



4024CA Spectrum Analyzer

User Manual



Ceyear Technologies Co., Ltd.

This manual applies to the following models of spectrum analyzers.

- 4024CA Spectrum Analyzer

Version: A. 2 May 2022, Ceyear Technologies Co., Ltd.

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VERIFICATION OF CONFORMITY

Certificate No.: CTL2107013135-EC

Applicant : Ceyear Technologies Co.,Ltd
Address : No.98, Xiangjiang Rd, Huangdao District, Qingdao City, Shandong Province
Product : Spectrum Analyzer
Trademark : 思仪/Ceyear
Model(s) : 4024D, 4024, 4024A, 4024B, 4024C, 4024E, 4024F, 4024G, 4024H, 4024L, 4024CA
Manufacturer : Ceyear Technologies Co.,Ltd
Address : No.98, Xiangjiang Rd, Huangdao District, Qingdao City, Shandong Province
Test Report : CTL2107013135-E

Complies with the requirements of the
EC EMC directive 2014/30/EU with amendments.
Test Standards:

EN 61326-1: 2013

Remarks:

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For Chief Executive
Oct. 28, 2021



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VERIFICATION OF CONFORMITY

Certificate No.: CTL2107013135-SC

Applicant : Ceyear Technologies Co.,Ltd
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Shandong Province , China
Product : Spectrum Analyzer
Trademark : 思仪/Ceyear
Model(s) : 4024, 4024A, 4024B, 4024C, 4024D, 4024E, 4024F, 4024G,
4024H, 4024L, 4024CA
Manufacturer : Ceyear Technologies Co.,Ltd
Address : No.98, Xiangjiang Rd, Huangdao District, Qingdao City,
Shandong Province , China
Test Report : CTL2107013135-S

Complies with the requirements of the
LVD Directive 2014/35/EU

Test Standards:

EN 61010-1:2010+A1:2019

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VERIFICATION OF CONFORMITY

Certificate No. : CTL2107013135-RC

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Product : Spectrum Analyzer
Trademark : 惠仪/Ceyear
Model(s) : 4024D, 4024, 4024A, 4024B, 4024C, 4024E, 4024F, 4024G, 4024H, 4024L, 4024CA
Manufacturer : Ceyear Technologies Co.,Ltd
Address : No.98, Xiangjiang Rd, Huangdao District, Qingdao City, Shandong Province, China.
Test Report : CTL2107013135-R

Complies with the requirements of the
EC RoHS Directive 2011/65/EU & Amendment 2015/863

Test Standards:

IEC 62321-1:2013, IEC 62321-2:2013
IEC 62321-3-1:2013, IEC 62321-3-2:2013
IEC62321-4: 2013+A1:2017, IEC 62321-5:2013
IEC 62321-6:2015, IEC 62321-7-1: 2015
IEC 62321-7-2: 2017, IEC 62321-8: 2017

Remarks:

Based on the voluntary assessment of the product sample and technical file, we confirm that the above-mentioned product meets the requirements of the EC directive. The CE mark as show below can be used, under the responsibility of the manufacturer or the importer, after completion of an EC declaration of conformity and compliance with all relevant EC directives.



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Oct. 28, 2021



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Foreword

Thank you for choosing and using 4024CA spectrum analyzer developed and produced by Ceyear Technologies Co., Ltd.! This product features quality, precision and excellence, and has a high cost performance among similar products.

We will take the responsibility to meet your needs and provide you with high-quality measuring instruments and good 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.

Manual No.

AV2.731.1244SSCN

Version

A.2 2022.05

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.

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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 delivery. The calibration and measurement are completed by measuring bodies with 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. is qualified and has passed ISO 9001 and ISO 14001 management systems.

Safety precautions



The symbol "Warning" indicates a hazard. It reminds the user to pay attention to a certain operation process, operation method or the like. 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.



The symbol "notice" 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.

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1 Manual navigation

This chapter introduces the user's manual functions, chapter structure and main contents of 4024CA spectrum analyzer, as well as the instrument-related documents provided to users.

- [About the Manual](#) 1
- [Related Documents](#) 3

1.1. About the Manual

This manual introduces the basic functions and operation methods of 4024CA spectrum analyzer produced by Ceyear Technologies Co., Ltd. It describes such contents as product features, basic operations, menu description, 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**

It gives an overview of the main features, functions and typical application areas of 4024CA spectrum analyzer, as well as its main technical indicators.

- **Start Guide**

This chapter introduces the unpacking self-test, safety instructions, battery installation and replacement and user inspection of 4024CA spectrum analyzer, so that users can unpack for model confirmation and appearance inspection; to ensure your safety and proper use of the instrument, please be sure to read the safety instructions carefully before use; battery installation and replacement explains the method of routine battery maintenance and replacement steps; user inspection explains the process and status of the spectrum analyzer startup and shutdown.

- **Basic Operation**

The front panel and interface of 4024CA spectrum analyzer are described in detail.

- **Spectrum Analyzer mode**

Typical measurements in the spectrum analysis mode of 4024CA spectrum analyzer are introduced, and the menu structure of spectrum analysis is given and explained.

- **Interference Analyzer Measurement Mode**

The Spectrogram measurement and RSSI measurement in the Interference Analyzer measurement

1.1. About the Manual

mode are introduced, and the menu structure of Interference Analyzer is given and explained.

● Location Analyzer Measurement Mode

The three measurement methods for typical measurements in the Location Analyzer measurement mode and the corresponding schematics are presented, and the menu structure of Location Analyzer measurements is given and explained.

● Real-Time Spectrum Measurement Mode

The DPX measurement and Spectrogram measurement in Real-Time Spectrum measurement mode are introduced, and the menu structure of Real-Time Spectrum analysis is given and explained.

● GSM/EDGE Measurement Mode

The typical measurement methods in GSM/EDGE measurement mode and the corresponding schematics are presented, and the menu structure of GSM/EDGE measurement mode is given and explained.

● LTE Analyzer Measurement Mode

The eight measurement modes of typical measurements in LTE Analyzer measurement mode and the corresponding schematics are introduced, and the menu structure of LTE Analyzer measurement mode is given and explained.

● 5GNR Measurement Mode

The beam measurement, multi-PCI measurement, indoor and outdoor route Map location and the corresponding schematics in 5GNR measurement mode are introduced, and the menu structure of 5GNR measurement is given and explained.

● Technical Specifications

The functional characteristics of each complete part and module of 4024CA spectrum analyzer are introduced in conjunction with the functional block diagram of the instrument. A list of recommended instrumentation for 4024CA spectrum analyzer is given, and several performance characteristics measurement methods and procedures for 4024CA spectrum analyzer, such as third-order cross-tuning, are introduced.

● Fault Message Description and Repair Method

A description of the failure message of 4024CA spectrum analyzer and how to repair it when there is a problem that is difficult to solve are given.

● Appendix A

4024CA spectrum analyzer qualification records are given.

1.2 Related Documents

Product documentation for 4024CA spectrum analyzer includes:

- 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 operation, measurement, 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
- Start Guide
- Basic Operation
- Spectrum Analyzer mode
- Interference Analyzer measurement mode (option)
- Location Analyzer measurement mode (option)
- Real-Time Spectrum measurement mode (option)
- GSM/EDGE measurement mode (option)
- LTE Analyzer measurement mode (option)
- 5GNR measurement mode (option)
- Technical Specifications
- Fault Message Description and Repair Method
- Appendix A

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:

1.2 Related Documents

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

Quick Start Guide

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

- Get Prepared
- Typical Applications
- Get Help

2 General

This chapter introduces the main features, functions, typical applications and technical indicators of 4024CA spectrum analyzer.

- [Product Overview](#) 5
- [Safe Operation Guide](#) 9
- [Main Technical Indicators](#) 16

2.1 Product Overview

4024CA spectrum analyzer is a broadband handheld Real-Time Spectrum analyzer designed for field testing, with a maximum real-time analysis bandwidth of 120MHz and multiple measurement modes such as Real-Time Spectrum analysis, 5G NR demodulation analysis, LTE FDD/TDD demodulation analysis, GSM/EDGE demodulation analysis, Location Analyzer, as well as multiple intelligent measurement functions such as field strength measurement, channel power, occupied bandwidth, adjacent channel power, audio demodulation, harmonic distortion, spectrum emission mask/spurious emission mask, and indoor/outdoor Map location. It is designed with 8.4-inch large screen LCD and capacitive touch screen to facilitate user operation, and constructed of handheld chassis, with small volume, light weight, flexible power and easy mobility, suitable for on-site use.

4024CA handheld spectrum analyzer can be applied to mobile communications, microwave communications, radar, satellite communications and other equipment field commissioning, installation maintenance, wireless communications signal demodulation analysis, interference source direction finding and map positioning, broadband modulation or transient signal test analysis and other fields, providing users with a more complete solution for the field spectrum test. The appearance diagram is shown in Figure 2-1.



Figure 2-1 4024CA spectrum analyzer

2.1 Product Overview

- [Product features](#) 6
- [Product functions](#) 7
- [Typical applications](#) 8

2.1.1 Product features

- [Basic functions](#) 6
- [High performance](#) 6
- [Agility](#) 7

2.1.1.1 Basic functions

The 4024CA spectrum analyzer is based on a highly integrated, modular and standardized design concept, with excellent performance. It is characterized by:

- 1) Multiple measurement modes: spectrum analysis, Interference Analyzer (Spectrogram, RSSI), Real-Time Spectrum analysis (digital fluorescence, Spectrogram), Location Analyzer (Point scan, horizontal scan, map positioning), 5GNR measurement, LTE FDD/TDD demodulation analysis, GSM/EDGE measurement, etc.;
- 2) Multiple intelligent measurement functions: field strength measurement, channel power, occupied bandwidth, adjacent channel power, audio demodulation, harmonic distortion, spectrum emission mask/spurious emission mask, indoor/outdoor Map location, etc., supporting GPS/BeiDou positioning and frequency taming calibration for the internal crystal oscillator;
- 3) Full-band preamplifier: standard configuration;
- 4) Resolution bandwidth: 1Hz-10MHz (1-3 times step), 20MHz.

2.1.1.2 High performance

1) Frequency coverage:

From 9 kHz to 9 GHz.

2)displayed average noise Level:

Up to -160dBm at 1Hz RBW.

3) Phase noise performance:

-110dBm/ Hz at 100kHz Frequency offset at 1GHz carrier.

4) Third-order interception point:

+13dBm (Typical).

5) Amplitude accuracy:

±1.3dB (10MHz–9GHz).

6) Sweep speed

Fastest sweep time for 1GHz span <20ms.

7) Real-Time Spectrum

Support two display modes of digital DPX spectrum and Spectrogram.

Maximum real-time analysis bandwidth: 120MHz;

Minimum 100% POI capture time: 5.8μs.

8) IQ capture

512M large-capacity IQ data capture function.

2.1.1.3 Agility

1) Various auxiliary test interfaces:

10MHz reference input and output interface, GPS antenna interface, zero-span IF output interface, external trigger input interface, etc.

2) Easy and fast user experience:

8.4-inch large screen with high brightness LCD and large font display, convenient capacitive touch screen operation, integrated design of LCD and touch screen, multiple display modes and automatic backlight brightness adjustment, etc.

3) Operating temperature range: -10°C to 55°C

Can be powered by battery or adapter.

2.1.2 Product functions

The 4024CA spectrum analyzer has a rich set of measurement functions, including

➤ Spectrum analysis: for basic spectrum analysis of signals, including field strength measurement, channel power, occupied bandwidth, adjacent channel power, audio demodulation, harmonic distortion, spectrum emission mask/spurious emission mask, indoor/outdoor Map location, etc., supporting GPS/BeiDou positioning and frequency taming calibration for the internal crystal oscillator;

2.1 Product Overview

- Interference Analyzer (option), for measurement of signal spectrum diagram, Spectrogram and RSSI (Received Signal Strength Indication);
- Location Analyzer (option), for positioning of interference sources or unknown signal sources;
- Real-time spectral analysis (option), for fluorescence spectrum and 3D Spectrogram analysis of transient signals;
- GSM/EDGE measurements (option), for demodulation analysis of GSM/EDGE signals;
- LTE Analyzer (option), for demodulation analysis and measurement of FDD frequency division multiplexing and TDD time division multiplexing;
- 5GNR (option), for demodulation measurement of single or multi-carriers of 5G signals;
- 120MHz analysis bandwidth (option), for zero span of 120MHz bandwidth, analog IF output, Real-Time Spectrum analysis, etc.

2.1.3 Typical applications

1) Comprehensive field performance evaluation of wireless communication base stations

4024CA spectrum analyzer provides with demodulation analysis of 5GNR, LTE FDD/TDD, GSM/EDGE and other wireless communication signals and Real-Time Spectrum analysis of 120MHz bandwidth. Featuring handheld structure, small volume, light weight and battery power, it can be applied to the field installation, commissioning and maintenance support of wireless communication base stations.

2) Field test and diagnosis of transmitter and receiver

4024CA spectrum analyzer has a variety of measurement modes such as spectrum analysis, Interference Analyzer, Real-Time Spectrum analysis and Location Analyzer, as well as intelligent measurement functions such as indoor/outdoor Map location, field strength measurement, channel power, occupied bandwidth, adjacent channel power, carrier-to-noise ratio, spectrum emission mask, spurious emission mask and harmonic distortion, which can provide comprehensive spectrum analysis and diagnostic services for the field test of transmitter and receiver.

3) Real-time monitoring and interference identification of broadband spectrum

4024CA spectrum analyzer is applicable to electromagnetic environment detection, radio Interference Analyzer, electromagnetic environment background evaluation, Real-Time Spectrum monitoring and identification of illegal channel interference signals through external omnidirectional or directional antenna, to monitor and capture broadband interference signals, intermittent signals or transient interference signals in space.

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 safety guarantee. The design and testing of our products and the auxiliary equipment used meet relevant safety standards, and a quality assurance system has been established to monitor the product quality and ensure the products to always comply with such standards. In order to keep the equipment in good condition and ensure operation safety, please observe the precautions mentioned in this manual. If you have any questions, please feel free to consult us.

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

- [Safety marks](#) 9
- [Operation Status and Locations](#) 11
- [Electrical Safety](#) 12
- [Operation Precautions](#) 13
- [Maintenance](#) 14
- [Batteries and Power Modules](#) 15
- [Transportation](#) 15
- [Waste Disposal/Environmental Protection](#) 16

2.2.1 Safety marks

















- [Product-related marks](#) 9
- [Manual-related marks](#) 11


2.2.1.1 Product-related marks

Safety marks on the products are described as follows (Table 2- 1):

2.2 Safe Operation Guide

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 mark, information about the instrument and its operation.

