	1.55GHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	2GHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	2.4GHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	2.6GHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	3GHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	3.5GHz	Off	5225MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	30MHz	On	5225MHz	-10dBm	dBm	dBm	dB
			140MHz	-10dBm	dBm	dBm	dB
	75MHz	On	5225MHz	-10dBm	dBm	dBm	dB
			140MHz	-10dBm	dBm	dBm	dB
	90MHz	On	5225MHz	-10dBm	dBm	dBm	dB
			140MHz	-10dBm	dBm	dBm	dB
	160MHz	On	5225MHz	-10dBm	dBm	dBm	dB
			140MHz	-10dBm	dBm	dBm	dB
	220MHz	On	5225MHz	-10dBm	dBm	dBm	dB
			140MHz	-10dBm	dBm	dBm	dB
	500MHz	On	5225MHz	-10dBm	dBm	dBm	dB
			140MHz	-10dBm	dBm	dBm	dB
	660MHz	On	5225MHz	-10dBm	dBm	dBm	dB
			140MHz	-10dBm	dBm	dBm	dB
	1GHz	On	5225MHz	-10dBm	dBm	dBm	dB
			140MHz	-10dBm	dBm	dBm	dB
	1.45GHz	On	5225MHz	-10dBm	dBm	dBm	dB
			140MHz	-10dBm	dBm	dBm	dB
	1.55GHz	On	5225MHz	-10dBm	dBm	dBm	dB
			140MHz	-10dBm	dBm	dBm	dB
	2GHz	On	5225MHz	-10dBm	dBm	dBm	dB
			140MHz	-10dBm	dBm	dBm	dB
	2.4GHz	On	5225MHz	-10dBm	dBm	dBm	dB

8.5 Performance characteristics test

Item	Center frequency	Att Control	IF frequency	Signal generator setting power	IF signal input power	IF interference output power	Test results
	2.6GHz	On	140MHz	-10dBm	dBm	dBm	dB
			5225MHz	-10dBm	dBm	dBm	dB
	3GHz	On	140MHz	-10dBm	dBm	dBm	dB
			5225MHz	-10dBm	dBm	dBm	dB
	3.5GHz	On	140MHz	-10dBm	dBm	dBm	dB
			5225MHz	-10dBm	dBm	dBm	dB
	3.601GHz	--	1975MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	4.1GHz	--	1975MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	4.6GHz	--	1975MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	4.75GHz	--	1975MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	5.2GHz	--	1975MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	5.7GHz	--	1975MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	5.85GHz	--	1975MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	6.3GHz	--	1975MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
	6.8GHz	--	1975MHz	-25dBm	dBm	dBm	dB
			140MHz	-25dBm	dBm	dBm	dB
6.95GHz	--	1975MHz	-25dBm	dBm	dBm	dB	
		140MHz	-25dBm	dBm	dBm	dB	
7.5GHz	--	1975MHz	-25dBm	dBm	dBm	dB	
		140MHz	-25dBm	dBm	dBm	dB	
8GHz	--	1975MHz	-25dBm	dBm	dBm	dB	
		140MHz	-25dBm	dBm	dBm	dB	

Table B.14 (Tests of local oscillation re-radiation)

Item	Center frequency	Attenuation control	Signal/Spectrum Analyzer intermediate frequency	Test results
Local oscillator	30MHz	Off	5.255GHz	dBm
	70MHz	Off	5.295GHz	dBm

8.5 Performance characteristics test

re-radiation	90MHz	Off	5.315GHz	dBm
	160MHz	Off	5.385GHz	dBm
	210MHz	Off	5.435GHz	dBm
	500MHz	Off	5.725GHz	dBm
	660MHz	Off	5.885GHz	dBm
	1GHz	Off	6.225GHz	dBm
	1.45GHz	Off	6.675GHz	dBm
	1.55GHz	Off	6.775GHz	dBm
	2GHz	Off	7.225GHz	dBm
	2.4GHz	Off	7.625GHz	dBm
	2.6GHz	Off	7.825GHz	dBm
	3GHz	Off	8.225GHz	dBm
	3.5GHz	Off	8.725GHz	dBm
	3.601GHz	--	5.576GHz	dBm
	4.1GHz	--	6.075GHz	dBm
	4.6GHz	--	6.575GHz	dBm
	4.75GHz	--	6.725GHz	dBm
	5.2GHz	--	7.175GHz	dBm
	5.7GHz	--	7.675GHz	dBm
	5.85GHz	--	7.825GHz	dBm
6.3GHz	--	8.275GHz	dBm	
6.8GHz	--	8.775GHz	dBm	
6.95GHz	--	8.925GHz	dBm	
7.5GHz	--	9.475GHz	dBm	
8GHz	--	9.975GHz	dBm	

Table B.15 (Tests of residual response)

Item	Residual response signal frequency	Residual response signal power
Residual response		dBm
		dBm

Table B.16 (Testing of panoramic scanning speed)

Item	Start Freq	Stop Freq	Dwell time	Test results
Scanning speed	10MHz	8GHz	s	GHz/s

8.5 Performance characteristics test

Table B.17 (Tests of magnitude accuracy)

