1433 Series

Signal Generator

User's Manual

Ceyear Technologies Co., Ltd.

This manual applies to the following models of signal generators:

- 1433D signal generator (1MHz-20GHz)
- 1433E signal generator (1MHz-26.5GHz)
- 1433F signal generator (1MHz-40GHz)
- 1433H signal generator (1MHz-50GHz)

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Foreword

Thank you for choosing and using 1433 series signal generator developed and produced by Ceyear Technologies Co., Ltd.! With high, precision and frontier technologies comprehensive, the product enjoys high quality and cost performances compared with similar products.

We will take the responsibility to maximally meet your needs and provide you with high-quality measuring instruments and first-class after-sales service. We aim to provide "high quality and considerate service", and operate on the principle of making customers satisfactory with our products and services.

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Ceyear Technologies Co., Ltd.

Manual Authorization

The contents of this manual are subject to change without notice. The contents and terms used in this manual are interpreted by Ceyear Technologies Co., Ltd.

Product warranty

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

Product quality certificate

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. already has the required qualifications and has passed the certification of ISO 9001 and ISO 14001 management systems.

Safety Precautions

Warning

The symbol "Warning" indicates a hazard. It reminds the user to pay attention to a certain operation process, operation method or the like. In case of any failure of observing the rule or maloperation, personal injury can occur. Further operation cannot be proceeded until the warning conditions are fully understood and met.

Notice

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

Contents

1. Manual Navigation

This chapter introduces the user's manual functions, chapter structure and main contents of the 1433 series signal generators, as well as the instrument-related documents provided to users.

1.1. About the Manual

This manual introduces the basic functions and operation methods of 1433 series signal generators produced by Ceyear Technologies Co., Ltd. It describes such contents as product features, basic operations, configuration guide, menu description, remote control, maintenance, technical indicators and testing methods, etc. of the instrument to help users get familiar with and master the operation method and key points of the instrument as soon as possible. To facilitate your skillful use of such instrument, please read carefully and follow this manual in advance for correct operation.

This manual contains the following chapters:

- Overview

This part introduces in general the main performance characteristics, typical application examples and safety precautions of operation for 1433 series signal generators. The purpose is to enable users to have a preliminary understanding of the main performance characteristics of the instrument and to guide users to operate the instrument safely.

- Quick Start

This chapter introduces the pre-operation inspection, instrument browsing, basic measurement method, measurement window description and data storage of 1433 series signal generators so that users can have a preliminary understanding of the instrument itself and its measurement processes as a preparation for the comprehensive introduction of the measurement operations of the instrument hereinafter. This section contains some contents consistent with the relevant sections in the Quick Start.

- Operation Guide

It introduces in detail the operation methods of various measurement functions of the instrument, including configuring the instrument, starting the measurement process and obtaining the measurement results. This part mainly includes two parts: functional operation guide and advanced operation guide. For users who are not familiar with 1433 series of signal generators, the basic operation guide introduces and enumerates each function systematically and in detail so that users can understand and master some basic usage of the signal generators, such as setting point frequency, power, and modulation, etc. The advanced operation guide introduces relatively complicated testing processes and advanced operation skills for users who have basic knowledge about using the signal generator but are not familiar with some special usage, and guides them to implement the measurement processes. For example: list configuration of step sweep and list sweep, start sweep, etc.

- Menus

This part introduces the menu structure and menu items according to the functions to facilitate

the users to query for reference.

- Troubleshooting and Repair

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

- Technical Indicators and Testing Methods

This part introduces the product features, main technical indicators and recommended testing methods of 1433 series signal generators.

1.2 Related Documents

Documents of 1433 series signal generator include:

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

User's Manual

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

- Manual Navigation
- Overview
- Quick Start
- Operation Guide
- Menus
- Troubleshooting and Repair
- Technical Indicators and Testing Methods

Program Control Manual

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

- Manual Navigation
- Remote Control
- Program Control Commands
- Programming Examples
- Error Description
- Appendixes

Quick Start Guide

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

- Manual Navigation
- Get Prepared

- Typical Applications
- Get Help

2 Overview

This chapter introduces the main performance characteristics, main applications and main technical indicators of 1433 series signal generators. It also gives introductions on correct operation of the instrument and precautions such as electrical safety.

2.1 Product Overview

The 1433 series signal generators include 1433D (1MHz-20GHz), 1433E (1MHz-26.5GHz), 1433F (1MHz-40GHz) and 1433H (1MHz-50GHz), which have the functions of continuous wave signal output, modulation of frequency, amplitude and pulse, wide dynamic range amplitude adjustment, as well as step and list sweep. They are designed with 8.4-inch large-screen high-brightness LCD and large font display, multiple display modes to improve the display clarity and ease of operation. They have built-in batteries, are compact and portable, and highly adaptable to the environment. They also provide external time base synchronization and remote program control capabilities. They are mainly used for fault diagnosis of electronic integrated systems, receiver performance testing, etc. and are applicable to the installation, commissioning, and daily maintenance of radar, communication, navigation equipment and other fields.

2.1.1 Product Features

2.1.1.1 Basic Functions

Main features of the 1433 series signal generators are as follows:

1) Three basic types of signal output are provided: continuous wave (CW) signal, sweep signal and analog modulation signal.

   - Continuous Wave (CW) Signal
     In this mode, the signal generator generates a continuous wave sinusoidal signal, and the frequency and power level of the signal are set by the user.
   - Sweep Signal
     In this mode, the output signal of the signal generator is swept within a certain frequency and power range, and there are two sweep modes: step sweep and list sweep.
   - Analog Modulation Signal

In this mode, the signal generator uses analog signals to modulate continuous wave (CW) signals, providing three modulation modes: pulse modulation, amplitude modulation and frequency modulation. Some of them can be used together.

2) The signal generator has the unfixed amplitude alarm function, which enables you to obtain the alarm information at the first time when the instrument has unfixed amplitude, to facilitate the troubleshooting of problems;

3) The signal generator has LAN and USB interfaces, through which you can remotely control the instrument, which is convenient for you to remotely control the instrument in various ways;

4) When the reference signal input/output interface is used as 10MHz reference output, the signal level is greater than 0dBm; When used as a reference input, the frequency reference signal of 10MHz to 100MHz, -5dBm to +10dBm is received from the external time base.

2.1.1.2 High Performance

1) Frequency Coverage

From 1MHz to 20GHz, 26.5GHz, 40GHz and 50GHz

2) High Frequency Resolution

Frequency resolution: 0.1 Hz.

3) Wide Dynamic Range Broadband Power Output

From -120dBm to 10dBm.

4) Multiple Modulation Functions

Frequency, amplitude and pulse modulation functions.

2.1.1.3 Agility

1) Chinese/English operation interface, with large touch screen display

The 1433 series signal generators adopt fully self-designed software, with large screen and Chinese and English operation interface, and a panoramic view of the current state information. 8.4-inch large screen with high brightness LCD and large font display, integrated design of LCD and touch screen, multiple display modes, backlight button and automatic backlight brightness adjustment, and other operation interface can also be set to English for your convenience according to different uses and occasions.

Fig.2.1 Screenshot of actual operation interface

2) Rich Test Interfaces

Ref In/Out, Pulse In, Sync Out, Video Out interface, etc.

3) Rich Program Control Interfaces

1433 series signal generators offer additional extension interfaces such USB interface and LAN interface, which are helpful for remote control.

4) Operating Temperature Range: -10℃ to 50℃

5) Be able to powered by battery or adapter

2.1.2 Product Functions

The 1433 series signal generator has a rich set of measurement functions, including

1) Continuous wave signal output function

The 1433 series signal generators have continuous wave signal output function, which can output continuous wave signals from 1MHz-20GHz/26.5GHz/40GHz/50GHz.

2) Frequency, amplitude and pulse modulation functions

The 1433 series signal generators have multiple modulation functions such as frequency, amplitude and pulse, which can output the frequency, amplitude and pulse modulation signals.

3) Wide dynamic range amplitude adjustment function

The 1433 series signal generators have wide dynamic range amplitude adjustment functions, which can output fixed amplitude power in the range of -120dBm to +10dBm.

4) Auto-run self-test on boot

The 1433 series signal generators have the function of automatic running self-test on boot.

5) Unfixed amplitude and loss-of-lock alarm function

The 1433 series signal generators have unfixed amplitude and loss-of-lock alarm function. When the equipment produces unfixed amplitude or loss-of-lock, it will provide the user with alarm prompt in the equipment interface.

6) Embedded operating instructions, and online help function

The 1433 series signal generators have embedded operating instructions and online help function, and you can get the usage of the instrument through the built-in embedded operating instructions.

7) Support remote control function of LAN and USB interface

The 1433 series signal generators support the remote control function of LAN and USB interface, which can remotely control the instrument via LAN port and USB.

8) Built-in battery, with automatic charge and discharge management function

The 1433 series signal generators have built-in batteries with automatic charge/discharge management function. When the battery is supplying power or being charged, the charge/discharge state of the battery can be displayed in the interface.

9) Step, list sweep function

The 1433 series signal generators offer step and list sweep function.

2.1.3 Typical Applications

1) Electronic system anti-interference performance test

The 1433 series signal generators have a wide range of output frequency and power, and have a variety of analog modulation functions. They can simulate and generate interference signals in the real operation environment for electronic system anti-interference performance test.

2) Radar receiving performance test and fault troubleshooting

For the application of reception performance test and troubleshooting of radar and other

electronic equipment, the 1433 series signal generators provide continuous wave and analog modulation wave output, which can provide excitation signal simulation.

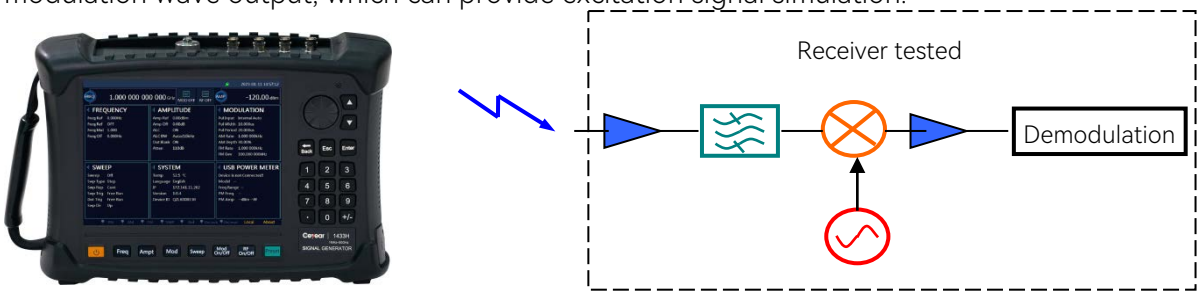


Fig.2.2 Radar receiving performance test and fault troubleshooting

3) Antenna pattern field test

For the field test application of antenna pattern, the 1433 series signal generators output signals with known fixed amplitude, which are used to test the transmission antenna pattern index.

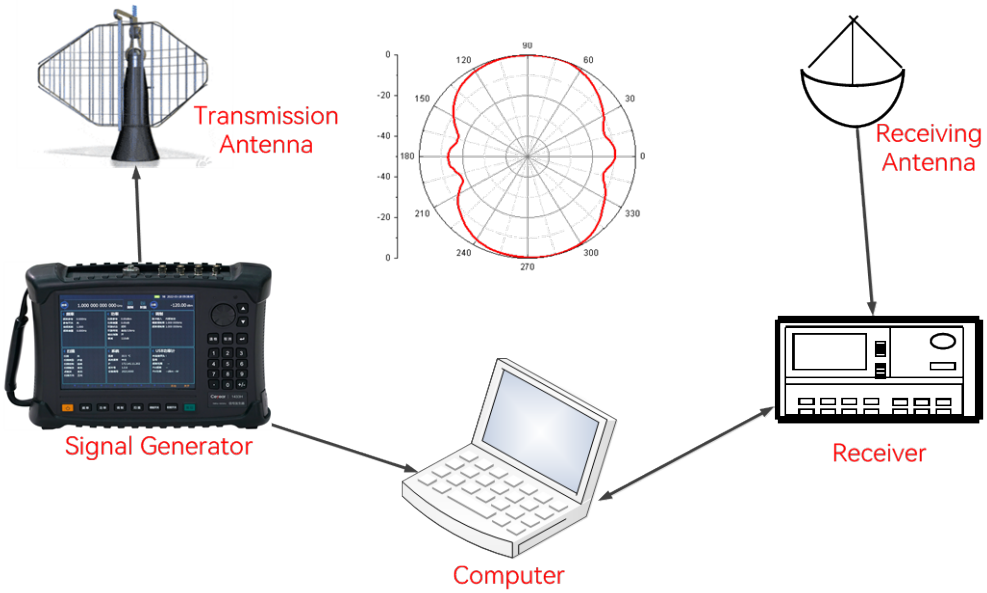


Fig.2.3 Schematic diagram of antenna pattern field test

2.2 Safe Operation Guide

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.

2.2 Safe Operation Guide

In addition, the correct use of this product is also your responsibility. Please read carefully and observe the safety instructions before starting to use this instrument. This product is suitable for use in industrial and laboratory environments or field measurement. Always use the product correctly according to its restrictions to avoid personal injury or property damage. You will be responsible for problems caused by improper use of the product or noncompliance with the requirements, and we will not be held responsible. **Therefore, in order to prevent personal injury or property damage caused by dangerous situations, please always observe the safety instructions.** Please keep the basic safety instructions and the product documentation properly and deliver them to end users.

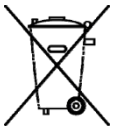
2.2.1 Safety Marks

2.2.1.1 Product-related Marks

Safety marks on the products are described as follows:

Table 2.1 Products safety marks

Symbol	Meaning	Symbol	Meaning
	Notice, reminding users of information to be paid special attention to. It reminds users of the operation information or instructions to be paid attention to.		Power ON/OFF
	Notice, handling heavy equipment.		Standby indication

	Danger! Hazard of electric shock.		DC
	Warning! Hot surface.		AC
	Protective conductive end		DC/AC
	Ground		Reinforced insulation protection of the instrument
	Ground terminal		EU mark for batteries and accumulators. Please refer to Item 1 of "2.2.8 Waste Disposal/Environmental Protection" in this section for specific instructions.
	Notice, please handle classical sensitive devices with care.	 	EU mark for separate collection of electronic devices. Please refer to Item 2 of "2.2.8 Waste Disposal/Environmental Protection" in this section for specific instructions.
	Warning! Radiation. Please refer to Item 7 of "2.2.4 Operation Precautions" in this section for specific instructions.		

2.2.1.2 Manual-related Marks

In order to remind users to operate the instrument safely and pay attention to relevant information,

the following safety warning marks are used in the product manual, which are explained as follows:

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

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

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

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

Tips on information about the instrument and its operation.

2.2.2 Operation Status and Locations

Please note before operating the instrument:

1) Unless otherwise specified, the 1433 series signal generator should be operated in an environment that allows for smooth placement of the instrument. The maximum altitude for operating the instrument shall not exceed 4,600m, and the maximum altitude for transporting the instrument shall not exceed 4600m. The range of actual supply voltage is ±10% of the marked voltage, and the range of supply frequency is±5% of the marked frequency.

2) Unless otherwise specially stated, the instrument has not received any waterproof treatment, do not place the instrument on surfaces with water, vehicles, cabinets, tables and other objects that are not fixed and do not meet the load conditions. Please place the instrument securely and fix it on the surface of a solid object (e.g., an ESD workbench).

3) Do not place the instrument in an environment where mist is easily formed, for example, 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.

4) 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.

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

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) According to the power requirements of the adapter, a three-core power cord should be adopted while ensuring reliable grounding of the ground wire during operation. Either floating ground or poor grounding may cause damage to the instrument and even cause injury to operators.

3) 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.

4) If the power supply socket does not provide an on/off switch, to cut the power of the instrument, you can just directly unplug the instrument, and therefore, it should be ensured that the power plug can be inserted or drawn conveniently.

5) 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.

6) The TN/TT power supply network is required for the instrument, and the maximum rated current of its fuse is 16A (if a fuse with higher rated current is used, it shall be discussed and determined with the manufacturer).

7) Keep the socket clean and tidy, and ensure the plug and the socket in good contact and reliable engagement.

8) Neither the socket nor the power cord can be overloaded, otherwise fire or electric shock will be caused.

9) Ifthe instrument is tested in a circuit with the voltage Vrms > 30 V, it shall be protected properly to avoid damage (e.g. by using appropriate test instruments, adding fuses, limiting current value, electrical isolation and insulation, etc.).

10) The instrument shall comply with IEC60950-1/EN60950-1 or IEC61010-1/EN 61010--1 standards to connect with PC or IPC.

11) 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.

12) 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.

13) Take appropriate overload protections to prevent overload voltage (caused by lightning, for instance) from damaging the instrument or causing personal injury.

14) When opening the housing of the instrument, do not place objects not belonging to the interior of the instrument, otherwise, short circuit, damage to the instrument and even personal injury may be caused.

15) 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.

16) 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) Before moving or transporting the instrument, please refer to the relevant instructions in "2.2.7 Transportation" of this section.

3) The inevitable use of substances (e.g. nickel) in the production process of the instrument may cause allergy to personnel. If an operator of the instrument has allergic symptoms (e.g. rash, frequent sneezing, ophthalmia or dyspnea) during the operations, please seek medical care in time to find out the reason and solve the symptoms.

4) Please refer to the relevant instructions in "2.2.8 Waste Disposal/Environmental Protection" of this section before disassembling this instrument for disposal.

5) RF instruments will generate high electromagnetic radiation, during which period, pregnant women and operators with cardiac pacemakers need special protection. If the radiation level is high, corresponding measures may be taken to remove the radiation sources to prevent personal injury.

6) In case of fire, the damaged instrument will release toxic substances. Therefore, the operators should wear appropriate protective equipment (e.g. Protective masks and exposure suits) for safety.

7) Laser products shall have different warning signs according to the laser category, because the radiation characteristics of laser and such equipment have high-intensity electromagnetic power characteristics, which will cause harm to human body. If the product is integrated with other laser products (e.g. CD/DVD drive),it will not provide other functions except the settings and functions described in the product manual in order to prevent the injury of the laser beam to the human body.

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

— Class A equipment:

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

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

— Class B equipment:

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

2.2.5 Maintenance

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

2.2.6 Batteries or Power Modules

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

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

6) Please use the manufacturer's original batteries and power modules. Any incorrect replacement and charging of alkaline batteries (such as lithium batteries) is likely to cause an explosion.

7) Discarded batteries and power modules shall be recycled and disposed of separately from other wastes. Due to the toxic substances inside the battery, they shall be properly discarded or recycled according to local regulations.

2.2.7 Transportation

1) If the instrument is heavy, please handle it with care. If necessary, use tools (a crane, for instance) to move the instrument so as to prevent damaging the body.

2) The handle of the instrument is suitable for personal handling of the instrument and cannot be fixed on the transportation equipment when during the transportation of the instrument. In order to prevent property loss and personal injury, please follow the manufacturer's safety regulations on the transportation of the instrument.

3) When operating the instrument on the vehicle, the driver should drive carefully to ensure transportation safety, and the manufacturer is not responsible for any emergencies during the transportation. Therefore, please do not use this instrument during the transportation, and reinforcement and preventive measures should be taken to ensure the transportation safety of the product.

2.2.8 Waste Disposal/Environmental Protection

1) Do not dispose of devices marked with batteries or accumulators together with unclassified waste; instead, such devices should be collected separately and disposed of in a suitable collection location or through the customer service center of the manufacturer.

2) Do not dispose of waste electronic devices together with unclassified waste; instead, such devices should be collected separately. The manufacturer has the right and responsibility to help end users dispose of waste products. If necessary, please contact the customer service center of the manufacturer for corresponding disposal so as not to damage the environment.

3) During mechanical or thermal processing of the product or its internal components, toxic substances (dust of heavy metals, such as lead, beryllium, and nickel, etc.) may be released. Therefore, specially trained technicians with relevant experience are required to disassemble the product to avoid personal injury.

4) During the reprocessing, please refer to the safety operation rules recommended by the manufacturer to dispose of toxic substances or fuel released from the product with specific methods to avoid causing personal injury.

3 Quick Start

This chapter introduces the pre-operation precautions, front panel and roof description and diagram, common basic measuring method, and storage and recall of instrument test status data files. so that users can have a preliminary understanding of the instrument itself and its measurement processes.

3.1 Get Prepared

3.1.1 Preparations before Operation

The chapter introduces precautions for the 1433 series signal generators before initial setting and operation.

Warning

Avoid damaging the instrument

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

- Do not open the cabinet arbitrarily.
- Do not try to disassemble or refit any part of the instrument not mentioned in the manual. Otherwise, such consequences as reduced electromagnetic shielding property and internal component damage can occur, affecting product reliability. In this case, we will not provide any free maintenance any more even if the product is still in the warranty period.
- Please carefully read the relevant contents in "2.2 Safe Operation Guide" of this manual and the safety precautions therein for operation. Also please pay attention to the requirements for specific operating environment mentioned in the data page.

Notice

Electrostatic Protection

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

Notice

Pay attention to the following when operating the instrument:

Improper operating or measuring position can damage the instrument or the one connected to it. Pay attention to the following before powering on the instrument:

- In order to ensure that the fan blades and heat radiation holes are unobstructed, the instrument shall be at least 10cmaway from the wall, and ensure that all fanvents are unobstructed.
- Keep the instrument dry;
- Arrange the instruments properly.
- Make sure the environment temperature meets with the requirement noted in the data page;
- Make sure the signal output port is connected properly, without any overload.

Tips

Effect 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;
- Please close any cable connection port that is enabled but temporarily unused or connect a matching load to the connection port in time;
- Please refer to the EMC level labels in the Data Page.

3.1.1.1 Unpacking

1) Visual Examination

Step 1: check whether the outer package and the shockproof packing of the instrument are damaged. If there is any damage, keep the outer package for standby and proceed with the following examination steps.

Step 2: unpack, and check the mainframe and articles provided in the package for any damage;

Step 3: check carefully the articles mentioned above as per Table 3.1 for any problem;

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 service consultation center with the service hotline provided on the cover, and we will repair or change it as soon as possible accordingly.

Notice

Handling: since the instrument and packing box are heavy, it shall be handled by two people at the same time, and placed with care.

2) Model Confirmation

Table 3.1 Packing list of 1433 series

Name	Quantity	Function
Mainframe:		
✧ 1433 Series Signal Generators	1	—
Standard Configuration:		
✧ Standard 3-core power cord	1	—
✧ Power Adapter	1	—
✧ Quick Start Guide	1	—
✧ USB cable	1	—
✧ Rechargeable li-ion battery	1 piece	—
✧ Product Certificate of Conformity	1	—
✧ Packing list	1	—
Options		
✧ Several	—	—

3.1.1.2 Environmental Requirements

The operation sites of 1433 series signal generators should meet the following environmental requirements:

3.1 Get Prepared

1) Operating Environment

The operating environment should meet the following requirements:

Table 3.2 Environmental requirements of 1433 series

Working temperature range	-10℃~50℃
Storage temperature range	-40℃~70℃
Operating temperature range when battery is supplying power	0℃~45℃
Low air pressure (altitude)	0 ~ 4,600 m

Notice

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

Warning

Since the storage temperature range of the instrument equipped with battery is-20℃ to 60℃, the instrument should not work continuously for a long time when it is equipped with the battery at high temperature, so as to avoid danger caused by high internal temperature. It is recommended to use an adapter for power supply.

2) Power Cord Selection

The 1433 series signal generator adopts three-core power cords conforming to international safety standards. When in use, insert a suitable power socket with protective ground so that the power cord can ground the shell of the instrument. It is recommended to use the power cord provided together with the instrument, when replacing the power cord, it is recommended to use the same type of 250V/10A power cord.

3) Power Supply Requirements

The 1433 series signal generator can be powered in three ways:

a) AC Power Supply and Adapter

When adopting AC power supply, the enclosed AC-DC adapter must be used. The input of the adapter is 100-240V, 50/60Hz AC.

To avoid overheating, please do not connect the AC-DC adapter to the analyzer when transporting or carrying it with a backpack.

The voltage input range of the AC-DC adapter is wide. Please ensure that the power supply voltage is within the range required in the table below.

Table 3.3 Power supply requirements

Power supply parameter	Applications
Input voltage	100V~240VAC
Rated input current	1.7A
Working frequency	50/60Hz
Output voltage/current	15.0V/4.0A

b) DC Power Supply

Voltage: 15V
Current: 3A (minimum)

c) Built-in Battery Power Supply

It can be powered by a rechargeable lithium-ion battery. If the battery is left unused for a long time, it will be discharged by itself, so it must be charged before being used again. The basic parameters of the enclosed battery are as follows:

Nominal voltage: 10.8V
Nominal capacity: ≥8800mAh

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. 1MΩ earth isolation resistor must be provided for the antistatic components at least for ensuring user safety.

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

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

- Operators must wear anti-static wrist straps or take other antistatic measures before touching the joints, core or conducting any assembly.
- Before connecting the cable to the instrument for testing, make sure that the center conductor of the cable is grounded first. This can be achieved in the following steps: connect a shorting device to one end of the cable to short-circuit the center conductor and the outer conductor of the cable. When wearing antistatic wrist straps, grasp the housing of the cable connector, connect the other end of the cable, and then remove the shorting device.

5) Output Port Protection

The standard impedance of the RF port of the 1433 series signal generator is 50 Ω, so a suitable load impedance shall be connected strictly according to the port requirements to prevent damage to the subsequent circuit.

3.1.1.3 Initial Power-up

Connect the 1433 series with the external power adapter, and observe that the power indicator on the front panel is yellow, which indicates that the standby power supply is working normally. Gently press the soft power switch on the front panel for more than 3 seconds, observe that the power indicator on the front panel turns green and the backlight of the display is on. It takes about 30 seconds for the display startup until the normal startup status interface is displayed. After 10 minutes of warm-up after startup, there shall be no alarm indication in the display interface.

Note: The indicator "flashing" indicates that the internal battery is not full and is charging.

3.1.1.4 Correct Use of Connectors

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

1) Connector Check

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

a) Whether the electroplated surface is worn or not and whether there are deep scratches;
b) Whether the thread is deformed;

c) Whether there are metal particles on the threads and the joint plane of the connector;
d) Whether the inner conductor is bent or broken;
e) Whether the screw sleeve of the connector rotates improperly.

Caution

Check the connector to prevent damaging ports of the instrument

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

2) Connection Method

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

Step 1: as shown in Fig.3.1, align the axes of the two interconnecting devices to ensure that the pin of the male connector slides concentrically into the socket of the female connector.

Fig.3.1 Axes of interconnected devices in a straight line

Step 2: as shown in Fig.3.2, move the two connectors leveled together so that they can be smoothly engaged. Rotate the screw sleeve of the connector (note, not the rotating connector itself) until it is tightened, and there can be no relative rotational movement between the connectors during the connection.

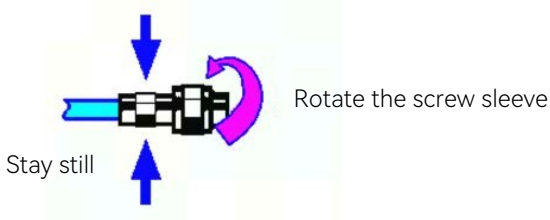


Fig.3.2 Connection method

Step 3: as shown in Fig.3.3, tighten the connectors with a torque wrench to complete the connection. Pay attention that the torque wrench should not exceed the initial folding point. Use an auxiliary wrench to prevent the connector from rotating.

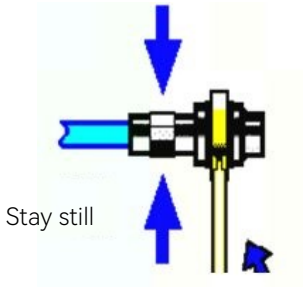


Fig.3.3 Finishing the connection with a torque wrench

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 screw sleeve of the connector by hand to complete the disconnection;
Step 5: pull the two connectors levelly apart.

4) Usage of a Torque Wrench

The use of a torque wrench is shown in Fig.3.4. The following points should be paid attention to when using it:

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

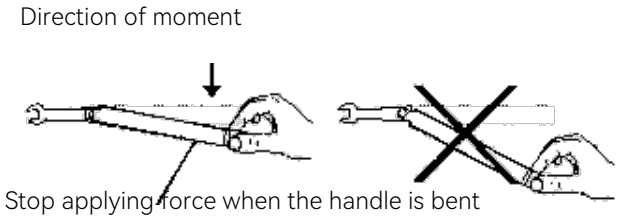


Fig.3.4. Usage of a torque wrench

5) Use and Storage of Connectors

a) The connectors should be covered by protective sleeves when not in use.
b) Do not mix various connectors, air lines and standard calibration pieces in a box because this is one of the most common causes of connector damage.
c) Keep the connectors and the signal generators at the same temperature. Holding a connector by hand or cleaning a connector with compressed air will significantly change its temperature.

The connectors should be calibrated after its temperature is stable.

d) Do not touch the joint plane of the connectors because the grease and dust particles on the skin are difficult to be removed from the joint plane;
e) Do not put the contact surface of a connector downward on a hard table surface. Contact with any hard surface may damage the electroplated layer and the joint surface of the connector.
f) Always wear anti-static wrist straps and work on a grounded conductive workbench pad, which can protect the analyzer and the connectors from electrostatic discharge.

6) Connector Cleaning

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

a) Remove loose particles on the thread and joint plane of the connectors with clean low-pressure air, and thoroughly inspect the connectors. If further cleaning treatment is required, proceed as follows:
b) Soak (but not thoroughly soak) a lint-free cotton swab with isopropyl alcohol;
c) Remove the dirt and debris from the joint plane and threads of the connectors with cotton swabs. When cleaning the inner surface of a connector, be careful not to apply external force to the central inner conductor and not to leave the fibers of cotton swabs on the central conductor of the connector.
d) Let the alcohol volatilize, then blow the surface clean with compressed air;
e) Check the connector to make sure that it is free of particles and residues.
f) If any defects of the connector are still obvious after cleaning, it indicates that the connector may have been damaged and should not be used again. Make clear the cause of the connector damage before connection.

7) Use of Adapters

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

8) Joint Plane of Connectors

An important concept in microwave measurement is reference plane. And an analyzer, it is the benchmark reference plane for all measurements. During the calibration, the reference plane is defined

as the plane where the measurement port and the calibration standard are engaged. Good connection and calibration depend on thorough and level contact between the connectors on the joint plane.