2.2.2 Operation Status and Locations

Please note before operating the instrument:

2.2 Safe Operation Guide

- 1) Unless otherwise specified, the 4024CA spectrum analyzer should be operated in an environment that allows for smooth placement of the instrument and indoor/outdoor operation. The maximum altitude for operating the instrument shall not exceed 4,600m, and the maximum altitude for transporting the instrument shall not exceed 4,600m. The range of actual supply voltage is $\pm 10\%$ of the marked voltage, and the range of supply frequency is $\pm 5\%$ of the marked frequency.
- 2) Unless otherwise 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 an environment where cold and heat are in alternation, where water droplets formed on the instrument may cause electric shock and other hazards.
- 4) Do not place the instrument on the surface of a heat-dissipating object (e.g., a radiator). The 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. If the power supply voltage changes, the fuse model of the instrument shall be changed synchronously.
- 2) According to the power requirements of the real panel of the instrument, 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.

2.2 Safe Operation Guide

- 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) The instrument shall comply with IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards to connect with PC or IPC.
- 10) 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.
- 11) 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.
- 12) Take appropriate overload protections to prevent overload voltage (caused by lightning, for instance) from damaging the instrument or causing personal injury.
- 13) 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.
- 14) 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.
- 15) 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.

2.2 Safe Operation Guide

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 with EN 55011/CISPR 11, EN 55022/CISPR 22 and EN 55032/CISPR 32 standards)

— Class A equipment:

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

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

— Class B equipment:

Equipment 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.

2.3 Main Technical Indicators

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.

2.3 Main Technical Indicators

The 4024CA spectrum analyzer have been strictly tested for technical indicators at the factory, and users can also test and verify it in accordance with the technical indicators provided in this manual. The main technical indicators of 4024CA spectrum analyzer are shown in Table 2-2.

Prompt

Operating indicators

The 4024CA spectrum analyzer shall be stored at ambient temperature for 2 hours and warmed up for 30 minutes to meet all performance metrics within the given operating temperature range. The supplementary features given in the form of typical values are for user reference only and not for assessment.

Figure 2-2 Technical indicators of 4024CA spectrum analyzer

Test Item	Requirements
Model	4024CA
Frequency range	9kHz ~ 9GHz
Frequency reference	Nominal frequency: 10MHz Frequency reference error: \pm (to last calibration date \times aging rate + temperature stability + calibration accuracy) Aging rate: \pm 0.5ppm/year Temperature stability: \pm 0.1ppm (-10 to 50°C, relative to 25°C \pm 5°C) Initial calibration accuracy: \pm 0.3ppm Note: By default, the time until the last calibration is 1 year.
Sweep Time	Range: 1 μ s-6000s (zero span) Accuracy: \pm 2.00% (zero span)
Frequency reading accuracy	Frequency readout accuracy = \pm (frequency reading \times frequency reference error + 2% \times span + 10% \times resolution bandwidth)
Span	Range: 10Hz-9GHz or 0Hz (zero span) Accuracy: \pm 2%
RBW	1Hz-10MHz (in 1-3 steps), 20MHz
VBW	1Hz-10MHz (in 1-3 steps), 20MHz
Single sideband phase noise (Carrier 1GHz, 20°C-30°C)	\leq -108dBc/Hz at 10kHz frequency offset \leq -110dBc/Hz at 100kHz frequency offset \leq -118dBc/Hz at 1MHz frequency offset \leq -129dBc/Hz at 10MHz frequency offset
Displayed average noise level (50 Ω load connected at input, 0dB input attenuation, average detector, logarithmic video type, RBW normalized to 1Hz, 20°C-30°C)	Preamplifier OFF \leq -140dBm 2MHz-3GHz \leq -138dBm 3GHz-9GHz Preamplifier ON: \leq -160dBm 2MHz-3GHz \leq -157dBm 3GHz-9GHz
Residual responses (RF input matching, 0dB attenuation)	Exceptional frequency: 3.15GHz Preamplifier OFF: \leq -82dBm (10MHz-9GHz) Preamplifier ON: \leq -95dBm (10MHz-9GHz)
Second harmonic distortion (Attenuation 0dB, -30dBm input)	\leq -65dBc 50MHz-2GHz \leq -70dBc 2GHz ~ 4.5GHz
Third-order intermodulation distortion (-15dBm dual tone signal, 100kHz interval, attenuation 0dB, preamplifier OFF)	\geq +10dBm 50MHz-5.2GHz \geq +12dBm 5.2GHz~9GHz

2.3 Main Technical Indicators

Table 2-2 (Continued)

Absolute amplitude accuracy (input signal 0dBm to -50dBm, all settings for auto-coupling, 20°C-30°C, 30 minutes warm-up)	±1.3dB (10MHz-9GHz)
Input attenuator	Attenuation range: 0dB-30dB, 5dB step Switch uncertainty: ±1.20dB
Maximum safe input level (Continuous wave input, preamplifier OFF)	+27dBm, typical (≥10dB attenuation)
Reference Level	Range: -150dBm to +30dBm, 1dB step Conversion uncertainty: ± 1.20dB(Reference Level: 0dBm to -60dBm)
Overall dimensions	W×H×D (mm)=(314±1.2)mm×(217±1.2)mm×(91±0.8)mm, excluding side strap, rear support, etc.
Weight (excluding battery)	≤4.6kg
Working temperature:	-10°C to +50°C (battery operating temperature: 0°C to +45°C,relative humidity ≤80%RH)
Storage temperature	-40°C to +70°C (battery storage temperature: -20°C to +60°C,relative humidity ≤80%RH)
Electromagnetic compatibility	Complies with 3.9.1 in GJB 3947A-2009
Power input type	AC power adapter: output 15V _{DC} , 4A Lithium-ion battery: 10.8V
Battery power duration	2h (typical)
Instrument power consumption (without charging the battery, loss of AC to DC conversion of the power adapter)	≤40W
Test port	RF input: N-type female connector
Other interface	10MHz reference input/output: BNC female connector External trigger input: BNC female connector IF output: BNC female connector GPS antenna input: BNC female connector

3 Start Guide

This chapter introduces the unpacking self-test, safety instructions, battery installation and replacement and user inspection of 4024CA spectrum analyzer, so that users can unpack for model confirmation and appearance inspection; to ensure your safety and proper use of the instrument, please be sure to read the safety instructions carefully before use; battery installation and replacement explains the method of routine battery maintenance and replacement steps; user inspection explains the process and status of the spectrum analyzer startup and shutdown.

- [Unpacking self-test](#) 19
- [Safety instructions](#) 20
- [Battery installation and replacement](#) 24
- [User check](#) 26

3.1 Unpacking self-test

- [Model confirmation](#) 19
- [Appearance inspection](#) 20

3.1.1 Model confirmation

Notice

Instrument movement

Because the instrument is a valuable item, it should be handled with care when moving.

When you open the package, you will see the following items:

- | | |
|--|---|
| a) 4024CA Spectrum Analyzer | 1 |
| b) Power adapter | 1 |
| c) 3-core power cable | 1 |
| d) Quick Start Guide | 1 |
| c) USB cable | 1 |
| f) Built-in rechargeable lithium-ion battery | 1 |

3.2 Safety instructions

g) Certificate of Quality	1
h) Options	Several
i) Packing list	1

Please check carefully for any incorrect or missing items against the order contract and the packing list. If there is any problem, please contact our operation center according to the contact information in the preface, and we will solve it as soon as possible.

3.1.2 Appearance inspection

Check the instrument carefully for any damage during transportation. It is strictly prohibited to switch on the instrument if any obvious damage to the instrument is found. Please contact our operation center according to the contact information in the preface. We will repair or replace ground product accordingly as soon as possible.

3.2 Safety instructions

The 4024CA spectrum analyzer conforms to the safety requirements specified in GJB3947A-2009. There are no user-operable parts inside this instrument, please do not open the instrument shell without permission, otherwise it may cause personal injury. To ensure your safety and proper use of the instrument, please read the following safety instructions carefully before use.

- [Environmental Requirements](#) 20
- [Power cord selection](#) 21
- [Power supply requirements](#) 21
- [Electrostatic discharge \(ESD\) protection](#) 22
- [Input/output port protection](#) 23
- [Cleaning front panel display](#) 23

3.2.1 Environmental Requirements

In order to ensure the service life of 4024CA spectrum analyzer and the validity and accuracy of measurement, please carry out the tests under the following environmental conditions:

1)Temperature range:

Storage temperature range: -40°C to +70°C

Operating temperature range: -10°C to +50°C

Operating temperature range when battery powered: 0°C to +45°C

2) Low air pressure:

Low air pressure (altitude): 0-4600m

Warning

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

3.2.2 Power cord selection

The 4024CA spectrum analyzer uses a three-prong power cord in line with 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, and replace it with the same type of 250V/10A power cord if required.

3.2.3 Power supply requirements

The 4024CA spectrum analyzer can be powered in three ways:

1) 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 Table 3-1.

Table 3-1 Power 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

3.2 Safety instructions

2)DC power supply

Voltage: 15V

Current: 3A (minimum)

3)Built-in battery power supply

The 4024CA spectrum analyzer 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. See section III for details of battery usage. The basic parameters of the enclosed battery are as follows:

Nominal voltage: 10.8V

Notice

Operating voltage and frequency

The operating voltage and frequency ranges should be subject to the data on the nameplate of the power adapter.

Notice

Rechargeable battery

Rechargeable batteries should not be exposed to fire and high temperature (higher than 60°C), thrown into fresh water or salt water or wetted, and should be kept away from children.

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

3.2.4 Electrostatic discharge (ESD) protection

Static electricity is extremely destructive to electronic components and equipment, so the instrument must be operated on an anti-static workbench. Attention should be paid to ESD protection when using the instrument. The following ESD protection measures, if applicable, can be taken:

- a) Ensure all instruments are grounded properly, so as to avoid any static electricity;
- b) Staff must wear an anti-static wrist straps before touching connectors, cores, or conducting any assembly operations.
- c) 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.

3.2.5 Input/output port protection

The standard impedance of the RF port of 4024CA spectrum analyzer is 50 Ω , so the test signal shall be added or the appropriate load impedance shall be terminated in strict accordance with the port requirements to prevent damage to the subsequent circuit.



Maximum input level

There is the maximum allowable input level at the RF input of the spectrum analyzer. It is strictly prohibited to inject the over-limit input signal, otherwise the instrument will be damaged.

3.2.6 Cleaning front panel display

To clean the display panel of the instrument after operation for some time, follow the steps below:

- a) Shut down the analyzer, and put out the power cord;
- b) Dip a piece of clean and soft cotton cloth into the cleaner and then gently wipe the display panel;
- c) Dry the display panel with a piece of clean and soft cotton cloth;
- d) Connect the power cord only after the cleaner is completely dried.

Notice

Display screen 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.

3.3 Battery installation and replacement

3.3 Battery installation and replacement

This section describes how to install and replace the battery of the 4024CA spectrum analyzer, including.

- [Battery description](#) 24
- [Battery installation and replacement](#) 24
- [Check battery status](#) 25
- [Battery charging](#) 25

3.3.1 Battery description

The 4024CA spectrum analyzer is equipped with a high-capacity rechargeable lithium-ion battery, which can last for approximately 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, the battery should be removed from the battery compartment and charged as fully as possible during transportation and long-term storage, otherwise the battery life may be reduced or the battery may not be charged.

3.3.2 Battery installation and replacement

The battery for 4024CA spectrum analyzer is easy to install or replace. Installation and replacement can be carried out by users according to Figure 3-1.

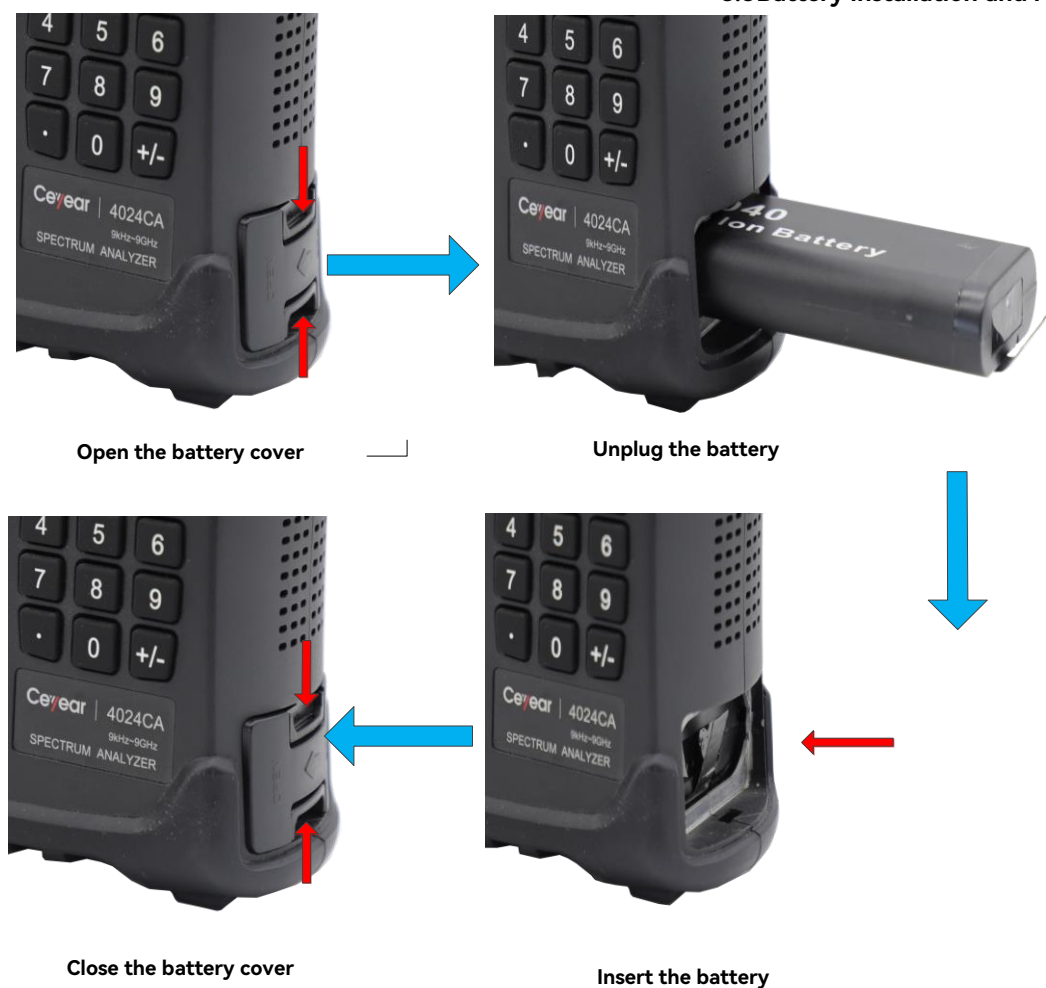
3.3 Battery installation and replacement

Figure 3-1 Battery installation and replacement steps

3.3.3 Check battery status

The 4024CA spectrum analyzer 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 button at the white point at the end of the battery, and the indicator above the button will light up to indicate the current remaining power. When there is still one indicator on, please charge the battery in time.