0-band									
Test frequency	Synthetic source output power	Test value of the device to be tested	Power meter test value	Magnitude error	Test frequency	Synthetic source output power	Test value of the device to be tested	Power meter test value	Magnitude error
11MHz	-25dBm	dBm	dBm	dB	29MHz	-25dBm	dBm	dBm	dB
1-band, low distortion mode (attenuator on)									
30MHz	-15dBm	dBm	dBm	dB	2.1GHz	-15dBm	dBm	dBm	dB
60MHz	-15dBm	dBm	dBm	dB	2.4GHz	-15dBm	dBm	dBm	dB
300MHz	-15dBm	dBm	dBm	dB	2.7GHz	-15dBm	dBm	dBm	dB
600MHz	-15dBm	dBm	dBm	dB	3GHz	-15dBm	dBm	dBm	dB
900MHz	-15dBm	dBm	dBm	dB	3.3GHz	-15dBm	dBm	dBm	dB
1.2GHz	-15dBm	dBm	dBm	dB	3.59GHz	-15dBm	dBm	dBm	dB
1.5GHz	-15dBm	dBm	dBm	dB					
1.8GHz	-15dBm	dBm	dBm	dB					
1-band, low-noise mode (attenuator off)									
30MHz	-25dBm	dBm	dBm	dB	2.1GHz	-25dBm	dBm	dBm	dB
60MHz	-25dBm	dBm	dBm	dB	2.4GHz	-25dBm	dBm	dBm	dB
300MHz	-25dBm	dBm	dBm	dB	2.7GHz	-25dBm	dBm	dBm	dB
600MHz	-25dBm	dBm	dBm	dB	3GHz	-25dBm	dBm	dBm	dB
900MHz	-25dBm	dBm	dBm	dB	3.3GHz	-25dBm	dBm	dBm	dB
1.2GHz	-25dBm	dBm	dBm	dB	3.59GHz	-25dBm	dBm	dBm	dB
1.5GHz	-25dBm	dBm	dBm	dB					
1.8GHz	-25dBm	dBm	dBm	dB					
2-band									
3.6GHz	-25dBm	dBm	dBm	dB	6.3GHz	-25dBm	dBm	dBm	dB
3.9GHz	-25dBm	dBm	dBm	dB	6.6GHz	-25dBm	dBm	dBm	dB
4.2GHz	-25dBm	dBm	dBm	dB	6.9GHz	-25dBm	dBm	dBm	dB
4.5GHz	-25dBm	dBm	dBm	dB	7.2GHz	-25dBm	dBm	dBm	dB
4.8GHz	-25dBm	dBm	dBm	dB	7.5GHz	-25dBm	dBm	dBm	dB
5.1GHz	-25dBm	dBm	dBm	dB	7.8GHz	-25dBm	dBm	dBm	dB
5.4GHz	-25dBm	dBm	dBm	dB	8GHz	-25dBm	dBm	dBm	dB
5.7GHz	-25dBm	dBm	dBm	dB					
6GHz	-25dBm	dBm	dBm	dB					

8.5 Performance characteristics test

8.5.4 Recommended instrument for performance characteristics test

Table 8.5 Recommended instrument for performance characteristics test

No.	Instrument	Main technical indicators	Recommended model
1	Composite Generator Signal	Frequency range:250kHz to 20GHz Power output:-100dBm to +15dBm Frequency Accuracy:±0.02% Power levels can be calibrated and stored With internal and external AM mode	E8257D or 1464
2	Audio analyzer	With SINAD test function Measurement bandwidth: 10Hz to 1.5MHz Test items: frequency, AC voltage	U8903A/U8903B
3	Signal/spectrum analyzer	Frequency range:250kHz to 13.2GHz Display average noise level: -150dBm/Hz	FSW26/4051
4	Power meter	Power range: -70dBm ~ +20dBm Calibration source magnitude: 0dBm	2436 or E4419
5	Amplitude probe	Frequency range: 10MHz ~ 18GHz Power range: -60dBm ~ +20dBm	71710 or 9304A
6	Power splitter	Frequency range:DC~26.5GHz Insertion loss:6dB Equivalent output VSWR:<1.22:1	11667B
7	RF directional coupler	Frequency range: 300kHz to 4GHz Directionality: 35dB VSWR:<1.45	70607
8	Directional coupler	Frequency range: 2GHz ~ 20GHz Directionality: 13dB VSWR: <1.45	70604
9	Low-pass filter	Cutoff frequency:1.6GHz Insertion loss:<0.9dB Out-of-band rejection:>65dB	Homemade
10	Low-pass filter	Cutoff frequency:4GHz Insertion loss:<1dB Out-of-band rejection:>65dB	Homemade
11	Load	Impedance:50Ω	SMA-50JR
12	Adapter	N type (m) to 3.5(f)	Homemade

Appendix

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Annex A Terminology

Units of measurement

The units of measurement commonly used for monitoring receivers are shown in Table 1.

Table 1 Measurement Units

Measurement parameters	Name of Unit	Unit Abbreviation
Freq	Hertz	Hz
Power level	Decibel relative to milliwatt	dBm
Power ratio	Decibel	dB
Voltage	Volt	V
Time	Second	s
Impedance (resistance)	Ohm	Ω

Measuring range

The power ratio (dB) of the maximum signal (typically the maximum safe input level) to the minimum signal (display average noise level) that can be measured at the input of the monitoring receiver for a given accuracy range, which is typically much greater than the dynamic range possible in a single measurement.

Logarithmic scale display

The vertical scale on the display is displayed logarithmically. In the logarithmic mode, dBm and dB μ V can be used as magnitude units.

Trace

A trace consists of a series of data points containing frequency (time) and amplitude information, which are usually treated as a set.

Frequency scale

The visible indicator cursor, which can be placed anywhere on the screen trace, provides a digital display of the absolute value of the frequency and magnitude of the trace at the marker point. Active frequency scales are those located on the trace that can be moved directly by dragging or programmed commands.

Differential frequency scale

One way of marking frequency scale, one of which is a fixed reference marker, and the other is an active frequency scale that can be placed anywhere on the display trace, and the displayed data is the relative amplitude and frequency difference (or time difference) between the active marker and fixed reference frequency scale.

Filter selectivity

Filter selectivity, also known as the rectangular coefficient, is an indicator for evaluating the ability of a monitoring receiver to resolve unequal amplitude signals, and usually defines the ratio of the 60dB bandwidth to the 3dB bandwidth of the filter. The bandwidth selectivity indicates the steepness of the filter edge.

LO

The short for the local oscillator. In the monitoring receiver, the local oscillator frequency is mixed with the received signal to generate the intermediate frequency signal of instrument.

Spurious response

The unexpected spurious signal on the monitoring receiver display. Spurious response consists of spurious response and residual response, the former refers to the abnormal response occurred in the monitoring receiver display along with the input signal, consisting of harmonic response, intermodulation response, mirror frequency response, multiple response and out-of-band response; the spurious response can also be divided into the harmonic response and non-harmonic response, and the later refers to the intermodulation response and residual response. The sub-items are described below:

a) Harmonic distortion

When the input signal amplitude increases to a level to let the mixer works in the non-linear status, the mixer will generate harmonic components of such input signal, and such components are called harmonic distortion.

b) Mirror frequency and multiple responses

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 the mirror frequency.

Multiple responses refer to two or multiple responses caused by the input signal with signal frequency on the display, that is, to respond to two or multiple LO frequencies, the interval between the LO frequencies of such multiple responses is two times of the IF. Multiple responses occur only when the mixing mode overlaps and LO sweeps a sufficient range to make the input signal mixed in more than one mode. monitoring receiver has different principle structure, and the frequency causing mirror and multiple responses varies, too.

c) Residual response

It refers to the discrete response displayed when monitoring receiver is not input with any signal.

Dynamic range

The maximum power ratio between two or more signals present at the input of the monitoring receiver at the specified accuracy, expressed in dB, characterizes the ability to measure the difference in amplitude of two or more signals simultaneously. The dynamic range has multiple signal dynamic range, single signal dynamic range, instantaneous dynamic range, and safe dynamic range, which has different from the concept of displaying range and measurement range. Factors that affect dynamic range include display average noise level, internal distortion, noise sidebands, input attenuators, logarithmic amplifiers, detectors, and AD converters.