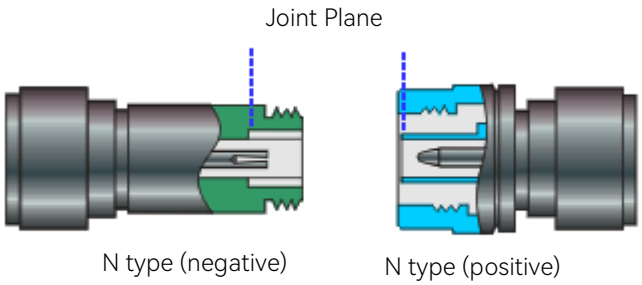


Fig.3.5 Calibration plane

3.1.1.5 Battery Installation and Replacement

1) Battery Description

The 1433 series signal generators are equipped with a large-capacity rechargeable li-ion battery, which can last for approx. 2 hours. In order to facilitate long-time field tests and avoid interruptions due to insufficient battery capacity, users may also purchase spare batteries. It is recommended to purchase batteries of the same model as the attached batteries.

Notice

Battery maintenance

To ensure the service life, always remove the battery from the battery compartment and do not allow the battery charge to be below 5% during transportation and long-term storage. Otherwise, the battery may not be charged.

2) Battery Installation and Replacement

The batteries of the1433 series signal generators are easy to install or replace. The battery compartment is at the bottom of the signal generator, and the battery cover is at the lower right side of the body. Users can install or replace the battery according to the following figure.

Fig.3.6 1433 series signal generator battery replacement

a) Squeeze the battery cover up and down at the position of the red arrow in the vertical direction, and then remove the battery cover along the red arrow in the horizontal direction.
b) After opening the battery cover, a black battery pull strip can be seen at the position shown in the figure.
c) Pull the strip to take out the battery.
d) Take out the battery completely and expose the battery compartment.
e) Install or replace the new battery into the battery compartment in the reverse order of the above diagram, and finally install the battery cover in the reverse order of step a) above to complete the battery installation or replacement.

3) Check Battery Status

The 1433 series signal generator is provided with a battery. The fully charged battery can last for approximately 2 hours. The user can check the battery status in either of the following ways:

a) Roughly check the battery power through the battery icon on the system status bar. When the battery icon shows 15%, please replace the battery or charge it in time.
b) Take out the battery; press the “PUSH” icon on the front of the battery, and the indicator on the right side of the button will light up to indicate the current remaining power. When there is still one indicator on, please charge the battery in time.

4) Battery Charging

a) The 1433 series signal generator can charge the battery when it is shut down or in operation. The charging steps are as follows:
b) First, install the battery to be charged into the instrument.

c) Use the attached AC-DC adapter to connect the external power supply.

d) If the battery is charged in shutdown state, the power indicator at the lower left corner of the front panel of the instrument is yellow and flashes, indicating that the battery is charging. After charging, the indicator is yellow and always on; If the battery is charged in startup stage, the power indicator is green and flashes, indicating that the battery is charging. After charging, the indicator is green and always on. At this time, the battery icon on the right side of the system status bar of the instrument display screen will be full.

In addition, for batteries with less than 5% power, the charging time in shutdown state is approx. 6 hours.

Notice

Power indicator

The power indicator is located inside the yellow Power ON button.

3.1.1.6 User Check

After a 1433 series signal generator is powered on for the first time, it is necessary to check whether the instrument works normally to ensure subsequent measuring operations.

Tips

Description of front panel hardkeys and softkeys on menus

The description form of the front panel hardkeys and menu softkeys is as follows:

Description form of hardkeys: 【XXX】,XXXis the name of the hardkey;

Description form of softkeys: [XXX], XXXis the name of the softkey.

If a softkey value corresponds to multiple states, the option that the background color of the selected value is highlighted indicates that its state is valid. For example: [AM Type Exp Linear] means the amplitude type is exponential amplitude.

1) Signal Generator Start

Connect the 1433 series with the external power adapter, and observe that the power indicator on the front panel is yellow, which indicates that the standby power supply is working normally. Gently press the soft power switch on the front panel for more than 3 seconds, observe that the power indicator on the front panel turns green and the backlight of the display is on. It takes about 30 seconds for the display startup until the normal startup status interface is displayed. After 10 minutes of warm-up after startup, there shall be no alarm indication in the display interface.

Note: The indicator "flashing" indicates that the internal battery is not full and is charging.

2) Signal Generator Shutdown

Press the yellow power switch key for approx. 3s at the lower left corner of the front panel of the signal generator, and then the signal generator will automatically exit the measurement application program and power off.

3) Self-test

Connect 1433 series signal generator to the power supply, and observe that the power indicator above the power switch in the lower left corner of the front panel is yellow, which indicates that the standby power supply is working normally. Touch the front panel power switch gently and observe whether the front panel power indicator turns green and the back light of the display turns on. You need to wait for about 30 seconds for the display startup until the startup status interface is displayed.

After preheating for 10 minutes, set the signal generator as follows:

Step 1: press the [SYSTEM] key in the display area of the main screen to enter the System window;

Step 2: click the [Selftest] key on the right to enter the Self Test window;

Step 3: click the [Allow All] key on the Self Test window;

Step 4: click [Test OFF ON] in the window to start the test;

Step 5: observe the test results: if it is successful, the "Self-test completed, number of failed items: 0" is displayed, indicating that the instrument works normally; If it fails, the "Self-test completed, number of failed items: XXX" is displayed, indicating that the instrument is not working normally. At this time, please contact our service consulting center according to the contact information provided in the cover II of this manual or "6.3 Repair Methods", and we will repair or replace it quickly according to the situation.

4) Function Validation

Start the 1433 series signal generator and preheat it for at least 30 minutes to add matching load to the RF output. Set the generator as follows:

Step 1: press the【Freq】hardkey or [FREQUENCY] softkey to enter the frequency configuration window, then the frequency input box will get input focus and display the current frequency value. Type 1, and press the virtual unit key [GHz] on the right to end the input when you have finished entering data in the input box. The parameters shown in the main frequency parameter display area will change accordingly. The input frequency value can also be changed using the knobs and arrow keys;

Step 2: press the【Ampt】hardkey or [AMPLITUDE] softkey to enter the power configuration window, then the power input box will get input focus and display the current power value. After typing 0, the unit of power will be shown on the right side of the display area. Press [dBm] to end the input. The parameters shown in the main power parameter display area will change accordingly;

Step 3: press【RF On/Off】. Before there is an RF signal on the RF switch connector, you must press

the【RF On/Off】 hardkey or click the [RF ON/OFF] softkey to confirm that the RF switch indication background becomes highlighted, indicating that the RF switch has been turned on. If the input power level exceeds the fixed amplitude power range generated by the signal generator, "unfixed amplitude" will be displayed in the status information zone at the bottom of the instrument.

Step 4: Press the arrow keys on the front panel to set the frequency of the signal generator to step upward at the interval of 100MHz until the max. Frequency is reached. Observe the alarm indication zone of the front panel display. If there is no alarm indication, the instrument is working normally. If there is alarm information, the instrument is not working properly. In this case, please contact our service consulting center according to the contact information provided in the title page or in "6.3 Method to Obtain After-sales Services" of this manual, and we will repair or replace the instrument as soon as possible accordingly.

3.1.2 Routine Maintenance

This section introduces the routine maintenance of the 1433 series signal generators.

3.1.2.1 Cleaning

1) Cleaning Instrument Surface

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

Step 1: shut down the instrument and disconnect the power cord connected to it;

Step 2: wipe the surface gently with dry or slightly wet soft cloth, and do not wipe the inside of the instrument.

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

2) Cleaning the Display

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

Step 1: shut down the instrument and disconnect the power cord connected to it;

Step 2: dip a piece of clean and soft cotton cloth into the cleaner and then gently wipe the display panel;

Step 3: dry the display with a piece of clean and soft cotton cloth;

Step 4. Connect the power cord only after the cleaner is completely dried.

Notice

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 the cleaner directly onto the display panel, otherwise it may penetrate into the instrument and damage the instrument.

3.1.2.2 Test Port Maintenance

The 1433 series signal generators have a 2.4mm male connector (N-type female connector for the 1433D) and four BNC connectors on its top. Damage to the connector or the presence of dust inside the connector will affect the test results. Please maintain such kind of connectors as follows:

- The connectors should be kept away from dust and kept clean.
- To prevent electrostatic discharge (ESD), do not directly contact the joint surface.
- Do not use damaged connectors;
- Please use an air blower to clean the connectors instead of using tools such as sandpaper to grind the surface of the joint.

Notice

Port impedance matching

The RF port of the 1433 series signal generator is the 2.4mm male connector (N-type female connector for 1433D). If the connection does not match the impedance connector, the connector will be damaged.

3.2 Front Panel and Top Description

This section introduces the element composition and functions of the front panel and top as well as operation interface of 1433 series signal generators.

3.2.1 Front Panel Description

This section introduces the front panel composition and functions of 1433 series signal generators. The front panel is shown below:

3.2 Front Panel and Top Description

Fig.3.7 Front panel description

3.2.1.1 Touch Screen Display Area

The 1433 series signal generator is designed with an 8.4-inch color touch screen, which allows the parameters to be set at the touch of a finger, eliminating the need for tedious soft and hardkey menu setting and greatly simplifying user operation.

When the instrument performs different functions, the following contents will be shown in the display zone: instrument frequency and power information; instrument operating status information; current input data when frequency and power and other data need to be input; system setting information and system time; the sweep process of the instrument in the sweep state; and the battery operating status. The specific introduction is shown in the following figure:

Fig.3.8 Touch screen display zone

According to the position of information on the screen, it can be divided into 11 areas: system time and battery state display area, quick frequency setting and display area, RF, quick modulation switch and display area, quick power setting and display area, frequency setting and state display panel, power setting and state display panel, modulation setting and state display panel, sweep setting and state display panel, system setting and state display panel, USB power meter setting and state display panel, and system state display area. The functions of each area are described in the following table.

Table 3.4 Function description of touch screen display area

No.	Name	Description
1	System time and battery status display zone	This area is mainly used to display the system time, the current capacity of the battery, whether it is in the charging state and error prompt information.
2	Fast frequency setting and display area	This area is mainly used to display the current frequency value. Click this area to quickly set the frequency.
3	RF, quick modulation switch and display area	This area is mainly used to display the current switch state of RF, modulation and other functions. Click the button in this area to quickly turn on/off RF and modulation functions.
4	Quick power setting and display area	This area is mainly used to display the current power value. Click this area to quickly set the power.

5	Frequency setting and state display panel	This area is mainly used to display the current setting state related to frequency. Click this area to enter the frequency configuration window, where you can set the specific frequency state.
6	Power setting and state display panel	This area is mainly used to display the current setting state related to power. Click this area to enter the power configuration window, where you can set the specific power state.
7	Modulation setting and state display panel	This area is mainly used to display the current setting state related to modulation. Click this area to enter the modulation configuration window, where you can set the specific modulation state.
8	Sweep setting and state display panel	This area is mainly used to display the current setting state related to sweep. Click this area to enter the sweep configuration window, where you can set the specific sweep state.
9	System setting and state display panel	This area is mainly used to display the state parameters of the current system settings. Click this area to enter the system configuration window, where you can set the system state parameters of the instrument.
10	USB power meter setting and state display panel	This area is mainly used to display the setting state of USB power meter. Click this area to enter the USB power meter configuration window, where you can set the specific parameters.
11	System status display zone	This area is mainly used to display the current system state information, including modulation information, external reference switch state and whether it is in external control state.

3.2.1.2 Digital Keypad

The digital keypad includes arrow keys, knobs, numeric keys, Backspace, Cancel, and Enter keys. All inputs can be changed through keys and the knob in the digital keypad. Among them, the functions of the keys in the digital keypad are shown in table below.

Table 3.5 Function description of digital keypad

No.	Name	Description
1	Direction keys	Up/Down keys are used to increase or decrease the value. There is no left/right key there. The step value of Up/Down keys corresponds to the

		step amount of each parameter.
2	Knob	Increase or decrease the value. The variable increases when the knob is turned clockwise and decreases vice versa. The knob can change the size of the value together with the Up/Down keys, and the knob has the same amount of steps as the Up/Down keys.
3	Digital key	Enter numbers (including negative signs).
4	[Back] key	Undo the last data bit by bit depending on the state of the set number.
5	[Esc] key	Cancel the currently entered data that is not valid.
6	[Enter] key	Confirm the current parameter setting.

3.2.1.3 Function Keypad

It is located below the screen and is used to change the measurement parameter setting, including six keys: frequency, power, modulation, sweep, modulation switch and RF switch. The function introduction of each key in the function keypad is shown in table below.

Table 3.6 Function keypad description

No.	Name	Description
1	Freq	Press this key to enter the frequency configuration window.
2	Ampt	Press this key to enter the power configuration window.
3	Mod	Press this key to enter the modulation configuration window.
4	Sweep	Press this key to enter the sweep configuration window.
5	Mod On/Off	Press this key to turn on/off the modulation switch.
6	RF On/Off	Press this key to turn on/off the RF switch.

3.2.1.4 Reset Button

Press this key to reset the instrument and return it to the initial startup state.

3.2.1.5 Power Switch

Power ON/OFF key ([⏻] key) is used to turn on and off the 1433 series signal generators. If an external power adapter is used for power supply, when the instrument is in the "standby" state, the

yellow indicator near the power switch is on; Press and hold the power switch for over 3 seconds, and the green indicator will be on, indicating that th instrument is in the "working" state. In the working state, press and hold the power switch for more than 3 seconds to shut down the analyzer. The power indicator colors correspond to the physical states of the instrument, as shown in the following table.

Table 3.7 Indicators states

Instrument state	Indicator state	Physical state of signal generator
Power off	OFF	a) Battery installed, power not connected. b) Battery not installed, power not connected.
	Normal on, yellow	a) Battery not installed, power connected. b) Battery installed and full, power connected.
	Flashing, yellow	a) Battery installed and not full, power connected.
Power on	Normal on, green	a) Battery not installed, power connected. b) Battery installed and full, power connected. c) Battery installed, power not connected.
	Flashing, green	a) Battery installed and not full, power connected.

3.2.2 Top Description

This section introduces the top composition and functions of 1433 series signal generators. The peripheral interfaces of these generators are mainly concentrated on the top panel, as shown in the figure below, which can be divided into three parts: power supply interface, test port and digital interface. The top composition is shown in the figure below.

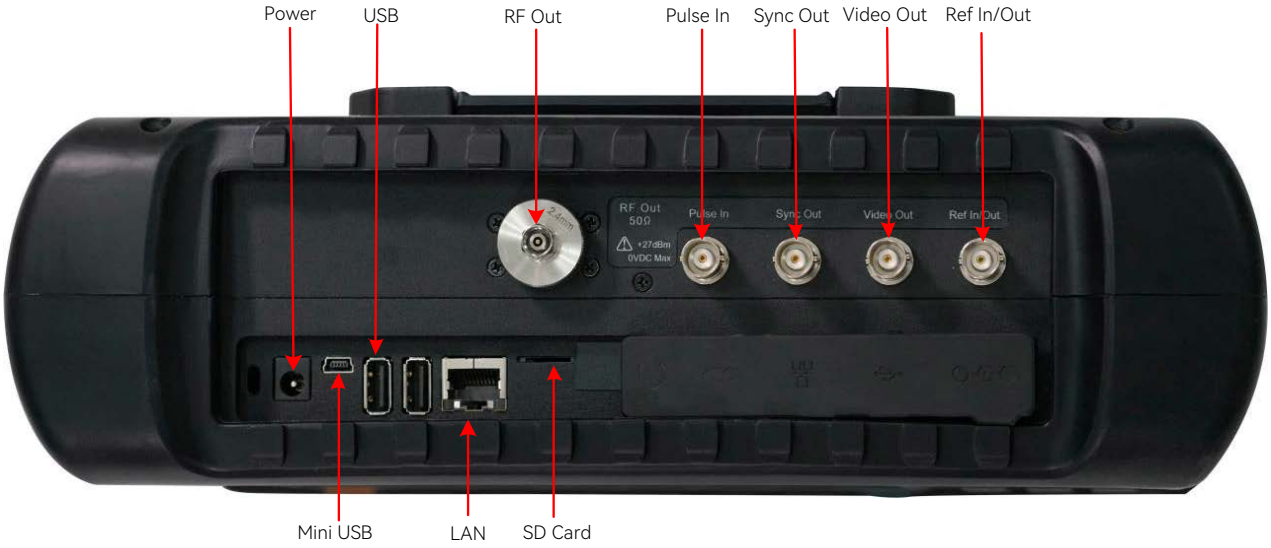


Fig.3.9 Top description

3.2.2.1 Power Interface

The power interface of the instrument can supply power to the signal generator via the DC output of an AC-DC adapter or external DC power supply.

The inner conductor of the external power interface is positive, and the outer conductor is grounded.

3.2.2.2 Test Port

The test port includes RF output port, pulse input, synchronous output, monitoring output and reference input/output. The functions of each test port are described in the following table.

Table 3.8 Description of test port

No.	Name	Description
1	RF Out	For signal output, the output impedance of 1433 series is 50Ω, and the connector form is 2.4mm male (N-type female connector for 1433D).
2	Pulse In	External pulse signal input interface of signal generator, BNC female connector.
3	Sync Out	The synchronous output interface of the signal generator, BNC female

		connector, outputs a synchronous pulse signal in the internal and triggers pulse modulation process.
4	Video Out	The monitoring output interface of the signal generator, BNC female connector, outputs pulse signals.
5	Ref In/Out	The reference input/output interface of the signal generator, as well as BNC female connector can be externally connected to 10MHz~100MHz signals from other devices as the reference signal of the signal generator; or the internal 10MHz reference signal of the signal generator can be output for use by external devices.

3.2.2.3 Digital Interface

Digital interfaces include Mini USB interface, USB type-A interface, LAN interface, SD card slot etc. The functions of each digital interface are described in the following table.

Table 3.9 Description of digital interface

No.	Name	Description
1	Mini USB interface	Connect an external PC, which can remotely control the 1433 series signal generator through programmed commands or programmed function libraries.
2	USB A-type interface	It is used to connect USB peripherals, such as USB storage devices and USB power probe.
3	LAN Interface	It is a 10/100Mbps network interface that can be connected to a computer (PC) via a network cable. The PC can remotely control or transmit data to the 1433 series signal generator through programmable commands or programmable function libraries.
4	SD card slot	Micro SD card slot, which can be used for expanding the storage space of the instrument.

3.3 Basic Measurement Methods

This part introduces the basic settings and measurement methods of the 1433 series signal generators, including:

3.3.1 Basic Settings

This section describes the basic measurement setup methods of the 1433 series signal generator, which will be used for different measurement tasks subsequently.

1) Set Frequency

Set the frequency to 1.234567GHz.

Operation steps:

a) Press【Freq】hardkey or [FREQUENCY] softkey to enter the frequency configuration window, then the frequency input box will get input focus and display the current frequency value. Type 1.234567, and press the virtual unit key [GHz] on the right to end the input when you have finished entering data in the input box. The parameters shown in the main frequency parameter display area will change accordingly. You can also select the corresponding bit and then use the knobs and arrow keys to change the input frequency value.

b) Press the【RF On/Off】hardkey or click the [RF ON/OFF] softkey at the modulation and quick RF switch in the display area of the instrument. At this time, the RF switch is turned on and the RF state background in the instrument display area is highlighted. Before there is an RF signal on the RF switch connector, you must press the【RF On/Off】hardkey or click the [RF ON/OFF] softkey to confirm that the RF switch indication changes from dark to highlighted.

2) Set Amplitude

Set the amplitude to 0dBm.

Operation steps:

a) Press the【Ampt】hardkey or [AMPLITUDE] softkey to enter the power configuration window, then the amplitude input box will get the input focus and display the current power value. After typing 0, the unit of power will be shown on the right side of the display area. Press [dBm] to end the input. The parameters shown in the main amplitude parameter display area will change accordingly. You can also select the corresponding bit and then use the knobs and arrow keys to change the input frequency value.

b) Press the【RF On/Off】hardkey or click the [RF ON/OFF] softkey at the modulation and quick RF switch in the display area of the instrument. At this time, the RF switch is turned on and the RF state background in the instrument display area is highlighted. Before there is an RF signal on the RF switch connector, you must press the【RF On/Off】hardkey or click the [RF ON/OFF] softkey to confirm that the RF switch indication changes from dark to highlighted.

Note: If the input amplitude exceeds the fixed amplitude range generated by the signal generator, “UnLevel” will be displayed in the status information zone at the bottom of the instrument.

3.3.2 Operation Examples

This section introduces some common and important basic settings and functions of 1433 series signal generators step by step through examples so as to enable users to quickly understand the characteristics of the instrument and master the basic measurement method.

First, the signal generator completes the pre-operation preparations according to the following steps:

Step 1: power on and startup;

Step 2: initialization after entering the system;

Step 3: preheating for 10 minutes;

Step 4: proceed with the following operations when there are no error messages on the main operation interface of the front panel.

Basic measurements include the settings and outputs of the CW RF signals and modulation signals via the front panel user interface of the signal generator. Follow the steps below to output relevant RF signal via the RF output port of the signal generator front panel, and save the user status via the system configuration window.

Step 1: set the frequency and amplitude parameter of the CW RF signal.

Step 2: set the carrier modulation parameter.

Step 3: save user status.

3.3.2.1 Set CW RF Output

1) Set the continuous wave RF output frequency to 1 GHz and the amplitude to 0 dBm.

Tips

Reset status of the instrument

The reset condition of the signal generator can be set to a status specified by the user according to user requirements. However, in the following example, factory settings are used as the reset status.

Step 1: Preset.

- Press the 【Rreset】 key to set the signal generator to factory settings.

Step 2: RF On/Off.

- Press 【RF On/Off】 hardkey to switch to RF On to output RF signals.

Step 3: set point frequency to 1GHz:

- Press【Freq】hardkey or [FREQUENCY] softkey to enter the frequency configuration

window, then the frequency input box will get input focus and display the current frequency value. Type 1, and press the virtual unit key [GHz] on the right to end the input when you have finished entering data in the input box.

Fig.3.10 Set the point frequency to 1GHz

Step 4: set amplitude to 0dBm.

- Press the【Ampt】hardkey or [AMPLITUDE] softkey to enter the amplitude power configuration window, then the amplitude input box will get the input focus and display the current amplitude value. After typing 0, the unit of amplitude will be shown on the right side of the display area. Press [dBm] to end the input.

Fig.3.11 Set amplitude to 0dBm

Tips

Changing input box parameters by stepping

When the input box is in the edition status, the input parameter values can also be changed by stepping with the front panel rotary knob or the arrow keys.

Tips

The input amplitude value exceeds the amplitude setting range of the signal generator.

The amplitude input box automatically limits its range and displays the upper and lower limits closest to the input value. If the input amplitude exceeds the fixed amplitude range that can be generated by the signal generator, the alarm "UnLevel" will be displayed in the bottom status indication zone.

2) Set the continuous wave RF reference frequency to 1GHz and the frequency offset to 1MHz

When the frequency reference is turned on, the frequency related parameters are all based on the relative values of the currently set frequency reference values. For example, the frequency displayed in the main info zone is the difference between the RF output frequency and the frequency reference value. Set frequency reference and frequency offset in the following steps:

Step 1: Preset .

- Press the 【Reset】 key to set the signal generator to factory settings.

Step 2: RF On/Off .

- Press 【RF On/Off】 to switch to RF On to output RF signals.

Step 3: set the point frequency to 1 GHz and the step increase output frequency to 1 MHz.

- Press【Freq】hardkey or [FREQUENCY] softkey to enter the frequency configuration window, then the frequency input box will get input focus and display the current frequency value. Type 1, and press the virtual unit key [GHz] on the right to end the input when you have finished entering data in the input box.
- Select the third digit (1MHz) after the decimal point in the Set-point Frequency Input edit box, and press the up arrow key to step up the output frequency by 1MHz.
- Then, the power value displayed in the main info zone is 1.001 000 000 000GHz.

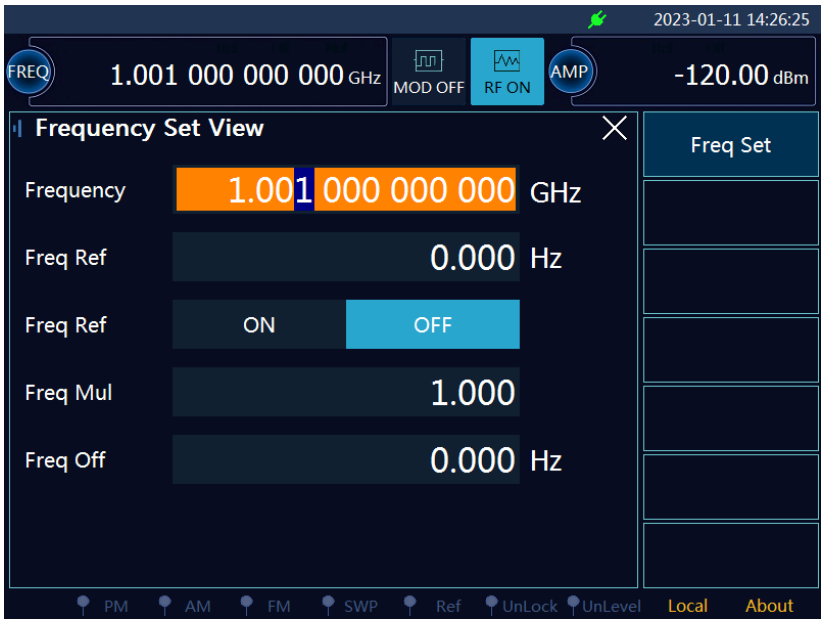


Fig.3.12 Step up the output frequency by 1MHz

Step 4: set the frequency reference to 1GHz and the frequency offset to 1MHz.

- Press【Freq】hardkey or [FREQUENCY] softkey to enter the frequency configuration window, then the frequency input box will get input focus and display the current frequency value. Then click [Freq Ref] input box, and type 1. After entering data in the input box, press the right virtual unit key [GHz] to end input, then click [Freq Ref ON OFF] to switch to Reference ON.
- Click the [Freq Off] input box and type 1. After entering data in the input box, press the right virtual unit key [MHz] to end the input. At this time, the frequency value displayed in the main information zone is 2.000 000 000MHz (output frequency (1GHz + 1MHz) minus frequency reference (1GHz) plus frequency offset (1MHz)).

Fig.3.13 Set frequency reference to 1GHz and frequency offset to 1 MHz.

Tips

Mark “Ref” and “Off” above frequency

If frequency reference is turned on, "Ref" is marked above the displayed frequency value in the main information zone.

If the frequency offset value is not 0, "Off" is marked above the displayed frequency value in the main information zone.

If the frequency reference is turned off or the frequency offset is 0, the frequency value displayed in the main information zone is the actual RF output frequency.

3) Set the continuous wave RF reference amplitude to 0dBm and the amplitude offset to 10 dB

When amplitude reference is turned on, the amplitude-related parameters are all based on the relative values of the currently set amplitude reference values. For example: the amplitude displayed in the main info zone is the difference between the RF output amplitude and the amplitude reference value.

Step 1: Preset .

- Press the 【Reset】 key to set the signal generator to factory settings.

Step 2: RF On/Off .

- Press 【RF On/Off】 to switch to RF On to output RF signals.

Step 3: set the amplitude to 0dBm and the step increase output amplitude to 10dB.

- Press the 【Ampt】 hardkey or [AMPLITUDE] softkey to enter the amplitude configuration window, then the amplitude input box will get the input focus and display the current amplitude value. After typing 0, the unit of amplitude will be shown on the right side of the display area. Press [dBm] to end the input.
- Select the first digit (1dB) before the decimal point in the amplitude Input edit box, and press the up arrow key continuously to step up the output amplitude to 10dBm.
- Then, the amplitude value displayed in the main info zone is 10.00dBm.

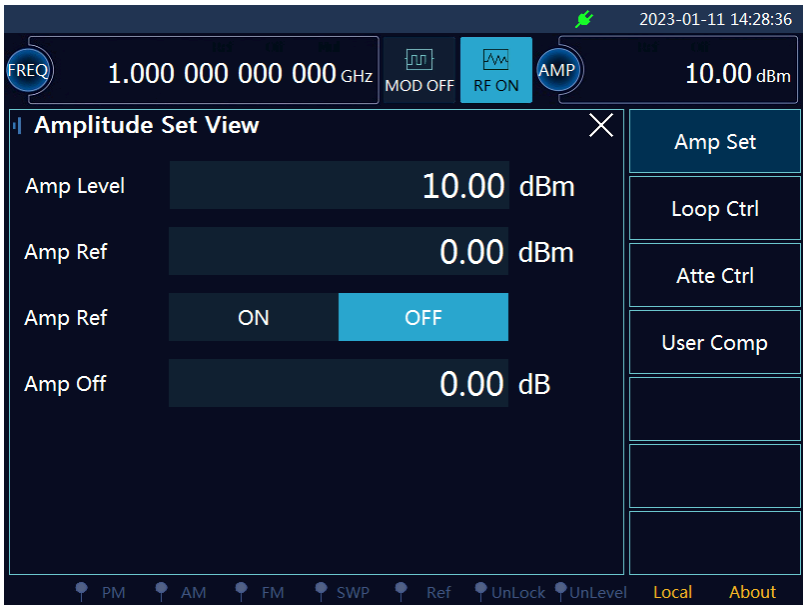


Fig.3.14 Step up the output amplitude to 10dBm

Step 4: set reference amplitude to 0dBm and the amplitude offset to 10dBm.

- Press the 【Ampt】 hardkey or [AMPLITUDE] softkey to enter the amplitude configuration window, then the amplitude input box will get the input focus and display the current amplitude value. Then click [Amp Ref] input box and type 0, the unit of amplitude will be shown on the right side of the display area. Press [dBm] to end the input, and then click [Amp Ref ON OFF] to switch to Reference On.
- Click the [Amp Ref] input box and type 10, and then the unit of amplitude will be shown on the right side of the display area. Press [dB] to end the input. At this time, the amplitude displayed in the main info zone is 20dBm (output amplitude 10dBm – amplitude reference 0dBm + amplitude offset 10dB).