3.3.4 Battery charging

The 4024CA spectrum analyzer can be charged with the battery either shutdown or in operation. The charging steps are as follows:

3.4 User check

- a) First, install the battery to be charged into the instrument.
- b) Use the attached AC-DC adapter to connect the external power supply.
- c) 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 more than 5% power, the charging time in shutdown state is less than 6 hours.

Notice

Power indicator

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

3.4 User check

This section describes how to check the 4024CA spectrum analyzer startup and shutdown.

- [Spectrum analyzer power-on](#) 26
- [Spectrum analyzer shutdown](#) 27

3.4.1 Spectrum analyzer power-on

Connect the 4024CA spectrum analyzer 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.

3.4.2 Spectrum analyzer shutdown

Press the yellow power switch button [⏻] at the lower left corner of the front panel of the spectrum analyzer for about three seconds, and the spectrum analyzer will automatically exit the measurement application program and power off.

4 Basic operation

This chapter describes the front panel and interface of the 4024CA spectrum analyzer.

- Front panel description 29
- Interface description 34

4.1 Front panel description

The front panel of 4024CA spectrum analyzer is shown in Figure 4-1.

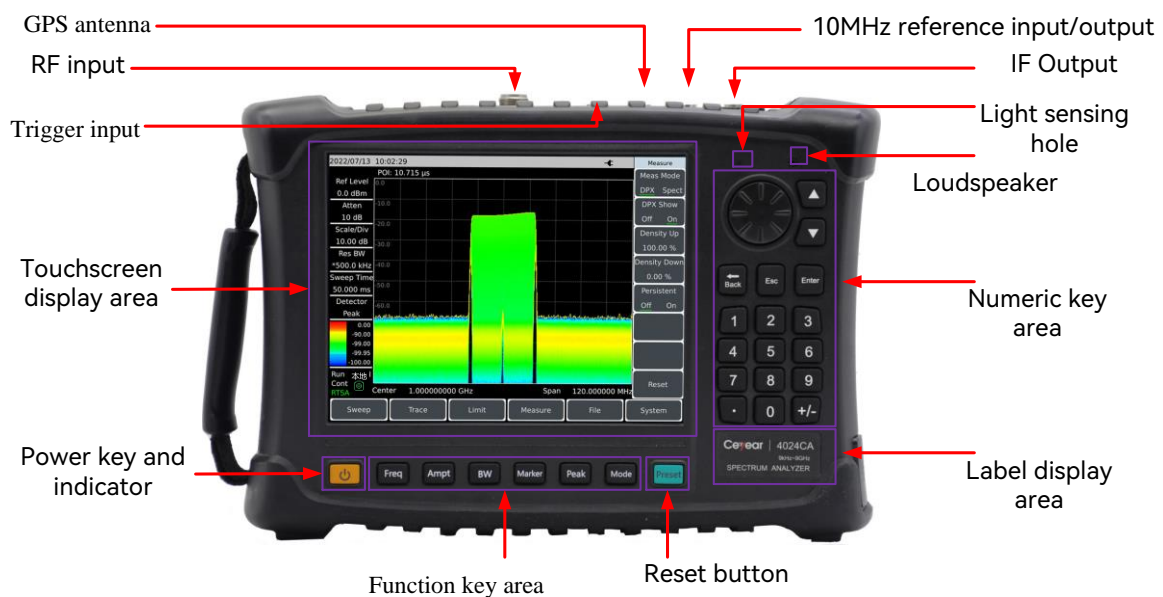


Figure 4- 1 Front Panel

Notice

In this Manual, the keys on the front panel are represented by **【XXX】**, with XXX being the key name; The keys on the bottom of the touch screen are represented by **【XXX】**, with XXX being the name of the key; The menu keys on the right are represented by **[XXX]**, with XXX being the menu name.

- Display space 30
- Numeric entry space 33
- Function key zone 33
- Reset key 34

4.1 Front panel description

- [Power switch](#) 34

4.1.1 Display space

The 4024CA spectrum analyzer is designed with an 8.4-inch color touch screen, which allows the parameters to be set and information to be displayed at the touch of a finger, eliminating the need for tedious soft and hard key menu setting and greatly simplifying user operation.

When the instrument performs different functions, the following contents will be shown in the display space: multiple instrument windows, with various settings and measurement data information; operating status information; current input data when it is necessary to input parameters such as frequency; current working time; menu information corresponding to the current operating window. See Figure 4-2 for details:

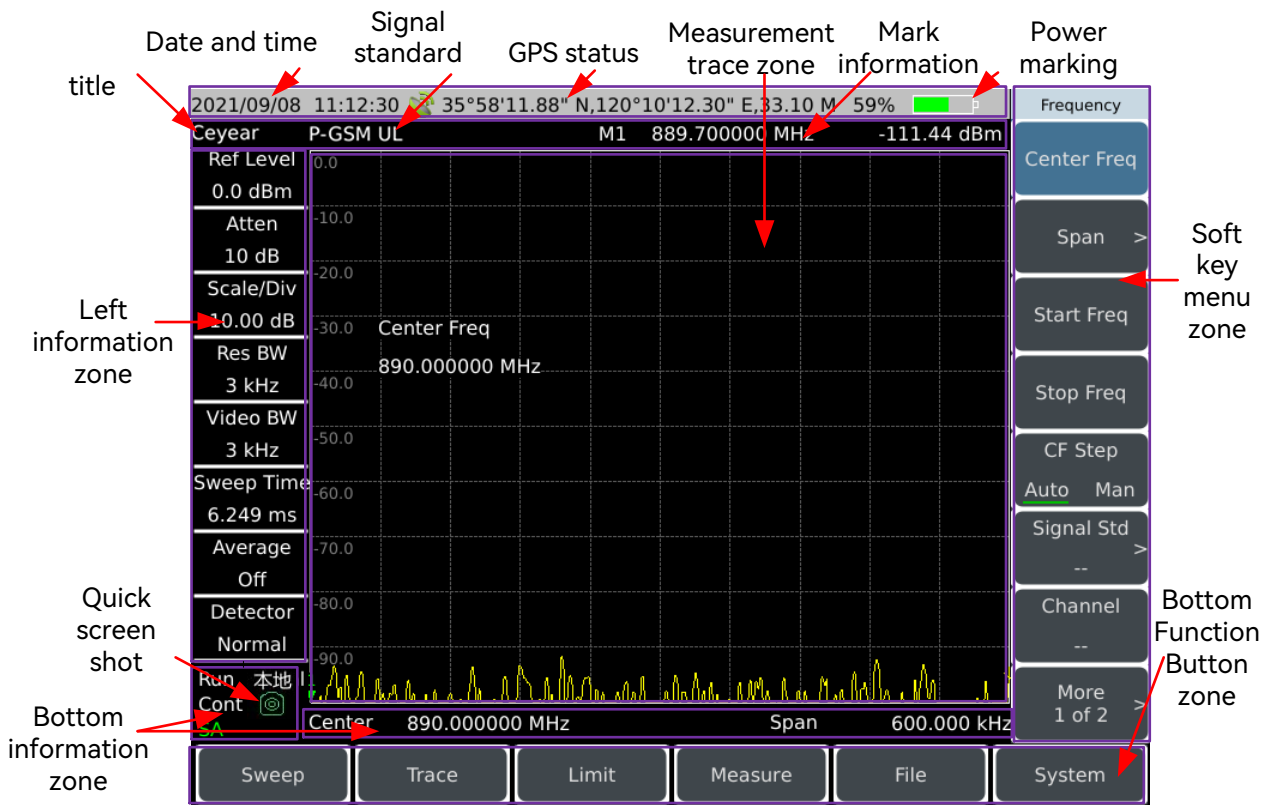


Figure 4-2 Display space

The information display space under the screen display space of 4024CA spectrum analyzer shows various settings for current measurement and instrument status, which can be divided into 7 zones as per the position on the screen, namely, top information zone, marker, signal standard and title zone, left information zone, measurement data zone, soft key menu zone, bottom information zone and bottom function button zone.

- [Top information zone](#) 31

4.1 Front panel description

- Marker, signal standard and title zone 31
- Measurement trace zone 32
- Left information zone 32
- Bottom information zone 32
- Soft key menu zone 33
- Bottom function button zone 33


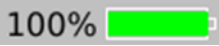
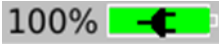


4.1.1.1 Top information zone

It is at the top of the screen and displays the system date and time, as well as the current power supply type, battery power and GPS status of the spectrum analyzer from left to right in sequence.

Setting and modification of system date and time: Set via **【System】** →[System config]→[Date /Time].

Date format modification: Set via **【System】** →[System config]→[Date Format].

The battery type and battery status indicator on the right side of the top information zone displays different signs according to whether there is external power supply or the battery capacity. The signs under different power supply states are described as follows:

- If the spectrum analyzer is not provided with a battery and externally powered, it shows ;
- When the spectrum analyzer is equipped with a fully charged battery and no external power adapter is connected, the icon is displayed as , and when the battery is fully charged and an external power adapter is connected, the icon is displayed as . As the battery power gradually decreases, the green area where the power capacity is displayed will gradually decrease.
- When the spectrum analyzer is equipped with a battery and connected with an external power adapter, the charging icon is displayed as  when the battery power is less than 100% and the battery is in the charging state.
- When the spectrum analyzer is not connected to the external power supply and the power is less than 20%, the battery is under voltage and the icon is displayed as . In this case, please charge the battery in time. When the power capacity is less than 10%, the spectrum analyzer can run for another 10 minutes. Please keep the measurement results in time, otherwise the spectrum analyzer will shut down automatically when the power capacity is less than 5%.

4.1.1.2 Marker, signal standard and title zone

Open **【System】** →[System config]→[Tip Off On], the area displays the set title information;

4.1 Front panel description

Press **【Freq】** →[Signal Std] to display the name of the currently selected signal standard.

Press **【Marker】** or **【Peak】** to display the frequency value of the currently active marker as well as the amplitude value information.

4.1.1.3 Measurement trace zone

It can display the measurement data. The contents displayed vary with the measurement mode.

4.1.1.4 Left information zone

It is located at the upper left part of the screen and displays the currently measured reference level, attenuator setting, display scale, resolution bandwidth, video bandwidth, scanning time and other information. Each information can be set through the corresponding function button. The operation of the corresponding buttons is shown in the table below:

Table 4-1 Function description for left display zone of 4024CA spectrum analyzer

Marker No.	Description	Correspondence function button
1	Ref Level 0.0dBm	【Ampt】 →[Ref Level]
2	Atten 10dB	【Ampt】 →[Atten <u>A</u> uto Man]
3	Scale/Div 10.0dB	【Ampt】 →[Scale/Div]
4	RBW 3MHz	【BW】 →[Res BW <u>A</u> uto Man]
5	VBW 3MHz	【BW】 →[Video BW <u>A</u> uto Man]
6	Swp Time 441.000ms	【Sweep】 →[Sweep Time <u>A</u> uto Man]
7	Average	【BW】 →[Average <u>O</u> ff <u>O</u> n]
8	Detection Automatic	【BW】 →[Detector]

4.1.1.5 Bottom information zone

It is located at the bottom of the screen and includes two main information contents:

- Local: displays the current operating state of spectrum analysis, which is controlled locally or remotely.
- The current center frequency and span information are displayed at the bottom of the screen.

4.1 Front panel description

When the spectrum analyzer is set to zero span, the information at the bottom is displayed successively as start time, center frequency and stop time.

4.1.1.6 Soft key menu zone

To improve the operational flexibility of the 4024CA spectrum analyzer and enable the superiority of the touch screen, the resident software of 4024CA spectrum analyzer is designed with eight gray touch keys on the right, and the functions of these keys are directly shown on the corresponding key zone.

4.1.1.7 Bottom function button zone

It is designed with 6 function buttons, which can achieve the same functions as the hard keys, and can display different menu names in different measurement modes for the convenience of users.

4.1.2 Numeric entry space

The numeric entry space includes arrow keys, knobs, numeric keys, Backspace, Cancel, and Enter keys. All inputs can be changed through keys and the knob in the input zone. The following describes the keys in the entry space.

- Arrow 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.
- Knobs: Used to 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.
- Numeric keys: Used to enter numbers (including negative signs).
- Backspace key: Used to undo the last data bit by bit depending on the state of the set number.
- Cancel key: Used to cancel the currently entered data that is not valid.
- Enter key: Used to confirm the current parameter setting.

4.1.3 Function key zone

It is located below the screen and is used to change the measurement parameter setting, including six keys:

- **【Freq】** : It is used to set such measurement parameters as center frequency, start and stop frequencies, span and frequency step.
- **【Ampt】** : It is used to set the reference level, attenuator, display scale, unit and preamplifier control, etc.

4.2 Interface description

- **【BW】** : It is used to set such parameters as measurement RBW, VBW, detector type and average.
- **【Marker】** : It is used to set the specific parameters of the measurement marker;
- **【Peak】** : It is used to obtain peak parameters;
- **【Mode】** : It is used to set the measurement mode, including spectrum analysis, Interference Analyzer, Location Analyzer, Real-Time Spectrum, GSM/EDGE, 5G NR and LTE Analyzer.

4.1.4 Reset key

Press **【Preset】** hard key to restore the system to the default startup state. See Reset Menu 5.4.31 for details.

4.1.5 Power switch

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

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

4.2 Interface description

The peripheral interfaces of the 4024CA spectrum analyzer are mainly concentrated on the top panel, as shown in Figure 4-3, and can be divided into three parts: power supply interface, test port and digital interface.