The optimal second- and third-order distortion-free measurement dynamic range can be calculated based on the following formula.

$$MDR_2 = \frac{1}{2} \times (SHI - DANL)$$

$$MDR_3 = \frac{2}{3} \times (TOI - DANL)$$

Whereas:

MDR_2 —the optimal second-order distortion-free measurement dynamic range

SHI - second order distortion intercept point

$DANL$ - display average noise level

MDR_3 —the optimal third-order distortion-free measurement dynamic range

TOI - third order distortion intercept point

FFT

Abbreviation for Fast Fourier Transform. It performs a specific mathematical analysis of the time domain signal and gives the results of the frequency domain analysis.

Resolution

Resolution is used to represent the capability of the monitoring receiver to clearly separate two input signals. It is subject to the influence of some factors such as IF filter bandwidth, rectangle coefficient, local-oscillator residual frequency modulation, phase noise and sweep time. Most monitoring receivers are using LC filters, crystal filters, active filters, digital filters, etc. to achieve different resolution bandwidths.

Amplitude accuracy

A parameter associated with the amplitude measurement result that characterizes the dispersion of the amplitude measurement value. Factors affecting amplitude measurement accuracy include frequency response, display fidelity, input attenuator conversion error, IF gain, scale factor and resolution bandwidth.

Intermodulation

If two or more signals are simultaneously loaded at the input of an active device (such as an amplifier or a mixer), multiple sum frequency and/or difference frequency component of each signal itself produces intermodulation products due to the nonlinearity of the active device and the harmonics of the generated signal. For monitoring receiver, these intermodulation products are interference signals, the lower the level, the better the result. The relationship between the level of the intermodulation product and level of the input signal is: if the amplitude of the two sinusoidal input signals varies by Δ dB, the corresponding intermodulation product level will vary by $n \cdot \Delta$ dB, where n is the order of the intermodulation product, and represents the sum of the sub-items of the contained frequencies, such as the frequency $2 \cdot f_1 + 1 \cdot f_2$, and the order is $2+1=3$. The intersection point when the amplitude of the signal and intermodulation product is equal is usually called the intercept point. In fact, this point does not exist because the output of the active device is compressed when the input signal is amplified to a certain extent. The intercept point can be defined by the input level or output level, so the nominal intercept point has an input and output intercept point, which refers to the input intercept point unless otherwise specified. The intercept point is usually expressed in dBm. The larger the intercept point, the better the linearity of the monitoring receiver, which is a prerequisite for obtaining a large dynamic range. In most cases, among the intermodulation products, the second-order products and the third-order products have the greatest impact on the measurement. The 2nd order intercept point is often defined as IP_2 or SOI (Second Order Intercept), and the 3rd order intercept point is IP_3 or TOI (Third Order Intercept). The calibration of interception point must specify the value of the input attenuator at the front end of the monitoring receiver (usually 0dB) as the intercept point will also increase as the attenuation of the attenuator increases.

The linearity of active devices varies with the increase of current and power. In normal case, the current supplied by the amplifier is proportional to the local oscillator power of the mixer, which will significantly improve the linearity, so the low power consumption of the monitoring receiver is often equivalent to poor linearity. However, it should be noted that this is contradictory to the noise requirement. The access attenuator of the monitoring receiver can control the intermodulation product, which will have a higher IP_3 value at a higher noise factor, so IP_3 and noise factor should be analyzed and compared in the same operating mode. IP_3 is an important indicator of the linearity of the monitoring receiver, which reflects the magnitude of intermodulation distortion when the monitoring receiver is subjected to strong signal interference.

Detector Mode

The mode in which the analog information is digitized and saved into the memory is mainly used as a display detection method for the signal energy in the monitoring receiver. Includes "Maximum Peak", "Power", "Sampling" and "Average".

Drift

The local oscillator frequency is subject to the change in the sweep voltage, resulting in a slow change in signal position on the display. If drift occurs, it may need to be re-adjusted without compromising the frequency resolution.

Span

The difference between the start frequency and the stop frequency on the monitoring receiver. The setting of the bandwidth determines the scale of the horizontal axis of the monitoring receiver display

Frequency range

The range between the min. frequency and max. frequency that can be measured by monitoring receiver under the specified performance conditions. The frequency span and relevant frequency band division shall be specified in the product specifications.

Frequency accuracy

The measured frequency shows how close the value is to the true value. It consists of absolute accuracy and relative accuracy. The former is the actual size of the readout frequency error, and the latter is the ratio of the readout frequency error to the ideal frequency value.

Frequency stability

Refers to the extent to which the signal frequency remains constant in the short or long term. The short-term frequency stability can be characterized by residual FM or phase noise. Long-term frequency stability is characterized by the aging rate.

Flatness

Corresponding to the variation of the display amplitude of the measurement frequency range of the monitoring receiver, indicating the corresponding relationship between the displayed signal amplitude variation and the frequency.

Measurement time

The time for the detector to output one level and spectrum measurement result. The measurement time of the detector can be set to 500us~900s.

Measurement mode

The measurement modes include periodic and continuous measurement. The cycle measurement mode is the output of all level check waves during the measurement time. The measurement time selected for the continuous measurement mode is the time constant of the RC filter, which is output every 200ms from the detector.

Input impedance

The terminal impedance presented by the receiver to the signal source, which is typically 50Ω. The normal impedance of some systems (for example, the cable TV) is 75Ω. The degree of mismatch between the rated impedance and the actual impedance is indicated by the voltage standing wave ratio (VSWR).

Explicit average noise level

In case of minimum resolution bandwidth and minimum input attenuation, the video bandwidth is reduced to minimize the peak-to-peak fluctuation of the noise, and the level observed on the monitoring receiver display is the display average noise level, expressed in dBm. The display average noise level of the monitoring receiver can be equivalently called to the sensitivity of the microwave analyzer.

Preselector

A bandpass filter with an adjustable center frequency located before the input mixer of the monitoring receiver. Used to eliminate multiple responses and mirror responses in monitoring receivers, while also improving the dynamic range of monitoring receivers.