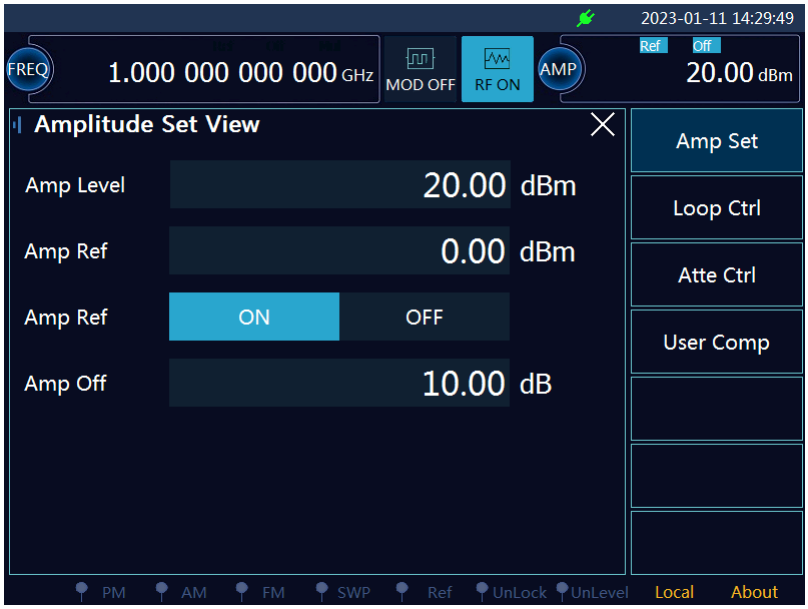


Fig.3.15 Set amplitude reference to 0dBm and amplitude offset to 10dB.

Tips

Mark “Ref” and “Off” above power

If power reference is turned on, "Ref" is marked above the displayed power value in the main information zone.

If the power offset value is not 0, "Off" is marked above the displayed power value in the main information zone.

If the power reference is turned off or the power offset is 0, the power value displayed in the main information zone is the actual RF output power.

3.3.2.2 Set Modulation Signals

The 1433 series signal generators have four modulation functions: amplitude modulation, frequency modulation and pulse modulation. This section takes amplitude modulation and pulse modulation as examples to introduce how to enable and set modulation signals.

1) Generate amplitude modulation signal: output frequency 1GHz, modulation rate 1 kHz, and amplitude modulation depth 30%

Step 1: set RF output signals of the signal generator:

- Set the point frequency to 1GHz and the amplitude to 0 dBm, and switch【RF ON/OFF】to On.

Step 2: set amplitude modulation parameter:

- Press the【Mod】hardkey or the [MODULATION] softkey to open the Modulation Configuration window, and then click [Amp Mod] on the right to open the Amplitude Modulation Configuration window;
- Set the AM Type: Linear.
- Turn off Deep AM.
- Set AM Rate: 1 kHz.
- Set Lin AM Depth: 30%

Step 3: enable AM:

- Select “AM ON”.
- Press the【Mod On/Off】hardkey on the front panel or the RF, quick modulation switch on the top of the display and the [MOD ON/OFF] softkey in the display area to Modulation ON state.

Fig.3.16 Setting AM signals

2) Generate pulse modulation signal: output frequency 1GHz, pulse width 50us, pulse period 1ms

Step 1: set RF output signals of the signal generator:

- Set the point frequency to 1GHz and the amplitude to 0 dBm, and switch 【RF On/Off】 to On.

Step 2: set pulse modulation parameter:

- Press the【Mod】hardkey or the [MODULATION] softkey in the modulation display area of the main interface to open the modulation configuration window, and then click [Pulse Mod] on the right to open the pulse modulation configuration window;
- Set Pulse Input: internally automatic.
- Set Pulse Width: 50us.
- Set the Pulse Period: 1ms.
- Other options of the pulse modulation configuration window are set by default.

Step 3: enable pulse modulation:

- Select “Pulse ON”.
- Press the【Mod On/Off】hardkey on the front panel or the RF, quick modulation switch on the top of the display and the [MOD ON/OFF] softkey in the display area to Modulation ON state.

Fig.3.17 setting pulse modulation signals

3.3.3 Main Configuration Scenes

The function configuration modules of 1433 series signal generators correspond to their respective configuration windows for centralized management of relevant parameter information to facilitate users to set and edit parameters to realize specific functions. The function configuration windows include:

3.3.3.1 Frequency

The Frequency window is used to set RF output frequency parameters, mainly including: frequency point, frequency offset, frequency reference and other parameters. In order to facilitate input, the point frequency input box is at the top of all controls in the Freq Config Dialog window. By pressing the【Freq】hardkey on the front panel, the user interface enters the frequency configuration window, as shown in the following figure.

Fig.3.18 Freq Config Dialog window

For all frequency functions, parameters in Hertz (Hz) are accepted. Digital input is terminated by four frequency units (GHz, MHz, kHz, or Hz), and the confirmation (Enter) key is terminated by the current display unit.

The setting parameter items in the frequency section include: setting point frequency, frequency reference, reference switch, frequency offset, frequency multiplication coefficient and other menus. The following describes the meaning and function of each parameter item.

1) Frequency

Point-frequency edit box, which activates Point-frequency state and allow to set Point-frequency.

2) Freq Reference ON/OFF

Set whether frequency reference is turned on when the frequency reference switch is turned on, a "Ref" mark is displayed above the frequency in the main information display area.

3) Freq Ref

Set the relative frequency reference in the range of -500GHz to 500GHz. This operation does not change the RF output frequency of the instrument. Their relationship shows that the following equation is satisfied: Displayed output frequency = Actual output frequency - Reference.

4) Frequency Off

Set the frequency offset, which can be used for all relevant frequency parameters. Range: -500GHz ~ 500GHz. This operation does not change the RF output frequency of the instrument. Their relationship shows that the following equation is satisfied: Displayed output frequency = Actual output frequency + Offset. If the frequency offset value is not 0, "Off" is marked above the frequency in the main information display zone.

5) Freq Mul

Set the frequency multiplication coefficient, which can be used for all frequency parameters. The frequency offset is equal to the product of the actual output frequency and the frequency multiplication coefficient, an integer value between the frequency multiplication coefficients. The default frequency multiplication factor value is 1. When the frequency multiplication factor is not 1, a "Mul" mark is displayed above the frequency in the main information display area.

3.3.3.2 Amplitude

The Amplitude window is used to set the RF output amplitude parameters, mainly including: Amp Level, Amp Ref, Amp Off and other parameters. In order to facilitate input, the power input box is at the top of all controls in the Amplitude Config Dialog window. By pressing the【Ampt】hardkey on the front panel, the user interface enters the Amplitude Configuration window, as shown in the following figure.

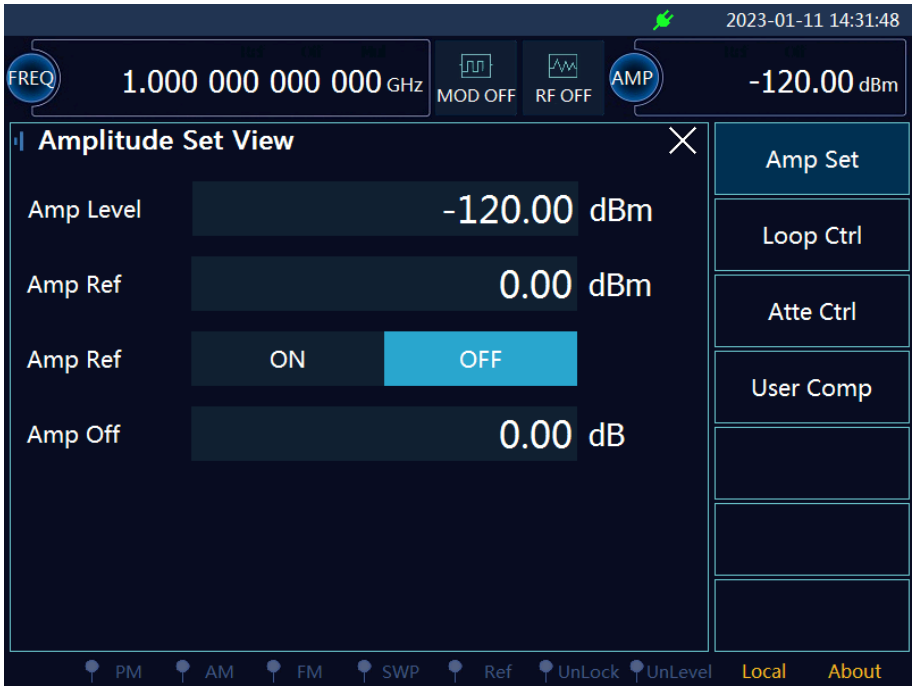


Fig.3.19 Amplitude Config window

The setting parameter items in the amplitude section include: Amp Level, Amp Ref, Amp Ref ON/OFF, Amp Off and other menus. The following describes the meaning and function of each parameter item.

1) Amp Level

Amp Level edit box, which activates amplitude state and allow setting amplitude.

2) Amp Ref ON/OFF

Set whether amplitude reference is turned on. When the amplitude reference switch is turned on, a "Ref" mark is displayed above the amplitude in the main information display area.

3) Amp Ref

Set the relative amplitude reference in the range of -500dBm to 500dBm. This operation does not change the RF output amplitude of the instrument. Their relationship shows that the following equation is satisfied: Displayed output amplitude = Actual output amplitude - Reference.

4) Amp Off

Set the amplitude offset, which can be used for all relevant amplitude parameters. Range: -500dBm to 500dBm. This operation does not change the RF output amplitude of the instrument. Their relationship shows that the following equation is satisfied: Displayed output amplitude = Actual output amplitude + Offset. If the amplitude offset value is not 0, "Off" is marked above the amplitude in the main information display zone.

3.4 Store/recall Working Status

This section introduces the working state storing/recalling of 1433 series signal generators.

3.4.1 Reset Status of Instrument

The 1433 series signal generators provides the user with the option of resetting state upon power-on as the initial state during power-on measurement. Usually, when there is an error in the instrument measurement, the initial state of the instrument during normal operation is restored by resetting the instrument state. The reset state of the signal generator is set as follows:

1) Reset type is User:

Step 1: open the Working State Store/Load window to set the restart type to User:

- Press the [SYSTEM] softkey to enter the System Configuration window, click the [File] softkey on the right to enter the Working State Store/Load window, and select the restart type as [User].

Step 2: save default status.

- Press [Save As Default User Status] to store the current settings of the instrument as the default state. The initial state of the instrument will be set according to the default state parameters saved by the user when it is next powered on or reset.

2) Reset type is Manufacturer:

Step 1: open the Working State Store/Load window to set the reset type to Manufacturer:

- Press the [SYSTEM] softkey to enter the System Configuration window, click the [File] softkey on the right to enter the Working State Store/Load window, and select the restart type as [Factory]. The initial state of the instrument will be set according to the default state parameters saved by the manufacturer when it is next powered on or reset.

3.4.2 Storing/Recalling Status

The 1433 series signal generators provide the function of storing and recalling the instrument measurement state, which is convenient for users to restore the required measurement state, and observe and evaluate the data again for further analysis.

Step 1: open the power configuration window

- Press the [SYSTEM] softkey to enter the System Configuration window, click the [File] softkey on the right to enter the Working State Store/Load window.

Step 2: select Store Location:

- Click [Storage Loc] to pop up the drop-down list. If no external storage device is connected, there is only "Internal" option in the drop-down list; If an SD card or USB flash disk is inserted, the options of SD card and USB flash disk will be added to the drop-down list.

Step 3: save status.

- Click [Save Status] to pop up the File Name Input dialog box, as shown in the following figure. Enter the file name, and then click [OK]. The dialog box disappears, and it prompts "Save Status File Successfully!" in the lower left corner of the instrument interface.

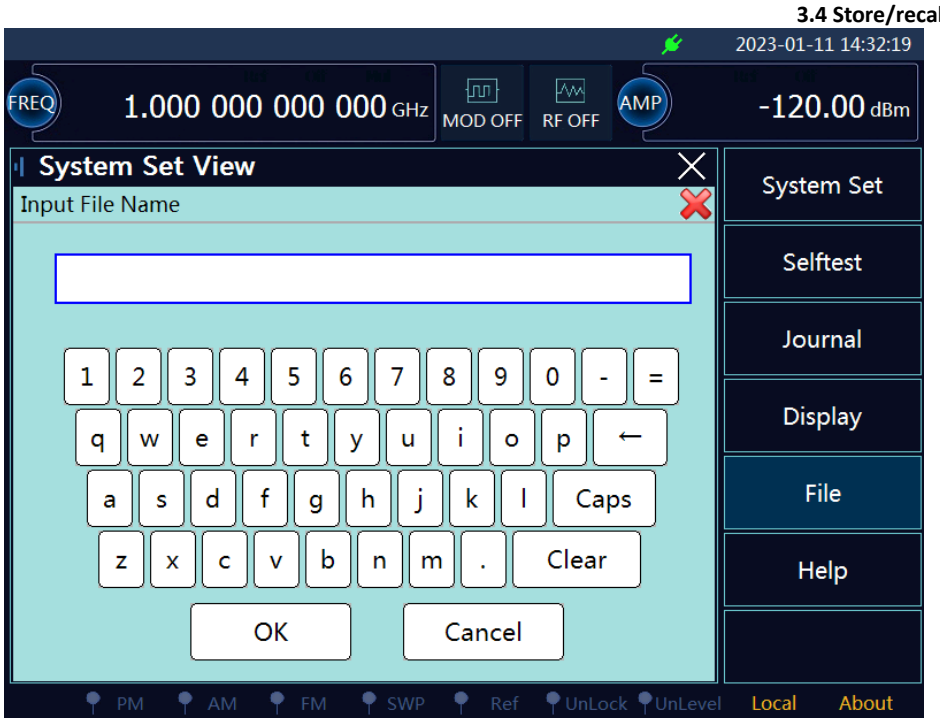


Fig.3.20 Store state file name input dialog box

Step 4: recall status.

- Click [Load Status] to pop up the Instrument State File List dialog box, as shown in the following figure. Select the instrument state file to recall, and then click [OK]. The dialog box disappears, and it prompts "Load Status File Successfully!" in the lower left corner of the instrument interface.

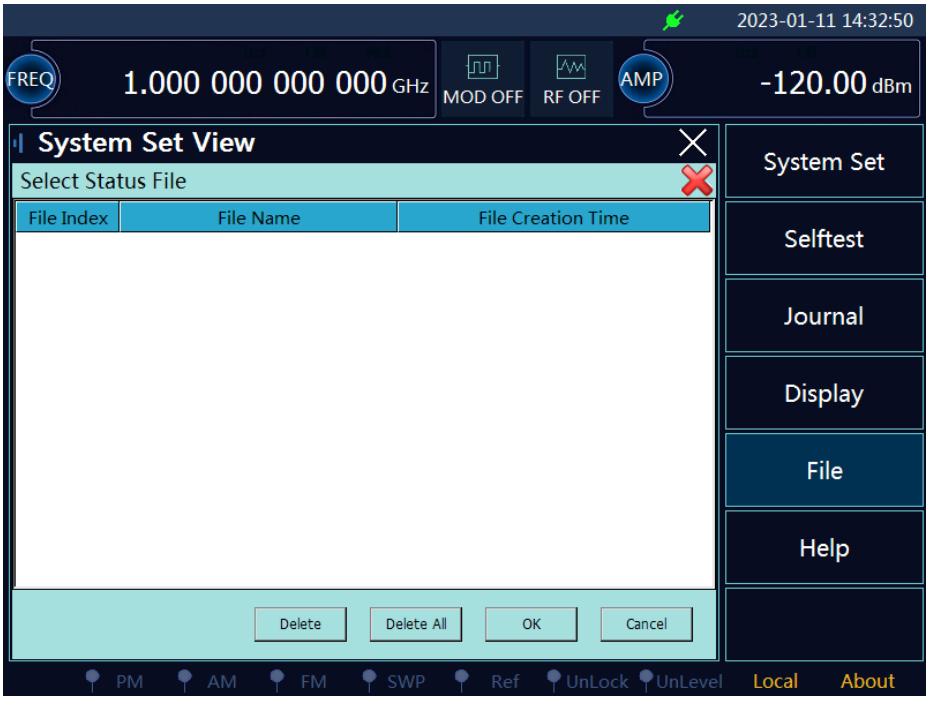


Fig.3.21 Recall user status

Tips

Max. Number of statuses of instruments stored /recalled

The max. number for 1433 series signal generator to save/recall instrument states is 200, and the state file number range is from 1 ~ 200.

4 Operation Guide

This chapter introduces the operation methods of different measurement functions and details the measurement steps of the 1433 series signal generators.

4.1 Function Operation Guide

This part introduces the operation methods of basic configuration functions of the 1433 series signal generators, including frequency, power, sweep, modulation and so on. The configuration steps are detailed as follows with examples.

4.1.1 Frequency

The 1433 series signal generator frequency is set to 1.234567GHz.

Step 1: set frequency

- Press【Freq】hardkey or [FREQUENCY] softkey to enter the frequency configuration window, then the frequency input box will get input focus and display the current frequency value. Type 1.234567, and press the virtual unit key [GHz] on the right to end the input when you have finished entering data in the input box. The parameters shown in the main frequency parameter display area will change accordingly. The input frequency value can also be changed using the knobs and arrow keys.

Step 2: switch RF on

- Press the【RF On/Off】hardkey or click the [RF ON/OFF] softkey at the modulation and quick RF switch in the display area of the instrument. At this time, the RF switch is turned on and the RF state in the instrument display area becomes highlighted. Before there is an RF signal on the RF switch connector, you must press the【RF On/Off】hardkey or click the [RF ON/OFF] softkey to confirm that the RF switch indication changes from dark to highlighted.

4.1.2 Amplitude

The 1433 series signal generator frequency is set to 0dBm.

Step 1: set amplitude:

- Press the【Ampt】hardkey or [AMPLITUDE] softkey to enter the amplitude configuration window, then the amplitude input box will get the input focus and

display the current amplitude value. After typing 0, the unit of amplitude will be shown on the right side of the display area. Press [dBm] to end the input. The parameters shown in the main amplitude parameter display area will change accordingly. The input amplitude value can also be changed using the knobs and arrow keys.

Step 2: switch RF on

- Press the【RF On/Off】hardkey or click the [RF ON/OFF] softkey at the modulation and quick RF switch in the display area of the instrument. At this time, the RF switch is turned on and the RF state in the instrument display area becomes highlighted. Before there is an RF signal on the RF switch connector, you must press the【RF On/Off】hardkey or click the [RF ON/OFF] softkey to confirm that the RF switch indication changes from dark to highlighted.

Note: If the input amplitude level exceeds the fixed amplitude range generated by the signal generator, "UnLevel" will be displayed in the status information zone at the right lower corner of the instrument.

4.1.3 Sweep

The sweep function is one of many important functions of signal generators. The 1433 series signal generators mainly provide two sweep modes: step and list. Configuration and implementation methods of step sweep and list sweep modes are described in detail below.

4.1.3.1 Step Sweep

Start frequency 1GHz, stop frequency 10GHz, start amplitude 0dBm, stop amplitude -10dBm, dwell time 10ms, and step points 10.

Step 1: set sweep type:

- Press the【Sweep】hardkey or [SWEEP] softkey to enter the Sweep Configuration window, click the [Sweep Mode] softkey on the right, and then click [Sweep Type Step List] to select as the Step Sweep.

Step 2: configure step sweep parameters

- Click the [Step Sweep] key on the right to enter the Step Sweep Parameter Configuration window;
- Set Freq Start: 1GHz
- Set Freq Stop: 10GHz
- Set Ampl Start: 0dBm
- Set Ampl Stop: -10dBm
- Set Step Dwell: 10ms
- Set Points: 10

Step 3: start sweep:

- Click the [Sweep Mode] key on the right, then click the drop-down menu on the right side of the sweep, and select Freq Power in the drop-down menu to start the frequency power step sweep.

Fig.4.1 Step sweep configuration

4.1.3.2 List Sweep

Start frequency 1GHz, stop frequency 10GHz, start amplitude 0dBm, stop amplitude -10dBm, dwell time 10ms, and step points 10.

Step 1: set sweep type:

- Press the【Sweep】hardkey or [SWEEP] softkey to enter the Sweep Configuration window, click the [Sweep Mode] softkey on the right, and then click [Sweep Type Step List] to select as the List Sweep.

Step 2: configure list sweep parameters:

- Click the [List Sweep] softkey on the right to enter the List Sweep Parameter Configuration window;
- then press the [Auto Fill] softkey to access the List Sweep Settings window;
- Set Freq Start: 1GHz
- Set Freq Stop: 10GHz
- Set Ampl Start: 0dBm
- Set Ampl Stop: -10dBm
- Set Dwell Start: 10ms
- Set Dwell Stop: 10ms
- Insert Points: 10

- Insert Dir: Down;
- Insert Pos: 1;

Step 3: start sweep:

- Click the [Sweep Mode] softkey on the right, then click the drop-down menu on the right side of the sweep, and select Freq Power in the drop-down menu to start the frequency power step sweep.

Fig.4.2 Configure list sweep

4.1.4 Modulation

The 1433 series signal generators have four modulation functions: amplitude modulation, frequency modulation and pulse modulation. This section introduces how to enable and set modulation signals.

4.1.4.1 Amplitude Modulation

Generate amplitude modulation signal: local frequency 1GHz, modulation rate 1 kHz, and amplitude modulation depth 30%.

Step 1: set RF output signals of the signal generator:

- Set the point frequency to 1GHz and the amplitude level to 0 dBm, and switch【RF

On/Off】to On.

Step 2: set amplitude modulation parameter:

- Press the【Mod】hardkey or the [MODULATION] softkey in the modulation information display area of the main interface to open the Modulation Configuration window, and then click [Amp Mod] on the right to open the Amplitude Modulation Configuration window;
- Set the AM Type: Linear.
- Turn off Deep AM.
- Set AM Rate: 1 kHz.
- Set Lin AM Depth: 30%

Step 3: enable AM:

- Select [AM ON].
- Press the【Mod On/Off】hardkey on the front panel or the RF, quick modulation switch on the top of the display and the [MOD ON/OFF] softkey in the display area to Modulation ON state.

Fig.4.3 Set amplitude modulation signal

4.1.4.2 Frequency Modulation

Generate FM signal: local oscillator frequency 1GHz, modulation rate 1kHz, and FM frequency offset 10 kHz

Step 1: set RF output signals of the signal generator:

- Set the point frequency to 1GHz and the power level to 0 dBm, and switch【RF On/Off】to On.

Step 2: set amplitude modulation parameter:

- Press the【Mod】hardkey or the [MODULATION] softkey in the modulation information display area of the main interface to open the modulation configuration window, and then click [Freq Mod] on the right to open the frequency modulation configuration window;
- Set FM Rate: 1 kHz.
- Set FM Dev: 10kHz

Step 3: enable FM:

- Select "FM ON".
- Press the【Mod On/Off】hardkey on the front panel or the RF, quick modulation switch on the top of the display and the [MOD ON/OFF] softkey in the display area to Modulation ON state.

Fig.4.4 Set frequency modulation signal

4.1.4.3 Pulse Modulation

Generate pulse modulation signal: Local frequency 1GHz, pulse width 50us, pulse period 1ms

Step 1: set RF output signals of the signal generator:

- Set the point frequency to 1GHz and the power level to 0 dBm, and switch【RF On/Off】to On.

Step 2: set pulse modulation parameter:

- Press the【Mod】hardkey or the [MODULATION] softkey in the modulation information display area of the main interface to open the modulation configuration window, and then click [Pulse Mod] on the right to open the pulse modulation configuration window;
- Set Pulse Input: Internal Auto.
- Set Pulse Width: 50us.

- Set the Pulse Period: 1ms.
- Other options of the pulse modulation configuration window are set by default.

Step 3: enable pulse modulation:

- Select "Pulse ON".
- Press the【Mod On/Off】hardkey on the front panel or the RF, quick modulation switch on the top of the display and the [MOD ON/OFF] softkey in the display area to Modulation ON state.

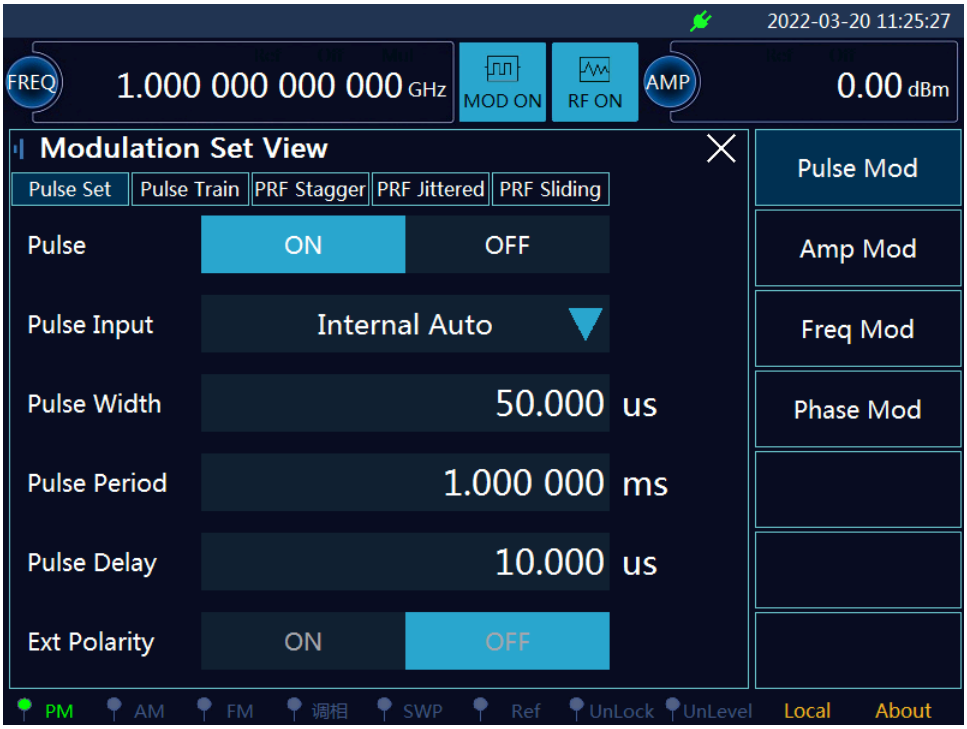


Fig.4.5 setting pulse modulation signals

4.1.4.4 Phase Modulation

Generate phase modulation signal: Local frequency 1GHz, modulation rate 1 kHz, phase deviation 5 rad.

Step 1: set RF output signals of the signal generator:

- Set the point frequency to 1GHz and the power level to 0 dBm, and switch【RF On/Off】to On.

Step 2: set phase modulation parameter:

- Press the【Mod】hardkey or the [MODULATION] softkey in the modulation information display area of the main interface to open the modulation configuration window, and then click [Phase Mod] on the right to open the phase modulation configuration window;
- Set PM Rate: 1kHz.
- Set PM Dev: 5rad.

Step 3: enable pulse modulation:

- Select “PM ON”.
- Press the【Mod On/Off】hardkey on the front panel or the RF, quick modulation switch on the top of the display and the [MOD ON/OFF] softkey in the display area to Modulation ON state.

Fig.4.6 setting phase modulation signals

4.2 Advanced Operation Guide

This section introduces the measurement processes of the 1433 series signal generators which are relatively complicated.

4.2.1 Select Loop Bandwidth

Step 1: open the loop configuration window:

- Press the【Ampt】hardkey or [AMPLITUDE] softkey to open the Amplitude Configuration window, then click [Loop Ctrl] on the right to open the Loop Configuration window;

Step 2: select the loop bandwidth:

- The default loop bandwidth is "Auto"; click [ALC BW] to pop up the drop-down list to select "Auto", "1kHz", "10kHz”or "100kHz".

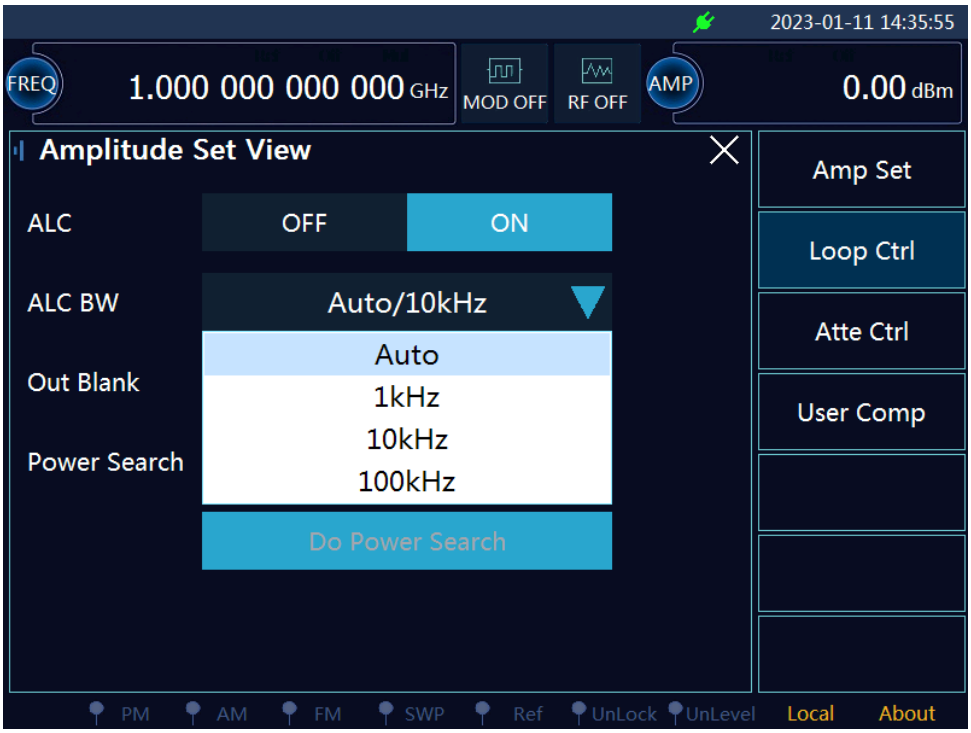


Fig.4.7 Select ALC bandwidth

4.2.2 Attenuator Control

Set the attenuator to manual mode, then set the attenuator value to 10dB

Step 1: open the attenuator control configuration window:

- Press the 【Ampt】 hardkey or [AMPLITUDE] softkey to open the Amplitude Configuration window, and then click [Atte Ctrl] on the right to open the Attenuator Configuration window;

Step 2: set the attenuator to manual mode:

- Click[Attenuator Manual Auto] to set to Manual mode;

Step 3: set the attenuator value to 10dB:

- In the manual mode, the attenuator value is settable. Click the [Attenuation] input box, and then type 10. The unit of attenuator will be shown on the right side of the display area. Press [dB] to end the input, and then the power display value will be changed accordingly.