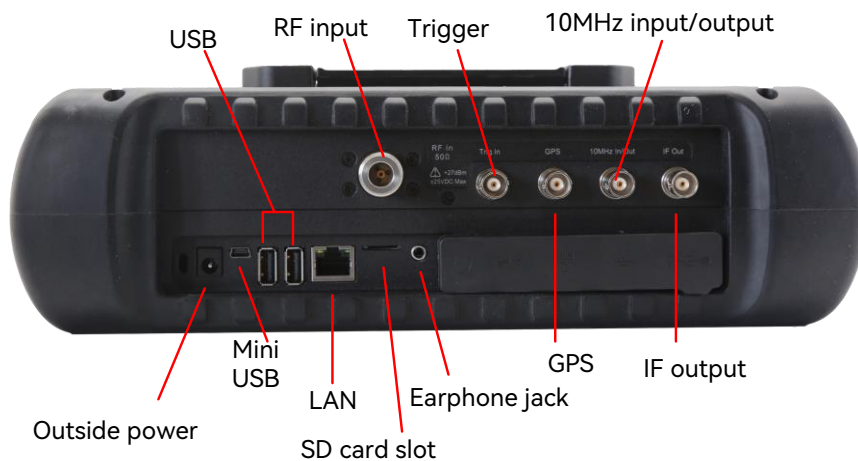


Figure 4-3 Interface description diagram

● [Power interface](#) 35

- Test ports 35
- Digital interface 36
- Instrument symbol 37

4.2.1 Power interface

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

4.2.2 Test ports

- RF input port 35
- 10MHz input/output port 35
- IF output port 35
- Trigger input port 35
- GPS antenna port 36

4.2.2.1 RF input port

For the input of the signal under test, the 4024CA has a 50Ω test signal input port, and the 4024CA uses an N-type negative adapter.

4.2.2.2 10MHz input/output port

The 10MHz signal from other devices can be externally connected as the reference signal of the spectrum analyzer; the internal 10MHz reference signal of the spectrum analyzer can also be output for use by external devices.

4.2.2.3 IF output port

In the case of zero span, the IF signal output can be provided through software configuration for use by external devices.

4.2.2.4 Trigger input port

The 4024CA can be set to external trigger mode. The external trigger source is connected to the trigger input port of the spectrum analyzer, and the output range of the source should be -5V to +5V. It can be set by software whether to use rising edge trigger or falling edge trigger.

4.2 Interface description

4.2.2.5 GPS antenna port

Connect a GPS antenna device to locate the current position of the spectrum analyzer.



Identification symbol

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

Refer to section 4.2.4 for the description of the symbols of the instrument.

4.2.3 Digital interface

- [Mini USB interface](#) 36
- [USB type-A interface](#) 36
- [LAN \(network\) interface](#) 37
- [SD card slot](#) 37
- [Earphone jack](#) 37

4.2.3.1 Mini USB interface

Connect an external PC, which can program or transfer data to the 4024CA spectrum analyzer via programmed commands or programmed function libraries.



Installing device driver

Device driver must be installed before connecting the spectrum analyzer to the PC via the USB for the first time.

4.2.3.2 USB type-A interface

Connect USB peripherals, such as USB storage devices.

4.2.3.3 LAN (network) interface

It is a 10/100/1000Mbps network interface that can be connected to a computer (PC) via a network cable. The PC can program or transfer data to the 4024CA spectrum analyzer via programmed commands or programmed function libraries.

4.2.3.4 SD card slot

Micro SD card slot, which can be used for expanding the storage space of the instrument.

4.2.3.5 Earphone jack

A standard 3.5mm/3-line earphone port for outputting the sound modulated via FM/AM/SSB. If the port is not connected to the earphone, the sound is output via the speaker of the spectrum analyzer; when it is connected to the earphone, the sound output is switched from the speaker to the earphone automatically.

4.2.4 Instrument symbol

The instrument symbol (Caution Label) shown in the figure indicates that the max power input from the test port is +27dBm. When using the instrument, do not connect a signal exceeding this range to the port, otherwise, the instrument may be burnt down!

5 Spectrum Analyzer mode

This chapter introduces the spectrum analysis mode of the 4024CA spectrum analyzer, including some typical measurement functions and measurement methods in the spectrum analysis mode, so that first-time users can have a general understanding of some typical applications of the spectrum analysis mode and the test operation process after reading this subsection, and be familiar with the use of the spectrum analysis mode.

Notice

All operations in this section are based on the premise that the spectrum analysis mode has been selected, and will not be described separately later.

- [Introduction to functional parameters](#) 39
- [Introduction to typical measurements](#) 42
- [Spectrum Analyzer menu structure](#) 94
- [Spectrum Analyzer menu description](#) 99

5.1 Introduction to functional parameters

The 4024CA spectrum analyzer has a variety of analysis modes and measurement functions, so it contains numerous and complex parameters. In addition to the most basic functional parameters such as frequency parameters, amplitude parameters, bandwidth averaging parameters, trace parameters, scan parameters, cursor parameters, it has other characteristic functional parameters, including signal tracking, noise cursor, peak tracking, counter, list sweep, trigger, limit line, field strength measurement, channel power, occupied bandwidth, adjacent channel power, carrier-to-noise ratio, spectrum/spurious emission mask, IQ capture, audio monitoring, indoor and outdoor maps, harmonic distortion, multi-carrier adjacent channel power, etc.

- [Signal tracking](#) 40
- [Noise marker](#) 40
- [Peak tracking](#) 40
- [Counter](#) 40
- [List sweep](#) 41
- [Trigger](#) 41

5.1 Introduction to functional parameters

- [Limit line](#) 41
- [Field strength measurement](#) 41
- [Carrier-to-noise ratio](#) 41
- [Spectrum emission mask](#) 41
- [IQ capture](#) 42
- [Audio monitor](#) 42
- [Security data](#) 42
- [Indoor and outdoor map](#) 42
- [Harmonic distortion](#) 42
- [Multi-carrier adjacent channel power](#) 42

5.1.1 Signal tracking

If the signal under test is a drift signal, when the signal tracking function of the spectrum analyzer is used to place the activated marker on the peak point of the signal, the marker peak will always be displayed on the center frequency of the spectrum analyzer, which can be easily measured.

5.1.2 Noise marker

The noise marker displays the noise power near the activation marker that is normalized to 1 Hz bandwidth. When the noise marker is turned on, the detector is set to the root mean square detection mode. When the logarithmic mode (dBm, dBmV, dB μ V, dBW, dBV, dBA, dBmA, dB μ A) is selected for the amplitude unit, the unit of marker reading is automatically switched to dBm/Hz; when V is selected for the amplitude unit, the unit of reading is automatically switched to V/(Hz)^{1/2}; when A is selected, the unit of reading is automatically switched to A/(Hz)^{1/2}; when W is selected, the unit of reading is automatically switched to W/(Hz)^{1/2}.

5.1.3 Peak tracking

When the peak tracking function is turned on, the marker will perform a peak search operation after each scan.

5.1.4 Counter

When the frequency counter function is turned on, the frequency counter function will make the reading of marker more accurate, which is conducive to improving the accuracy of frequency

5.1 Introduction to functional parameters

measurement. The measurement accuracy can reach Hz level, and the error is within 10Hz.

5.1.5 List sweep

Under the List Sweep function, users can edit the sweeping frequency band, and the spectrum analyzer can sweep according to the set frequency range and other parameters with the edited list.

5.1.6 Trigger

Select the trigger mode for sweep or measurement, including [Free Run], [Video], [External(TTL)TTL], [Slope Rising Falling], and [Delay]. Users can choose the appropriate mode according to different needs. When the Free Trigger is set after the last continuous sweep or single sweep, a new sweep or measurement will be started. Set the trigger mode to Video Trigger. As long as the positive ramp portion of the input trigger signal passes the video trigger level set by the [Slope Rising Falling] command, the sweep will be triggered. When set to External Trigger mode, the sweep and measurement are selected to be synchronized with the next voltage cycle.

5.1.7 Limit line

The limit line function can be used to monitor the signal in a certain frequency band. The spectrum analyzer provides upper and lower limit lines. The user can set the limit. When the amplitude of the signal in a certain frequency band exceeds the set upper limit line or is less than the set lower limit line, the spectrum analyzer sends an audible alarm signal.

5.1.8 Field strength measurement

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

5.1.9 Carrier-to-noise ratio

The carrier-to-noise ratio function measures the ratio of carrier power to noise power, including carrier bandwidth, noise bandwidth, offset frequency, span, carrier power, noise power, carrier-to-noise ratio and other parameters.

5.1.10 Spectrum emission mask

The function of spectrum emission mask is to call the limit line as a mask to measure whether the signal power is limited by the mask. The mask parameter is a limit line, which is assigned by calling the limit line. The mask can move up and down, left and right according to the center frequency and reference power. The mask always moves the center point of the limit line left and right to the center frequency, and moves the center point up and down to the reference power value point according to

5.2 Introduction to typical measurements

the calculated reference power. The reference power is divided into peak power and channel power. Which one to choose is determined by the type of reference power.

5.1.11 IQ capture

IQ capture function captures IQ data and stores it in the instrument through the capture time, sampling rate, capture mode and other parameters set by the user.

5.1.12 Audio monitor

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

5.1.13 Security data

The spectrum analyzer has the function of safe data operation, under which the host data can only be stored and called on the external memory.

5.1.14 Indoor and outdoor map

The outdoor map option can be used for RSSI test and ACPR test, and the test results can be marked on the map in real time according to time or distance.

5.1.15 Harmonic distortion

Set the fundamental frequency and harmonic number. After the instrument measures the fundamental according to the current parameters, the harmonics are measured for each valid range table with the center frequency set to the frequency of the range table.

5.1.16 Multi-carrier adjacent channel power

Unlike the adjacent channel power measurement mode, this mode can also be used to measure the adjacent channel power ratio of two carriers.

5.2 Introduction to typical measurements

The spectrum analysis mode of the 4024CA spectrum analyzer is the baseline mode of this product. Some typical measurement methods for this baseline mode are introduced in the *4024CA Spectrum Analyzer Quick Start Guide*, including several basic measurement methods, such as basic signal measurement, how to improve the frequency measurement accuracy, how to measure small signals, and how to distinguish signals with close frequencies. In addition, this section will expand on the spectrum analysis mode of the 4024CA spectrum analyzer to introduce some advanced typical

5.2 Introduction to typical measurements

measurement functions and methods, mainly containing the following:

- 1) Channel power measurement
- 2) Occupied bandwidth measurement
- 3) Adjacent channel power measurement
- 4) Third-order intermodulation distortion measurement
- 5) Drift signal measurement
- 6) Noise signal measurement
- 7) Distortion measurement
- 8) Pulse RF signal measurement
- 9) Carrier-to-noise ratio
- 10) Outdoor map (option)
- 11) Indoor map (option)
- 12) Spectrum emission mask
- 13) Audio demodulation
- 14) Harmonic distortion
- 15) Spurious emission mask
- 16) Multi-carrier adjacent channel power
- 17) IQ capture

Notice

If you press **【Preset】** on the front panel, the spectrum analyzer will run again. In the following examples, unless otherwise specified, they all start with pressing **【Preset】** .

- Channel power measurement 44
- Occupied bandwidth measurement 47
- Adjacent channel power measurement 50

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- [Drift signal measurement](#) 56
- [Noise signal measurement](#) 58
- [Distortion measurement](#) 62
- [Pulse RF signal measurement](#) 70
- [Carrier-to-noise ratio](#) 76
- [Outdoor map \(option\)](#) 78
- [Indoor map \(option\)](#) 81
- [Spectrum emission mask](#) 84
- [Audio demodulation](#) 86
- [Harmonic distortion](#) 88
- [Spurious emission mask](#) 90
- [Multi-carrier adjacent channel power](#) 91
- [IQ capture](#) 92

5.2.1 Channel power measurement

This section illustrates how to use the channel power measurement function of 4024CA spectrum analyzer to perform channel power measurements of signals, using the channel power measurement of FM signals as an example.

- [Definition of channel power](#) 44
- [Measurement steps](#) 45

5.2.1.1 Definition of channel power

Channel power measurement is one of the most common measurements RF transmission systems. Therefore, channel power is defined as the power transmitted by a signal over a range of frequencies at a specified time interval. In the test of the power amplifier and the filter circuit, the system is faulty if the specific power is not measured. The communication transmitter is evaluated by measurement of channel power, and its quality of the RF transmission is determined by comparing it to specific communication protocol.

4024CA spectrum analyzer can be used to measure the channel power of FM signals. Since the FM

5.2 Introduction to typical measurements

signal and continuous wave signal differ in many respects, an accurate setting can make the measured FM signal more accurate.

5.2.1.2 Measurement steps

To measure the power of an FM signal channel using the 4024CA spectrum analyzer, proceed as follows:

a) Set the signal generator to output FM signals:

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

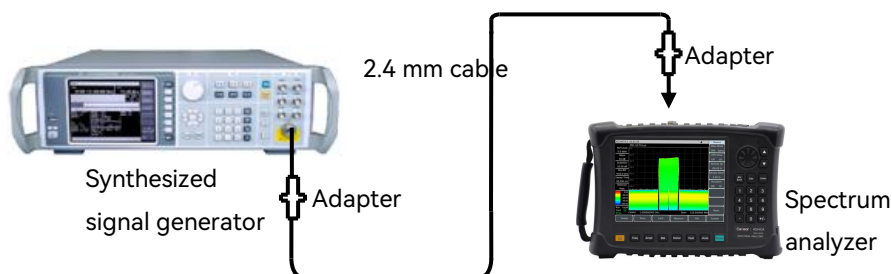


Figure 5-1 Schematic diagram of connection between signal generator and spectrum analyzer

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Turn on the channel power measurement function:

Press **【Measure】** →[Channel Power]→[ACPR Off On] . Turn on the channel power measurement function.

d) Set the center frequency:

Press **【Measure】** →[Channel Power]→[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys, which is set to 1GHz.

e) Set the channel power bandwidth

Press **【Measure】** →[Channel Power]→[Channel BW] to set the channel power bandwidth with the numeric keys, which is set to 1MHz.

f) Set the channel power span width:

Press **【Measure】** →[Channel Power]→[Span] to set the channel power sweep bandwidth with the

5.2 Introduction to typical measurements

numeric keys, which is set to 2MHz.

g) Set resolution bandwidth and video bandwidth:

Press **【BW】** → [Res BW Auto Man], set the resolution bandwidth to 30kHz;

Press **【BW】** → [Video BW Auto Man] to set the video bandwidth to 30kHz or less.