Sensitivity

The ability of monitoring receiver to measure the minimum level signal. Sensitivity is further divided into input signal level sensitivity and equivalent input noise sensitivity. The output produced by the former is approximately equal to twice of input signal level of average noise value, and the latter is the average level of internally generated noise converted to the input. The best sensitivity can be obtained at the narrowest resolution bandwidth with minimum input attenuation. Factors affecting sensitivity include input attenuators, preamplifier, insertion loss of front-end devices, bandwidth and noise sidebands of IF filters. The best sensitivity may conflict with other measurement needs. For example, a smaller resolution bandwidth increases the sweep time; 0dB input attenuation increases the input standing wave ratio (VSWR), which reduces the measurement accuracy; and the increasing of dynamic range of the preamplifier will affect the microwave analyzer. The relationship between sensitivity and resolution bandwidth is as follows:

$$PdBm = -174dBm + FdB + 10\text{Log}B$$

Where:

PdBm - the sensitivity of the monitoring receiver

FdB - noise factor of the monitoring receiver

B - 3dB bandwidth (in Hz) of the monitoring receiver

Phase noise

The oscillator in the monitoring receiver is used to convert the input signals of different frequencies to the intermediate frequency. The phase noise represents the relative value of the noise power and carrier power in the 1 Hz equivalent noise bandwidth at a certain frequency offset of the carrier, which is commonly expressed in dBc/Hz. It is a measure of the oscillator's short-term frequency stability, which is caused by phase or frequency variations, and is expressed as a bell-like noise characteristic in the oscillator signal. It affects the measurement ability of the whole machine to the phase noise of the measured signal, and also affects the sensitivity and dynamic range of the whole machine.

Gain compression

If the input signal level is increased, the mixer circuit, amplifier and other unit circuits of the monitoring receiver may work close to the saturation point. At this time, the output signal component no longer changes linearly with the input signal, and the displayed signal level is low, which is caused by gain compression. An 1dB (or 0.5dB) expression point is expressed typically with the input level corresponding to the output linear value deviation of 1dB (or 0.5dB).

Appendix B SCPI Command Quick Reference Table

Table B.1 SCPI Command Quick Reference Table

Command	Function
*CLS	Clear Status
*ESE	Set or query the event status enable register
*ESE?	Query event status enable register
*ESR?	Read the event status register decimal value, then set the register value to zero
*IDN?	Return instrument identification
*RST	Reset, which sets most of the device's functions to a known state predefined by the manufacturer
*SRE	This command sets the value of the Service Request Enable Register
*SRE?	Return the value of the Service Request Enable Register
*STB?	Query Status bytes
*TRG	Execute the trigger command
CALCulate:IFPan:AVERage:TYPE <aver_proc> CALCulate:IFPan:AVERage:TYPE?	Set or query the detection type of IF panorama
CALCulate:IFPan:MARKer:DMAXimum[:PEAK]	Set the relative frequency scale to the maximum peak
CALCulate:IFPan:MARKer:DMAXimum:LEFT	Set the relative frequency scale to the left adjacent peak
CALCulate:IFPan:MARKer:DMAXimum:RIGHT	Set the relative frequency scale to the right adjacent peak
CALCulate:IFPan:MARKer:MMAximum[:PEAK]	Set independent frequency scale to maximum peak
CALCulate:IFPan:MARKer:MMAximum:LEFT	Set independent frequency scale to left adjacent peak
CALCulate:IFPan:MARKer:MMAximum:RIGHT	Set independent frequency scale to right adjacent peak
CALCulate:IFPan:MARKer:DX <numeric_value> CALCulate:IFPan:MARKer:DX?	Set or query the IF panoramic frequency scale pair (relative frequency scale) X value
CALCulate:IFPan:MARKer:DY?	Query the Y value of the IF panoramic frequency scale pair (relative frequency scale)
CALCulate:IFPan:MARKer:MX <numeric_value> CALCulate:IFPan:MARKer:MX?	Set or query the IF panoramic frequency scale pair (independent frequency scale) X value
CALCulate:IFPan:MARKer:MY?	Query the Y-value of the IF panoramic frequency scale pair (independent frequency scale)
CALCulate:IFPan:MARKer:STATe <boolean> CALCulate:IFPan:MARKer:STATe?	Set or query the status of the IF panoramic frequency scale pair
CALCulate:RFPan:MARKer:DMAXimum[:PEAK]	Set the relative frequency scale of the RF panoramic frequency scale pair to the maximum peak
CALCulate:RFPan:MARKer:DMAXimum:LEFT	Set the relative frequency scale of the RF panoramic frequency scale pair to the left adjacent peak
CALCulate:RFPan:MARKer:DMAXimum:RIGHT	Set the relative frequency scale of the RF panoramic frequency scale pair to the right

	adjacent peak
CALCulate:RFPan:MARKer:MMAximum[:PEAK]	Set the independent frequency scale of the RF panoramic frequency scale pair to the maximum peak
CALCulate:RFPan:MARKer:MMAximum:LEFT	Set the independent frequency scale of the RF panoramic frequency scale pair to the left adjacent peak
CALCulate:RFPan:MARKer:MMAximum:RIGHT	Set the independent frequency scale of the RF panoramic frequency scale pair to the right adjacent peak
CALCulate:RFPan:MARKer:DX <numeric_value> CALCulate:RFPan:MARKer:DX?	Set or query the RF panoramic frequency scale pair (relative frequency scale) X value
CALCulate:RFPan:MARKer:DY?	Query RF panoramic frequency scale pair (relative frequency scale) Y value
CALCulate:RFPan:MARKer:MX <numeric_value> CALCulate:RFPan:MARKer:MX?	Set or query the RF panoramic frequency scale pair (independent frequency scale) X value
CALCulate:RFPan:MARKer:MY?	Query RF panoramic frequency scale pair (independent frequency scale) Y value
CALCulate:RFPan:MARKer:STATe <boolean> CALCulate:RFPan:MARKer:STATe?	Set or query the switching status of RF panoramic frequency scale pairs
CALCulate:IFPan:SElectivity <sel_panorama> CALCulate:IFPan:SElectivity?	Set or query the filter selectivity of IF panorama
CALCulate:IFPan:STEP <step_width> CALCulate:IFPan:STEP?	Set or query the step value of IF panorama
CALCulate:IFPan:STEP:AUTO <boolean> CALCulate:IFPan:STEP:AUTO?	Set or query the automatic switching status of the IF panoramic stepping value
CALCulate:PSCan:AVERAge:TYPE <aver_proc> CALCulate:PSCan:AVERAge:TYPE?	Set or query the average type of RF panorama
DIAGnostic[:SERVice]:ADAPter[:STATe]?	Query the power supply source of the instrument
DISPlay:BRIGhtness <set_brightness> DISPlay:BRIGhtness?	Set or query the display brightness
DISPlay:CMAP <select_colorscheme> DISPlay:CMAP?	Set or query the displayed color scheme
DISPlay:CMAP:DEFault	Set the default display color scheme (outdoor)
DISPlay:DATE:FORMAt <set_date_format> DISPlay:DATE:FORMAt?	Set or query the date format used for display
DISPlay:FSTRength <Boolean> DISPlay:FSTRength?	Set or query the switch status for displaying field strength information
DISPlay:IFPan:LEVel:AUTO	Automatically adjust the level range and reference level of the IF panorama
DISPlay:IFPan:LEVel:RANGe <set_range> DISPlay:IFPan:LEVel:RANGe?	Set or query the level range of the IF panorama
DISPlay:IFPan:LEVel:REFerence <set_level> DISPlay:IFPan:LEVel:REFerence?	Set or query the reference level of the IF panorama
DISPlay:LEVel:AUTO	Automatically adjust the level range of the level scale with the reference level
DISPlay:LEVel:LIMit:MINimum <set_level> DISPlay:LEVel:LIMit:MINimum?	Set or query the lower limit of the reference level of the horizontal scale
DISPlay:LEVel:RANGe <set_range>	Set or query the signal level range of the