5. Menus

The menus in the software interface of the 1433 series signal generators contain six groups of functions, namely "Frequency", " Amplitude ", "Modulation", "Sweep", "System", and "USB Power Meter". This chapter describes each group of menu structure and each function item in turn.

This section details menu items, functions, parameters and other information.

5.1 Frequency

Press the【Freq】hardkey or [FREQUENCY] softkey to enter the Frequency Configuration window for setting frequency-related parameters, including [Frequency], [Freq Ref], [Freq Ref ON OFF], [Freq Mul], and [Freq Off]. The displayed frequency and actual output frequency, frequency reference, frequency multiplication coefficient and frequency offset meet the following relationship:

Frequency reference ON: Displayed frequency = Output frequency * Frequency multiplier + Frequency offset - Frequency reference

Frequency reference OFF: Displayed frequency = Output frequency * Frequency multiplier + Frequency offset

When setting frequency reference, frequency multiplication coefficient and frequency offset parameters, the step sweep, list sweep and user compensation list data will be modified.

The menu structure and menu items are described below:

Fig.5.1 Frequency configuration window

Tips

Frequency unit

All frequency parameters accept parameters in hertz (Hz). All digital inputs must take four frequency units (GHz, MHz, kHz or Hz) as the termination key. When the input is finished, the new frequency value is automatically displayed in the appropriate units.

5.1.1 Frequency

Function description:

Activate Set Point-frequency state and allow to set Point-frequency. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

1433D: 1MHz-20GHz; 1433E: 1MHz-26.5GHz; 1433F: 1MHz-40GHz; 1433H: 1MHz-50GHz.

Default value:

1GHz

5.1.2 Freq Ref

Function description:

Activate Frequency Reference state and allow setting Frequency Reference. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

This menu item is associated with the menu item "Freq Ref ON OFF".

The frequency reference is used for the calculation of all associated frequency parameters, but does not change the actual output RF frequency. It satisfies the relationship: Displayed output frequency = Actual output frequency - Frequency reference. If the frequency reference is turned off, the frequency displayed in the main info zone is the actual RF output frequency value.

Effective range:

-500GHz ~ 500GHz

Default value:

0Hz

5.1.3 Freq Ref ON/OFF

Function description:

Click [Freq Ref ON OFF] to switch the reference switch state. The illuminated part of the menu option value indicates that its state is selected.

This menu item is associated with the menu item "Freq Ref", and in the case of "Freq Ref ON", a "Ref" mark is displayed above the frequency in the main information display area.

Effective range:

Off | On

Default value:

Off

5.1.4 Freq Mul

Function description:

Activate Frequency Multiplication Coefficient state and allow setting Frequency Multiplication Coefficient. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

The frequency multiplication coefficient is used for the calculation of all associated frequency parameters, but does not change the actual output RF frequency. It satisfies the relationship: Displayed output frequency = Actual output frequency * Frequency multiplication coefficient. When the frequency multiplication coefficient is not 1, a "Multiplication" mark is displayed above the frequency in the main information display area. If the frequency multiplication coefficient is 1, the frequency displayed in the main info zone is the actual RF output frequency value.

Effective range:

-100 ~ 100, excluding (-0.001, 0.001)

Default value:

1.0

5.1.5 Freq Off

Function description:

Activate Frequency Offset state and allow setting Frequency Offset. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

The frequency offset is used for the calculation of all associated frequency parameters, but does not change the actual output RF frequency. It satisfies the relationship: Displayed output frequency = Actual output frequency + Frequency offset. 0Hz If the frequency offset value is not 0, "Off" is marked above the frequency in the main information display zone. If the frequency offset is 0Hz, the frequency displayed in the main info zone is the actual RF output frequency value.

Effective range:

-500GHz ~ 500GHz

Default value:

0Hz

5.2 Amplitude

Press the【Ampt】hardkey or [AMPLITUDE] softkey to enter the amplitude configuration window. The amplitude key is used to complete the setting of the parameters related to the amplitude

characteristics of the signal generator. The amplitude menu mainly includes Amp Level, Amp Ref, Amp Ref ON/OFF, Amp Off, ALC OFF/ON, ALC BW, Out Blank, Power Search, Attenuator Manual/Auto, Attenuation and User Comp.

The displayed amplitude and actual output amplitude, amplitude reference and amplitude offset meet the following relationship:

Amplitude reference on: display amplitude = output amplitude + amplitude offset- amplitude reference

Amplitude reference OFF: display amplitude = output amplitude + amplitude offset

When setting amplitude reference and amplitude offset parameters, the step sweep and list sweep data will be modified.

The menu structure and menu items are described below:

5.2.1 Amp Set

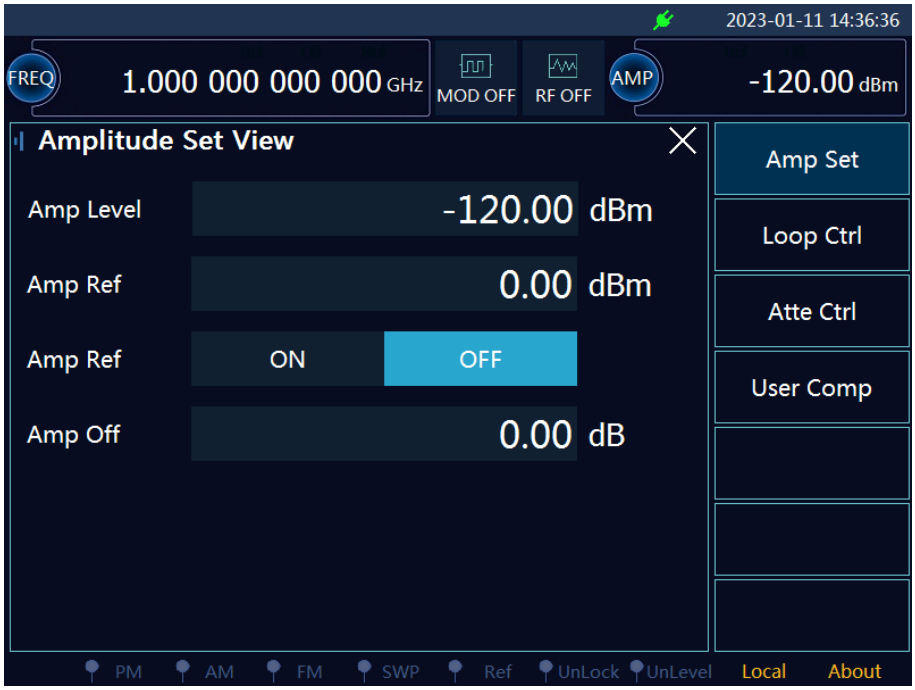


Fig.5.2 amplitude setting

5.2.1.1 Amp Level

Function description:

Activate Set Amplitude state and allow setting Amplitude. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

-135dBm ~ 25dBm

Default value:

-120dBm

5.2.1.2 Amp Ref

Function description:

Activate Amplitude Reference state and allow setting Amplitude Reference. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

This menu item is associated with the menu item "Amp Ref ON OFF".

The amplitude reference is used for the calculation of all associated amplitude parameters, but does not change the actual output amplitude. It satisfies the relationship: Displayed output amplitude = Actual output amplitude – amplitude reference. If the amplitude reference is turned off, the amplitude displayed in the main info zone is the actual RF output amplitude value.

Effective range:

-500dBm ~ 500dBm

Default value:

0dBm

5.2.1.3 Amp Ref ON/OFF

Function description:

Click [Amp Ref ON OFF] to switch the reference switch state. The illuminated part of the menu option value indicates that its state is selected.

This menu item is associated with the menu item “Amp Ref", and in the case of "Amp Ref ON", a "Ref" mark is displayed above the amplitude in the main information display area.

Effective range:

Off | On

Default value:

Off

5.2.1.4 Amp Off

Function description:

Activate Amplitude Offset state and allow setting Amplitude Offset. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

The amplitude offset is used for the calculation of all associated amplitude parameters, but does not change the actual output amplitude. It satisfies the relationship: Displayed output amplitude = Actual output amplitude + Amplitude offset. If the amplitude offset value is not 0dB, "Off" is marked above the amplitude in the main information display zone. If the amplitude offset is 0 dB, the amplitude displayed in the main info zone is the actual RF output amplitude value.

Effective range:

-500dB ~ 500dB

Default value:

0dB

5.2.2 Loop Ctrl

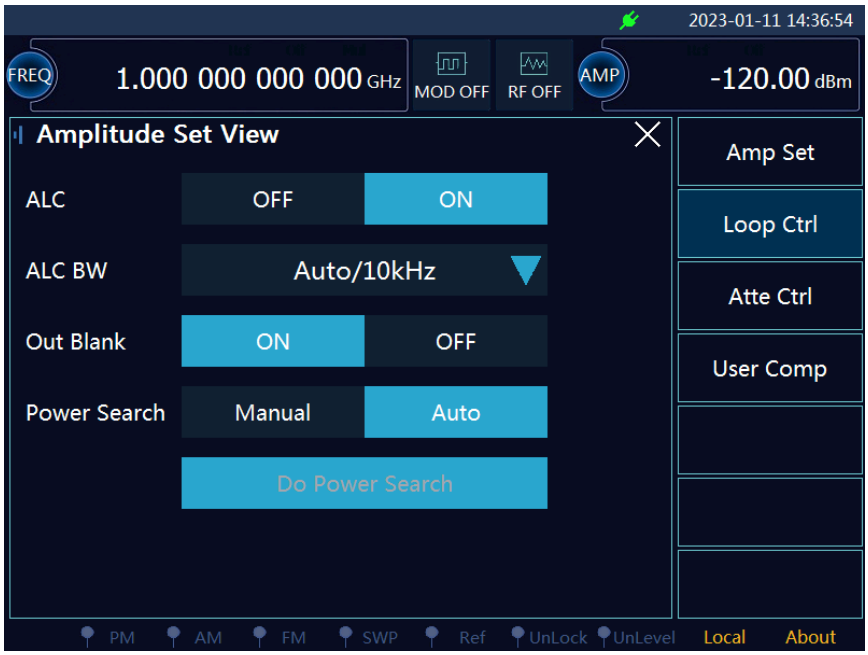


Fig.5.3 Loop control

5.2.2.1 ALC OFF/ON

Function description:

Click [ALC OFF ON] to switch the loop state. The illuminated part of the menu option value indicates that its state is selected. Set the loop state. When the loop is closed, the signal generator is in the normal continuous amplitude stabilization mode. When the loop is open, the ALC amplitude stabilization function is canceled.

Effective range:

OFF | ON

Default value:

ON

5.2.2.2 ALC BW

Function description:

Click [ALC BW] to pop up the drop-down list to select "Auto", "1kHz", "10kHz" or "100kHz".

Effective range:

Auto | 1 kHz | 10 kHz | 100 kHz

Default value:

Auto

5.2.2.3 Out Blank ON/OFF

Function description:

Click [Out Blank ON OFF] to switch the output blanking ON/OFF. The illuminated part of the menu option value indicates that its state is selected. Set the amplitude output state of the signal generator during the instrument state switching.

Effective range:

ON | OFF

Default value:

ON

5.2.2.4 Power Search

Function description:

Click [Power Search Manual Auto] to switch the power search method. The illuminated part of the menu option value indicates that its state is selected. In automatic mode, power search is performed automatically after the user changes the working state of the instrument. In manual mode, power search will be performed only when the user clicks [Do Power Search].

Effective range:

Manual | Auto

Default value:

Auto

5.2.2.5 Do Power Search

Manually perform a power search to align the open-loop output power of the signal source with the closed-loop output power. This function can only be triggered in the manual power search state.

5.2.3 Atte Ctrl

Fig.5.4 Attenuation control

5.2.3.1 Attenuator Manual/Auto

Function description:

Click [Attenuator Manual Auto] to switch the attenuator state. The illuminated part of the menu option value indicates that its state is selected. When setting the attenuator state, [Manual] allows you to set the ALC power and attenuator value manually. When [Auto], the generator automatically selects the value of the attenuator.

Effective range:

Manual| Auto

Default value:

Auto

5.2.3.2 ALC Power

Function description:

ALC power can be set manually when the attenuator is manual. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

-25dBm ~ 25dBm

Default value:

-10dBm

5.2.3.3 Attenuation

Function description:

Activate Attenuation state and allow setting Attenuation. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

0dB ~ 110dB

Default value:

110dB

5.2.4 User Comp

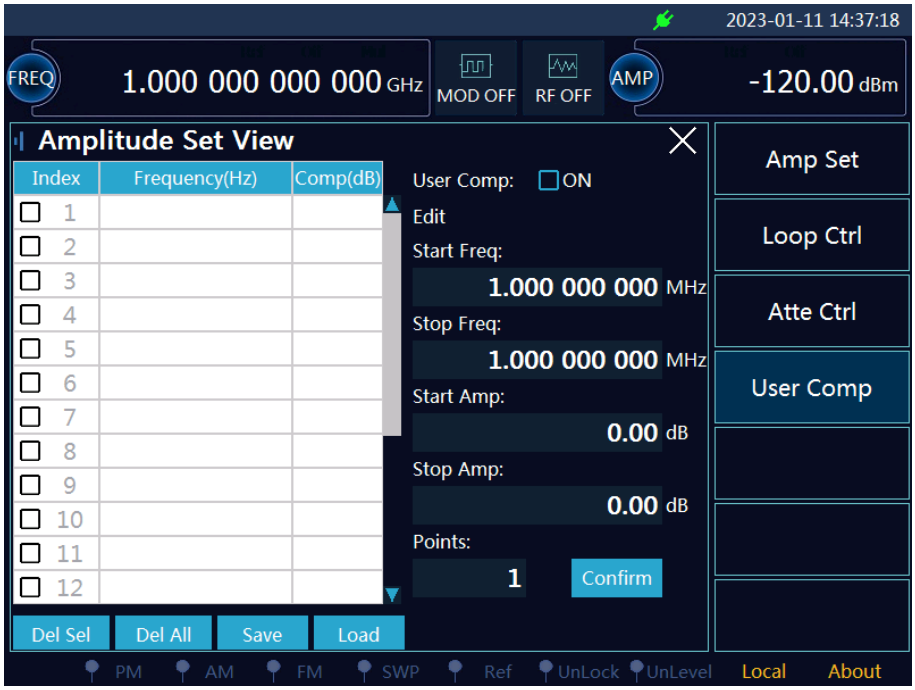


Fig.5.5 user comp

Users can set the frequency compensation point and amplitude compensation value through this interface, and turn on the user compensation switch to perform amplitude compensation.

Filling principle: If the start filling frequency is equal to the stop filling frequency, only one point will be filled regardless of the filling point setting, and the compensation amplitude at that point will be the stop compensation amplitude value.

5.3 Modulation

This instrument has a built-in modulation signal generator, which can realize pulse modulation,

amplitude modulation and frequency modulation, and the pulse modulation can be modulated with internal or external signals through a switch. Press the【Mod】hardkey or the [MODULATION] softkey in the modulation information display area of the main interface to enter the Modulation Configuration window. The modulation menu mainly includes pulse modulation, amplitude modulation and frequency modulation. The menu structure and menu items are described below:

5.3.1 Pulse Mod

Fig.5.6 Pulse modulation

5.3.1.1 Pulse ON/OFF

Function description:

Click [Pulse ON OFF] to toggle the pulse modulation between ON/OFF. The illuminated part of the menu option value indicates that its state is selected. Set the signal generator pulse modulation ON/OFF state.

Effective range:

ON|OFF

Default value:

OFF

5.3.1.2 Pulse Input

Function description:

Click [Pulse Input] to pop up the drop-down list to select "Internal Auto", "Internal Trigger", "Internal Gating", "Double Pulse" and "External". Where "Internal Auto": activates pulse modulation and sets the internal pulse generator inside the instrument as the pulse modulation source, no external connection is required and the parameters of the pulse are set by the user; "Internal Trigger": in the Pulse Configuration window, set the pulse delay value of the internal pulse generator and delay the pulse output of the internal pulse generator with the external pulse input signal fronts; "Internal Gating": activates the internal pulse gating trigger mode, which enables the internal pulse generator to perform a logical summation with the externally input pulse signal; "Double Pulse": activates the double pulse trigger mode; and "External": pulse modulation is performed using an external input pulse source. The modulated pulse source is fed from the pulse input connector and added to the pulse modulator via a buffer circuit.

Effective range:

Internal Auto | Internal Trigger | Internal Gating | Double Pulse | External

Default value:

Internal Auto

5.3.1.3 Pulse Width

Function description:

Activate Set Pulse Width and allow setting Pulse Width. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

80ns ~ 60s-20ns

Default value:

10us

5.3.1.4 Pulse Period

Function description:

Activate Set Pulse Period and allow setting Pulse Period. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

100ns ~ 60s

Default value:

20us

5.3.1.5 Pulse Delay

Function description:

Activate Set Pulse Delay and allow setting Pulse Delay. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

-60s ~ 60s

Default value:

0us

5.3.1.6 Ext Polarity ON/OFF

Function description:

Click [Ext Polarity ON OFF] to switch the input inversion state. The illuminated part of the menu option value indicates that its state is selected. When the input inversion is turned on, the external input pulse signal is logically reversed.

Effective range:

ON|OFF

Default value:

OFF

5.3.2 Amp Mod

Fig.5.7 Amp Mod

5.3.2.1 AM ON/OFF

Function description:

Click [AM ON/OFF] to toggle the AM between ON/OFF. The illuminated part of the menu option

value indicates that its state is selected. Set the signal generator amplitude modulation ON/OFF state.

Effective range:

ON|OFF

Default value:

OFF

5.3.2.2 AM Rate

Function description:

Activate Set Modulation Rate state and allow setting Modulation Rate. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

0Hz ~ 20kHz

Default value:

1 kHz

5.3.2.3 Lin AM Depth

Function description:

Activate Set Linear Amplitude Depth state and allow setting Linear Amplitude Depth. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

0% ~ 100%

Default value:

30%

5.3.2.4 Exp AM Depth

Function description:

Activate Set Exponential Modulation Depth state and allow to set Exponential Modulation Depth. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

0dB ~ 50dB

Default value:

10dB

5.3.2.5 AM Type Exp|Linear

Function description:

Click [AM Type Exp Linear] to switch the AM type state. The illuminated part of the menu option value indicates that its state is selected. "Linear AM": the RF output amplitude varies linearly with the amplitude of the amplitude modulation signal. "Exponential AM": the RF output amplitude varies exponentially with the amplitude of the amplitude modulation signal.

Effective range:

Exp | Linear

Default value:

Linear

5.3.2.6 Deep AM ON/OFF

Function description:

Click [Deep AM ON OFF] to switch deep AM ON/OFF. The illuminated part of the menu option value indicates that its state is selected. Set the signal generator depth amplitude modulation ON/OFF state.

Effective range:

ON|OFF

Default value:

OFF

5.3.3 Freq Mod

Fig.5.8 Freq Mod

5.3.3.1 FM ON/OFF

Function description:

Click [FM ON/OFF] to toggle the frequency modulation between ON/OFF. The illuminated part of the menu option value indicates that its state is selected. Set the signal generator frequency modulation ON/OFF state.

Effective range:

ON|OFF

Default value:

OFF

5.3.3.2 FM Rate

Function description:

Activate Set Modulation Rate state and allow setting Modulation Rate. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

0Hz ~ 20kHz

Default value:

1 kHz

5.3.3.3 FM Dev

Function description:

Activate Set FM Dev state and allow setting FM Dev. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

0Hz ~ 4MHz

Default value:

100 kHz

5.3.4 Phase Mod

Fig.5.9 Phase Mod

5.3.4.1 PM ON/OFF

Function description:

Click [PM ON/OFF] to toggle the phase modulation between ON/OFF. The illuminated part of the menu option value indicates that its state is selected. Set the signal generator phase modulation ON/OFF state.

Effective range:

ON|OFF

Default value:

OFF

5.3.4.2 PM Rate

Function description:

Activate Set Modulation Rate state and allow setting Modulation Rate. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

0Hz ~ 20kHz

Default value:

1 kHz

5.3.4.3 PM Dev

Function description:

Activate Set PM Dev state and allow setting PM Dev. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel. It should be noted that different frequency bands correspond to different phase deviation ranges when the phase deviation is set.

Effective range:

Frequency range	Phase deviation range
[1MHz, 2.35GHz)	0~12.5rad
[2.35GHz, 2.5GHz)	0~3.125rad
[2.5GHz, 5GHz)	0~6.25rad
[5GHz, 10GHz]	0~12.5rad
(10GHz, 20GHz]	0~25rad
(20GHz, 40GHz]	0~50rad
(40GHz, 50GHz]	0~100rad

Default value:

1 rad

5.4 Sweep

Press the【Sweep】hardkey or the [SWEEP] softkey to enter the Sweep Configuration window. This series signal generators support two sweep modes: step and list. In the sweep mode, the total time per sweep cycle depends on the selected trigger method, the number of band switches required and the time required for each switch. In addition, there is a manual sweep mode, in which the sweep position can be continuously adjusted by the front panel keys within the set range of start and stop sweep.

The sweep menu mainly includes Sweep, Sweep Type, Sweep Trig, Dot Trig, Sweep Dir, Sweep Repeat, Man Mode, and Man Points, configure Step Sweep, configure List Sweep and other menus. The menu structure and menu items are described below:

5.4.1 Sweep Mode

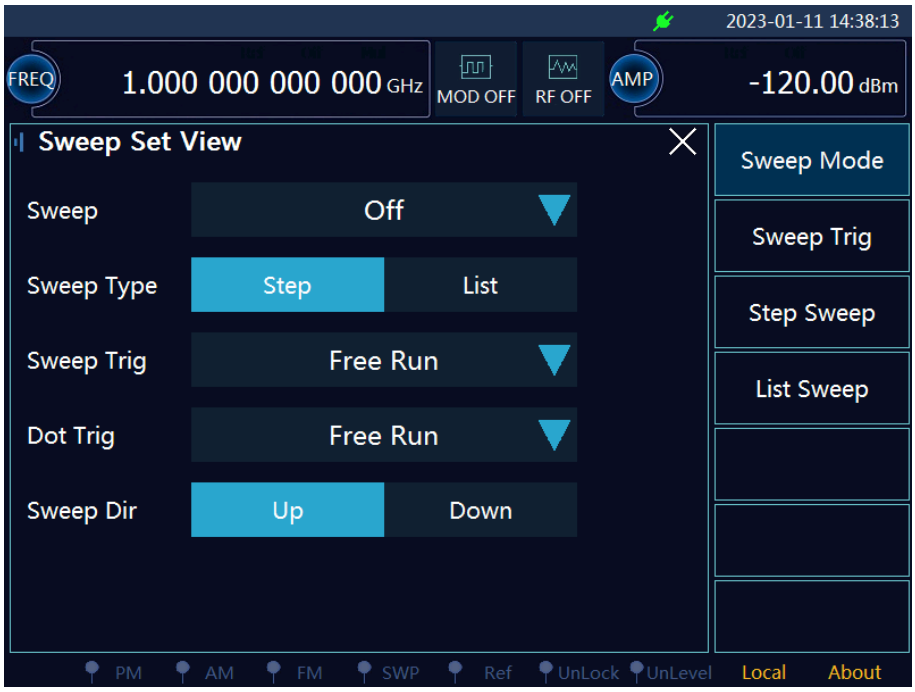


Fig.5.10 Sweep Mode

5.4.1.1 Sweep

Function description:

Click [Sweep] to pop up the drop-down list to select "OFF", "Frequency", "Amplitude", and "Freq& Amp". Among them, "OFF": stop sweeping; "Frequency": set the sweep object as frequency; "Amplitude": set the sweep object as amplitude; "Freq& Amp": set the sweep object as frequency amplitude.

Effective range:

OFF | Frequency | Amplitude | Freq& Amp

Default value:

Off

5.4.1.2 Sweep Type Step/List

Function description:

Click [SweepType Step List] to switch the sweep type state. The illuminated part of the menu option value indicates that its state is selected. Set the sweep type to Step or List.

Effective range:

Step| List

Default value:

Step

5.4.1.3 Sweep Trig

Function description:

Click [Sweep Trig] to pop up a drop-down list to select "Free Run" or "Trigger Key". Among them, "Free Run": when the [Swp Repeat] key is pressed (Single) or (Cont), the instrument automatically triggers sweep; "Trigger Key": when the [Swp Repeat] key is pressed (Single) or (Cont), the instrument will start frequency sweep after receiving the manual trigger signal.

Effective range:

Free Run | Trigger Key

Default value:

Free Run

5.4.1.4 Dot Trig

Function description:

Click [Dot Trig] to pop up a drop-down list to select "Free Run" or "Trigger Key". Among them, "Free Run": the signal generator automatically sweeps to the next frequency point. The time interval between two points is equal to the dwell time plus the phase lock time; "Trigger Key": the signal generator jumps to the next frequency point when it receives a manual trigger signal from the user.

Effective range:

Free Run | Trigger Key

Default value:

Free Run

5.4.1.5 Sweep Dir Up/Down

Function description:

Click [Swep Dir Up Down] to switch the sweep direction state. The illuminated part of the menu option value indicates that its state is selected.

Effective range:

Up | Down

Default value:

Up

5.4.2 Sweep Trig

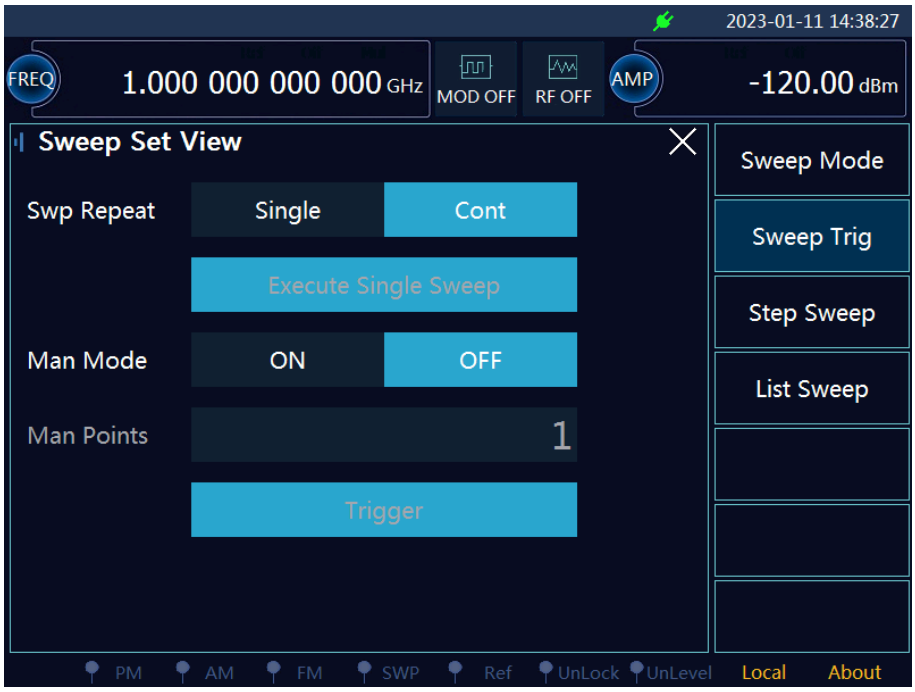


Fig.5.11 Sweep Trig

5.4.2.1 Swp Repeat Single/Cont

Function description:

Click [Swp Repeat Single Cont] to switch the sweep repeat state. The illuminated part of the menu option value indicates that its state is selected.

Effective range:

Single | Cont

Default value:

Cont

5.4.2.2 Execute Single Sweep

Function description:

When [Swp Repeat] is set to Single, the [Execute Single Sweep] button is enabled. Click [Execute Single Sweep] to start a single sweep. Selecting the single sweep mode will stop the sweep in progress.

Effective range:

None

Default value:

None

5.4.2.3 Man Mode ON/OFF

Function description:

Click [Man Mode ON OFF] to switch the manual mode ON/OFF. The illuminated part of the menu option value indicates that its state is selected. Set the signal generator manual mode ON/OFF state.

Effective range:

ON|OFF

Default value:

OFF

5.4.2.4 Man Points

Function description:

When [Man Mode] is set to ON, [Man Points] is enabled to set the number of manual points.

Effective range:

1 ~ 1601

Default value:

1

5.4.2.5 Trigger

Function description:

Click to send a point trigger signal. If the point trigger mode is set to manual and the manual mode is off and the sweep switch is on, the point trigger sweep will start.

Effective range:

None

Default value:

None

5.4.3 Step Sweep

Fig.5.12 Step Sweep

5.4.3.1 Freq Start

Function description:

Activate Set Start Frequency state and allow setting Start Frequency. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

1433D: 1MHz~20GHz; 1433E: 1MHz~26.5GHz; 1433F: 1MHz~40GHz; 1433H: 1MHz~50GHz.

Default value:

1MHz

5.4.3.2 Freq Stop

Function description:

Activate Set Stop Frequency state and allow setting Stop Frequency. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

1433D: 1MHz~20GHz; 1433E: 1MHz~26.5GHz; 1433F: 1MHz~40GHz; 1433H: 1MHz~50GHz.

Default value:

Maximum frequency

5.4.3.3 Ampl Start

Function description:

Activate Set Start Amplitude state and allow setting Start Amplitude. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

-135dBm ~ 25dBm

Default value:

-120dBm

5.4.3.4 Ampl Stop

Function description:

Activate Set Stop Amplitude state and allow setting Stop Amplitude. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

-135dBm ~ 25dBm

Default value:

-120dBm

5.4.3.5 Step Dwell

Function description:

Activate Set Step Dwell and allow setting Step Dwell. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel. Set the dwell time of each frequency point in the step swept frequency. The time interval between the two points during the step sweep is equal to the dwell time plus the phase lock time.

Effective range:

10ms ~ 100s

Default value:

10ms

5.4.3.6 Points

Function description:

Activate Set Sweep Points and allow setting of scan points. The parameter values can be set and adjusted by mouse/keyboard or rotary knob, numeric keys and step keys on the front panel.