Notice

Channel power bandwidth

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

h) Enable the average function:

Press **【BW】** → [Average Off On] and set the average count to 16 and turn on the average function.

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

5.2 Introduction to typical measurements

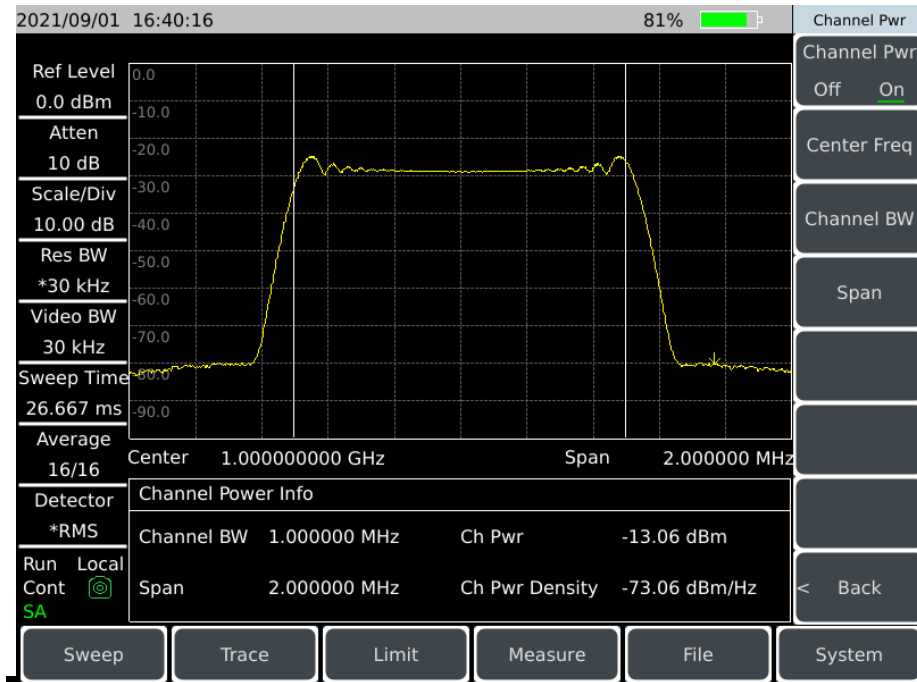


Figure 5-2 FM signal channel power measurement

5.2.2 Occupied bandwidth measurement

This section takes measuring the occupied bandwidth of FM signal as an example to illustrate how to use the occupied bandwidth measurement function of 4024CA spectrum analyzer to measure the occupied bandwidth of signal.

- [Definition of occupied bandwidth](#) 47
- [Measurement steps](#) 48

5.2.2.1 Definition of occupied bandwidth

The occupied bandwidth refers to the frequency bandwidth corresponding to a certain ratio of total transmit power of the energy, which is centered as the center frequency of the specified channel. The occupied bandwidth measurement of 4024CA spectrum analyzer can present the measurement results in a quick, clear and accurate manner. There are two methods for calculating the occupied bandwidth depending on the modulation method:

a) Power percentage method:

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

b) Power drop XdB method:

5.2 Introduction to typical measurements

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

5.2.2.2 Measurement steps

Steps for measuring the occupied bandwidth using the 4024CA spectrum analyzer are as follows:

a) Set the signal generator to output FM signals:

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

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Set center frequency:

Press **【Freq】** →[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys, which is set to 1GHz.

d)Set RBW

Press **【BW】** → [Res BW Auto Man] to set the resolution bandwidth to the appropriate value.

e) Set video bandwidth:

Press **【BW】** → [Video BW Auto Man] to set the video bandwidth to the appropriate value.

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

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

Press **【Measure】** →[OBW]→[OBW Off On].

After the occupied bandwidth measurement function is turned on, the spectrum analyzer switches to the occupied bandwidth measurement interface, and the measurement result is displayed at the bottom of the screen. The schematic diagram of occupied bandwidth measurement is shown in Figure 5-3. The two vertical white lines on the screen visually indicate the frequency range of occupied bandwidth. When the occupied bandwidth measurement function is turned on, if the detection mode of the spectrum analyzer is automatic, it will automatically switch to the root mean

5.2 Introduction to typical measurements

square detection mode. Users can change the measurement method, occupied bandwidth span and other parameters through the corresponding menu to get more accurate measurement results.

g) Select measurement method:

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

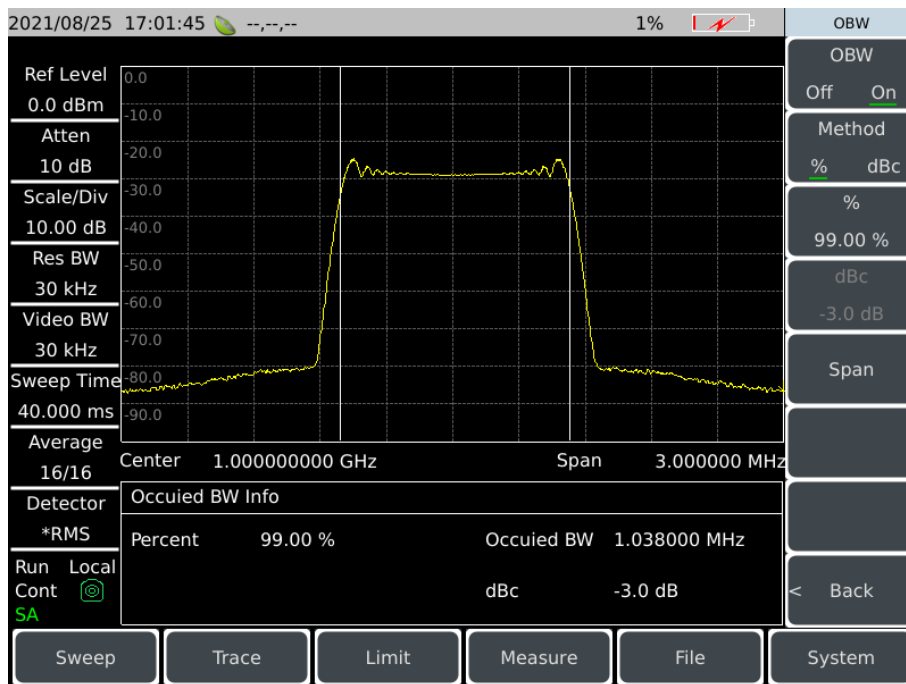


Figure 5-3 Occupied bandwidth measurement

h) Change percentage:

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

i) Change x DB value:

When the measurement method is selected as XdB method, Press **【Measure】** →[OBW]→[dBc -3.0dB], user can use the numeric keys, up and down keys or the rotary knob to change the value of XdB. The range of XdB value is set from -0.1dB to -100dB, the minimum step is 0.01dB, and the default is -3dB.

j) Change the occupied bandwidth span:

5.2 Introduction to typical measurements

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

k) Turn off occupied bandwidth measurement:

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

5.2.3 Adjacent channel power measurement

Taking the measurement of adjacent channel power ratio of FM signal as an example, this section illustrates the operation method of adjacent channel power ratio measurement using 4024CA spectrum analyzer.

- [Definition of adjacent channel power ratio](#) 50
- [Measurement steps](#)..... 50

5.2.3.1 Definition of adjacent channel power ratio

The adjacent channel power ratio (ACPR) is also called the Adjacent Channel Leakage Power Ratio (ACLR), which is the ratio of the transmit power of channel to the radiated power of its adjacent channel. It is usually expressed by the ratio of the power in the specified bandwidth to the total channel power at different frequency offsets of adjacent channels. The size of adjacent channel power mainly depends on the extension of the edge band and noise of the transmitter.

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

5.2.3.2 Measurement steps

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

The operation steps to measure the ACPR of WBFM signals using the ACPR measurement function of the 4024CA spectrum analyzer are as follows:

5.2 Introduction to typical measurements

a) Set the signal generator to output WBFM signals:

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

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Set the reference level of spectrum analyzer:

Press **【Ampt】** → [Ref Level] → -10 [dBm];

Press **【Ampt】** → [Scale/Div] to set the scale to 10dB/div.

d) Set resolution bandwidth and video bandwidth:

Press **【BW】** → [Res BW Auto Man], set the resolution bandwidth to 30kHz;

Press **【BW】** → [Video BW Auto Man] to set the video bandwidth to 30kHz or less.

e) Switch to adjacent channel power ratio measurement:

Press **【Measure】** → [ACPR] → [ACPR Off On] to switch to the ACPR measurement interface.

f) Set the center frequency of the main channel:

Press [Center Freq] to set the center frequency of the main channel with the numeric keys. The center frequency is set to 1GHz.

g) Set the main channel bandwidth:

Press [Main Ch BW] to set the bandwidth of the main channel with the numeric keys. The channel bandwidth is set to 1MHz.

h) Set the adjacent channel bandwidth:

Press [Adj Ch BW] to set the required adjacent channel bandwidth with the numeric keys. The adjacent channel bandwidth is set to 2MHz.

i) Set the channel offset:

Press [Ch Spacing] to set the desired channel offset with the numeric keys and enter 1MHz.

j) Turn on the adjacent channel power ratio test:

Press [ACPR Off On], and the measurement results are displayed at the bottom of the screen. The

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schematic diagram of adjacent channel power ratio measurement is shown in Figure 5-4.

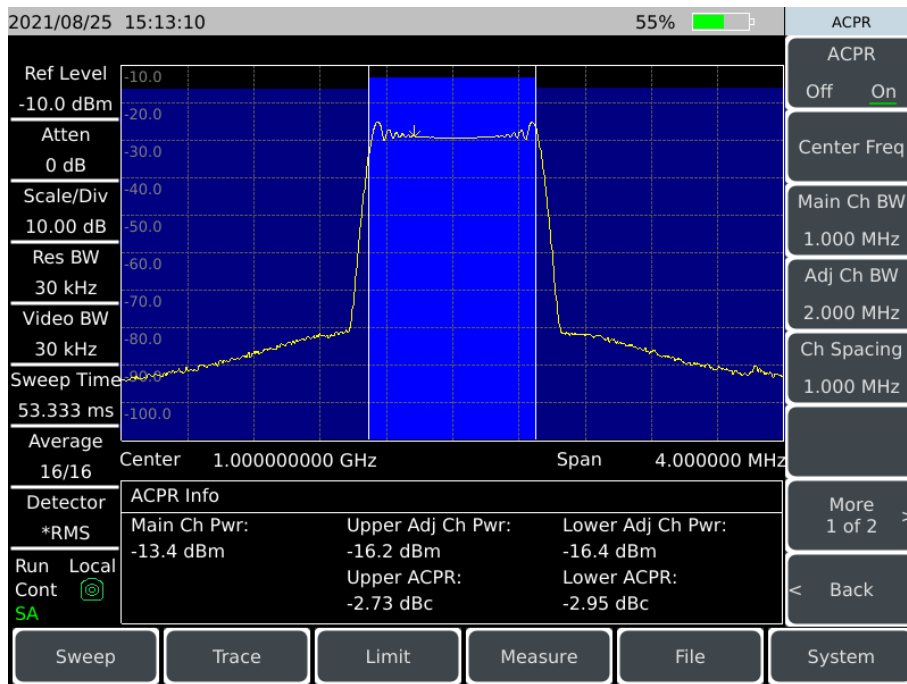


Figure 5-4 Adjacent channel power ratio measurement

k) Threshold setting:

The threshold test function will facilitate the user to observe whether the adjacent channel power exceeds the set range. Press **[Measure]** → **[ACPR]** → **[More 1 of 2]** to enter the adjacent channel power ratio threshold test setting menu;

Press **[Upper Limit]** to enter the upper adjacent channel limit with the numeric keys;

Press **[Lower Limit]** to enter the lower adjacent channel limit with the numeric keys.

l) Open the threshold test function:

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

5.2.4 Third-order intermodulation distortion measurement

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- Measurement steps 53

5.2.4.1 Definition of third-order intermodulation distortion

Mutual interference between devices is common in the crowded environment where communication systems work. For example, the second-order and third-order intermodulation distortion is often

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encountered in narrowband systems. When two signals (F_1 and F_2) are present in a system, they are mixed with the generated second harmonic distortion signals ($2F_1$ and $2F_2$) to generate third-order intermodulation products $2F_2-F_1$ and $2F_1-F_2$ close to the original signal. Higher-order intermodulation distortion may also occur. Most of these distortion products are generated by devices such as amplifiers and mixers in the system.

The following describes how to measure third-order intermodulation distortion. Examples will be given of how to display two signals simultaneously on the spectrum analyzer screen, and how to set the resolution bandwidth, mixer level and reference level, as well as incorporating the use of some cursor functions.

5.2.4.2 Measurement steps

a) Connect the instrument under test to the spectrum analyzer as shown in Figure 5-5.

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

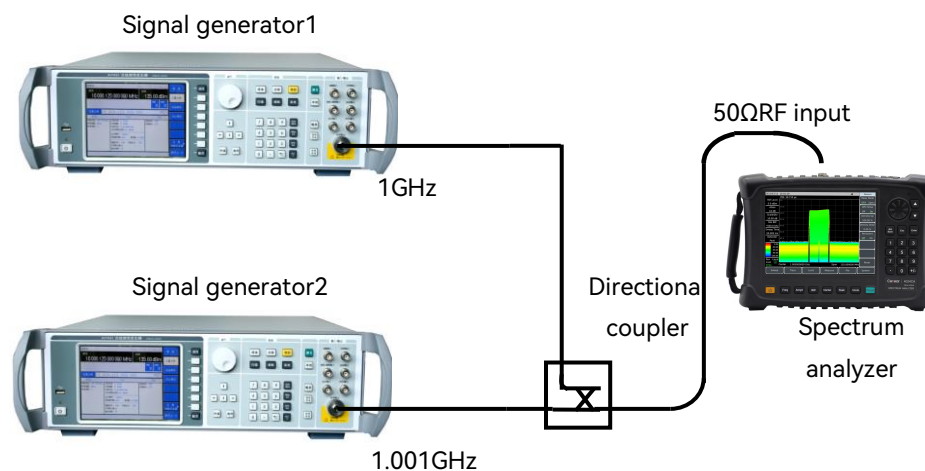


Figure 5-5 Connecting a third-order intermodulation distortion measurement system

Set the output frequency of one of the signal generators to 1GHz and the output frequency of the other signal generator to 1.001GHz, so that the frequency interval of the two signals input to the spectrum analyzer is 1MHz.