DISPlay:LEVel:RANGe?	horizontal scale view
DISPlay:PSCan:LEVel:AUTO	Automatically adjust the level range and reference level of RF panoramic scanning
DISPlay:PSCan:LEVel:RANGe <set_range> DISPlay:PSCan:LEVel:RANGe?	Set or query the level range of RF panorama scan
DISPlay:PSCan:LEVel:REFerence <set_reference> DISPlay:PSCan:LEVel:REFerence?	Set or query the reference level of the RF panorama
DISPlay:WATerfall:CMAP <color_map> DISPlay:WATerfall:CMAP?	Set or query the color mapping of the waterfall chart
DISPlay:WATerfall:CMAP:CATalog?	Query waterfall color mapping list
DISPlay:WATerfall:CMAP:RANGe <set_range> DISPlay:WATerfall:CMAP:RANGe?	Set or query the color mapping level range of the waterfall chart
DISPlay:WATerfall:CMAP:THReshold <set_threshold> DISPlay:WATerfall:CMAP:THReshold?	Set or query the display threshold of the waterfall chart
DISPlay:WATerfall:HOLD[::STATe] <Boolean> DISPlay:WATerfall:HOLD[::STATe]?	Set or query the freeze switch status of the waterfall chart
DISPlay:WATerfall:SPEed <set_speed> DISPlay:WATerfall:SPEed?	Set or query the display speed of the waterfall chart
DISPlay:WINDow <display> DISPlay:WINDow?	Set or query the display window of the instrument
DISPlay:WINDow:CATalog?	Query the list of display windows of the instrument
FORMat:BORDER <output_order> FORMat:BORDER?	Set or query the endpoint order of the output data
FORMat:MEMory <output_format> FORMat:MEMory?	Set or query the stored data format
FORMat:SREGister <data_format> FORMat:SREGister?	Set or query the instrument status register
FORMat[::DATA] <data_format> FORMat[::DATA]?	Set or query the output format of the measurement result data
INITiate[::IMMediate]	The INITiate command is an event that can initiate an acquisition or measurement when the instrument mode is fixed to a frequency reception or some kind of active scan mode. If a scan has been started, the valid scan will be restarted
INITiate:CONM[::IMMediate]	The command is identical to the INITiate[::IMMediate] command except that the trace buffer is not cleared and the currently active scan is not restarted
INPut:ATTenuation:STATe <boolean> INPut:ATTenuation:STATe?	Set or query attenuation control switch status
MEASure:DFINder DF:MODE <meas_mode> MEASure:DFINder DF:MODE?	Set or query the directional measurement mode
MEASure:DFINder DF:THReshold[::UPPer] <threshold> MEASure:DFINder DF:THReshold?	Set or query the directional level threshold
MEASure:DFINder DF:TIME <time> MEASure:DFINder DF:TIME?	Set or query directional measurement time

MEASure:MODE <meas_mode> MEASure:MODE?	Set or query measurement mode
MEASure:TIME <meas_time> MEASure:TIME?	Set and query measurement times for all measurement functions
MEMory:CLEar <mem_loc> [,<count> MAXimum]	Clear the configuration parameters of the specified memory location in the memory table
MEMory:CONTents <mem_loc>,<mem_paras> MEMory:CONTents?	Set or query configuration parameters for a specified memory location
MEMory:COpy <src_loc>, <dest_loc>	Copy the contents of one memory location to another
MEMory:EXCHange <mem_loc1>, <mem_loc2>	Swap the contents of the 2 memory locations
OUTPut:SQUelch:CONTRol <source> OUTPut:SQUelch:CONTRol?	Set or query the threshold value for squelch level
OUTPut:SQUelch:THReshold [:UPPer] <threshold> OUTPut:SQUelch:THReshold [:UPPer]?	Search for a target on the left side of the specified trace with the specified marker that meets the criteria
OUTPut:SQUelch:THReshold[:UPPer]:STEP[:INCRement] <step_width> OUTPut:SQUelch:THReshold[:UPPer]:STEP[:INCRement]?	Set or query the step value of the squelch level threshold
OUTput:SQUelch[:STATe] <boolean> OUTput:SQUelch[:STATe]?	Set or query the status of the squelch level switch
OUTPut:TONE:CONTRol <tone_level> OUTPut:TONE:CONTRol?	Set or query monotone control
OUTPut:TONE:GAIN <tone_gain> OUTPut:TONE:GAIN?	Set or query monotonic gain
OUTPut:TONE:THReshold <tone_threshold> OUTPut:TONE:THReshold?	Set or query the monotonic gain threshold
OUTPut:TONE:THReshold:STEP[:INCRement] <tone_step> OUTPut:TONE:THReshold:STEP[:INCRement]?	Set or query the monotonic gain threshold step value
OUTput:TONE[:STATe] <boolean> OUTput:TONE[:STATe]?	Set or query the monotonic gain switch status
[SENSe:]BANDwidth BWIDth:DFINder DF <DF_bandwidth> [SENSe:]BANDwidth BWIDth:DFINder DF?	Set or query the directional bandwidth
[SENSe:]BANDwidth BWIDth[:RESolution] <demod_bandwidth> [SENSe:]BANDwidth BWIDth[:RESolution]?	Set or query the bandwidth of the modulation/demodulation channel
[SENSe:]DEModulation <demodulator> [SENSe:]DEModulation?	Set or query modulation/demodulation type
[SENSe:]DEModulation:BFO:FREQUency <bfo_frequency> [SENSe:]DEModulation:BFO:FREQUency?	Set or query the differential frequency of modulation
[SENSe:]DETEctor[:FUNCTion] <meas_proc> [SENSe:]DETEctor[:FUNCTion]?	Set or query the detector type
[SENSe:]FREQUency:CONVersion:THReshold <threshold_freq> [SENSe:]FREQUency:CONVersion:THReshold?	Set or query frequency conversion thresholds