Effective range:

2 ~ 1601

Default value:

2

5.4.4 List Sweep

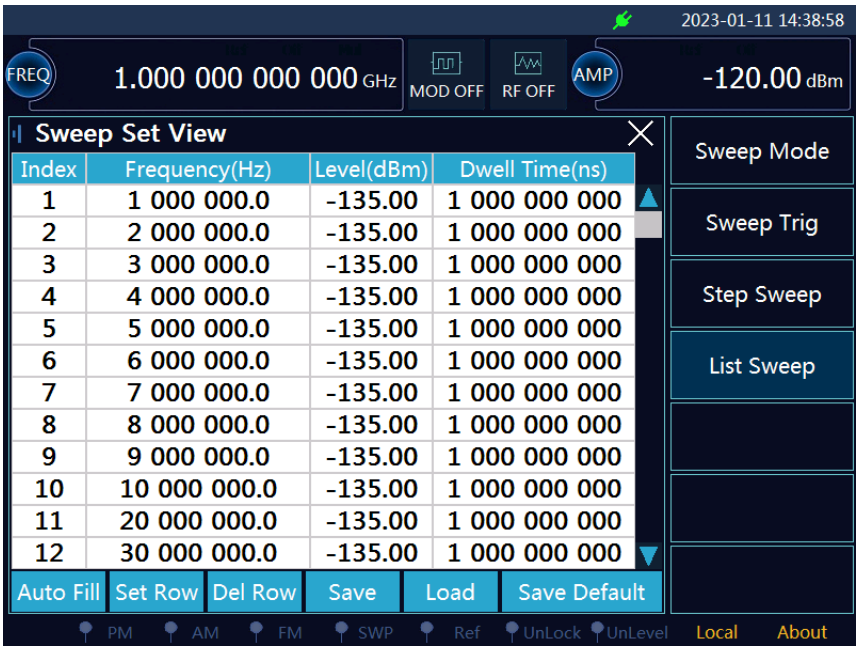


Fig.5.13 List Sweep

5.4.4.1 Auto Fill

Click to pop up the Auto Fill Configuration window which is used to configure the Auto Fill parameters.

The menu structure and menu items are described below:

Fig.5.14 Auto Fill

Function description:

Set the position of the insert row by [Insert Pos]; set the insert row above/below the insertion position by [Insert Dir]; set the number of insert rows by [Insert Points]; set the start frequency of the insert row by [Freq Start]; set the stop frequency of the insert row by [Freq Stop]; set the start power of the insert row by [Ampl Start]; set the stop power of the insert row by [Ampl Stop]; set the start dwell time of the insert row by [Dwell Start]; and set the stop dwell time of the insert row by [Dwell Stop]. After the parameters are set, click [Confirm] to automatically fill the list sweep list, and click [Quit] to cancel the filling.

Effective range:

None

Default value:

None

5.4.4.2 Set Row

Click to pop up the Set Row Configuration window, which is used to configure the Set Row parameters.

The menu structure and menu items are described below:

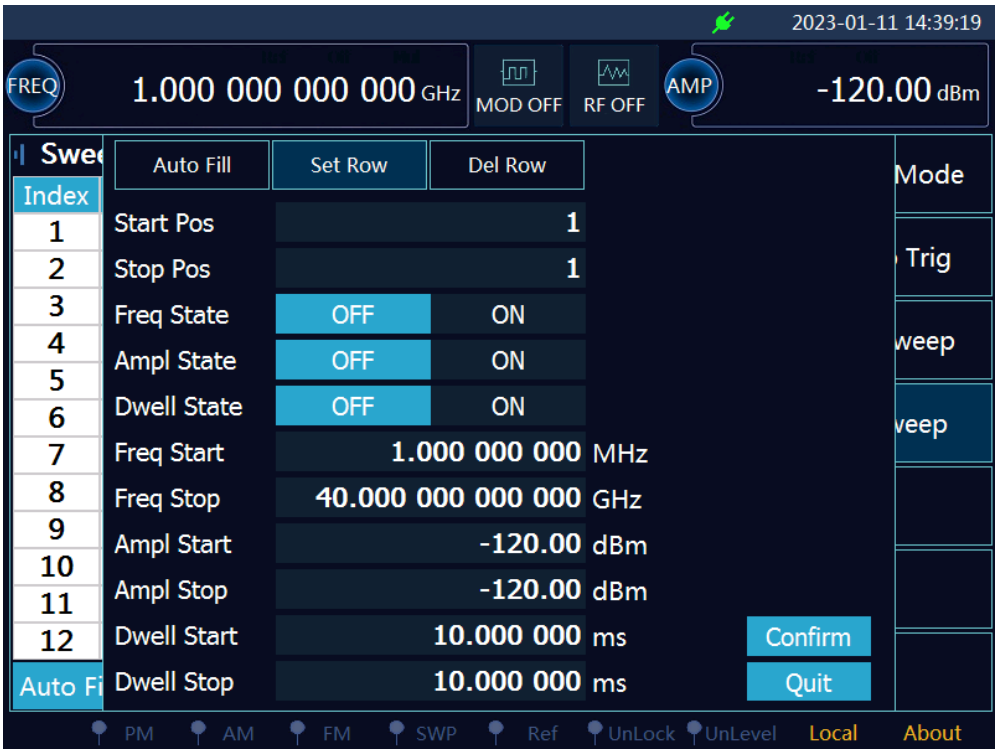


Fig.5.15 Set Row

Function description:

Set the start position of the modify column by [Start Pos]; set the stop position of the modify column by [Stop Pos]; set frequency state on/off by [Freq State]; set power state on/off by [Ampl State]; set the dwell time state on/off by [Dwell State]; set the start frequency of the modify column by [Freq

Start]; set the stop frequency of the modify column by [Freq Stop]; set the start power of the modify column by [Ampl Start]; set the stop power of the modify column by [Ampl Stop]; set the start dwell time of the modify column by [Dwell Start]; and set the stop dwell time of the modify column by [Dwell Stop]. After the parameters are set, click [Confirm] to modify the list sweep list, and click [Quit] to cancel the modification.

Effective range:

None

Default value:

None

5.4.4.3 Del Row

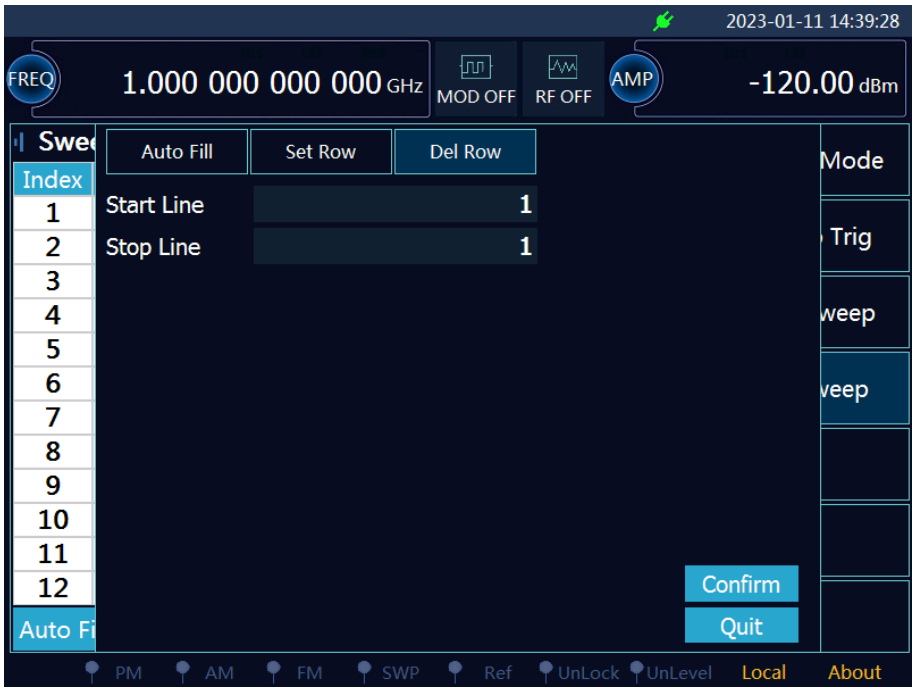


Fig.5.16 Del Row

Function description:

Set the start row of the delete row by [Start Line]; and set the stop row of the delete row by [Stop Line]. After the parameters are set, click [Confirm] to delete the list sweep list, and click [Quit] to cancel the deletion.

Effective range:

None

Default value:

None

5.4.4.4 Save

Function description:
Used to save List Sweep data.
Effective range:
None
Default value:
None

5.4.4.5 Load

Function description:
Click to load List Sweep data.
Effective range:
None
Default value:
None

5.4.4.6 Save Default

Function description:
When the reset type is [User] and [Save Default] is clicked, the next power-on list sweep recalls the data saved this time. When the reset type is [Factory], even if the user saves the default list, the Factory's default list sweep data is still called when resetting.
Effective range:
None
Default value:
None

5.5 System

Press the [SYSTEM] softkey on the front panel display area to enter the System window. The System window includes setting and viewing pages for System Set, Selftest, Journal, Display, File and Help, etc. System information can be modified or queried through the above pages.

The menu structure and menu items are described below:

5.5.1 System Set

Fig.5.17 System Set

5.5.1.1 Reference Int/Ext

Function description:

Click [Reference Int Ext] to switch the reference selection state. The illuminated part of the menu option value indicates that its state is selected. Set the reference selection to internal or external.

Effective range:

Int | Ext

Default value:

Int

5.5.1.2 Ext Ref Freq

Function description:

When the reference is selected as external reference, the external reference frequency input function is activated to set the reference signal of the signal generator.

Effective range:

10MHz ~ 100MHz

Default value:

10MHz

5.5.1.3 Language

Function description:

Click [Language] to pop up a drop-down list to select "Chinese". The selection will take effect immediately, and all the text displayed in the interface will change to the selected language.

Effective range:

Chinese | English

Default value:

Chinese

5.5.1.4 Fan

Function description:

Click [Fan] to pop up a drop-down list to select "AUTO", "OFF" or "ON". When [ON] is checked, the fan will turn on; when [OFF] is checked, the fan will turn off; when [AUTO] is checked, the fan will be automatically turned on or off according to the internal temperature of the instrument.

Effective range:

AUTO | OFF | ON

Default value:

AUTO

5.5.1.5 Net Config

Function description:

Click to pop up the Network Configuration window, where you can view or change network parameters, including IP address, subnet mask, and default gateway.

Effective range:

None

Default value:

None

5.5.2 Selftest

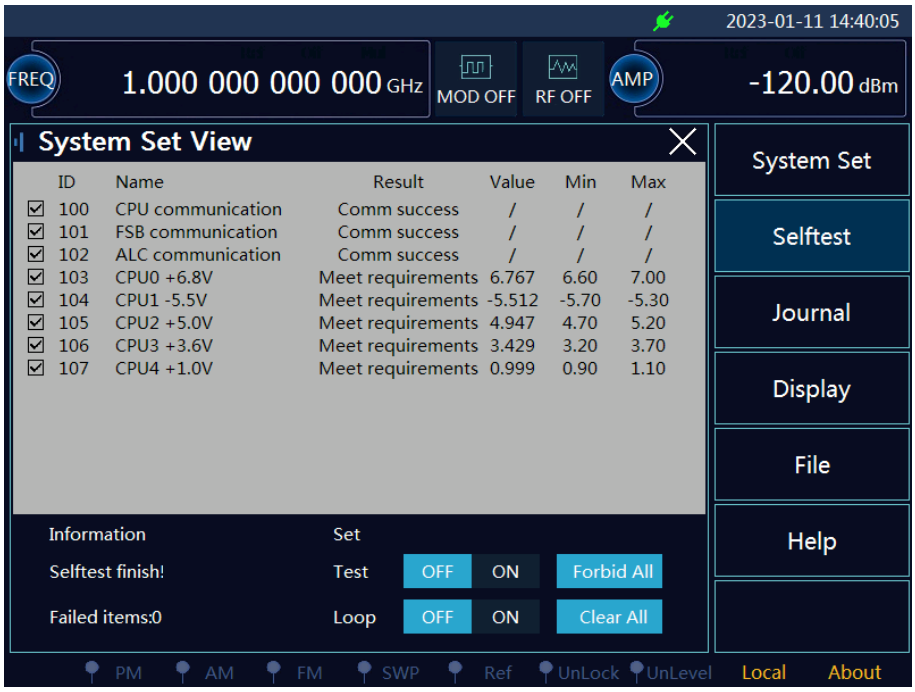


Fig.5.18 Selftest

5.5.2.1 Test OFF/ON

Function description:

Click [Test OFF ON] to switch the test ON/OFF. The illuminated part of the menu option value indicates that its state is selected. Turn on or off self test function.

Effective range:

OFF | ON

Default value:

OFF

5.5.2.2 Loop OFF/ON

Function description:

Click [Loop ON OFF] to switch the loop test ON/OFF. The illuminated part of the menu option value indicates that its state is selected. Turn on or off self-test loop test function.

Effective range:

OFF | ON

Default value:

OFF

5.5.2.3 Forbid/Allow All

Function description:
Change all properties of all test items to Forbid/Allow.
Effective range:
None
Default value:
None

5.5.2.4 Clear All

Function description:
Clear the results of the last test.
Effective range:
None
Default value:
None

5.5.3 Journal

The Journal Display window, which mainly displays information related to alerts, alarms, errors, and other messages in the instrument.

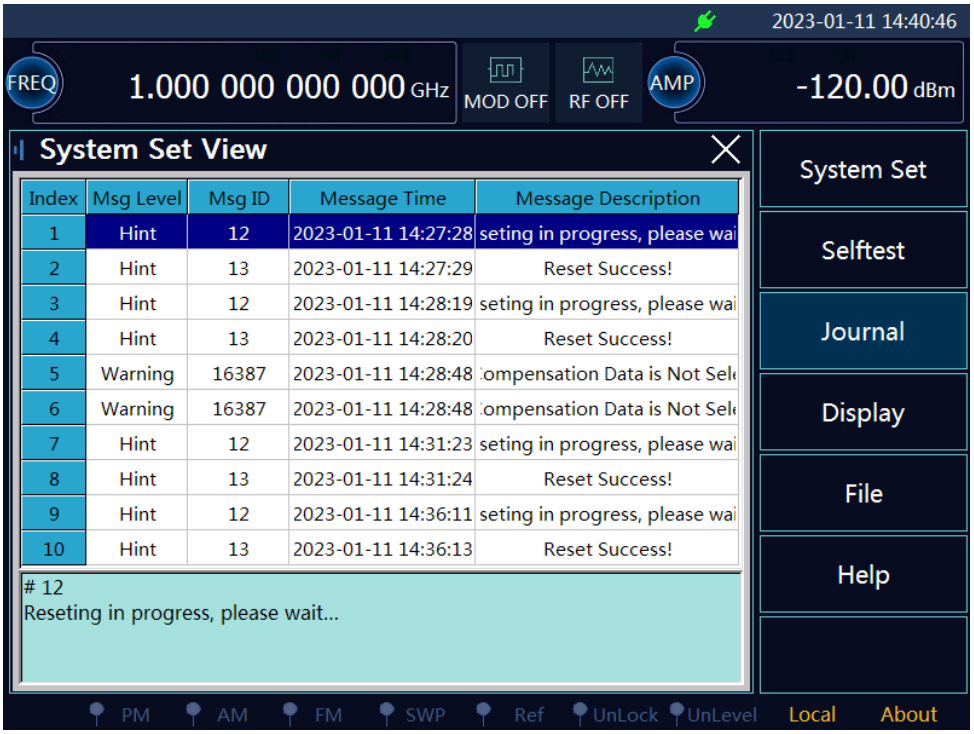


Fig.5.19 Journal

5.5.4 Display

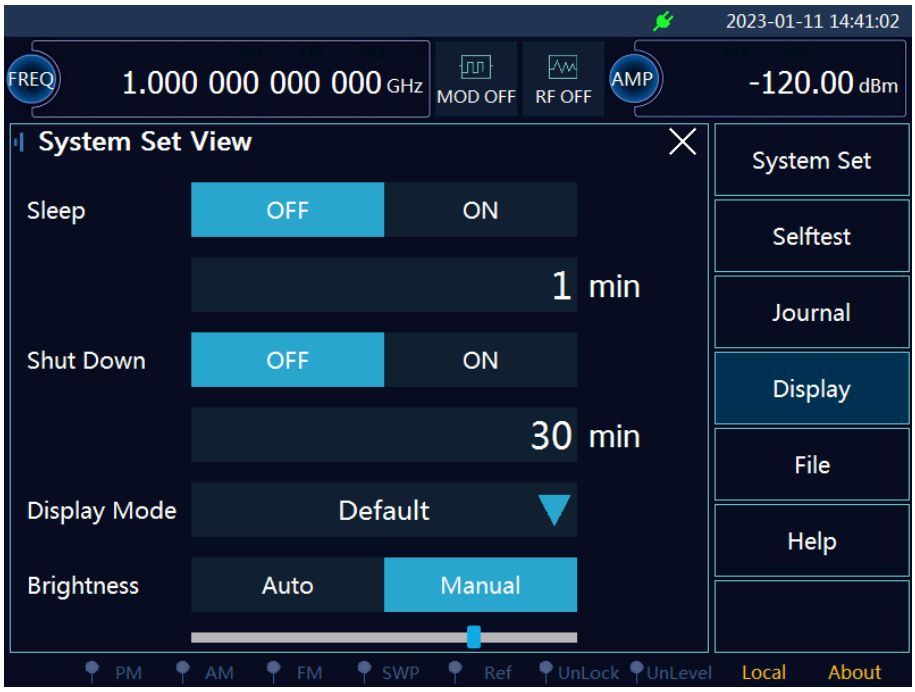


Fig.5.20 Display

5.5.4.1 Sleep OFF/ON

Function description:

Click [Sleep OFF ON] to switch the sleep time ON/OFF. The illuminated part of the menu option value indicates that its state is selected. After the sleep is turned off, the instrument will never enter the sleep state; after the sleep is turned on, if there is no operation within the set time, the instrument will enter sleep state.

Effective range:

OFF | ON

Default value:

OFF

5.5.4.2 Shut Down OFF/ON

Function description:

Click [Shut Down OFF ON] to switch the timed shutdown ON/OFF. The illuminated part of the menu option value indicates that its state is selected. After the timed shutdown is turned off, the instrument will not be shut down regularly; after the timed shutdown is turned on, the instrument will shut down automatically after reaching the set time.

Effective range:

OFF | ON

Default value:

OFF

5.5.4.3 Display Mode

Function description:

Click [Display Mode] to pop up a drop-down list to select "Default" and "Black&White".

Effective range:

Default | Black&White

Default value:

Default

5.5.4.4 Brightness Auto/Manual

Function description:

Click [Brightness Auto Manual] to switch the brightness adjustment state. The illuminated part of the menu option value indicates that its state is selected. When auto is selected, the instrument automatically selects the display brightness according to the ambient brightness; when manual is selected, the brightness can be adjusted manually.

Effective range:

Auto | Manual

Default value:

Manual

5.5.5 File

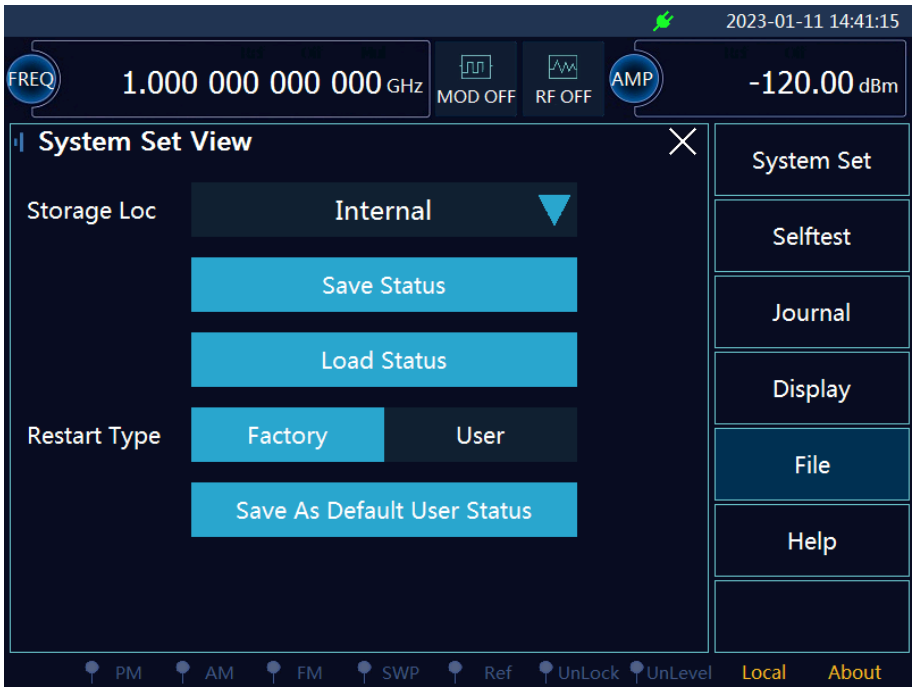


Fig.5.21 Files

5.5.5.1 Storage Loc

Function description:

Click [Storage Loc] to pop up the drop-down list. If no external storage device is connected, there is only "Internal" option in the drop-down list; If an SD card or USB flash disk is inserted, the options of SD card and USB flash disk will be added to the drop-down list.

Effective range:

Internal | SD Card | USB Flash Disk

Default value:

Internal

5.5.5.2 Save Status

Function description:

Click [Save Status] to pop up the File Name Input dialog box. Enter the file name, and then click [OK]. The dialog box disappears, and it prompts "Save Status File Successfully!" in the lower left corner of the instrument interface.

Effective range:

None

Default value:

None

5.5.5.3 Load Status

Function description:

Click [Load Status] to pop up the Instrument State File List dialog box. Select the instrument state file to recall, and then click [OK]. The dialog box disappears, and it prompts "Load Status File Successfully!" in the lower left corner of the instrument interface.

Effective range:

None

Default value:

None

5.5.5.4 Save As Default User Status

Function description:

Press [Save As Default User Status] to store the current settings of the instrument as the default state. If the reset type is set to [User], the initial state of the instrument will be set according to the default state parameters saved by the user when it is next reset. It prompts "Save as Default Successfully!" in the lower left corner of the instrument interface.

Effective range:

None

Default value:

None

5.5.5.5 Restart Type Factory/User

Function description:

If [Factory] is selected, the default state parameters of the factory will be called to set the initial state of the instrument when it is reset; if [User] is selected, the default state parameters saved by the user will be called to set the initial state of the instrument when it is reset.

Effective range:

Factory | User

Default value:

Factory

5.5.6 Help

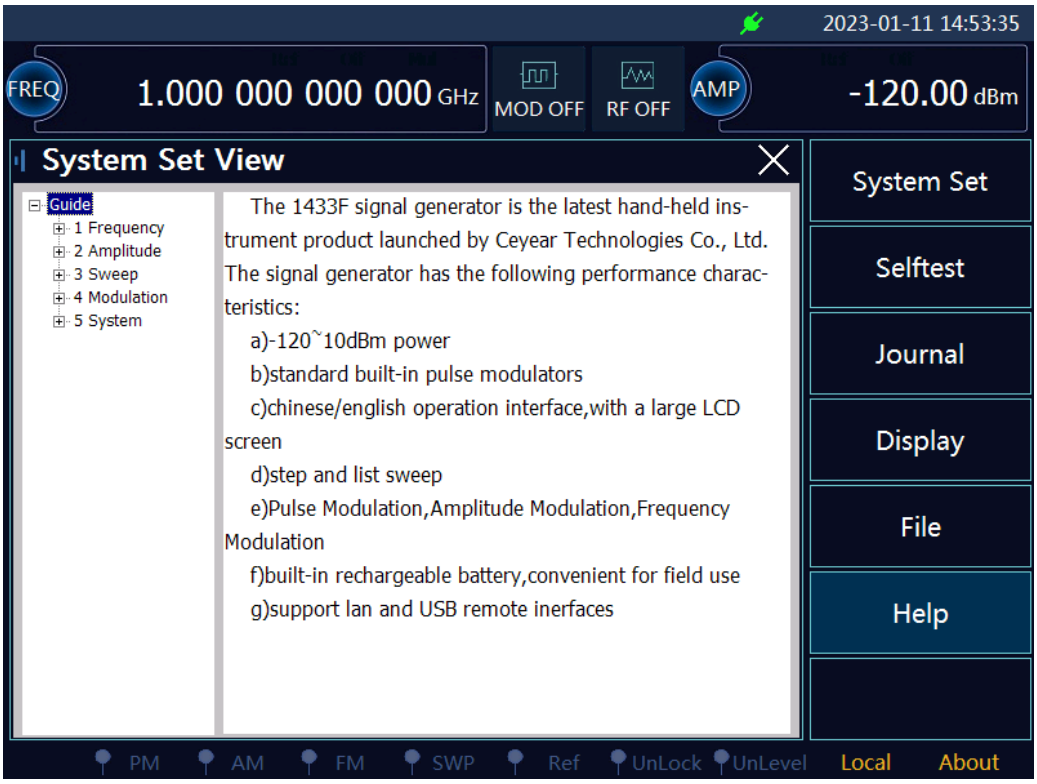


Fig.5.22 Help

In Help window, you can find and view the system help to solve problems quickly. Double click the "Online Help" on the left to pop up the subdirectory.

5.6 USB Power Meter (Option)

Press the [USB POWER METER] softkey on the front panel display area to enter the USB Power Meter window.

The upper left corner of the window shows five buttons [Channel Setting], [Measurement Setting], [Display Setting], [Trigger Setting] and [Calibration], and the corresponding controls can be displayed on the right side of the window after clicking, which can be controlled after connecting the USB power meter.

Fig.5.23 USB power meter numerical mode

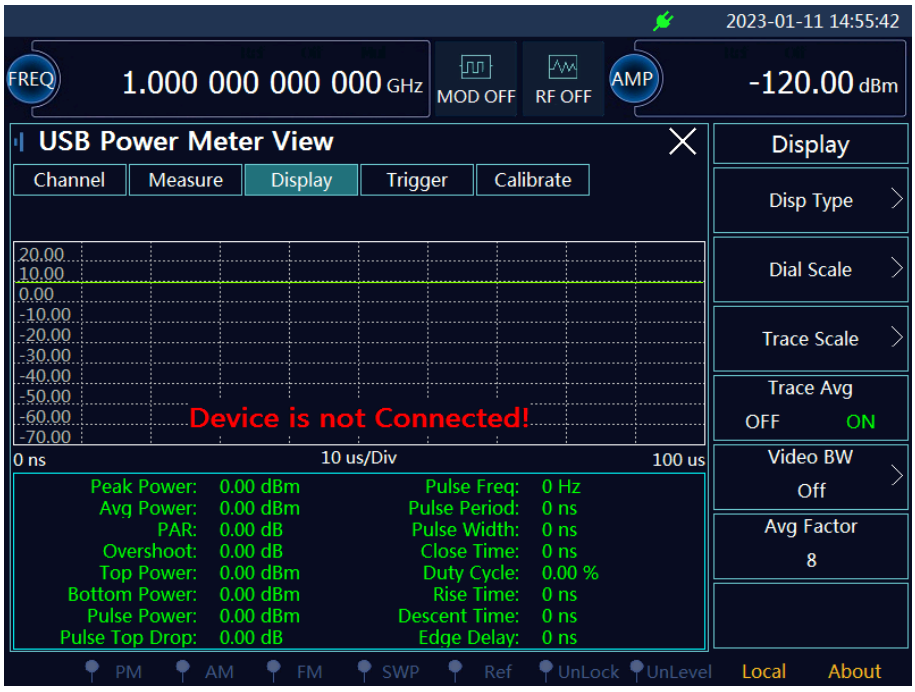


Fig.5.24 USB power meter trace mode

6 Troubleshooting and After-sales Services

This chapter will show you how to find problems and accept after-sales service, and explain error message of the signal generator.

If you encounter any problem when operating the 1433 series signal generator or want to buy relevant components or accessories, we can provide you with complete after-sales services.

Generally, causes of problems include hardware, software or user maloperation. In case of any problem, please contact us in time. If the signal generator is within the warranty period, we will repair it for free as per the provisions specified in the warranty bill. Otherwise, we will charge maintenance costs as per the contract requirement.

6.1 Working Principles

The section introduces the basic working principle and hardware function block diagram of the signal generator, so as to facilitate users' understanding on functions of the 1433 series signal generators and solving problems encountered during operation.

6.1.1 Overall Working Principle and Hardware Function Block Diagram

The 1433 series signal generators contain four models from 1MHz-20GHz/26.5GHz/40GHz/50GHz with high frequency range, phase noise, modulation output and other key indexes, which is very difficult to develop. In the process of development, we have, based on the existing technology, starting from the requirements of product functions and technical & tactical indicators, and in accordance with the principles of generalization and modularization, formulated the hardware program, software program and structure program of this project, to ensure the integrity of product functions and the progressiveness of technology, so that the products have good producibility, maintainability and high reliability, and can be easily operated and used. The main research content of this project plan is to implement the frequency coverage from 1MHz to 20GHz/26.5GHz/40GHz/50GHz in the required volume space, so as to fully realize the functions and technical & tactical indicators required by the instrument in combination with the refinement and decomposition of various functions and technical indicators.

The project is divided into four types of products according to the output frequency range: 1MHz-20GHz, 1MHz-26.5GHz, 1MHz-40GHz and 1MHz-50GHz, and the overall plan is based on VCO low-power high-purity frequency synthesis plus crossover frequency multiplier switching filter, which makes the volume, weight and power consumption of the instrument and other tactical indicators significantly reduced, and makes the miniaturization of the signal generator possible. To facilitate the design and implementation, we conduct a detailed index analysis according to the technical and tactical index requirements of this project. Considering the maintainability, producibility and product

6.1 Working Principles

serialization in the later stage, the instrument is divided into data display and control module, frequency synthesis module, channel processing module, ALC board, frequency doubling module, coupler, detector and program control attenuator. The principle block diagram of the instrument is shown in the figure below.