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

b) Set the spectrum analyzer so that both signals are displayed on the spectrum analyzer screen at the same time:

Press **【Preset】** .

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Press **【Freq】** → [Center Freq] → 1.001 [GHz].

Press **【Freq】** → [Span] → 5 [MHz].

Two signals can be seen in the center of the screen, as shown in Figure 5-6. If the frequency interval used is different from this example, a span greater than three times the frequency interval of the signal generator shall be selected.

c) Decrease the resolution bandwidth until the distortion products are visible:

Press **【BW】** and use the step key [**↓**] to reduce the resolution bandwidth.

d) Adjust the two signal generators to determine that the input signal amplitudes are equal:

Press **【Marker】** → [Delta] → **【Peak】** → [Next Peak] or [Next pk Left] or [Next pk Right]. Adjust the signal generator corresponding to the cursor until the amplitude difference reading is zero. If needed, reduce the video bandwidth.

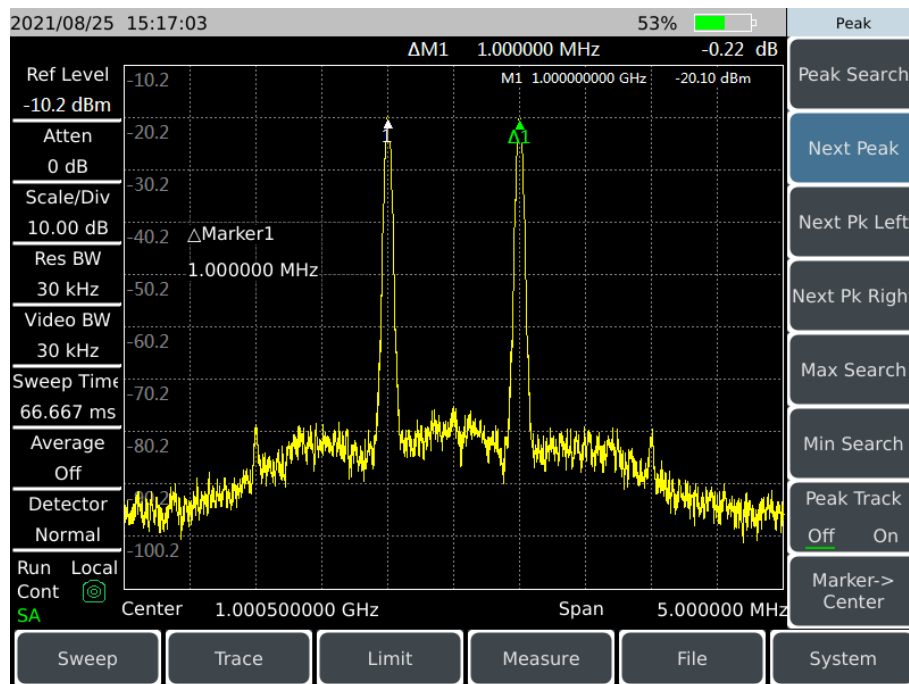


Figure 5-6 Signal in the center of spectrum analyzer display

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

Press **【Peak】** → [Peak Search] to read the power value of the peak.

Press **【Ampt】** → [Ref Level].

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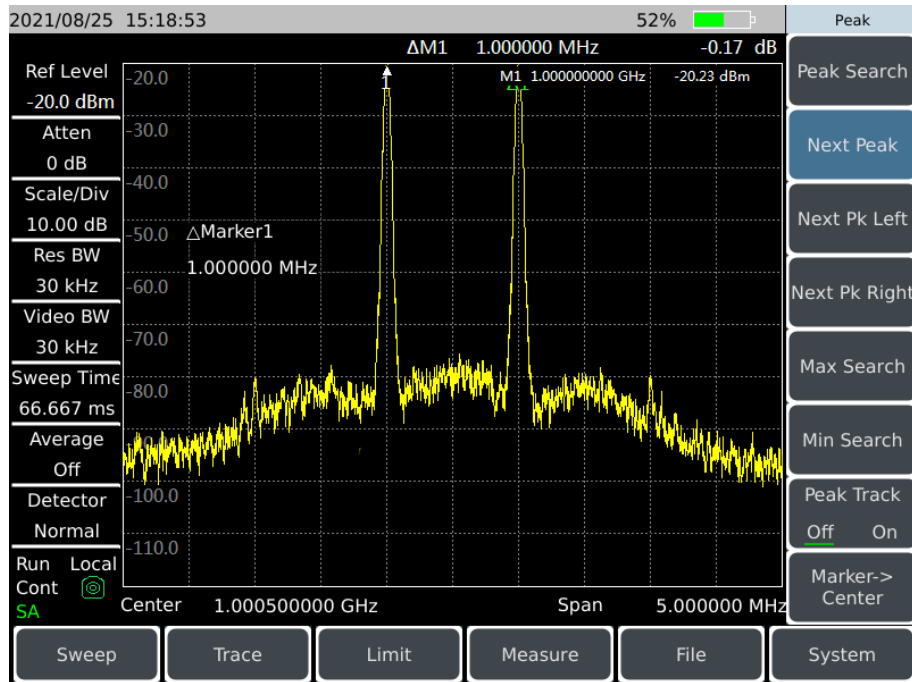


Figure 5-7 Placing the signal peak at the reference level

To get the best measurement accuracy, the signal generator signal peak should be placed at the reference level, as shown in Figure 5-7.

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

Once the marker is activated, the delta marker function generates a second marker and displays the difference between the two markers. Relative measurements can be easily performed at this point.

Press **【Peak】** to activate a marker.

Press **【Marker】** → **[Delta]** to activate the second marker.

Press **【Peak】** → **[Next pk Left]** or **[Next pk Right]** to set the second marker on the peak point of distortion product next to the signal of signal generator. Referring to Figure 5-8, the frequency and amplitude differences between the two markers are shown in the marker display area, and the marker amplitude difference is the third-order intermodulation distortion measurement value.

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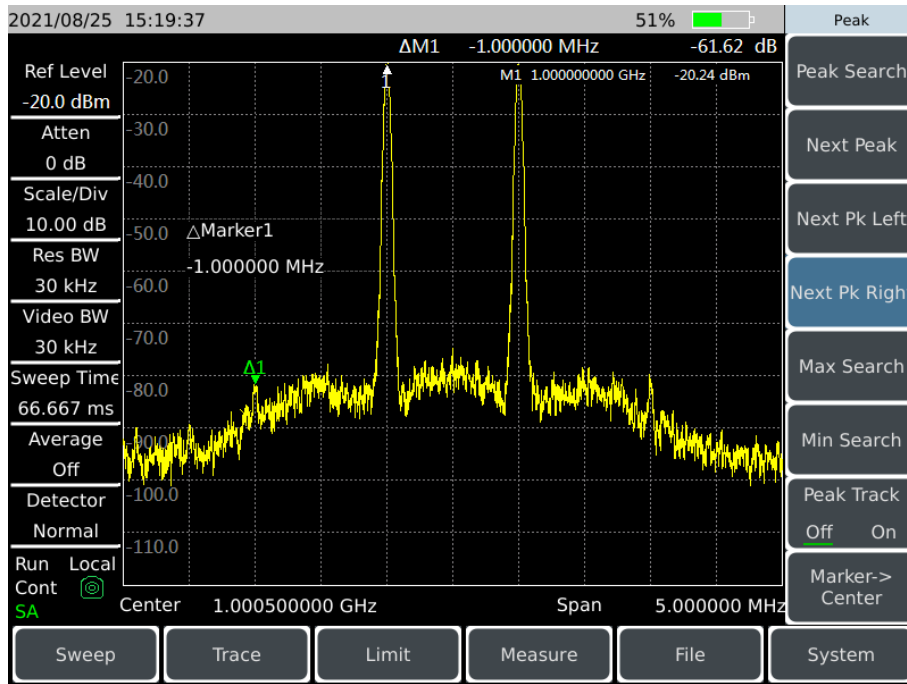


Figure 5-8 Relative measurement of internal modulation distortion

g) Calculation of the Third-order Intercept Point (TOI):

The ratio of distortion component level to signal level (in dB) specifies that the distortion of the system is not very meaningful unless the signal level is also specified. The concept of intercept point can be used to specify and pre-estimate the distortion level of the system, where the difference between the third-order distortion component level and the fundamental signal level is twice the difference between the fundamental signal level and the third-order intercept point. Therefore, the third-order intercept point (TOI) can be calculated according to the following equation:

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

Where:

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

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

As shown in Figure 5-7, if the delta marker reading is -61.62dB and the signal level is -20.24dBm, the input third-order intercept point (TOI) is:

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

5.2.5 Drift signal measurement

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- [Measuring the frequency drift of signal generators](#) 57

5.2.5.1 Definition of drift signal

If the signal under test is a drift signal, it needs to keep changing the center frequency at different times to be observed when measured with a spectrum analyzer. If the signal tracking function of the spectrum analyzer is used, the marker peak will always be displayed on the center frequency of the spectrum analyzer, which can be easily measured.

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

5.2.5.2 Measuring the frequency drift of signal generators

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

This example will use the signal tracking function of the spectrum analyzer to keep the drift signal always displayed in the center, and use the maximum track holding function of the spectrum analyzer to capture the drift.

a) Set the signal generator output signal:

Set the output frequency of the signal generator to 300MHz and the amplitude to -20dBm, connect the output of the signal generator to the input port of the spectrum analyzer, as shown in Figure 5-1, and turn on its RF output.

b) Set the center frequency, span and reference level of the spectrum analyzer:

Press **【Preset】** .

Press **【Freq】** → [Center Freq]→ 300 [MHz].

Press **【Freq】** →[Span]→ 10 [MHz].

Press **【Ampt】** → [Ref Level]→ -10 [dBm]

c) Place the marker at the signal peak position and turn on the signal tracking function:

Press **【Peak】** →[Peak Track Off On].

Press **【Freq】** →[More 1 of 2]→[Signal Track Off On].

d) Reduce span:

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Press **【Freq】** →[Span]→ 500 [kHz] to see that the signal stays in the center.

e) Turn off signal tracking function:

Press **【Freq】** →[More 1 of 2]→[Signal Track Off On].

f) Use the Max Hold to measure signal drift:

Press **【Trace】** → [Max Hold] .

When the signal changes, the Max Hold will maintain the maximum response to the input signal.

g) Activate Trace 2 and set to continuous refresh mode.

Press **【Trace】** →[Trace 1 2 3]→[Clear Write].

h) Change the output frequency of the signal generator:

Slowly change the output frequency of the signal generator in 1kHz steps, varying at ± 50 kHz, and the spectrum analyzer displays as shown in Figure 5-9.

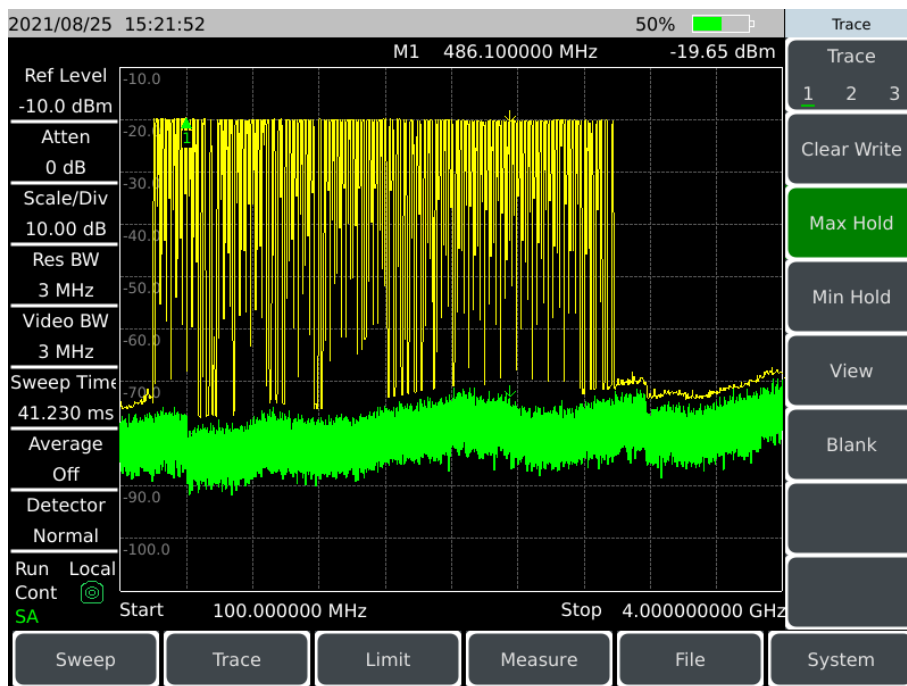


Figure 5-9 Observing drift signal using Max Hold

5.2.6 Noise signal measurement

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- Measuring signal-to-noise ratio 59
- Measuring noise with noise marker function 60

5.2.6.1 Definition of noise signal

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

The following describes how to use the marker function of 4024CA spectrum analyzer to measure signal-to-noise ratio and noise. The example describes the signal-to-noise measurement in the case where the signal (carrier) is a single frequency point. If there is a modulated signal in the system under test, the test procedure needs to be modified to correct the level of the modulated signal.

5.2.6.2 Measuring signal-to-noise ratio

a) Set the signal generator output signal:

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

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

Press **【Preset】** .

Press **【Freq】** → [Center Freq]→ 1 [GHz].

Press **【Freq】** →[Span]→ 5 [kHz].

Press **【Ampt】** → [Ref Level]→ -10 [dBm]

Press **【Ampt】**→[Atten Auto Man]→ 30 [dB] (the maximum attenuation value of 4024CA is 30dB, and only 30dB attenuation is set).

c) Place the marker at the peak position of the signal, then place the difference marker at the noise position with a frequency offset of 200 kHz:

Press **【Peak】** →[Peak Search].

Press **【Marker】** →[Delta]→ 200 [kHz].

d) Turn on the noise marker function to view the signal to noise ratio:

Press **【Marker】** →→ [Marker Noise Off On] , as shown in Fig. 5-10.