[SENSe:]FREQUency:DEModulation <demodulation_freq > [SENSe:]FREQUency:DEModulation?	Set or query demodulation frequency
[SENSe:]FREQUency:MODE <op_mode> [SENSe:]FREQUency:MODE?	Set or query measurement mode
[SENSe:]FREQUency:PSCan:CENTer <center_frequency> [SENSe:]FREQUency:PSCan:CENTer?	Set or query the center frequency of the RF panorama
[SENSe:]FREQUency:PSCan:SPAN <span_frequency> [SENSe:]FREQUency:PSCan:SPAN?	Set or query the bandwidth of RF panorama
[SENSe:]FREQUency:PSCan:STARt <start_frequency> [SENSe:]FREQUency:PSCan:STARt?	Set or query the starting frequency of panoramic scanning
[SENSe:]FREQUency:PSCan:STOP <stop_frequency> [SENSe:]FREQUency:PSCan:STOP?	Set and query the termination frequency of panorama scanning
[SENSe:]FREQUency:SPAN <range> [SENSe:]FREQUency:SPAN?	Set or query the bandwidth of IF panorama
[SENSe:]FREQUency:STARt <start_frequency> [SENSe:]FREQUency:STARt?	Set or query the starting frequency of the frequency scan
[SENSe:]FREQUency:STOP <stop_frequency> [SENSe:]FREQUency:STOP?	Set or query the frequency scan termination frequency
[SENSe:]FREQUency[:CW FIXed] <receive_frequency> [SENSe:]FREQUency[:CW FIXed]?	Set or query the reception frequency of fixed frequency reception mode
[SENSe:]FREQUency[:CW FIXed]:STEP[:INCRement] <step_width> [SENSe:]FREQUency[:CW FIXed]:STEP[:INCRement]?	Set or query the step value of the center frequency of the fixed frequency reception mode
[SENSe:]GCONtrol:MODE <gainctrl_mode> [SENSe:]GCONtrol:MODE?	Set or query gain control mode
[SENSe:]GCONtrol[:FIXed MGC] <mgc_value> [SENSe:]GCONtrol[:FIXed MGC]?	Set or query the manual gain control value
[SENSe:]GCONtrol[:FIXed MGC]:STEP[:INCRement] <mgc_step_value> [SENSe:]GCONtrol[:FIXed MGC]:STEP[:INCRement]?	Set or query the manual gain control step value
[SENSe:]MSCan:CONtrol:OFF <control_function> , <control_function> [SENSe:]MSCan:CONtrol:OFF?	Set or query the status of one or more list scan control functions off
[SENSe:]MSCan:CONtrol[:ON] <control_function> , <control_function> [SENSe:]MSCan:CONtrol[:ON]?	Set or query list scan control function
[SENSe:]MSCan:COUnT <scan_num> [SENSe:]MSCan:COUnT?	Set or query the number of list scans
[SENSe:]MSCan:DIRection <direction> [SENSe:]MSCan:DIRection?	Set or query list scan direction
[SENSe:]MSCan:DWELI <dwel_time> [SENSe:]MSCan:DWELI?	Set or query list scan dwell time

[SENSe:]MSCan:HOLD:TIME <hold_time> [SENSe:]MSCan:HOLD:TIME?	Set or query list scan hold time
[SENSe:]PSCan:COUNT <cycle_count> [SENSe:]PSCan:COUNT?	Set and query the number of RF panoramic scans
[SENSe:]PSCan:STEP <res_bandwidth> [SENSe:]PSCan:STEP?	Set or query the step value of RF panoramic scan
[SENSe:]ROSCillator:EXternal:FREQUENCY?	Query external reference frequency
[SENSe:]ROSCillator[:INTERNAL]:FREQUENCY?	Query internal reference frequency
[SENSe:]ROSCillator:SOURce <source> [SENSe:]ROSCillator:SOURce?	Set or query the frequency reference source
[SENSe:]SWEep:CONTRol:OFF <control_function> , <control_function> [SENSe:]SWEep:CONTRol:OFF?	Set or query the status of one or more frequency sweep control functions off
[SENSe:]SWEep:CONTRol[:ON] <control_function> {,<control_function>} [SENSe:]SWEep:CONTRol[:ON]?	Set or query the frequency scan control function that is turned on
[SENSe:]SWEep:COUNT <sweep_count> [SENSe:]SWEep:COUNT?	Set or query the number of frequency scans
[SENSe:]SWEep:DIRection <direction> [SENSe:]SWEep:DIRection?	Set or query the direction of the frequency scan
[SENSe:]SWEep:DWELI <dwel_time> [SENSe:]SWEep:DWELI?	Set or query frequency scan dwell time
[SENSe:]SWEep:HOLD:TIME <hold_time> [SENSe:]SWEep:HOLD:TIME?	Set or query the hold time of the frequency scan
[SENSe:]SWEep:STEP <step_width> [SENSe:]SWEep:STEP?	Set or query the frequency step value of the frequency scan
[SENSe:]SWEep:SUPPress	Insert the current frequency in the suppression table
[SENSe:]SWEep:SUPPress:SORT	Sorting and compressing suppression lists
SYSTem:AUDio:DEModulator:INVerse:FREQUENCY <inv_freq> SYSTem:AUDio:DEModulator:INVerse:FREQUENCY ?	Set or query the inverse demodulation audio frequency
SYSTem:AUDio:DEModulator:INVerse[:STATe] <Boolean> SYSTem:AUDio:DEModulator:INVerse[:STATe]?	Set or query the switching status of the audio inverse demodulation frequency
SYSTem:AUDio:Mute <Boolean> SYSTem:AUDio:Mute?	Set or query audio playback switch status
SYSTem:AUDio:OUTPut <audio_out> SYSTem:AUDio:OUTPut?	Set or query audio output channels
SYSTem:AUDio:REMOte:MODE <audio_mode> SYSTem:AUDio:REMOte:MODE?	Set or query the audio mode of audio records and audio streams
SYSTem:AUDio:VOLume <volume> SYSTem:AUDio:VOLume?	Set or query the volume of speakers and headphones
SYSTem:BEEPer:VOLume <volume> SYSTem:BEEPer:VOLume?	Set or query the buzzer volume
SYSTem:CLOCK:ORIGin <clock_origin> SYSTem:CLOCK:ORIGin?	Set or query the clock source