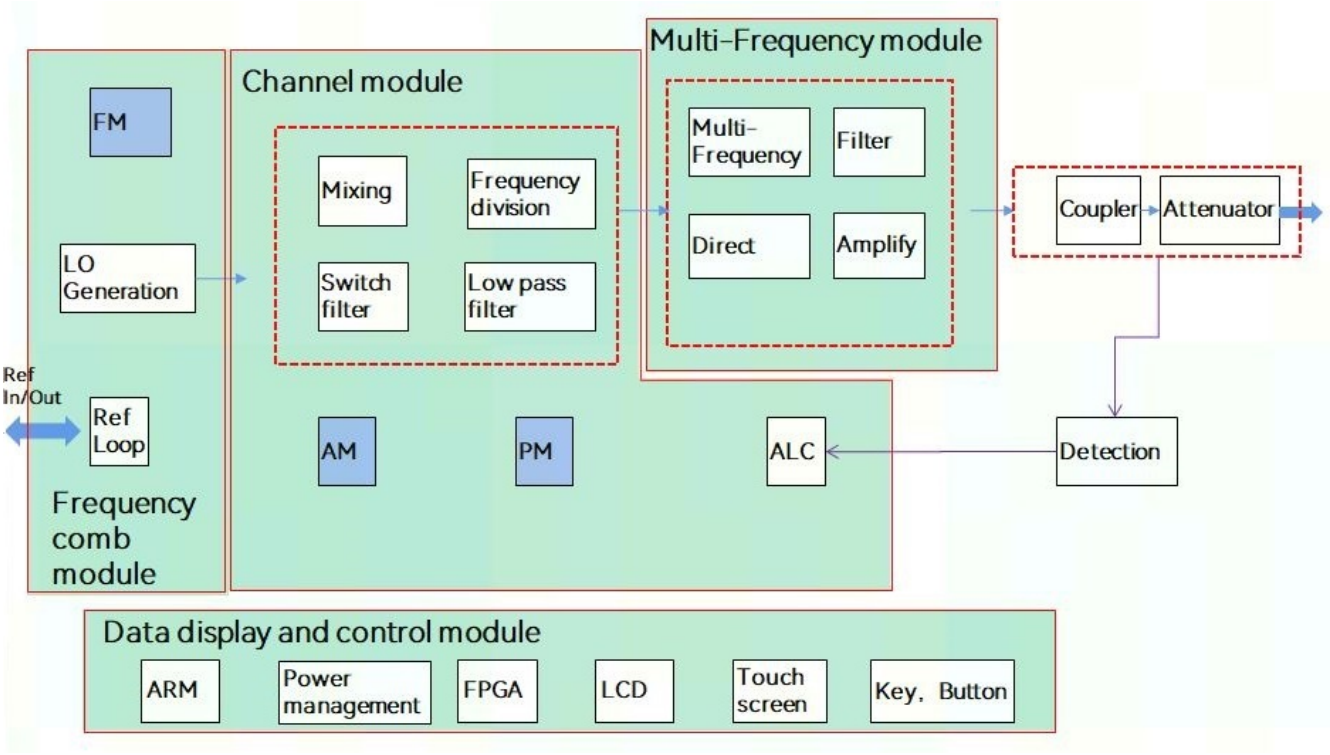


Fig.6.1 Instrument hardware planning block diagram

The frequency synthesis module generates the local oscillator signal and sends it to the channel processing module. The scheme of down mixing, frequency division and switching filtering is adopted to realize the generation of broadband synthetic signal, complete the expansion of the output frequency range, as well as the functional circuits such as power control, amplitude modulation and pulse modulation; The signal generated by the channel module is sent to the frequency doubling module, and the signal generated through switching filtering, frequency doubling, direct connection, amplification, etc. is sent to the coupler of the corresponding frequency band. After detection, the coupling output of the coupler sends the detection voltage to the ALC loop for amplitude control. The coupler is directly terminated with a program control attenuator to expand the output power range of the instrument.

The amplitude modulation and pulse modulation of the instrument are implemented by the corresponding modulation signal generation circuit, modulation circuit and ALC amplitude stabilization loop in the channel processing module and the frequency modulation is implemented in the frequency synthesis.

6.2 Troubleshooting and Debugging

Tips

Troubleshooting and instructions

This section introduces the way on how to judge and handle failures (if any) of the 1433 series signal generators, and feed them back to the manufacturer as accurately as possible if necessary for quick solution.

If there is an error message prompt in the user interface status indication area of the signal generator, please check the menu "system - > Journal" to understand the specific error message description.

The following failures and debugging methods are listed as per function types.

6.2.1 System Problem

If the fan does not turn when the whole machine temperature exceeds the set temperature threshold in the automatic state, please check whether the fan is blocked by objects or there is too much dust. Then, the machine should be turned off to remove obstacles or clean the fan. After that, power it on. If the fan still does not rotate, send it back to the manufacturer for repairing or fan replacement.

6.2.2 Hardware Losing Lock

The "UnLock" highlight appears in the indication area at the bottom of the display screen. In case of failure, please perform the following operations:

Step 1: press the [SYSTEM] softkey;

Step 2: press the [Journal] softkey;

Step 3: please record the specific loss-of-lock indication information and return to the manufacturer.

6.2.3 UnLevel

Notice

Unleveled indication

If the amplitude level setting of the signal generator exceeds the index range, an “UnLevel” indication may appear which is normal, reminding the user of output amplitude uncertainty of the signal generator.

6.2.4 RF Output Amplitude Failure

6.2.4.1 Abnormal RF Output Amplitude

When the RF output power is found to be abnormal, perform the following actions:

Operation steps:

Step 1: check the RF switch indicator on the front panel display. If the [RF ON/OFF] softkey is not highlighted, press the【RF On/Off】hardkey so that the RF output indicator is highlighted.

Step 2: check the amplitude display area on the front panel display screen for any amplitude offset indication. If there is amplitude offset or amplitude reference indication, the amplitude offset or amplitude reference has been set. The amplitude offset can change the value displayed in the amplitude area of the display, but will not affect the output amplitude. The amplitude displayed is the actual output amplitude of the signal generator plus the offset value.

Step 3: cancel the amplitude offset, press [AMPLITUDE] to enter the Power Configuration page, press [Amp Set] to enter the Amplitude Setting page, and click [OFF] on the right side of [Amp Ref]. When [OFF] of the amplitude reference switch is highlighted, the amplitude offset indication in the amplitude display area disappears, and then confirm that [Amp Off] is set to 0dB. At this time, the amplitude reference function and offset function are canceled.

Step 4: If the output amplitude is still abnormal, please return to the manufacturer for repair.

6.2.4.2 No Signal Detected by Spectrum Analyzer

If the signal generator is used together with the spectrum analyzer without the preselector function, the reverse power effect can cause RF output failure of the signal generator. Some spectrum analyzers can have LO feed-through of up to +5dBm at the RF input port at some frequencies. If the frequency difference between the LO feed-through and RF carrier is lower than the ALC bandwidth of the signal generator, the reverse LO amplitude may conduct amplitude modulation on the RF output of the signal generator. The influence of reverse power can be solved by setting the ALC loop state as

Open Loop. If the signal is still not detected by the spectrum analyzer, please return to the manufacturer for repair.

6.2.5 No Modulation at RF Output Port

Check the modulation switch indicator on the front panel display. If the [MODULATION] softkey is not highlighted, press the【Mod On/Off】hardkey to make the modulation output indication display as [MOD] highlighted. Although various modulations can be set and started when the modulation is OFF, the RF carrier can only be modulated when the modulation switch is set to ON. If there is still no modulation at the RF output port, please return to the manufacturer for repair.

6.2.6 Sweep Failure

When the Sweep Indicator is set to ON, the sweep state is indicated by a shaded rectangle in the progress bar. You can observe the progress bar to determine whether the sweep is in progress, and you can also determine whether the sweep is in progress by observing the frequency or power edit area at the top. If sweep is stopped, do as follows:

Operation steps:

Step 1: check whether sweep is started, or sweep is in the continuous mode. If it is in the single mode, check whether the single sweep softkey in the sweep control has been clicked at least once after previous sweep is completed.

Step 2: check whether the signal generator receives proper sweep trigger signal. Set the sweep trigger mode to auto, and check whether the missing sweep trigger signal stops the sweep.

Step 3: whether the dwell time is appropriate, try to set the dwell time to one second to determine whether the dwell time is set too slowly or too fast to see the dwell time.

Step 4: check whether the step sweep or list sweep involves at least 2 points.

Step 5: if the sweep is still abnormal, please return to the manufacturer for repair.

6.2.7 No Response from Front Panel Keys

If the signal generator has no response to the front panel keys, check whether the signal generator is in the remote control mode (A remote control highlight mark will show at the bottom of the display screen in such mode). To exit the remote control mode, press [Remote] softkey to switch the status of the signal generator from remote control to local control.

6.3 Method to Obtain After-sales Services

6.3.1 Contact us

In case of any failure to the 1433 series signal generators, check and save the error message, analyze possible causes, and refer to the methods provided in "6.2 Troubleshooting and debugging" for preliminary troubleshooting. If the problem cannot be solved, contact the service and consultation center of the Company as per the contact information provided below and provides us with the error message collected. We will coordinate with you to solve the problem as soon as possible.

Contact information:

Service Consultation:	0532--86889847 400--1684191
Technical Support:	0532--86880796
Quality Supervision:	0532--86886614
Fax:	0532--86889056
Website:	www.ceyear.com
E-mail:	sales@ceyear.com
Address:	No. 98, Xiangjiang Road, Huangdao District, Qingdao, Shandong Province
Zip Code:	266555

6.3.2 Package and Mailing

In case of any failure to the signal generator that is difficult to be eliminated, contact us by phone or fax. If it is confirmed that the signal generator 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 signal generator and put it into the package along with it.
2) Pack it with the original packing materials, so as to minimize possible damage.
3) Place cushions at the four corners of the outer packing carton, and place the instrument in the outer packing carton.
4) Seal the opening of the packing carton with adhesive tape and reinforce the packing carton with nylon tape.
5) 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.

Notice

Precautions on packing the signal generator

Using other materials to pack the signal generator may damage the instrument. Never use polystyrene beads as packing materials because on the one hand, they cannot provide sufficient protection on the instrument, and on the other hand, they can be sucked in to the instrument fan by the static electricity generated, resulting in instrument damage.

Tips

Instrument package and transportation

Please follow carefully the precautions described in “3.1.1.1 Unpacking” when transporting or handling the instrument.

7 Technical Indicators and Testing Methods

The section introduces the technical indicators and testing methods of the 1433 series signal generators.

7.1 Statement

The test conditions for all indicators are under the temperature of 25℃ ± 10℃ (half hours after startup), unless otherwise specified. 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 specification (spec): place the calibrated instrument in the working environment of -10℃ - 50℃ for at least 2h, and then warm it up for 45 min., so as to ensure its performance (including the measurement uncertainty), unless otherwise specified. 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℃).

Nominal value (nom): It indicates such performances as the expected average performance, designed performance features or those that cannot be tested by limited test means, for example, the 50 Ω connector. Products marked with nominal values are not included in the warranty, and such values are taken at the room temperature (about 25℃).

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. Such data is not a guarantee, which is also taken at the room temperature (about 25℃).

7.2 Product Features

Table 7.1 Product features

General characteristics	
Overall dimensions (W × H × D)	(314±1.2)mm× (217±1.2)mm× (91±0.8)mm (Excluding side strap, rear support, etc.)
Weight	≤5.5Kg (with battery)

Power supply	Power Adapter	Input: 100-240V, 50/60Hz AC
		Output: $15V_{DC}$, 4A
	Lithium-ion batteries	10.8V, ≥8800mAh
Power consumption	≤45W (excluding battery charging)	
Temperature range	Working temperature:	-10℃ ~ +50℃ (battery charging temperature is 0℃ ~ +45℃)
	Storage temperature	-40℃ ~ +70℃ (battery storage temperature: -20℃ ~ +60℃)
Operating humidity (rated value)	When the temperature is lower than 10 ℃, the humidity is not controlled; When temperature range is 10℃ ~ 30℃, the relative humidity is (5 ~ 95)%. When temperature range is 30℃ ~ 40℃, the relative humidity is (5 ~ 75)%. When the temperature is above 40 ℃, the relative humidity is (5 ~ 45)%.	
Elevation	0 ~ 4600 m	

7.3 Technical Indicators

The 1433 series signal generators are stored at ambient temperature for 2h and preheated for more than 30min when the ambient temperature is 25℃±10℃ with power on. Because some indicators are limited by the frequency range, only the maximum frequency of some models is tested.

Table 7.2 Technical indicators

Frequency characteristics			
Frequency range	1433D: 1MHz ~ 20GHz 1433E: 1MHz ~ 26.5GHz 1433F: 1MHz ~ 40GHz 1433H: 1MHz ~ 50GHz	Frequency	N (Number of times of harmonic wave of the fundamental wave)
		1MHz≤f < 2.35GHz	1/2
		2.35GHz≤f < 2.5GHz	1/8
		2.5GHz≤f < 5GHz	1/4
		5GHz≤f≤10GHz	1/2

7.3 Technical Indicators

		10GHz < f≤20GHz	1
		20GHz < f≤40GHz	2
		40GHz < f≤50GHz	4
Frequency resolution	0.1Hz		
Internal time base	Aging rate	±0.5×10^{-6}/year	
	Temperature stability	±0.3×10^{-6} (-10℃ to 50℃, relative to 25℃±5℃)	
Initial frequency accuracy	±0.5×10^{-6}		
Reference input	Frequency	10MHz ~ 100MHz, stepping of 1MHz	
	Power	-5dBm ~ +10dBm, impedance 50Ω	
Reference output	Frequency	10MHz	
	Power	> 0dBm, up to a load of 50Ω	
Sweep feature			
Sweep feature	Sweep mode	Step,List	
	Sweep Points	2 ~ 1601	
	Dwell time	10ms ~ 100s	
	Trigger mode	Auto/manual	

Power characteristics		
Fixed amplitude output power range (25 ℃ ±10 ℃ , continuous wave mode)	1MHz≤f < 2.5GHz	-120dBm ~ +5dBm
	2.5GHz≤f≤10GHz	-120dBm ~ +10dBm
	10GHz < f≤20GHz	-120dBm ~ +5dBm
	20GHz < f≤40GHz	-120dBm ~ +5dBm
	40GHz < f≤50GHz	-120dBm ~ 0dBm
Power accuracy	-10dBm < P≤ max. fixed amplitude output power	±1.0dB

(25℃±10℃)	-60dBm < P≤-10dBm	±1.5dB
	-90dBm < P≤-60dBm	±1.8dB
Output impedance	50Ω (rated value)	
Source standing-wave ratio VSWR	1MHz≤f≤20GHz	< 1.80
	20GHz < f≤40GHz	< 2.00
	40GHz < f≤50GHz	< 2.50
Max. reverse power	+27dBm (0V DC) (rated value)	
Spectrum purity (its indicator is the point frequency non-modulation type)		
Harmonic wave (Max. fixed amplitude output power)	1MHz≤f≤1.5GHz	≤ -40 dBc
	1.5GHz < f≤2.5GHz	≤ -30 dBc
	2.5GHz < f≤19GHz	≤ -40 dBc
	19GHz < f≤25GHz	≤ -30 dBc
	25GHz < f≤50GHz	≤-35dBc (typical value)
Anharmonic wave (0dBm, 10kHz frequency offset or more)	1MHz≤f < 2.5GHz	≤ -54 dBc
	2.5GHz≤f < 5GHz	≤ -60 dBc
	5GHz≤f≤10GHz	≤ -56 dBc
	10GHz < f≤20GHz	≤ -50 dBc
	20GHz < f≤38GHz	≤ -44 dBc
	38GHz < f≤50GHz	≤ -40 dBc
Single sideband phase noise (max. fixed amplitude output power position)	1MHz≤f < 2.35GHz	≤-82dBc/Hz@100Hz
		≤-98dBc/Hz@1kHz
		≤-108dBc/Hz@10kHz
		≤-106dBc/Hz@100kHz
	2.35GHz≤f < 2.5GHz	≤-94dBc/Hz@100Hz
		≤-110dBc/Hz@1kHz
		≤-120dBc/Hz@10kHz

7.3 Technical Indicators

		≤-118dBc/Hz@100kHz
	2.5GHz≤f < 5GHz	≤-88dBc/Hz@100Hz
		≤-104dBc/Hz@1kHz
		≤-114dBc/Hz@10kHz
		≤-112dBc/Hz@100kHz
	5GHz≤f≤10GHz	≤-82dBc/Hz@100Hz
		≤-98dBc/Hz@1kHz
		≤-108dBc/Hz@10kHz
		≤-106dBc/Hz@100kHz
	10GHz < f≤20GHz	≤-76dBc/Hz@100Hz
		≤-92dBc/Hz@1kHz
		≤-102dBc/Hz@10kHz
		≤-100dBc/Hz@100kHz
	20GHz < f≤40GHz	≤-70dBc/Hz@100Hz
		≤-86dBc/Hz@1kHz
		≤-96dBc/Hz@10kHz
		≤-94dBc/Hz@100kHz
	40GHz < f≤50GHz	≤-68dBc/Hz@100Hz
		≤-84dBc/Hz@1kHz
		≤-94dBc/Hz@10kHz
		≤-92dBc/Hz@100kHz
Modulation characteristic		
Pulse modulation (applicable to frequencies greater than 10MHz)	On/off ratio	≥80dB
	Rise/fall time	≤30ns
	Min. pulse width of the internal fixed amplitude	1μs (error: ±50ns)

	Min. pulse width of the non-fixed amplitude	100ns (error: ±20ns)
Amplitude modulation (applicable to frequencies greater than 10MHz)	Modulation mode	Linear amplitude modulation, exponential amplitude modulation
	Modulation rate (3dB bandwidth)	DC ~ 20kHz
	Max. depth	Closed loop in linear mode: ≥ 90%
		Closed loop in exponential mode: ≥ 20dB
	Linear AM accuracy	± (5% × Set depth + 1%) (modulation rate 1kHz)
	Exponential AM accuracy	± (5 % × Set depth + 1dB) (modulation rate 1kHz)
Frequency modulation (applicable to frequencies greater than 10MHz)	Modulation rate (3dB bandwidth)	DC ~ 20kHz
	Max. frequency offset	N × 800KHz (N is the fundamental harmonic number), error ± 10% (modulation rate 1kHz)
	Accuracy	± 3% (1kHz modulation rate, 100kHz frequency offset, 300Hz-3kHz demodulation bandwidth)
Phase modulation (applicable to frequencies greater than 10MHz)	Modulation rate (3dB bandwidth)	DC ~ 20kHz
	Max. phase offset	N x 20.0 rad (N is the fundamental harmonic number), error ±10% (modulation rate 1 kHz)
	Accuracy	± (3%×setting phase deviation+0.01rad) (modulation rate 1kHz, phase deviation N×10.0rad)
Note: The rated value refers to the expected performance, or describes the product performance that is useful for the product but not included in the product warranty.		

7.4 Interface

Table 7.3 Interface

Top interfaces		
RF output port	1433D	N type (negative), impedance 50Ω
	1433E	2.4Mm (positive), impedance 50Ω
	1433F	2.4Mm (positive), impedance 50Ω
	1433H	2.4Mm (positive), impedance 50Ω
USB interface	A-type, 2; B-type Mini USB, 1	
LAN Interface	Standard RJ-45 type	
Memory card slot	Micro SD card interface	
Pulse input	BNC (female)	
Sync input	BNC (female)	
Monitor output	BNC (female)	
Reference input/output	BNC (female)	

7.5 Performance Characteristics Test

7.5.1 Recommended Testing Method

7.5.1.1 Frequency Characteristics

1) Frequency Range

a) Description of test

The frequency span is also called the frequency coverage, namely, the frequency span of the signal generator capable of providing qualified signals, which is described in the upper and lower frequency limit. The test is to check whether the frequency span of the signal generator is qualified.

b) Testing diagram

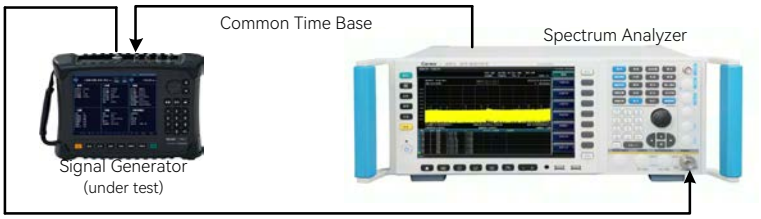


Fig.7.1 Frequency Range test block diagram

c) Test equipment

Spectrum analyzer (recommended model: 4051H) 1 set

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.

Step 2: set the signal generator under test to the point frequency mode, with the power of 0dBm. Then, select external reference.

Step 3: set the output frequency of the signal generator under test to the lower limit frequency of 1MHz, and measure the output frequency of the signal generator under test directly using spectrum analyzer, and record the test results.

Step 4: If the test result is within 1MHz±1Hz, then this frequency point is acceptable, otherwise, it is unacceptable.

Step 5: set the output frequency of the signal generator under test to the upper limit frequency, and measure the output frequency of the signal generator under test directly using spectrum analyzer, and record the test results. If the 1433D test result is within 20GHz±2kHz, 1433E is within 26.5GHz±2.65kHz, 1433E is within 26.5GHz±2.65kHz, 1433F is within 40GHz±4kHz, 1433H is within 50GHz±5kHz, , then this frequency point is acceptable, otherwise, it is unacceptable.

Step 6: Record the test results to the performance test record table.

2) Frequency Resolution

a) Description of test

The frequency resolution is the output frequency interval controlled accurately by the signal

generator.

b) Testing diagram

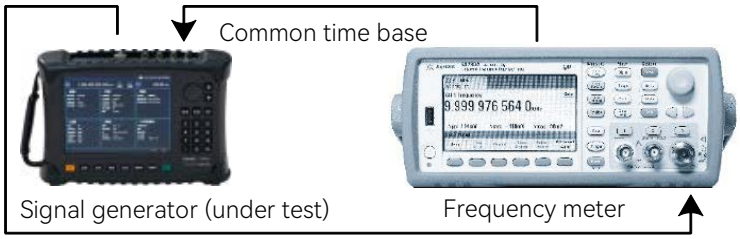


Fig.7.2 Diagram of the frequency resolution test

c) Test equipment

Frequency meter (recommended model: Agilent 53230A) 1 set

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.

Step 2: set the output frequency of the signal generator under test to 1MHz, the output power to 0dBm, and select the external reference; measure the output frequency f_1 of the signal generator under test using the frequency meter.

Step 3: Increase the output frequency of the signal generator under test by 0.1Hz, and measure the output frequency f_2 of the signal generator under test using the frequency meter.

Step 4: Calculate the minimum step of the signal generator $\Delta f = f_2 - f_1$.

Step 5: If $\triangle f$ is within 0.1Hz±0.05Hz, then the test is acceptable, otherwise, it is unacceptable.

Step 6: Record the test results to the performance test record table.

3) Frequency Accuracy

a) Description of test

Frequency accuracy refers to the deviation of the actual output frequency from the set frequency, and is divided into relative accuracy and absolute accuracy. Relative frequency accuracy = (Set frequency of signal generator - Readout frequency of frequency meter) ÷ Set frequency of signal generator, Absolute frequency accuracy = Set frequency of signal generator - Readout frequency of frequency meter. In this specification, the relative frequency accuracy is used for testing. The frequency of the signal generator is set to 10GHz, and the frequency meter is used for testing.

b) Testing diagram

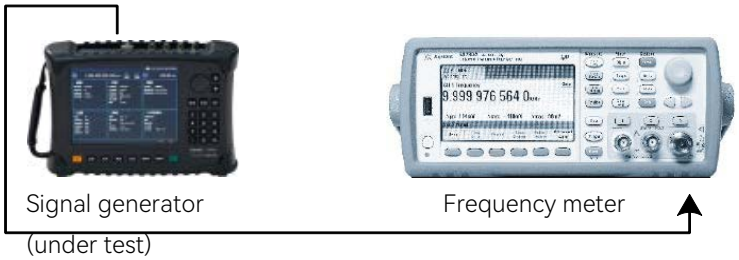


Fig.7.3 Frequency accuracy test

c) Test equipment

Frequency meter (recommended model: Agilent 53150A) 1 set

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.

Step 2: set the output frequency of the signal generator under test to 10 GHz, record as f_0, and the output power to 0 dBm, and measure the output frequency of the signal generator under test using the frequency meter.

Step 3: Read the measured value of the frequency meter f_1, accurate to 1Hz;

Step 4: Calculate the relative frequency accuracy of the signal generator, the relative frequency accuracy = $(f_1-f_0)/f_0$.

Step 5: If the result is better than $\pm 0.5\times10^{-6}$, then the test is acceptable, otherwise, it is unacceptable.

Step 6: Record the result to the performance test record table.

4) Harmonic/Subharmonic Wave Parasitism

a) Description of test

The test is to verify whether the harmonic/subharmonic wave indicator of the signal generator is qualified.

b) Testing diagram

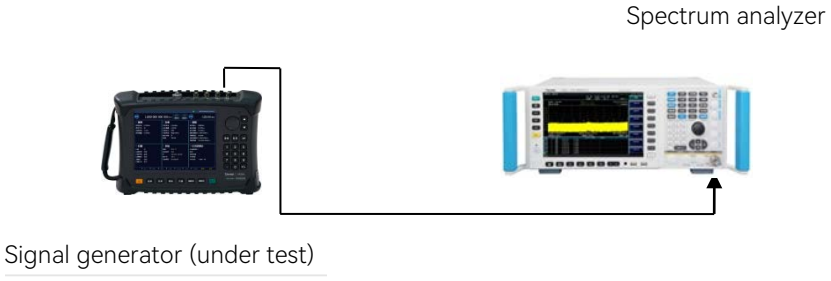


Fig.7.4 Harmonic/Subharmonic test

c) Test equipment

Spectrum analyzer (recommended model: 4051H) 1 set

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.

Step 2: set the signal generator to point frequency mode with an output power of the lesser between +5dBm and the maximum fixed amplitude output power.

Step 3: Adjust the output frequency within the signal generator index to 25GHz (1433D to the highest frequency) with a frequency step of 100MHz. Then, observe and find the worst point of

harmonics with a spectrometer; adjust the output frequency within the signal generator index to 33.3GHz (1433D/E to the highest frequency) with a frequency step of 100MHz. Then, observe and find the worst point of subharmonics with a spectrometer.

Step 4: Record the test results in the performance test record.

5) Anharmonic Wave Parasitism

a) Description of test

The test is to check whether the anharmonic wave indicator of the signal generator is acceptable. A anharmonic wave refers to a parasitic or residual signal generated from frequency synthesis, which is expressed as a fixed signal output or a signal output with a certain frequency deviation. Set the signal generator to a series of output frequency points likely generating non-harmonic wave, and modulate the spectrum analyzer to corresponding parasitic signal, and then conduct measurement and find the poorest point of the anharmonic wave.

b) Testing diagram

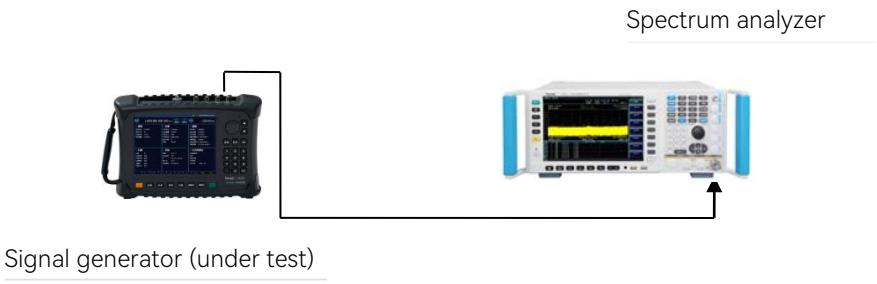


Fig.7.5 Non-harmonictest

c) Test equipment

Spectrum analyzer (recommended model: 4051H) 1 set

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.

Step 2: in the point frequency working mode, set the output frequency of the signal generator to 1GHz, and amplitude level to 0dBm.

Step 3: Set the reference level of the spectrum analyzer to 0dBm, span to 50kHz, resolution bandwidth and video bandwidth to auto, and center frequency to the output frequency of the signal generator.

Step 4: Use the spectrum analyzer to observe the non-harmonic parasitic waveforms that are 10 kHz from the carrier waveform, and if any, measure the amplitude difference between them and the carrier waveform, and record it in the test record. If no non-harmonic parasitic waveforms are found, no recording is required.

Step 5: Gradually widen the span of the spectrum analyzer to 500 kHz, 5 MHz, 50 MHz, 500 MHz and repeat Step 4.

Step 6: Set the output frequency of signal generator to 3GHz, 10GHz, 20GHz, 26.5GHz, 40GHz,

50GHz index to the highest frequency and repeat steps 3 to 5.

Step 7: Record the test results to the performance test record table.

6) Single Sideband Phase Noise

a) Description of test

This test is to check whether the SSB phase noise of the signal generator is qualified by using the phase noise test function of the spectrum analyzer.

b) Testing diagram

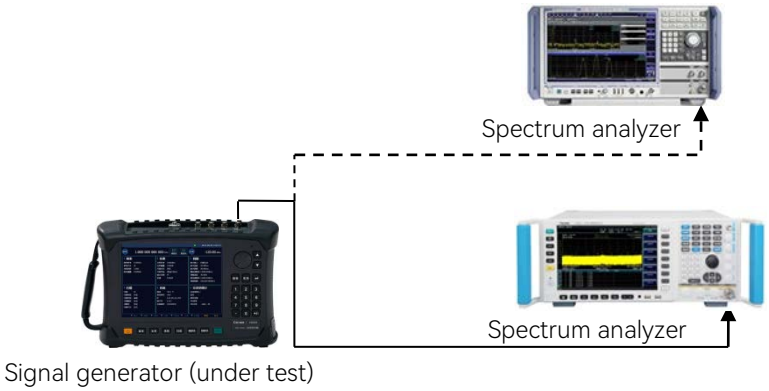


Fig.7.6 SSB phase noise test

c) Test equipment

Spectrum analyzer (recommended model: 4051H) 1 set

Spectrum analyzer (recommended model: FSW13) 1 set

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.

Step 2: set the point frequency of signal generator to 10GHz and output power to the highest power.

Step 3: set the spectrum analyzer as follows:

The center frequency is 1GHz.

Span is 400Hz.

Step 4: measure and record the phase noise at 100Hz frequency offset with the phase noise test function.

Step 5: repeat Steps 3 to 4, and adjust the span of the spectrum analyzer, and measure the phase noise at 1 kHz, 10 kHz and 100 kHz frequency offset.

Step 6: Change the output frequency of the signal generator to 2.4GHz, 3GHz, 10GHz, 20GHz, 26.5GHz, 40GHz, 50GHz index to the highest frequency, and repeat steps 3 to 5.

Step 7: Record the test results to the performance test record table.