The reading of signal-to-noise ratio is expressed in dB/Hz because the noise value is a value noise bandwidth that is normalized to 1 Hz. The ratio is reduced by $10 \times \log(BW)$. If you want to get the noise value under different channel bandwidth, the measurement result needs to be corrected

5.2 Introduction to typical measurements

according to the current bandwidth. For example, if the data read by the spectrum analyzer is -85dB/Hz and the channel bandwidth is 30kHz, the signal-to-noise ratio is:

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

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

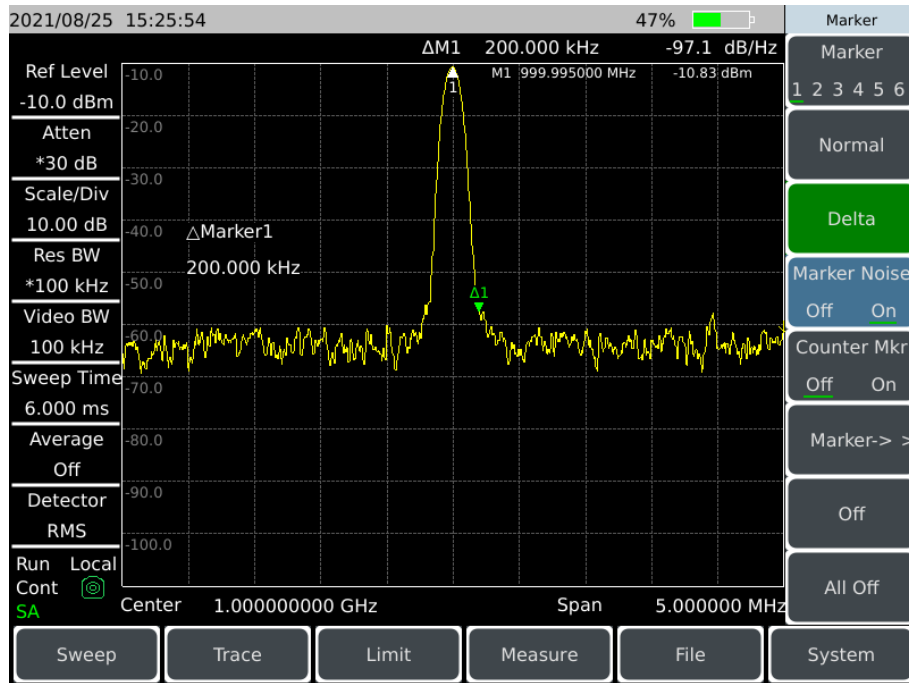


Figure 5-10 Measurement Signal to Noise Ratio

5.2.6.3 Measuring noise with noise marker function

This example will use the noise marker function to measure noise in the 1 Hz bandwidth with 1GHz external signal.

a) Set the signal generator output signal:

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

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

Press **【Preset】** .

Press **【Freq】** → [Center Freq]→ 999.98 [MHz].

Press **【Freq】** →[Span]→ 1 [MHz].

Press **【Ampt】** → [Ref Level]→ -10 [dBm]

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Press **[Ampt]** → [Atten Auto Man] → 30 [dB] (the maximum attenuation value of 4024CA is 30dB, and only 30dB attenuation is set).

c) Activate the noise marker.

Press **[Marker]** → [Marker Noise Off On]

Note that the detection mode at this time will be automatically set to root mean square detection. If you want to get the noise power value under different bandwidth, it should be corrected according to the current bandwidth by $10 \times \log(BW)$. For example, if you want to get the noise power in the 1 kHz band, please add $10 \times \log(1000)$ or 30 dB to the read data.

d) Reduce the measurement error by averaging.

Press **[BW]** → [Res BW Auto Man] → 100 [kHz] .

Press **[BW]** → [Average Off On].

Enable the average function to reduce the measurement error.

e) Move the marker to 1GHz.

Press **[Marker]** and turn the rotary knob in the front panel to make the noise marker readout 1GHz.

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

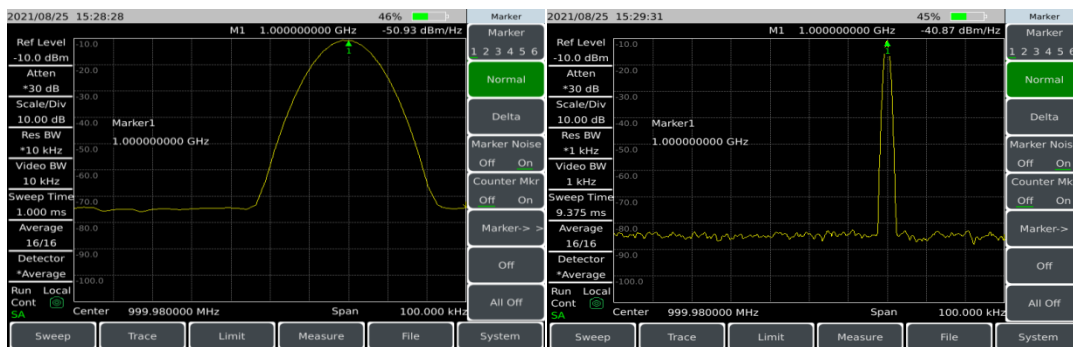


Figure 5-11 Measuring noise with noise marker function

f) Set the spectrum analyzer to zero span centered on the marker position.

Press **[Peak]** → [Marker-> Center].

Press **[Freq]** → [Span] → [Zero Span] ;

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Press **【Marker】** .

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

5.2.7 Distortion measurement

Mutual interference between devices is common in the crowded environment where communication systems work. For example, the second-order and third-order intermodulation distortion is often encountered in narrowband systems. When two signals (F_1 and F_2) are present in a system, they are mixed with the generated second harmonic distortion signals ($2F_1$ and $2F_2$) to generate third-order intermodulation products $2F_2-F_1$ and $2F_1-F_2$ close to the original signal. Higher-order intermodulation distortion may also occur. Most of these distortion products are generated by devices such as amplifiers and mixers in the system. Most transmission devices and signal generators contain harmonics, and harmonic components are often required to be measured.

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- [Fast harmonic measurement method](#) 64
- [Accurate harmonic measurement method](#) 67

5.2.7.1 Identifying distortion generated by spectrum analyzer

When a large signal is input to the spectrum analyzer, it will cause distortion in the spectrum analyzer thus affecting the distortion measurement results of the real signal. Using the attenuator setting, you can determine which signal is the distorted signal generated inside the spectrum analyzer. This example will use the input signal generated by the signal generator to explain whether the spectrum analyzer produces harmonic distortion.

a) Set the signal generator output signal:

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

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

Press **【Preset】** .

Press **【Freq】** → [Center Freq]→ 400 [MHz].

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Press **【Freq】** →[Span]→ 500 [MHz].

The harmonic distortion generated by the signal can be seen on the spectrum analyzer trace as 200MHz frequency offset from the original 200MHz signal, as shown in Figure 5-12.

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

Press **【Peak】** →[Next Peak].

Press **【Peak】** →[Marker-> Center].

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

Press **【Freq】** →[Span]→ 50 [MHz].

Press **【Peak】** →[Marker-> Center].

e) Set the attenuator to 0dB.

Press **【Ampt】** →[Atten Auto Man]→ 0 [dB].

Press **【Peak】** →[Peak Track Off On].

Press **【Marker】** →[Delta].

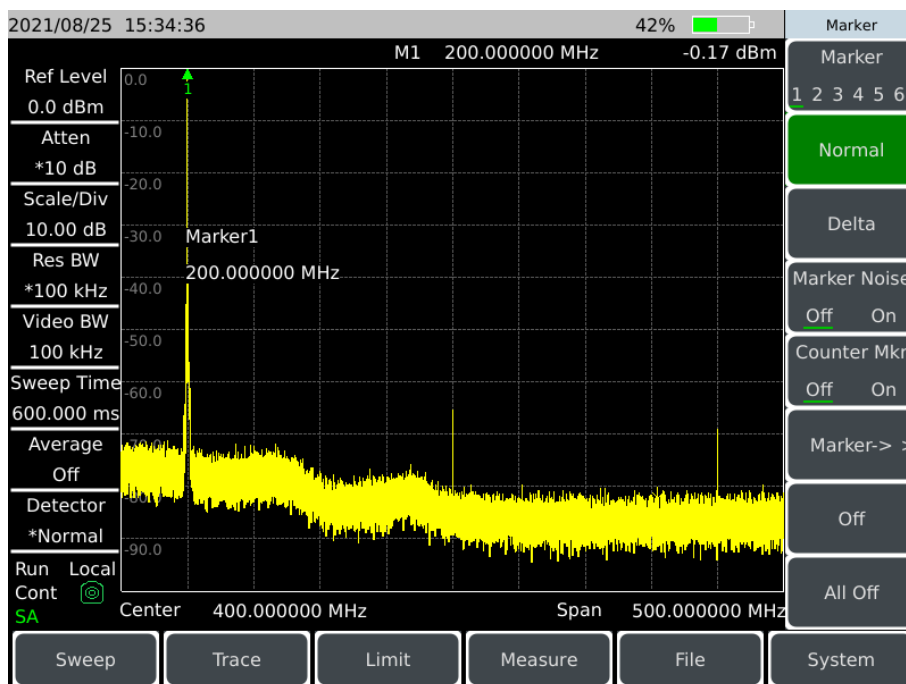


Figure 5-12 Observing harmonic distortion

f) Increase the attenuator setting to 10dB:

Press **【Ampt】** →[Atten Auto Man]→ 10 [dB].

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Pay attention to the reading of the delta marker, as shown in Figure 5-13. This reading is the distortion difference generated by the attenuator at 0dB and 10dB. When the attenuator changes, if the difference frequency marker reading is greater than or equal to 1dB, it means that the spectrum analyzer has produced some distortion. The attenuation may also be increased when the delta marker reading is not obvious.

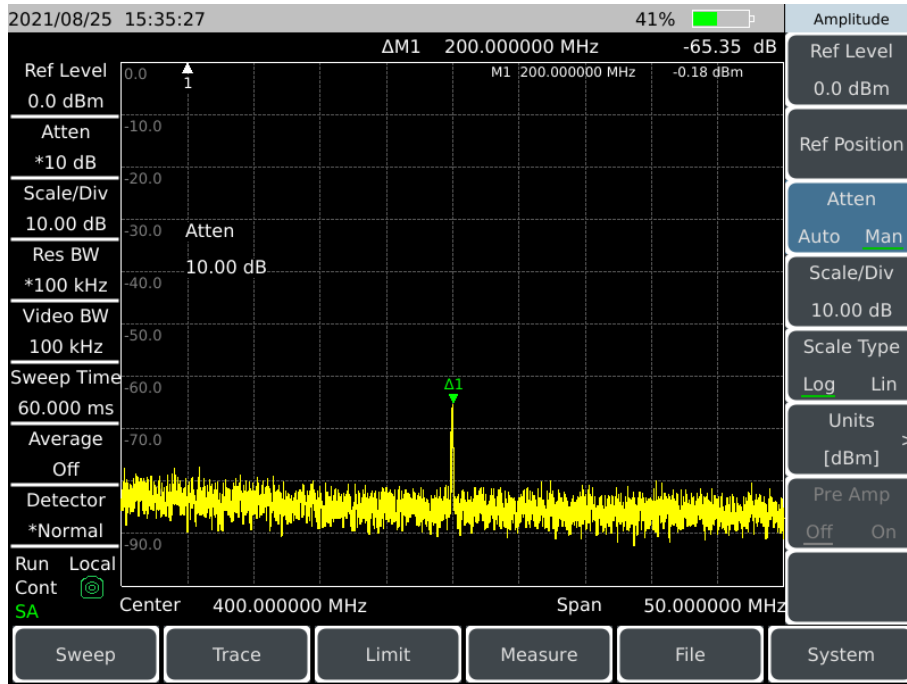


Figure 5-13 Attenuator set to 10dB

The amplitude reading of the delta marker has two sources: first, increasing RF attenuation will reduce the signal-to-noise ratio, which will cause the reading to be positive; Second, the harmonic distortion generated by the spectrum analyzer circuit is reduced, which will cause the reading to be negative. The larger the reading, the greater the measurement error. The absolute amplitude of the delta marker reading can be reduced by changing the attenuator.

5.2.7.2 Fast harmonic measurement method

This example measures the harmonic component of the signal with frequency of 1GHz and power of -10dBm generated by the signal generator.

a) Set the signal generator output signal:

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

b) Set the start and stop frequencies of spectrum analyzer.

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Press **[Preset]** .

Press **[Freq]** →[Start Freq]→ 800 [MHz]→[Stop Freq]→ 2.5 [GHz].

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

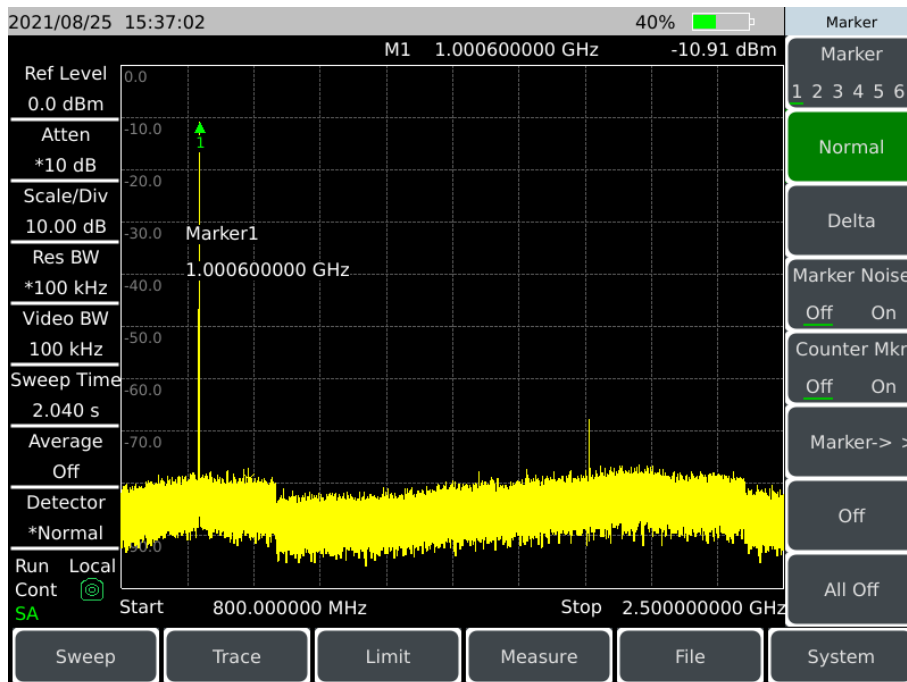


Figure 5-14 Input signals and harmonics

c) Set video bandwidth to smooth noise to improve the resolution.

Press **[BW]** →[Video BW Auto Man] to make manual effective.

Use the step-down key [**↓**] to reduce the video bandwidth.

d) To improve the measurement accuracy, set the fundamental peak level as the reference level.