SYSTem:CLOCK:SETDate?	Check the local date according to the set clock
SYSTem:CLOCK:SETTime?	Check the local time according to the set clock
SYSTem:CLOCK:START <start_mode> SYSTem:CLOCK:START?	Set or query the clock start method after clock adjustment
SYSTem:COMMunicate:LAN:GATeway <ip-address> SYSTem:COMMunicate:LAN:GATeway?	Set or query the default gateway
SYSTem:COMMunicate:LAN:SUBMask <subnetmask> SYSTem:COMMunicate:LAN:SUBMask?	Set or query the subnet mask
SYSTem:COMMunicate:SOCKet:ADDRess <ip-address> SYSTem:COMMunicate:SOCKet:ADDRess?	Set or query the IP address of the instrument
SYSTem:DATE <date> SYSTem:DATE?	Set or query the current time of the instrument
SYSTem:DECLination?	Query magnetic declination angle
SYSTem:DF DFINder:QUALity:SQUelch?	Query the quality threshold of the measurement direction
SYSTem:DF DFINder:STATe <df_state> SYSTem:DF DFINder:STATe?	Set or query the switch status of directional measurement
SYSTem:DF DFINder:CORRection <df_correction>	Set direction finding calibration
SYSTem:ERRor:ALL?	Query all error codes and their descriptions in the error queue and zero out the error list
SYSTem:ERRor:CODE:ALL?	Query all error codes in the error queue and zero out the error list
SYSTem:ERRor:CODE[:NEXT]?	Query the first error code in the error queue and clear the error from the error list
SYSTem:ERRor:COUNt?	Query error codes in the error queue without clear the error list
SYSTem:ERRor[:NEXT]?	Query the first error code in the error queue and its description and clear the error from the error list
SYSTem:GPS:DATA:AUTO <boolean> SYSTem:GPS:DATA:AUTO?	Set or query the status of the switch for automatic update of the instrument clock from GPS
SYSTem:GPS:TIME:OFFSet <time_offset> SYSTem:GPS:TIME:OFFSet?	Set or query the calibration time synchronized with GPS time
SYSTem:COMPass:DATA?	Query the electronic compass value and direction type of the specified electronic compass
SYSTem:GPS:DATA?	Query GPS data information
SYSTem:GPS:VALid:STATe?	Check if GPS is valid
SYSTem:HSCan:CALibrate <calibrate_state> SYSTem:HSCan:CALibrate?	Set or query the calibration status of the horizontal scan
SYSTem:HSCan:DATA:CLEar	Clear horizontal scan data
SYSTem:HSCan:DATA:SAVE	Save horizontal scan data
SYSTem:HSCan:STATe <hscan_state> SYSTem:HSCan:STATe?	Set or query the horizontal scan status
SYSTem:IF:REMote:AGCBypass <Boolean> SYSTem:IF:REMote:AGCBypass?	Set or query the AGC enable switch status of the digital IF data stream

SYSTem:IF:REMOte:MODE <if_mode> SYSTem:IF:REMOte:MODE?	Set or query the mode of digital IF stream data
SYSTem:KLOCK <set-lock> SYSTem:KLOCK?	Set or query touch screen lock status
SYSTem:PRESet:FACTory	Reset the device to factory settings
SYSTem:PRESet:MEASurements	Reset the device to the measurement settings
SYSTem:RESet:COLD	Reboot the device and reset the device to its default settings
SYSTem:RESet[:WARM]	Reboot the device
SYSTem:TIME <time> SYSTem:TIME?	Set or query the current time of the instrument
SYSTem:VERSion?	Check the version of the SCPI standard used by the instrument
TRACe:IQ:DATA:NUMBer <data_number> TRACe:IQ:DATA:NUMBer?	Set or query the length of the recorded or reported IQ data
TRACe:RECORD:SElectivity <sel_panorama> TRACe:RECORD:SElectivity?	Set or query the current execution method
TRACe:RECORD:STATe <Boolean> TRACe:RECORD:STATe?	Set or query the switch status of records
TRACe:TIME:STAMP <time_stamp> TRACe:TIME:STAMP?	Set or query trigger interval
TRACe DATA:IQ:DATA:REPort <iqdata_report> TRACe DATA: IQ:DATA:REPort?	Set or query the way IQ data is reported
TRACe DATA:RECORD:SOURce <data_source> TRACe DATA:RECORD:SOURce?	Set or query the data source of the record
TRACe DATA:RECORD:STARt TRACe DATA:RECORD:STARt?	Set or query record start switch status
TRACe DATA:RECORD:STOP TRACe DATA:RECORD:STOP?	Set or query record stop switch status
TRACe DATA:RECORD:STORAge <data_storage> TRACe DATA:RECORD:STORAge?	Set or query the storage location of logged data
TRACe:UDP TCP:DELeTe:ALL	Delete all UDP paths
TRACe:UDP TCP:FLAG:OFF <ip_address>, <port_number>, <flag_list>	Remove the tag specifying the UDP path or TCP path
TRACe:UDP TCP:FLAG[:ON] <ip_address>, <port_number>, <flag_list>	Set the token for the specified UDP path or TCP path
TRACe:UDP TCP:TAG:OFF <ip_address>, <port_number>, <tag_list>	Deletes the attribute label of the specified UDP path or TCP path
TRACe:UDP TCP:TAG[:ON] <ip_address>, <port_number>, <tag_list>	Set the attribute label of the specified UDP path or TCP path
TRACe:UDP TCP? <query_param>	Query the UDP path set by the user
TRACe DATA:PATH <trace_path> TRACe DATA:PATH?	Protocol for setting or querying data upload paths
TRIGger[:SEquence]:ACTion <trig_action> TRIGger[:SEquence]:SCOPE?	Set or query trigger action
TRIGger[:SEquence]:BEEP <Boolean> TRIGger[:SEquence]:BEEP?	Set or query the status of the trigger beep switch
TRIGger[:SEquence]:COUNt <trig_count>	Set or query the number of triggers