Note: When the output frequency of the signal generator is less than 10GHz, use the spectrum analyzer FSW13 to test; and when the output frequency of the signal generator is more than 10GHz,

use the spectrum analyzer 4051H to test.

7.5.1.2 Power Characteristics

1) Fixed Amplitude Output Power (25℃±10℃)

a) Description of test

The test is to check whether the max./min. fixed amplitude output power of the 1433 series signal generator is acceptable.

b) Testing diagram

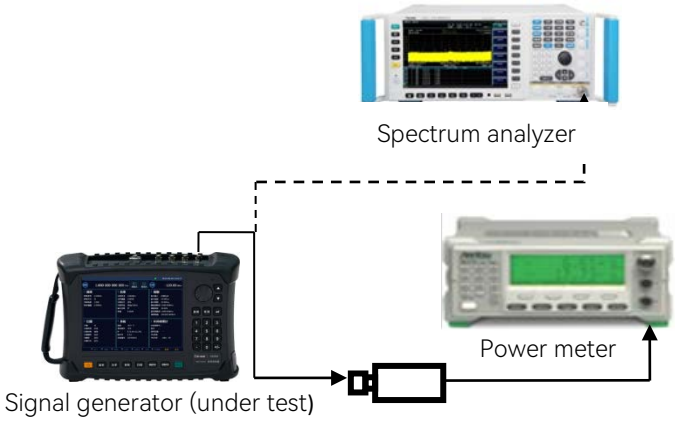


Fig.7.7 Fixed amplitude output power range test

c) Test equipment

Power meter (recommended model: ML2437A, 2438CA)	1 set
Power probe (recommended model: MA2475D, E9304A)	1 PCS
Spectrum analyzer (recommended model: 4051H)	1 set

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.

Step 2: set the point frequency of signal generator to 1MHz and the signal generator output power level to 3dB above the maximum indicator power and switch RF on.

Step 3: When there is no "unfixed amplitude" indication on the signal generator, record the minimum reading measured by the power meter and fill in the test record chart. When the signal generator shows “unfixed amplitude”, set the calibration parameter of the power meter at the current frequency; reduce the output power of the signal generator under test gradually at a stepping of 0.1dB. Record the reading of the power meter soon after the “unfixed amplitude” indication disappears, and fills in it to the test record chart. When there are multiple frequency points with unfixed amplitude hints, record the power meter reading at the smallest point.

Step 4: The signal generator under test gradually increases the output frequency to the highest frequency in 500MHz steps, and repeat steps 2 to 3.

Step 5: Connect the signal generator to the power meter as shown above, set the signal generator output frequency to 1MHz and power to 0dBm, and record the power meter reading P_1.

Step 6: Connect the signal generator to the spectrum analyzer as shown above, set the output power of the signal generator to 0dBm, set this level as the reference level, and use the relative measurement mode of the spectrum analyzer to set the output power value of the signal generator to the minimum fixed amplitude power -10dB.

Step 7: When there is no "unfixed amplitude" indication on the signal generator, use the spectrum analyzer to test the minimum fixed amplitude power relative to the relative difference between 0dBm P2. P1+P2 is the measured value of minimum fixed amplitude output power, and record the measured value to the test record table. When the "unfixed amplitude" indication appears on the signal generator, gradually increase the measured signal generator output power in steps of 0.1dB. When the indication disappears, use the spectrum analyzer to obtain the difference P_2 of its minimum fixed amplitude power relative to that at 0 dBm. P_1+P_2 is the measured value of minimum fixed amplitude output power, and the measured value is recorded to the test record table.

Step 8: If the measured minimum fixed amplitude output power is less than the minimum fixed amplitude function indicator, the minimum fixed amplitude output power is acceptable.

Step 10: Set the output frequency of the signal generator to 2.4GHz, 2.5GHz, 10GHz, 20GHz, 26.5GHz, 40GHz, 50GHz index to the highest frequency, and repeat steps 5~7.

Step 11: Record the test results to the performance test record table.

2) Power Accuracy (25 ℃ ± 10 ℃)

a) Description of test

The test is to check whether the power accuracy of the 1433 series signal generator is acceptable.

b) Testing diagram

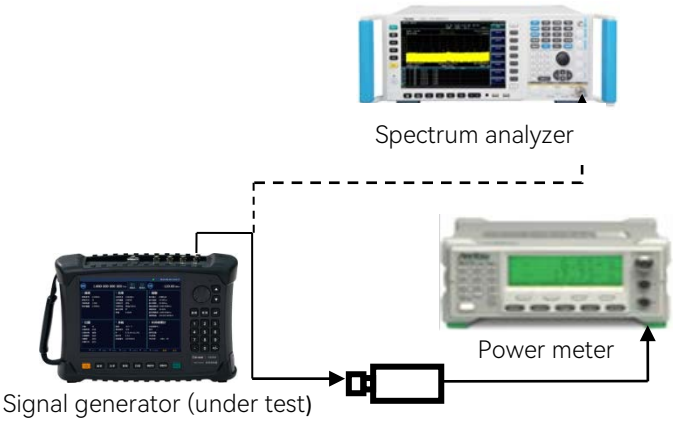


Fig.7.8 Power accuracy test

c) Test equipment

Power meter (recommended model: ML2437A, 2438CA) 1 set

Power probe (recommended model: MA2475D, E9304A) 1 PCS

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.

Step 2: set output frequency of the signal generator to 1GHz and switch RF on.

Step 3: the output power of the signal generator is set to the maximum indicator power, and the output power of the signal generator is gradually reduced in 1dB steps to -10dBm. When the measured power range is less than or equal to -10dBm, the output power of the signal generator is gradually reduced in 10dB steps to -30dBm, while the power meter is used to measure and record the maximum error of the measured power in each power range of the signal generator.

Step 4: set the signal generator output power to 0dBm, and record the power meter reading P_1.

Step 5: Connect the signal generator to the spectrum analyzer as shown above, set the output power of the signal generator to 0dBm, the output power of the signal generator is gradually reduced in 10dB steps to P_2, use the spectrum analyzer to obtain the difference P_3 of its minimum fixed amplitude power relative to that at 0 dBm, power accuracy error is $\triangle P=P_3+P_1-P_2$.

Step 6: set the output frequency of the signal generator to 1GHz, 10GHz, 20GHz, 26.5GHz, 40GHz, 50GHz index to the highest frequency, and repeat steps 3~5.

Step 7: Record the max. error result measured to the performance test record table.

7.5.1.3 Pulse Modulation Characteristics

1) ON/OFF Ratio of Pulse Modulation

a) Description of test

Pulse modulation ON/OFF ratio mainly reflects signal leakage when pulse modulation is off. Turn the pulse modulation on an off, and meaure the difference between the signal power under these two conditions, which is the pulse modulation switch ratio.

b) Testing diagram

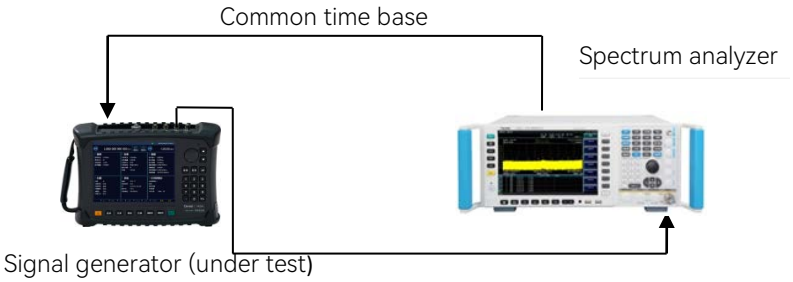


Fig.7.9 Pulse modulation ON/OFF ratio test

c) Test equipment

Spectrum analyzer (recommended model: 4051H) 1 set

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: set the signal generator to point frequency of 500MHz, with power level of 0 dBm.

Step 3: set the spectrum analyzer as follows:

Center frequency	500 MHz
Span	200 kHz
Reference level:	5dBm

Step 4: set the signal generator as follows:

Modulation	pulse modulation
Pulse modulation	ON
Pulse Input:	External
Modulation switch	ON

Step 5: Use the spectrum analyzer to measure and record the signal power P_{on}(dBm) at this moment. This power value is equal to the power value of "Pulse ON", namely, when the pulse modulation input is high.

Step 6: set the modulation mode of the signal generator under test to pulse modulation, and turn on the modulation function, select external pulse input, and ground or suspend the external pulse modulation input, i.e. the state of "Pulse OFF". The spectrum analyzer is used to measure and record the leakage power P_{off}=dBm of the signal at this moment.

Step 7: subtract the power measured during "pulse on" and "pulse off" to obtain the measured value of pulse modulation ON/OFF ratio at the frequency dot under test.

Step 8: Set the signal generator as follows for canceling pulse modulation:

Modulation Pulse modulation Pulse modulation OFF

Step 9: Test the pulse modulation switching ratio of the signal generator at 5GHz, 10GHz, 20GHz, 26.5GHz, 40GHz and 50GHz index to the highest frequency.

Step 10: Record the test results to the performance test record table.

2) Rise/Fall Time for Pulse Modulation

a) Description of test

This Test is to verify whether the pulse modulation rise and fall time of the signal generator is qualified.Use an oscilloscope to test whether the rise and fall time of the pulse signal meets the index requirements.

b) Testing diagram

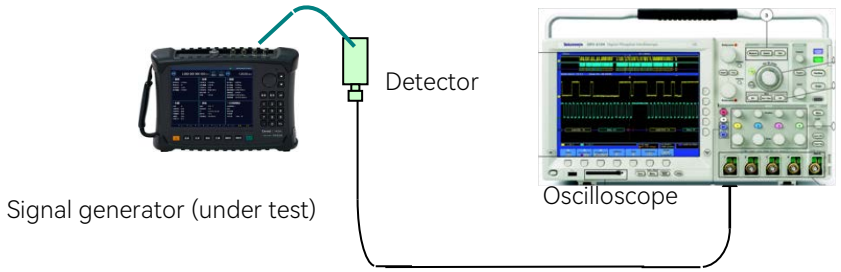


Fig.7.10 Test on rise/fall time for pulse modulation

c) Test equipment

Digital storage oscilloscope (recommended model: MDO4054B) 1 set
SMA coaxial detector 1

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: set the output frequency of the signal generator under test to 2GHz and the output power to 0dBm.

Step 3: set the signal generator under test as follows:

Pulse Input:	Internal Auto
Pulse Width	5μs
Pulse Period	10μs
Pulse Modulation	ON
Modulation on/off	OFF
RF on/off	ON

Step 4: set the digital storage oscilloscope to measure the rise and fall time of pulse modulation as follows:

Channel 1 Turn on DC coupling 10mV/Div inverted phase open probe 1X impedance 50Ω
Trigger trigger source channel 1 Trigger coupling DC Trigger mode auto Edge trigger
Trigger level 10mV Trigger edge rising edge
Time base 1μs/Div

Adjust the appropriate time base size so that the oscilloscope displays at least one cycle of the signal.

Use the rise time and fall time measurement function in the measurement function [MEASURE] of the oscilloscope to automatically measure the pulse rise and fall times. Then, fill the results in the performance test record sheet.

Step 5: follow the steps above. Test the pulse modulation rise and fall times of the signal generator under test at 10GHz, 20GHz, 26.5GHz, 40GHz and 50GHz index to the highest frequency.

Step 6: Record the test results to the performance test record table.

3) Min. Pulse Width

a) Description of test

The test is to check whether the min. pulse width of the signal generator is acceptable. Detect the pulse modulated signal with a detector, and observe whether the minimum fixed amplitude pulse width of the detected pulse signal meets the index requirements with an oscilloscope.

b) Testing diagram

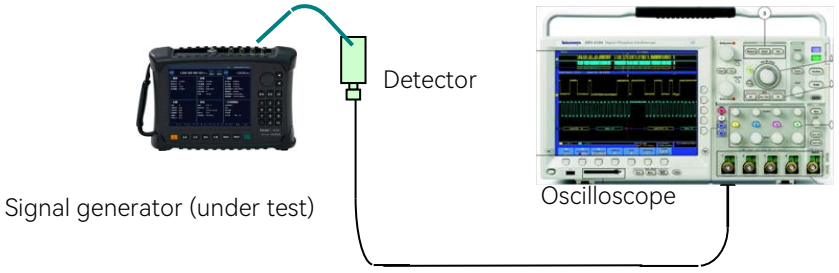


Fig.7.11 Minimum pulse width test block diagram

c) Test equipment

Digital storage oscilloscope (recommended model: MDO4054B) 1 set
SMA coaxial detector 1

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: set the output frequency of the signal generator under test to 2GHz and the output power to 0dBm.

Step 3: set the signal generator under test as follows:

Pulse Input:	Internal Auto
Pulse Width	1μs
Pulse Period	5μs
Pulse modulation	ON
Modulation on/off	OFF
RF on/off	ON
Loop state	Closed

Step 4: set the digital storage oscilloscope to measure the rise and fall time of pulse modulation as follows:

Channel 1 Turn on DC coupling 10mV/Div inverted phase open probe 1X impedance 50Ω
Trigger trigger source channel 1 Trigger coupling DC Trigger mode auto Edge trigger
Trigger level 10mV Trigger edge rising edge
Time base 1μs/Div

Adjust the time base delay so that the oscilloscope displays at least one cycle of the signal.

The period measurement in the measurement function [MEASURE] of the oscilloscope is used. The oscilloscope automatically measures the pulse period.

Step 5: set the signal generator under test as follows:

Pulse Input:	Internal Auto
Pulse Width	100ns
Pulse Period	1μs
Pulse modulation	ON
Modulation on/off	OFF
RF on/off	ON
Loop state	Open

Step 6: Operate according to Step 5 to measure the minimum pulse width in the open-loop state.

Step 7: Test the steady minimum pulse width of the signal generator at 10GHz, 20GHz, 26.5GHz, 40GHz and 50GHz index to the highest frequency, and repeat steps 2~6. If the test result is within 100ns±20ns in the open loop state and 1μs±50ns in the closed loop state, the minimum pulse width meets the requirement.

Step 8: Record the test results to the performance test record table.

7.5.1.4 Amplitude Modulation Characteristics

1) AM Frequency Response

a) Description of test

The test is to check whether the AM frequency response of the signal generator is qualified.

b) Testing diagram

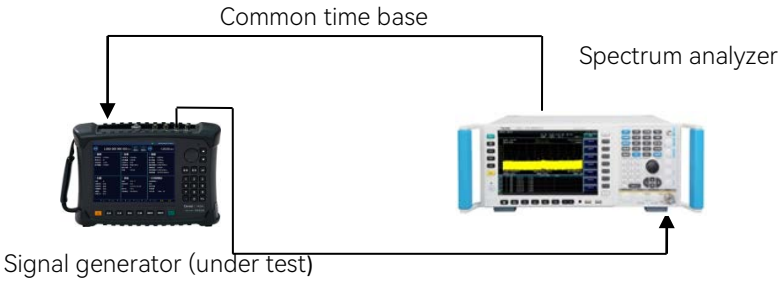


Fig.7.12 AM frequency response test block diagram

c) Test equipment

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: connect the RF output of the signal generator under test to the RF input of the measurement receiver, and connect the 10 MHz time base output of the measurement receiver to the time base input of the signal generator under test.

Step 3: set the signal generator under test as follows:

Frequency	1GHz

Power level	0dBm
Modulation	Amplitude modulation
Amplitude modulation	ON
AM Type	Linear
Lin AM Depth	30%
Modulation on/off	ON
RF on/off	ON

Step 4: set the measurement receiver as follows:

Measurement mode	Receiver
Demodulation type	AM
Carrier frequency	1GHz

Turn on the AM depth measurement function

Step 5: In the range of 500Hz-20kHz, change the modulation rate in 1kHz steps, record the maximum and minimum values of the modulation depth. 20*1og (maximum/minimum) is the in-band modulation flatness of the current frequency.

Step 6: change the frequencies of the signal generator under test and measurement receiver to 10GHz, 20GHz, 26.5GHz, 40GHz, and 50GHz index to the highest frequency, and measure the amplitude flatness.

Step 7: Record the worst AM flatness value in the above test in the performance test record.

2) Linear AM Accuracy

a) Description of test

The test is to check whether the linear AM accuracy of the signal generator is acceptable.

b) Testing diagram

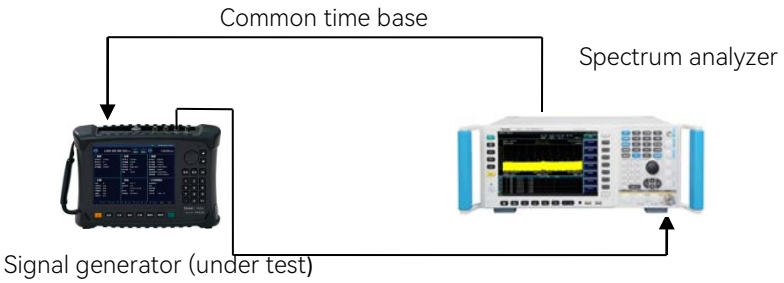


Fig.7.13 Linear AM accuracy test

c) Test equipment

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: connect the RF output of the signal generator under test to the RF input of the measurement receiver, and connect the 10 MHz time base output of the measurement receiver to the

time base input of the signal generator under test.

Step 3: set the signal generator under test as follows:

Frequency	1GHz
Power level	0dBm
Modulation	Amplitude modulation
Amplitude modulation	ON
AM Type	Linear
AM Rate	1kHz
Lin AM Depth	30%
Modulation on/off	ON
RF on/off	ON

Step 4: set the measurement receiver as follows:

Measurement mode	Receiver
Demodulation type	AM
Carrier frequency	1GHz
Turn on the AM depth measurement function	

Step 5: record the difference between the measured value and the set value of AM depth, which reflects the accuracy of amplitude modulation, and fill the results in the performance test record schedule.

Step 6: change the AM depth to 60%, repeat Step 4, and fill the AM accuracy results in the record schedule.

Step 7: change the AM depth to 90%, repeat Step 4, and fill the AM accuracy results in the record schedule.

Step 8: Change the output frequency of the signal generator to 10GHz, 20GHz, 26.5GHz, 40GHz, 50GHz index to the highest frequency, and repeat steps 4~7, and re-measure the modulation error of AM.

Step 9: Record the test results to the performance test record table.

3) Exponential AM Accuracy

a) Description of test

The test is to check whether the exponential AM accuracy of the signal generator is acceptable.

b) Testing diagram

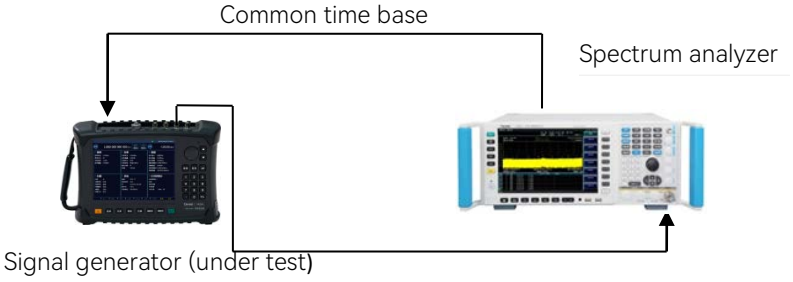


Fig.7.14 Exponential AM accuracy test

c) Test equipment

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: connect the RF output of the signal generator under test to the RF input of the measurement receiver, and connect the 10 MHz time base output of the measurement receiver to the time base input of the signal generator under test.

Step 3: set the signal generator under test as follows:

Frequency	1GHz
Power level	5dBm
Modulation	Amplitude modulation
Amplitude modulation	ON
AM Type	Exp
AM Rate	1kHz
Exp AM Depth	10dB
Modulation on/off	ON
RF on/off	ON

Step 4: set the measurement receiver to spectrum analysis mode

Center frequency	1GHz
Span	0Hz
Sweep time	5ms
BW	100kHz
TRIG	FREE

Step 5: at this time, the receiver displays the amplitude waveform of the final output modulated signal. Set TRIG IF POWER (or single trigger), and the waveform is static; Record the maximum and minimum values displayed by the measurement receiver in a cycle. The difference between the maximum and minimum values is the exponential amplitude modulation depth of the current frequency, and then subtract 10dB from this value to obtain the exponential amplitude modulation accuracy, which should be recorded in the test record schedule.

Step 6: change the amplitude modulation depth of the signal generator to 20dB, re-measure the exponential amplitude modulation depth of the output signal, and then subtract the difference of 20dB from this value to obtain the exponential amplitude modulation accuracy, which should be recorded in the test record schedule.

Step 7: change the frequencies of the signal generator under test and measurement receiver to 10GHz, 20GHz, 26.5GHz, 40GHz, and 50GHz index to the highest frequency, and repeat Steps 3-6. And record the worst exponential amplitude modulation accuracy value

Step 8: Record the test results to the performance test record table.

4) Maximum amplitude modulation depth (closed loop in linear mode)

a) Description of test

The test is to verify that the maximum amplitude modulation depth (closed loop in linear mode) of the generator is qualified.

b) Testing diagram

The test block diagram is the same as "Figure 7.13 Linear AM Accuracy Test Block Diagram".

c) Test equipment

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: connect the equipment according to the diagram and warm up the test instrument according to the required time.

Step 2: connect the RF output of the signal generator under test to the RF input of the measurement receiver, and connect the 10 MHz time base output of the measurement receiver to the time base input of the signal generator under test.

Step 3: set the signal generator under test as follows:

Frequency	1GHz
Power level	0dBm
Modulation	Amplitude modulation
Amplitude modulation	ON
AM Type	Linear
AM Rate	1kHz
Lin AM Depth	30%
Modulation on/off	ON
RF on/off	ON

Step 4: set the measurement receiver to spectrum analysis mode

Measurement mode	Receiver
Demodulation type	AM
Carrier frequency	1GHz

Turn on the AM depth measurement function

Step 5: If there is no "unstable amplitude" indication on the signal generator, record the measured value of the linear maximum AM depth, and fill in the results in the attached table of performance test records; if there is "unstable amplitude" indication on the signal generator, gradually reduce the measured linear AM depth in steps of 0.1%, and when the "unstable amplitude" indication just disappears, the measured depth will be reduced. If "unstable amplitude" appears on the signal generator, gradually reduce the linear amplitude modulation depth of the signal generator under test in steps of 0.1%, and when the "unstable amplitude" indication disappears, record the measured value of the linear maximum amplitude modulation depth, and fill in the results in the attached table of performance test records.

Step 6: change the output frequency of the signal generator to 10GHz, 20GHz, 26.5GHz, 40GHz, 50GHz until the highest frequency, repeat steps 3 to 5, and re-measure the maximum linear AM depth.

Step 7: Record the test results to the performance test record table.

5) Maximum Amplitude Modulation Depth (Exponential Mode Closed Loop)

a) Description of test

This test is to verify that the maximum AM depth (exponential mode closed loop) of the generator is qualified.

b) Testing diagram

The test block diagram is the same as "Figure 7.14 Exponential AM Accuracy Test Block Diagram".

c) Test equipment

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: connect the RF output of the signal generator under test to the RF input of the measurement receiver, and connect the 10 MHz time base output of the measurement receiver to the time base input of the signal generator under test.

Step 3: set the signal generator under test as follows:

Frequency	1GHz
Power level	0dBm
Modulation	Amplitude modulation
Amplitude modulation	ON
AM Type	Exp
AM Rate	1kHz
Exp AM Depth	22dB
Modulation on/off	ON
RF on/off	ON

Step 4: set the measurement receiver to spectrum analysis mode

Center frequency	1GHz
Span	0Hz
Sweep time	5ms
BW	100kHz
TRIG	FREE

Step 5: If there is no "unstable amplitude" indication on the signal generator, proceed to step 6; if there is "unstable amplitude" indication on the signal generator, gradually reduce the depth of the measured signal generator index amplitude modulation in 0.1dB steps, and then proceed to step 6 when the "unstable amplitude" indication just disappears. If the "unstable amplitude" indication appears on the signal generator, gradually reduce the depth of the measured signal generator index amplitude modulation in 0.1dB steps, and when the "unstable amplitude" indication disappears, then carry out step 6.

Step 6: At this time, the receiver displays the final output of the amplitude of the tuned signal waveform, set the "video trigger", the waveform is stationary; record the maximum and minimum values of the measurement of the receiver display a cycle, the difference between the maximum and minimum values is the current frequency of the index of the maximum depth of amplitude modulation.

Step 7: Change the frequencies of the signal generator under test and the measurement receiver to 10GHz, 20GHz, 26.5GHz, 40GHz, 50GHz until the highest frequency, repeat steps 3 to 6, and record the maximum exponential amplitude modulation depth at each frequency point.

Step 8: Record the test results to the performance test record table.

7.5.1.5 Frequency Modulation Characteristics

1) FM Frequency Offset Accuracy

a) Description of test

The test is to check whether the FM frequency offset accuracy of the signal generator is acceptable.

b) Testing diagram

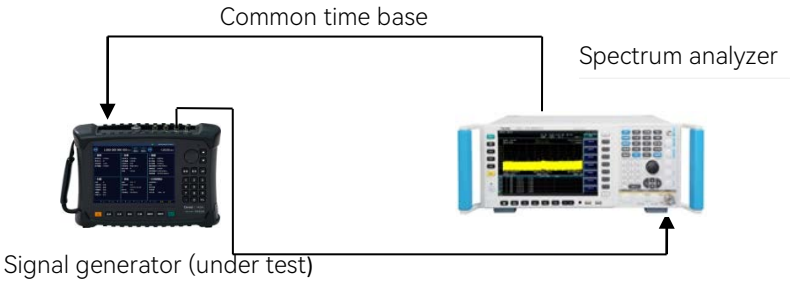


Fig.7.15 FM frequency offset accuracy test

c) Test equipment

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: connect the RF output of the signal generator under test to the RF input of the measurement receiver, and connect the 10 MHz time base output of the measurement receiver to the time base input of the signal generator under test.

Step 3: set the signal generator under test as follows:

Frequency	1GHz
Power level	0dBm
Frequency modulation	ON
FM Rate	1kHz
FM Dev	100kHz
Modulation on/off	ON
RF on/off	ON

Step 4: set the measurement receiver as follows:

Measurement mode	Receiver

Demodulation type	FM
Modulation bandwidth	0.3 ~ 3kHz
Carrier frequency	1GHz

Turn on the FM frequency offset measurement function

Step 5: Record the difference between the measured value and the set value of FM frequency offset, which reflects the accuracy of FM, and fill the results in the performance test record schedule.

Step 6: Change the output frequency of the signal generator to 5GHz, 10GHz, 20GHz, 26.5GHz, 40GHz, 50GHz index to the highest frequency, and re-measure the FM accuracy.

Step 7: Record the test results to the performance test record table.

2) Max. FM Frequency Offset

a) Description of test

This test is to verify whether the maximum FM frequency offset meets the requirements by using the measurement receiver.

b) Testing diagram

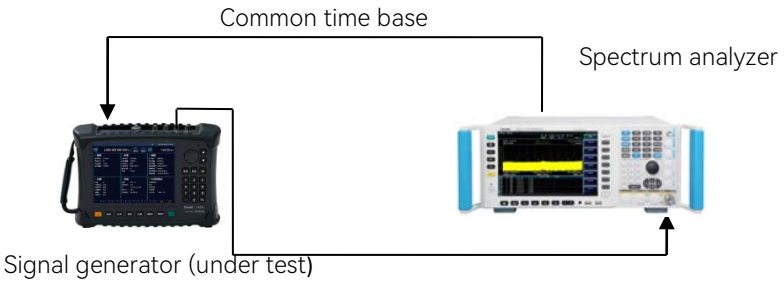


Fig.7.16 Block diagram of maximum FM frequency offset test

c) Test equipment

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: connect the RF output of the signal generator under test to the RF input of the measurement receiver, and connect the 10 MHz time base output of the measurement receiver to the time base input of the signal generator under test.

Step 3: set the signal generator under test as follows:

Frequency	1GHz
Power level	0dBm
Frequency modulation	ON
FM Rate	1kHz
FM Dev	400kHz
Modulation on/off	ON
RF on/off	ON

Step 4: set the measurement receiver as follows:

Measurement mode	Receiver
Demodulation type	FM
Modulation bandwidth	0.3 ~ 3kHz
Carrier frequency	1GHz

IF bandwidth 1MHz (IF bandwidth should be not less than 2 times of FM frequency offset)

Turn on the FM frequency offset measurement function

Step 5: Record the measured value of the maximum FM frequency offset and fill the results in the performance test record schedule.

Step 6: Change the output frequency of the signal generator to 3GHz, 5GHz, 10GHz, 20GHz, 26.5GHz, 40GHz, 50GHz index to the highest frequency, and re-measure.

Step 7: Record the test results to the performance test record table.

3) FM Frequency Response

a) Description of test

This test is to verify the flatness index within the modulation bandwidth in the frequency modulation performance of the signal generator.

b) Testing diagram

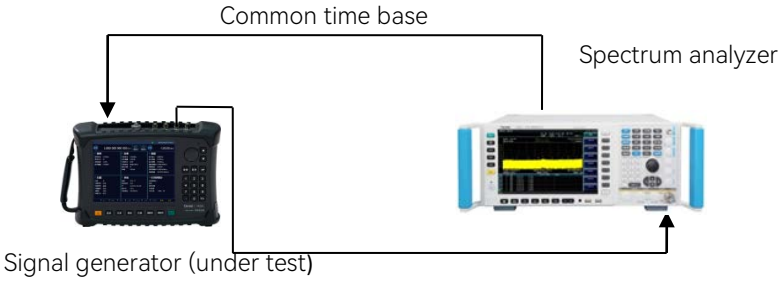


Fig.7.17 FM frequency response test block diagram

c) Test equipment

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: connect the RF output of the signal generator under test to the RF input of the measurement receiver, and connect the 10 MHz time base output of the measurement receiver to the time base input of the signal generator under test.

Step 3: set the signal generator under test as follows:

Frequency	1GHz
Power level	0dBm
Frequency modulation	ON
FM Rate	1kHz

FM Dev	100 kHz
Modulation on/off	ON
RF on/off	ON

Step 4: set the measurement receiver as follows:

Measurement mode	Receiver
Demodulation type	FM
Modulation bandwidth	0.3 ~ 3kHz
Carrier frequency	1GHz

Step 5: In the range of 500Hz-20kHz, change the modulation rate in 1kHz steps, record the maximum and minimum FM frequency offset, 20*1og (maximum/minimum) is the FM frequency response of the current frequency, which should be recorded in the performance test record.

Step 6: Keep the modulation frequency offset unchanged, set the frequencies of signal generator and measurement receiver to 5GHz, 10GHz, 20GHz, 26.5GHz, 40GHz and 50GHz index to the highest frequency, and repeat Step 5.

Step 7: Record the test results to the performance test record table.

7.5.1.6 Phase Modulation Characteristics

1) PM Phase Offset Accuracy

a) Description of test

This test is to verify the phase modulation accuracy of the generator using the measurement receiver.

b) Testing diagram

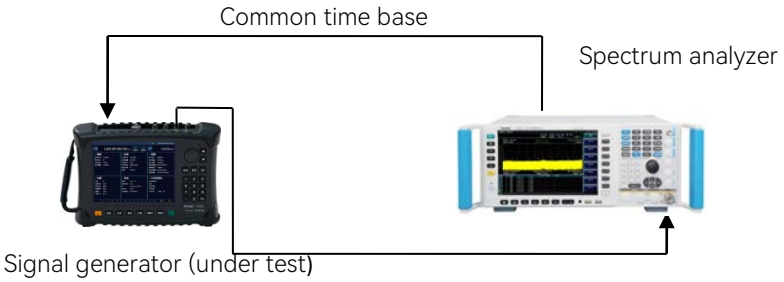


Fig.7.18 PM phase offset accuracy test

c) Test equipment

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: Connect the equipment according to the diagram, and warm up the test instrument according to the required time.

Step 2: Connect the RF output of the signal generator under test to the RF input of the measurement receiver, and the 10MHz time base output of the measurement receiver to the time base

input of the signal generator under test.

Step 3: set the signal generator under test as follows:

Frequency	1GHz
Power level	0dBm
Phase modulation	ON
PM Rate	1kHz
PM Dev	5rad
Modulation on/off	ON
RF on/off	ON

Step 4: set the measurement receiver as follows:

Measurement mode	Receiver
Demodulation type	ϕM
Modulation bandwidth	0.3 ~ 3kHz
Carrier frequency	1GHz

Turn on the PM phase offset measurement function

Step 5: Record the difference between the measured value and the set value of PM phase offset, which reflects the accuracy of PM, and fill the results in the performance test record schedule.

Step 6: Change the output frequency of the signal generator to 5GHz, 10GHz, 20GHz, 26.5GHz, 40GHz, 50GHz index to the highest frequency, and re-measure the PM accuracy.

Step 7: Record the test results to the performance test record table.

2) Max. PM Phase Offset

a) Description of test

This test is to verify whether the maximum PM phase offset meets the requirements by using the measurement receiver.

b) Testing diagram

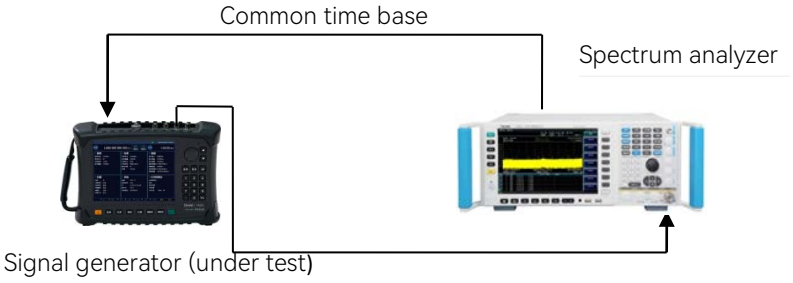


Fig.7.19 Block diagram of maximum PM phase offset test

c) Test equipment

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: connect the RF output of the signal generator under test to the RF input of the measurement receiver, and connect the 10 MHz time base output of the measurement receiver to the time base input of the signal generator under test.

Step 3: set the signal generator under test as follows:

Frequency	1GHz
Power level	0dBm
Phase modulation	ON
PM Rate	1kHz
PM Dev	10rad
Modulation on/off	ON
RF on/off	ON

Step 4: set the measurement receiver as follows:

Measurement mode	Receiver
Demodulation type	ϕM
Modulation bandwidth	0.3 ~ 3kHz
Carrier frequency	1GHz

Turn on the PM phase offset measurement function

Step 5: Record the measured value of the maximum PM phase offset and fill the results in the performance test record schedule.

Step 6: Change the output frequency of the signal generator to 3GHz, 5GHz, 10GHz, 20GHz, 26.5GHz, 40GHz, 50GHz index to the highest frequency, and re-measure.

Step 7: Record the test results to the performance test record table.

3) PM Frequency Response

a) Description of test

This test is to verify the flatness index within the modulation bandwidth in the phase modulation performance of the signal generator.

b) Testing diagram

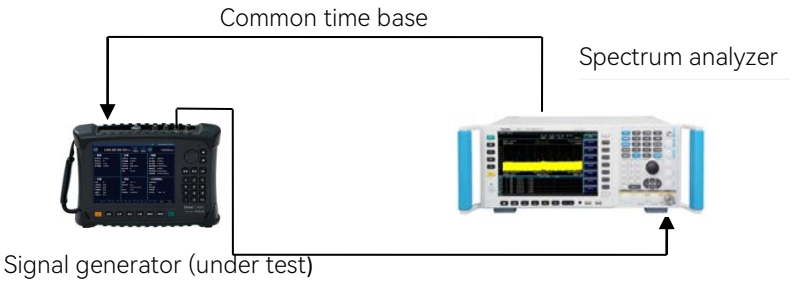


Fig.7.20 PM frequency response test block diagram

c) Test equipment

Measurement receiver (recommended model: 3927H) 1 unit

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: connect the RF output of the signal generator under test to the RF input of the measurement receiver, and connect the 10 MHz time base output of the measurement receiver to the time base input of the signal generator under test.

Step 3: set the signal generator under test as follows:

Frequency	1GHz
Power level	0dBm
Phase modulation	ON
PM Rate	500Hz
PM Dev	5rad
Modulation on/off	ON
RF on/off	ON

Step 4: set the measurement receiver as follows:

Measurement mode	Receiver
Demodulation type	ϕM
Carrier frequency	1GHz

Step 5: In the range of 500Hz-20kHz, change the modulation rate in 1kHz steps, record the maximum and minimum PM phase offset, 20*1og (maximum/minimum) is the PM frequency response of the current frequency, which should be recorded in the performance test record.

Step 6: Keep the modulation frequency offset unchanged, set the frequencies of signal generator and measurement receiver to 5GHz, 10GHz, 20GHz, 26.5GHz, 40GHz and 50GHz index to the highest frequency, and repeat Step 5.

Step 7: Record the test results to the performance test record table.

7.5.1.7 Source VSWR

a) Description of test

The source output port standing wave ratio is the ratio of the max. and min. standing wave voltages at the RF output port due to external load characteristics change, which reflects the offset degree of the output impedance of the signal generator against the standard one. For the signal generator with auto level control function, such ratio is determined mainly by the directivity of the internal directional coupler.

b) Testing diagram

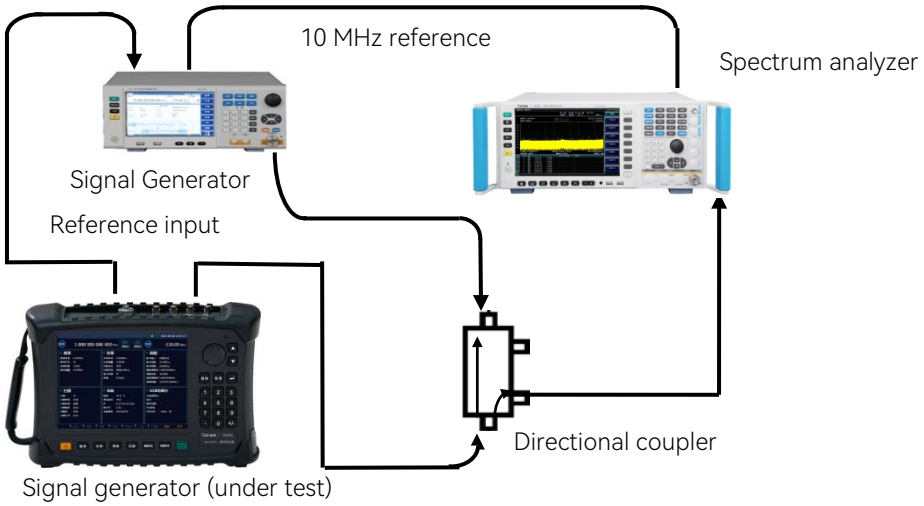


Fig.7.21 Source VSWR test

c) Test equipment

Signal generator (recommended model: 1464/1465)	1
Spectrum analyzer (recommended model: 4051H)	1 set
Directional coupler	1

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: connect the reference output of the signal generator under test to the reference input of the signal generator, and connect the reference output of the signal generator to the reference input of the spectrum analyzer.

Step 3: set the output frequency of the signal generator under test to 1GHz and the output power to 0dBm. Then, switch RF on.

Step 4: set the spectrum analyzer, external reference, center frequency 1GHz, span 0Hz, amplitude 0dBm, resolution with video bandwidth 10 kHz, linear level scale, and sweep time 20ms.

Step 5: set the signal generator, external reference, output frequency of 1GHz-100Hz, and the minimum output power.

Step 6: adjust the reference level of the spectrum analyzer to let the test signal displayed in the middle of the screen, and measure the voltage of the signal V_{ref}.

Step 7: disconnect the connecting cable of the signal generator under test, and set the test port to open loop. Adjust the amplitude of the signal generator till the signal voltage value V_{ref} displayed on the spectrum analyzer is ±0.5%.

Step 8: reconnect the signal generator under test. At this time, the signal voltage of the spectrum analyzer is a sine curve. Measure the crest voltage V_{max} and trough voltage V_{min}, and calculate the standing wave ratio: VSWR = V_{max}/V_{min}. Record the test results to the performance test record table.

Step 9: Modify the output frequency of the signal generator under test to 10GHz, 20GHz, 26.5GHz, 40GHz, 50GHz index to the highest frequency, and repeat Steps 5-8., and record them in the result

table.

Step 10: Record the test results to the performance test record table.

7.5.1.8 Sweep Characteristics

a) Description of test

The 1433 series signal generators offer step and list sweep functions. This test is to verify the sweep function of the 1433 series signal generators.

b) Testing diagram

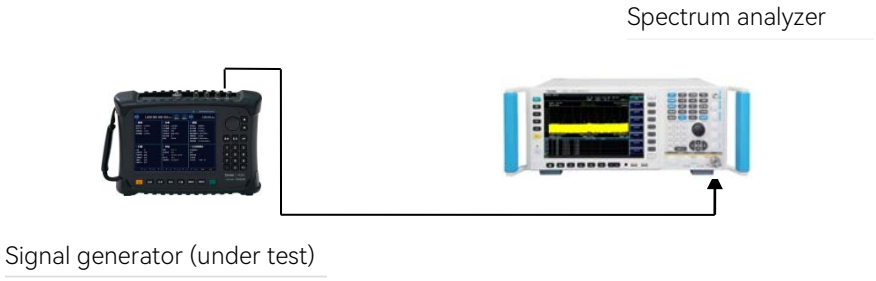


Fig.7.22 Sweep characteristics test

c) Test equipment

Spectrum analyzer (recommended model: 4051H) 1 set

d) Test procedure

Step 1: connect the equipment according to the above figure, and preheat according to the time required by the test instrument.required by the test instrument.

Step 2: set the signal generator to step sweep mode, power 0dBm, start frequency 1MHz, stop the highest frequency, sweep points 101, dwell time 1s, output blanking ON, and trigger mode Auto. Verify the output of the signal generator with spectrum analyzer. If it changes evenly from 1MHz to the highest frequency, then back to 1MHz and then changes evenly to the highest frequency, and so on in this cycle, then this test is acceptable, otherwise it is unacceptable.

Step 3: randomly select more than 2 frequency points within the frequency range of the signal generator under test and input the frequency list. The dwell time of each frequency point is 1s, and the trigger mode is automatic. Set the signal generator to the list sweep mode with a power of 0dBm, and verify the output of the signal generator with a spectrum analyzer. If the output of the signal generator jumps back and forth between each frequency point in the frequency list, this test is acceptable, otherwise it is unacceptable.

Step 4: if the above sweep states are working properly, this test is acceptable, otherwise it is unacceptable.

Step 5: record the test results of each kind of sweep type to the performance test record table.

7.5.1.9 Interface Characteristics

a) Description of test

This test is to verify that the top panel input and output interface characteristics of the signal generator meet the requirements. The input and output interfaces that have been verified in the previous performance index test are not tested here.

b) Testing diagram

Fig.7.23 Communication interface test block diagram

c) Test equipment

Computer (with Internet interface)

Digital storage oscilloscope (recommended model: MDO4054B)	1 set
Function generator (recommended model: Agilent 33250A)	1 set
Spectrum analyzer (recommended model: 4051H)	1 set

d) Test procedure

Step 1: connect the instrument as per the above figure

Step 2: for the type-A interface of USB, the USB mouse can operate normally.

Step 3: for the type-B interface of USB, connect the type-B interface of USB of the device and the USB interface of the computer via USB cable, and send program control instructions on the computer. If the program control state is displayed in the lower right corner of the device, it indicates that the type-B interface of USB is functioning normally.

Step 4: for LAN interface, connect the device LAN interface and computer network interface via commercial RJ45 cable, and send program control instructions on the computer. If the program control state is displayed in the lower right corner of the device, it indicates that the LAN interface is functioning normally.

Step 5: observe whether the memory card slot is complete, free of damage and looseness, and whether the memory card is inserted firmly. After inserting the memory card, if SD card access is displayed in the upper left corner of the device, it indicates that the memory card slot is functioning normally.

Step 6: for the Ref In/Out interface, the external reference signal with the frequency range of 10MHz-100MHz, -5dBm to +10dBm is provided. If the instrument is set to the external reference mode and there is no loss-of-lock prompt, it indicates that the external reference input of the Ref In/Out interface is functioning normally; When the instrument is set to the internal reference mode, use the spectrometer to test the interface, and the output 10MHz signal power is greater than 0dBm, it indicates that the reference output of the Ref In/Out interface is functioning normally.

Step 7: for the Pulse In interface, input the pulse modulation signal at the interface, turn on the pulse modulation function, select the external pulse, output it from the RF output port, and connect it with the oscilloscope via the coaxial detector. If the pulse signal output can be tested, it indicates that the Pulse In interface is functioning normally.

Step 8: for the Sync Out interface, when the pulse modulation function is turned on, and the pulse synchronization signal output can be tested, it indicates that the Sync Out interface is functioning normally.

Step 9: for the Video Out interface, when the pulse modulation function is turned on, and the pulse monitoring signal output can be tested, it indicates that the Video Out interface is functioning normally.

7.5.2 Record chart of performance characteristics test

Table 7.4 Performance characteristics test

Instrument No.:_____ Test Personnel:_____

Test Condition:_____ Test Date:_____

No.	Item	Unit	Standard Requirement		Test result
1	Design and structure	/	Structural style: Handheld		
			Color: the color of the chassis body is black		
			The appearance of the instrument is neat and beautiful, the screen and panel identification are clear, the key operation is flexible, the connectors are convenient and in place, and there is no obvious mechanical damage and stain.		
2	Safety	MΩ	The insulation resistance between the power input end of the equipment and the casing should not be less than 100 M under standard atmospheric conditions for testing.		
			The insulation resistance between the power input end of the equipment and the casing should not be less than 2 M in humid environment.		
		/	Dielectric strength	AC 1500V, 10mA/1min; no breakdown, no flying arc, and no scintillation phenomenon.	
		mA	Leakage current	Voltage 242 V, leakage current ≤3.5 mA, 1min.	
3	Functional normality	/	After power-on, the indicator light of the instrument power switch shall be on, the display shall work normally, the keys shall operate flexibly, and the front panel display shall be free of out-of-lock or unfixed amplitude prompts.		
4	Frequency range	/	Lower frequency limit	1MHz±1Hz	
			Frequency cap (1433D)	20GHz±2kHz	
			Frequency cap (1433E)	26.5GHz±2.65kHz	
			Frequency cap (1433F)	40GHz±4kHz	
			Frequency cap (1433H)	50GHz±5kHz	
5	Frequency resolution	Hz	1MHz	0.1±0.05	
6	Frequency accuracy	Hz	10GHz	±5000	

Table 7.4 (Continued 1) Record of performance characteristics test

No.	Item	Unit	Standard Requirement			Test result
7	Sweep feature	/	Step sweep		1MHz ~ 20GHz(1433D)	
					1MHz ~ 26.5GHz(1433E)	
					1MHz ~ 40GHz(1433F)	
					1MHz ~ 50GHz(1433H)	
			List Sweep		More than 2 frequency points	
8	Fixed amplitude output power range (25℃± 10℃, continuous wave mode)	dBm	Max. fixed amplitude output	1MHz≤f < 2.5GHz	≥+5.0	
				2.5GHz≤f≤10GHz	≥+10.0	
				10GHz < f≤20GHz	≥+5.0	
				20GHz < f≤40GHz（1433E/F/H）	≥+5.0	
				40GHz < f≤50GHz（1433H）	≥0.0	
			Min. fixed amplitude output	1MHz	≤-120.0	
				2.4GHz		
				2.5GHz		
				10GHz		
				20GHz		
				26.5GHz(1433E/F/H)		
				40GHz(1433F/H)		
				50GHz(1433H)		
9	Power accuracy (25 ℃ ± 10 ℃, continuous wave mode)	dB	1MHz		–10dBm < P≤Max. power ±1.0	
			1GHz			
			10GHz			
			20GHz			
			26.5GHz(1433E/F/H)			
			40GHz(1433F/H)			
			50GHz(1433H)			
			1MHz		–60dBm < P≤–10dBm ±1.5	
			1GHz			
			10GHz			
			20GHz			
			26.5GHz(1433E/F/H)			
			40GHz(1433F/H)			
			50GHz(1433H)			

Table 7.4 (Continued 2) Record of performance characteristics test

No.	Item	Unit	Standard Requirement			Test result
9	Power accuracy (25 ℃ ± 10 ℃, continuous wave mode)	dB	1MHz		-90dBm≤ P≤-60dBm ±1.8	
			1GHz			
			10GHz			
			20GHz			
			26.5GHz(1433E/F/H)			
			40GHz(1433F/H)			
			50GHz(1433H)			
10	Harmonic/Subharmonic wave parasitism	dBc	1MHz≤f≤1.5GHz		≤-40	
			1.5GHz < f≤2.5GHz		≤-30	
			2.5GHz < f≤19GHz		≤-40	
			19GHz < f≤25GHz		≤-30	
			25GHz < f≤33.3GHz(1433E/F/H)		≤-35	
11	Anharmonic wave parasitism (0dBm, 10kHz frequency offset or more)	dBc	1GHz		≤-54	
			3GHz		≤-60	
			10GHz		≤-56	
			20GHz		≤-50	
			26.5GHz(1433E/F/H)		≤-44	
			40GHz(1433F/H)		≤-40	
			50GHz(1433H)		≤-40	
12	Single sideband phase noise	dBc/Hz	1GHz	100Hz frequency offset	≤-82	
				1kHz frequency offset	≤-98	
				10kHz frequency offset	≤-108	
				100kHz frequency offset	≤-106	
			2.4GHz	100Hz frequency offset	≤-94	
				1kHz frequency offset	≤-110	
				10kHz frequency offset	≤-120	
				100kHz frequency offset	≤-118	
			3GHz	100Hz frequency offset	≤-88	
				1kHz frequency offset	≤-104	
				10kHz frequency offset	≤-114	
				100kHz frequency offset	≤-112	

Table 7.4 (Continued 3) Record of performance characteristics test

No.	Item	Unit	Standard Requirement			Test result
12	Single sideband phase noise	dBc/Hz	10GHz	100Hz frequency offset	≤-82	
				1kHz frequency offset	≤-98	
				10kHz frequency offset	≤-108	
				100kHz frequency offset	≤-106	
			20GHz	100Hz frequency offset	≤-76	
				1kHz frequency offset	≤-92	
				10kHz frequency offset	≤-102	
				100kHz frequency offset	≤-100	
			26.5GHz (1433E/F/H)	100Hz frequency offset	≤-70	
				1kHz frequency offset	≤-86	
				10kHz frequency offset	≤-96	
				100kHz frequency offset	≤-94	
			40GHz (1433F/H)	100Hz frequency offset	≤-70	
				1kHz frequency offset	≤-86	
				10kHz frequency offset	≤-96	
				100kHz frequency offset	≤-94	
			50GHz (1433H)	100Hz frequency offset	≤-68	
				1kHz frequency offset	≤-84	
				10kHz frequency offset	≤-94	
				100kHz frequency offset	≤-92	
13	ON/OFF ratio of pulse modulation	dB	500MHz		≥80	
			5GHz			
			10GHz			
			20GHz			
			26.5GHz(1433E/F/H)			
			40GHz(1433F/H)			
			50GHz(1433H)			

Table 7.4 (Continued 4) Record of performance characteristics test

No.	Item	Unit	Standard Requirement		Test result
14	Rise/fall time for pulse modulation	ns	2GHz	Rising time≤30	
				Fall time≤30	
			10GHz	Rising time≤30	
				Fall time≤30	
			20GHz	Rising time≤30	
				Fall time≤30	
			26.5GHz(1433E/F/H)	Rising time≤30	
				Fall time≤30	
			40GHz(1433F/H)	Rising time≤30	
				Fall time≤30	
			50GHz(1433H)	Rising time≤30	
				Fall time≤30	
15	Minimum fixed amplitude pulse width	/	2GHz	1us±50ns (fixed amplitude)	
				100ns±20ns (non-fixed amplitude)	
			10GHz	1us±50ns (fixed amplitude)	
				100ns±20ns (non-fixed amplitude)	
			20GHz	1us±50ns (fixed amplitude)	
				100ns±20ns (non-fixed amplitude)	
			26.5GHz(1433E/F/H)	1us±50ns (fixed amplitude)	
				100ns±20ns (non-fixed amplitude)	
			40GHz(1433F/H)	1us±50ns (fixed amplitude)	
				100ns±20ns (non-fixed amplitude)	
			50GHz(1433H)	1us±50ns (fixed amplitude)	
				100ns±20ns (non-fixed amplitude)	
16	Amplitude modulation frequency response (modulation depth 30%)	dB	1GHz	< 3.0	
			10GHz		
			20GHz		
			26.5GHz(1433E/F/H)		
			40GHz(1433F/H)		
			50GHz(1433H)		

Table 7.4 (Continued 5) Record of performance characteristics test

No.	Item	Unit	Standard Requirement		Test result
17	Linear amplitude modulation accuracy (modulation depth 30%, 1kHz rate)	/	1GHz	±2.5%	
			10GHz		
			20GHz		
			26.5GHz(1433E/F/H)		
			40GHz(1433F/H)		
			50GHz(1433H)		
	Linear amplitude modulation accuracy (modulation depth 60%, 1kHz rate)	/	1GHz	±4.0%	
			10GHz		
			20GHz		
			26.5GHz(1433E/F/H)		
			40GHz(1433F/H)		
			50GHz(1433H)		
	Linear amplitude modulation accuracy (modulation depth 90%, 1kHz rate)	/	1GHz	±5.5%	
			10GHz		
			20GHz		
			26.5GHz(1433E/F/H)		
			40GHz(1433F/H)		
			50GHz(1433H)		
18	Exponential amplitude modulation accuracy (modulation depth 10dB, 1kHz rate)	dB	1GHz	±1.5	
			10GHz		
			20GHz		
			26.5GHz(1433E/F/H)		
			40GHz(1433F/H)		
			50GHz(1433H)		
	Exponential amplitude modulation accuracy (modulation depth 20dB, 1kHz rate)	dB	1GHz	±2.0	
			10GHz		
			20GHz		
			26.5GHz(1433E/F/H)		
			40GHz(1433F/H)		
			50GHz(1433H)		

Table 7.4 (Continued 6) Record of performance characteristics test

No.	Item	Unit	Standard Requirement			Test result
19	Maximum amplitude modulation depth (closed loop in linear mode)	/	1GHz	≥90%		
			10GHz			
			20GHz			
			26.5GHz(1433E/F/H)			
			40GHz(1433F/H)			
			50GHz(1433H)			
	Maximum Amplitude Modulation Depth (Exponential Mode Closed Loop)	dB	1GHz	≥20		
			10GHz			
			20GHz			
			26.5GHz(1433E/F/H)			
			40GHz(1433F/H)			
			50GHz(1433H)			
20	FM frequency offset accuracy (1 kHz modulation rate, frequency offset 100 kHz)	/	1GHz	±3.0%		
			5GHz			
			10GHz			
			20GHz			
			26.5GHz(1433E/F/H)			
			40GHz(1433F/H)			
			50GHz(1433H)			
21	Max. frequency offset(1 kHz modulation rate)	/	Freq	offset	/	/
		/	1GHz	400kHz	±10.0%	
			2.4GHz	100kHz		
			4GHz	200kHz		
			10GHz	400kHz		
			20GHz	800kHz		
			26.5GHz(1433E/F/H)	1600kHz		
			40GHz(1433F/H)	1600kHz		
			50GHz(1433H)	3200kHz		
22	FM frequency response	dB	1GHz	< 3.0		
			5GHz			

Table 7.4 (Continued 7) Record of performance characteristics test

No.	Item	Unit	Standard Requirement			Test result
22	FM frequency response	dB	10GHz	< 3.0		
			20GHz			
			26.5GHz(1433E/F/H)			
			40GHz(1433F/H)			
			50GHz(1433H)			
23	PM phase offset accuracy (1 kHz modulation rate, phase offset N×10 rad)	/	freq	offset	/	/
		rad	1GHz	5rad	±0.16	
			5GHz	5rad	±0.16	
			10GHz	5rad	±0.16	
			20GHz	10rad	±0.31	
			26.5GHz(1433E/F/H)	20rad	±0.61	
			40GHz(1433F/H)	20rad	±0.61	
			50GHz(1433H)	40rad	±1.21	
24	Max. phase offset(1 kHz modulation rate)	/	Freq	offset	/	/
		/	1GHz	10rad	±10.0%	
			2.4GHz	2.5rad		
			4GHz	5rad		
			10GHz	10rad		
			20GHz	20rad		
			26.5GHz(1433E/F/H)	40rad		
			40GHz(1433F/H)	40rad		
			50GHz(1433H)	80rad		
25	PM frequency response	dB	1GHz	< 3.0		
			5GHz			
			10GHz			
			20GHz			
			26.5GHz(1433E/F/H)			
			40GHz(1433F/H)			
			50GHz(1433H)			

Table 7.4 (Continued 8) Record of performance characteristics test

No.	Item	Unit	Standard Requirement			Test result
26	Source VSWR	/	1GHz	< 1.80		
			10GHz	< 1.80		
			20GHz	< 1.80		
			26.5GHz(1433E/F/H)	< 2.00		
			40GHz(1433F/H)	< 2.00		
			50GHz(1433H)	< 2.50		
27	Interface	/	RF interface	1433D	N type (negative)	
				1433E	2.4mm (positive)	
				1433F	2.4mm (positive)	
				1433H	2.4mm (positive)	
			Communication interface	USB interface	Type A, two	
					Type B mini USB, one	
				LAN interface	Standard RJ-45 type	
			Auxiliary interface	Memory card slot	Micro SD Card interface	
			Reference input/output	Ref In/Out	BNC(female)	
			Other interface	Pulse In	BNC(female)	
				Sync Out	BNC(female)	
				Video Out	BNC(female)	
Remarks	1. “√” indicates normal function or meet the requirements; “X” indicates that the function is abnormal or does not meet the requirements; 2. "/" indicates that there is no such test item on this device.					
	Comprehensive judgment: Pass☐ Fail☐					

7.5.3 Recommended Instrument for Performance Characteristics Test

Table 7.5 Recommended instrument for performance characteristics test

No.	Instrument	Main technical indicators	Recommended model
1	Frequency meter	Frequency range: 400MHz ~ 15GHz	Agilent 53230A
2	Frequency meter	Frequency range: 250kHz ~ 67GHz	Agilent 53120A
3	Power meter	Power range: -70dBm ~ +20dBm	Anritsu ML2437A
4	Power probe	Frequency range: 10MHz ~ 50GHz Power range: -70dBm ~ +20dBm	Anritsu MA2475D
5	Power meter	Frequency range: 10MHz ~ 67GHz Power range: -70dBm ~ +20dBm	2438CA power meter
6	Power probe	Frequency range: 9kHz ~ 6GHz Power range: -60dBm ~ +20dBm	Keysight E9304A
7	Spectrum analyzer	Frequency range: 3kHz ~ 50GHz	4051H
8	Measurement receiver	Frequency range: 100kHz ~ 50GHz	3927H
9	Digital storage oscilloscope	Bandwidth: DC ~ 500MHz Input impedance: 50Ω 及 1MΩ Direct resolution: ≤5mV/Div Horizontal resolution: 10ns/Div	MDO4054B
10	Composite Signal Generator	Frequency range: 250kHz ~ 50GHz/100kHz ~ 50GHz	1464 or 1465
11	Function generator	Pulse frequency range: 500uHz ~ 80MHz	Agilent 33250A
12	Coaxial detector	Frequency range: 10MHz ~ 50GHz	AV2.984.1521
13	Directional coupler	Frequency range: 10MHz ~ 50GHz	AV2.969.1111
14	Mixer	Frequency: 50GHz	AV2.983.11HPQ
15	Leakage current puncture tester	Leakage current 0.5 mA ~ 20mA, voltage 242V, 3kV and 5kV	CJ2673 leakage current withstand voltage tester
16	Variable-frequency power source	Frequency 47Hz ~ 400Hz, voltage 0 ~ 3000V	AFC-1kW inverter power supply
17	Temperature & humidity chamber	Temperature -70℃ to +150℃, humidity 25-98%RH	ESL-10P high and low temperature alternating temperature humidity chamber

18	Impact testbed	Maximum load 100kg, acceleration (50-400)m/s^2	P-100 impact testbed
19	Electrodynamic vibration generator	Maximum load 500kg, maximum displacement 51mm (p-p) Rated thrust 31.36kN, frequency range 5-2500Hz	DC-3200-36 Electrodynamic vibration generator
20	Digital megohmmeter		FLUKE 1508 digital megohmmeter
21	Vernier caliper	0 ~ 1000mm	41-A-54
22	Counter scale	Minimum division value ≥ 5g	Counter scale
23	Computer	Operating system: Windows 7.0 Memory: 1G Hard disk: 100G	