TRIGger[:SEQuence]:COUNt?	
TRIGger[:SEQuence]:COMPLex:COMMand	Set up IQ data to trigger reporting of compound commands
TRIGger[:SEQuence]:DATA:SUM <data_sum> TRIGger[:SEQuence]:DATA:SUM?	Set or query the total number of trigger points
TRIGger[:SEQuence]:DELay <trig_delay> TRIGger[:SEQuence]:DELay?	Set or query the trigger delay
TRIGger[:SEQuence]:ENABle <Boolean> TRIGger[:SEQuence]:ENABle?	Set or query the trigger enable status
TRIGger[:SEQuence]:IQ:DATA:FORMat <iqdata_format> TRIGger[:SEQuence]:IQ:DATA:FORMat?	Set or query the storage format of IQ data
TRIGger[:SEQuence]:MODE <trig_mode> TRIGger[:SEQuence]:MODE?	Set or query trigger mode
TRIGger[:SEQuence]:POSition <trig_positon> TRIGger[:SEQuence]:POSition?	Set or query the trigger location
TRIGger[:SEQuence]:SOURce <trig_source> TRIGger[:SEQuence]:SOURce?	Set or query the trigger source
TRIGger[:SEQuence]:STARt:SLOPe <trig_slope> TRIGger[:SEQuence]:STARt:SLOPe?	Set or query trigger start polarity
TRIGger[:SEQuence]:STARt:SOURce <trig_source> TRIGger[:SEQuence]:STARt:SOURce?	Set or query the end trigger start source
TRIGger[:SEQuence]:STARt:TIME <time> TRIGger[:SEQuence]:STARt:TIME?	Set or query the trigger start time
TRIGger[:SEQuence]:STOP:SLOPe <trig_slope> TRIGger[:SEQuence]:STOP:SLOPe?	Set or query trigger termination polarity
TRIGger[:SEQuence]:STOP:SOURce <trig_source> TRIGger[:SEQuence]:STOP:SOURce?	Set or query the trigger termination source
TRIGger[:SEQuence]:STOP:TDURation <stop_tdur> TRIGger[:SEQuence]:STOP:TDURation?	Set or query the duration of the trigger
TRIGger[:SEQuence]:STOP:TIME <time> TRIGger[:SEQuence]:STOP:TIME?	Set or query the trigger termination time

Annex C Zoom table of failure information

Table C.1 Table of Local Error Messages

Failure code	Key failure field	Description
1	USBINITERR	Touch screen initialization failed, please check the hardware and driver
2	LANINIT ERR	LAN port initialization failed, please check the hardware and driver
3	HARDINIT ERR	Functional hardware initialization failed. Please check the hardware and driver.
4	SOCKETCRT ERR	Failed to create SOCKET interface
5	SOCKETBAND ERR	Failed to bind SOCKET interface
6	LISTEN ERR	Interface monitoring failed
7	LINK ERR	Link connection failed
8	FMDATA ERR	Failed to call the FM offset data
9	GPS INIT	GPS initialization failed
10	FACTDATA ERR	Loading factory debugging status data failed
11	FLATNESS ERR	Loading flatness data failed
12	LOADFILE ERR	Loading file failed
13	SAVEFILE ERR	Saving file failed
14	LICENSE ERR	Invalid License
15	LICENSE OPEN	Opening License failed
16	NO MEMRY	Dynamic memory allocation failed
17	SPACE LOW	Insufficient disk space
18	CRET DIRY	Creating folder failed
19	CRET FILE	Creating file failed
20	CHECK DISK	Querying disk free space failed
21	READ FILE	Reading file failed
22	WRITE FILE	Writing file failed
100	LO UNLOCK	Local oscillator unlocked
101	10MHz UNLOCK	10MHz reference output signal out of lock
102	+3.4V ERR	Digital +3.4V voltage error
103	+5.4V ERR	Digital +5.4V voltage error
104	+5V ERR	Digital +5V voltage error
105	+3.3V ERR	Digital +3.3V voltage error
106	-12V ERR	Analog-12V voltage error
107	-5V ERR	Analog-5V voltage error
108	+28V ERR	Analog+28V voltage error
109	Battery Temp	Lithium battery temperature abnormal
110	Battery Volt	Lithium battery voltage abnormal
111	Battery Curt	Lithium battery current abnormal
112	Battery Err	Lithium battery temperature is too high
113	Digital Temp	Abnormal temperature in digital area

114	Power Temp	Abnormal temperature in the power supply area
115	CPU BD Temp	CPU board temperature abnormal
116	Battery Perc	Lithium battery power abnormalities
117	CPU CP Temp	CPU chip temperature abnormalities
118	BBS DEV	Opening audio acquisition equipment failed
119	BBS INIT	Initializing audio acquisition equipment failed
120	BBS WRKP	Setting audio equipment working parameters failed
121	A2 LO1 Temp	Temperature abnormality near 1st local oscillator of A2 board
122	LO1 PLL	PLL error voltage error near 1st local oscillator of A2 board
123	A3 LO1 Temp	Temperature abnormality near 1st local oscillator of A3 board
200	CMD ERR	Command with parameter not allowed
201	CMD ERR	Command parameter error
202	GPIB ERR	Current mode command file corrupted
203	CMD ERR	Program control command not existed
204	CMD ERR	Command in current mode not existed
205	CMD ERR	Too many keywords with figures
206	CMD ERR	Keywords with figures not allowed
207	I2C ERR	I2C microcontroller communication failure
208	SPI ERR	CPU board SPI communication failure
209	SPI ERR	Local oscillator board SPI communication exception
210	SPI ERR	RF channel board SPI communication exception
211	ADC ERR	ADC status abnormal
212	MEM ERR	Memory initialization exception
300	ADC Overload	ADC Overload

Table C.2 Remote control error message table

Failure code	Description (English)
0	No Error
-100	Command error
-101	Invalid character
-102	Syntax error
-103	Invalid separator
-104	Data type error
-105	GET not allowed
-108	Parameter not allowed
-109	Missing parameter
-111	Header separator error
-112	Program mnemonic too long
-113	Undefined header
-114	Header suffix out of range
-121	Invalid character in number
-123	Exponent too large
-124	Too many digits
-128	Numeric data not allowed
-130	Suffix error
-131	Invalid suffix
-134	Suffix too long
-138	Suffix not allowed
-140	Character data error
-141	Invalid character data
-144	Character data too long
-148	Character data not allowed
-150	String data error
-151	Invalid string data
-158	String data not allowed
-160	Block data error
-161	Invalid block data
-168	Block data not allowed
-170	Expression error
-171	Invalid expression
-178	Expression data not allowed
-200	Execution error
-203	Command protected
-211	Trigger Ignored
-221	Settings conflict
-222	Data out of range

-223	Too much data
-224	Illegal parameter value
-240	Hardware error
-241	Hardware missing
-250	Mass storage error
-257	File name error
-258	Media Protected
-291	Out of memory
-292	Referenced name does not exist
-293	Referenced name already exists
-300	Device-specific error
-350	Queue overflow
-400	Query error
-410	Query INTERRUPTED
-420	Query UNTERMINATED
-430	Query DEADLOCKED