Press **[Peak]** →[Max Search] to read the power of the peak.

Press **[Ampt]** →[Ref Level] to set the peak power. The result is shown in Figure 5-15.

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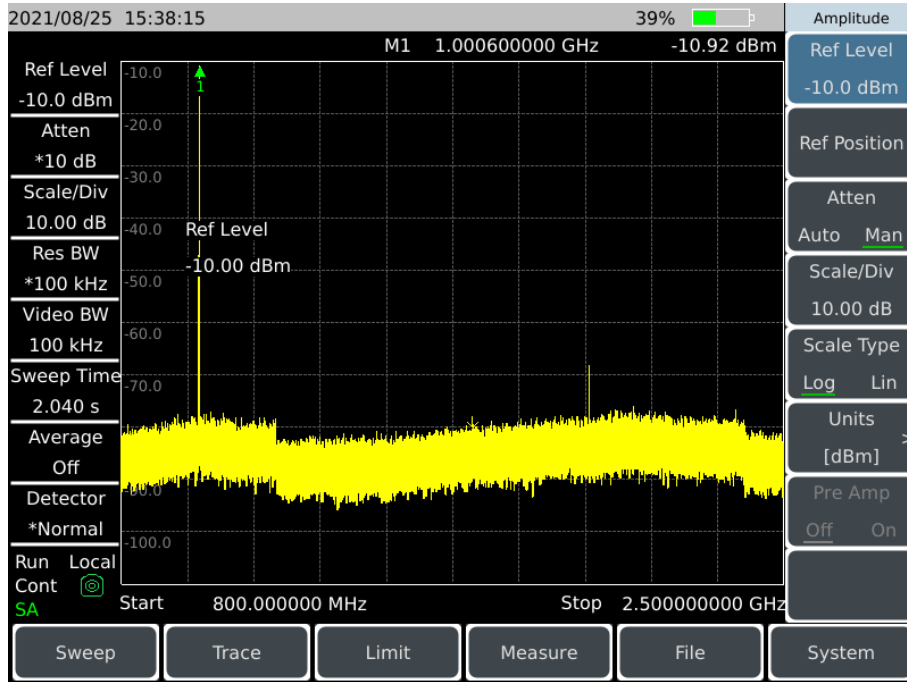


Figure 5-15 Placing the signal peak at the reference level for maximum accuracy

e) Activate second marker.

Press **[Marker]** → **[Delta]** → **[Peak]** → **[Next Peak]**.

At this time, the fixed marker is marked on the fundamental wave, and the active marker is located on the peak point of the second harmonic, as shown in Figure 5-16.

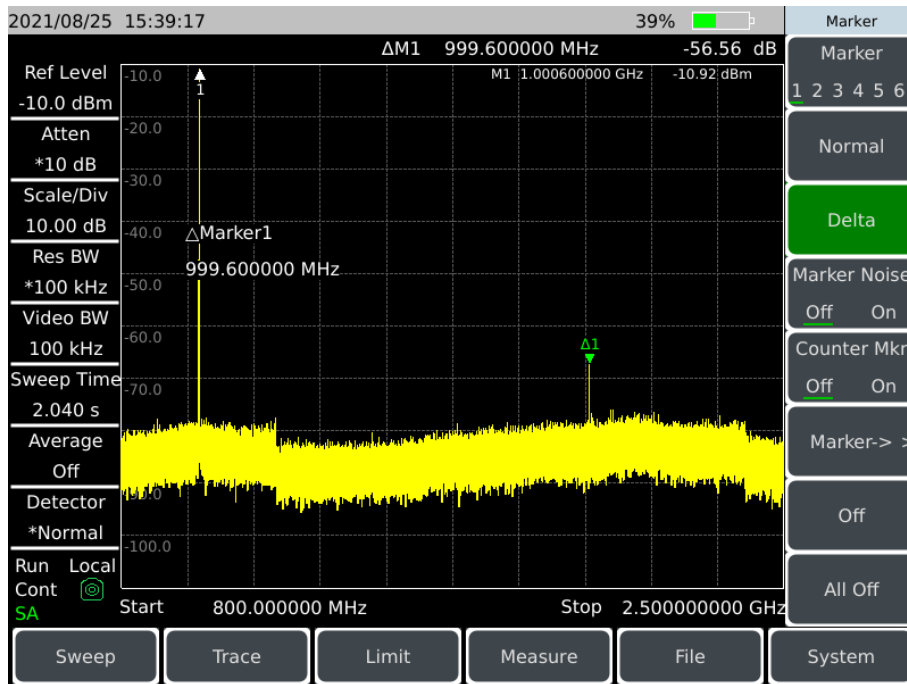


Figure 5-16 Measuring the second harmonic with marker difference

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f) Measure harmonic distortion (Method 1).

The figure shows that the amplitude difference between the fundamental wave and the second harmonic is about -56dB, or 0.2% of the harmonic distortion (see Figure 5-17).

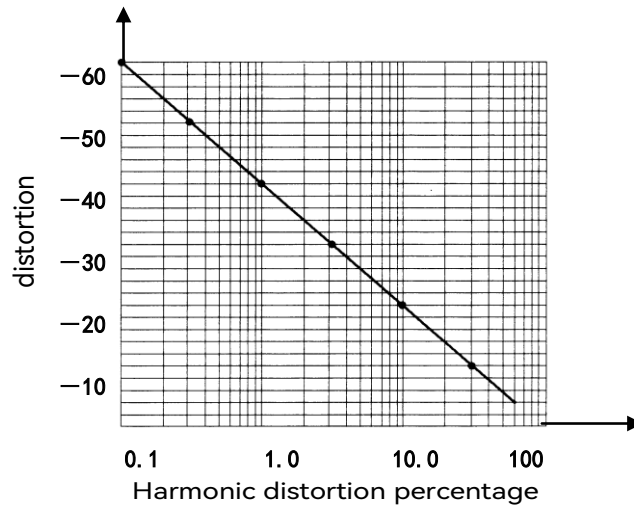


Figure 5-17 Harmonic distortion amplitude percentage conversion

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

g) Measure harmonic distortion (Method 2).

Press **[Ampt]** →[Units]→[Volt].

At this point the unit of delta marker automatically changes to volts. An easy way to determine the distortion percentage is to change the unit to volts. The distortion percentage is obtained by moving the decimal point of the ratio shown by the delta marker two places to the right. The smallest scale that can be displayed is 0.01 or one percent.

5.2.7.3 Accurate harmonic measurement method

The steps of this method are slightly longer, but because each signal is measured under a small span and resolution bandwidth, the signal-to-noise ratio is improved, and the measurement result is more accurate. The following describes how to measure the harmonics of 1GHz signals.

a) Set the signal generator output signal:

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

b) Set the start and stop frequencies of spectrum analyzer:

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Press **【Preset】** .

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

c) Set video bandwidth to smooth noise to improve the resolution:

Press **【BW】** →[Video BW Auto Man] to make manual effective.

Use the step-down key [↓] to reduce the video bandwidth.

d) Reduce the span by using the signal tracking function:

Press **【Peak】** to activate the marker to search for signal peaks.

Press **【Freq】** →[Signal Track Off On].

Press **【Freq】** → [Span]→ 100 [kHz].

e) Turn off signal tracking.

Press **【Freq】** →[Signal Track Off On].

f) The best amplitude measurement accuracy is obtained by shifting the signal peak to the top grid line.

Press **【Peak】** →[Peak Search] to read the power of the peak.

Press **【Ampt】** →[Ref Level] to set the peak power. The result is shown in Figure 5-18.

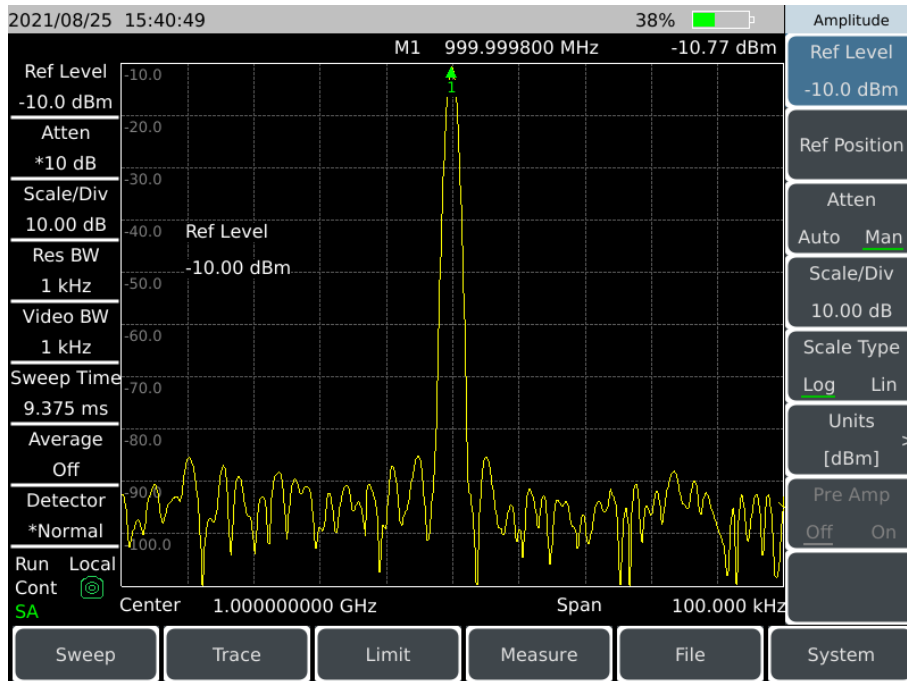


Figure 5-18 Input signal displayed at 100kHz span

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g) Set the center frequency step as the fundamental signal frequency value.

Press **【Freq】** →[CF Step Auto Man]→1[GHz];

h) Measure second harmonic.

Press **【Marker】** →[Marker->Center]→[Marker->Center] and step key [**↑**]. The step operation transforms the spectrum analyzer center frequency to the second harmonic. Press **【Peak】** →[Peak Search] to read the power of the peak.

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

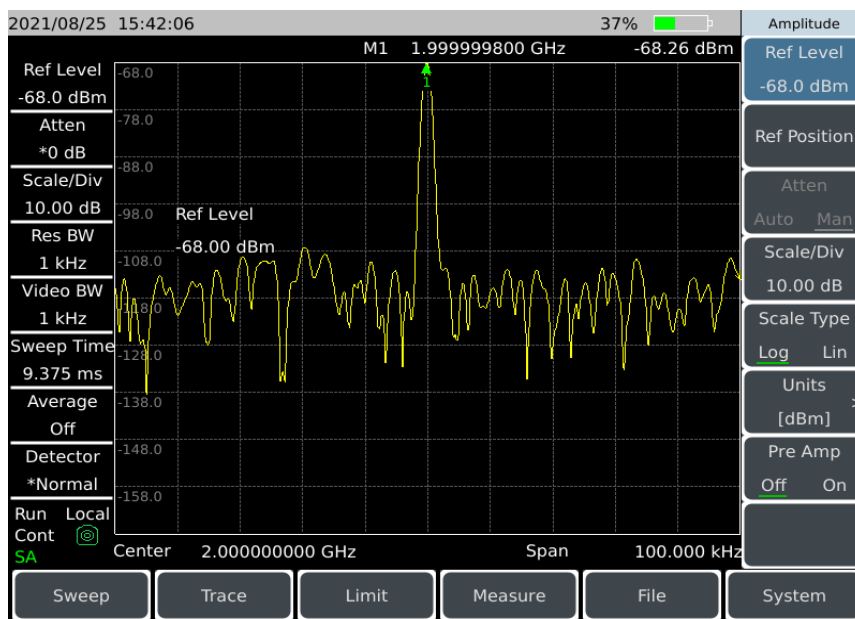


Figure 5-19 Second harmonic amplitude

i) Calculate harmonic distortion.

Figure 5-17 is used to transform the distortion percentage between the second harmonic and the fundamental wave. The unit can then be converted to volts in order to read the voltage ratio of the two signals.

j) Measure other harmonics.

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

The total harmonic distortion percentage of the signal is also a parameter that often needs to be tested. To test this parameter, the amplitude of each harmonic must be measured in linear units (such as volts), not in relative units dBc. Press **【Ampt】** →[Units]→[Volt]. The unit of amplitude is volt. The measured signal amplitude value can be used to calculate the total harmonic distortion in the

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following equation:

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

Where:

A₁ -- fundamental wave amplitude, in volt

A₂ -- second harmonic amplitude, in volt

A₃ -- third harmonic amplitude, in volt

A_n -- nth harmonic amplitude, in volt

The percentage of harmonic distortion measured in this process is very accurate if the signal amplitude is carefully measured as in the previous example.

5.2.8 Pulse RF signal measurement

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- Measurement of center frequency, sidelobe ratio and pulse width of pulse RF signal 70
- Pulse repetition frequency (PRF) measurement 74
- Peak pulse power measurement 75

5.2.8.1 Definition of pulse RF signal

A pulse RF signal is an RF pulse train with the same repetition frequency, constant pulse width, and constant shape and amplitude. In this section, several methods for measuring parameters of pulse RF signal are described. The method will explain how to measure the center frequency, pulse width and pulse repetition frequency. In addition, issues such as the measurement of peak pulse power are discussed.

The impact of resolution bandwidth on pulse RF signal measurement is significant. It is important to understand the relationship between resolution bandwidth and pulse repetition frequency. When the resolution bandwidth is narrower than the pulse repetition frequency, only the individual frequency components that make up the pulse RF signal appear on the screen, which is called narrowband mode. When the resolution bandwidth is wider than the pulse repetition frequency, it is called the broadband mode. At this time, the spectrum envelope depicted by the pulse segments equally divided by the pulse repetition frequency can be seen.

5.2.8.2 Measurement of center frequency, sidelobe ratio and pulse width of pulse RF signal

a) Set the signal generator output signal:

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

b) Set the spectrum analyzer:

The measurement of pulse RF signal is generally carried out in broadband mode. In order to ensure that the video filter does not affect the measurement results, the video bandwidth is set to 3MHz.

Press **[Preset]** .

Press **[Freq]** → [Center Freq]→ 1 [GHz].

Press **[Freq]** →[Span]→10 [MHz], **[Sweep]** →[Sweep Time Auto Man] →60 [ms].

Press **[BW]** →[Res BW Auto Man]→100[kHz], [Video BW Auto Man]→ 100 [kHz].

Press **[BW]** →[Detector]→[Peak] to activate the positive peak detection.

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

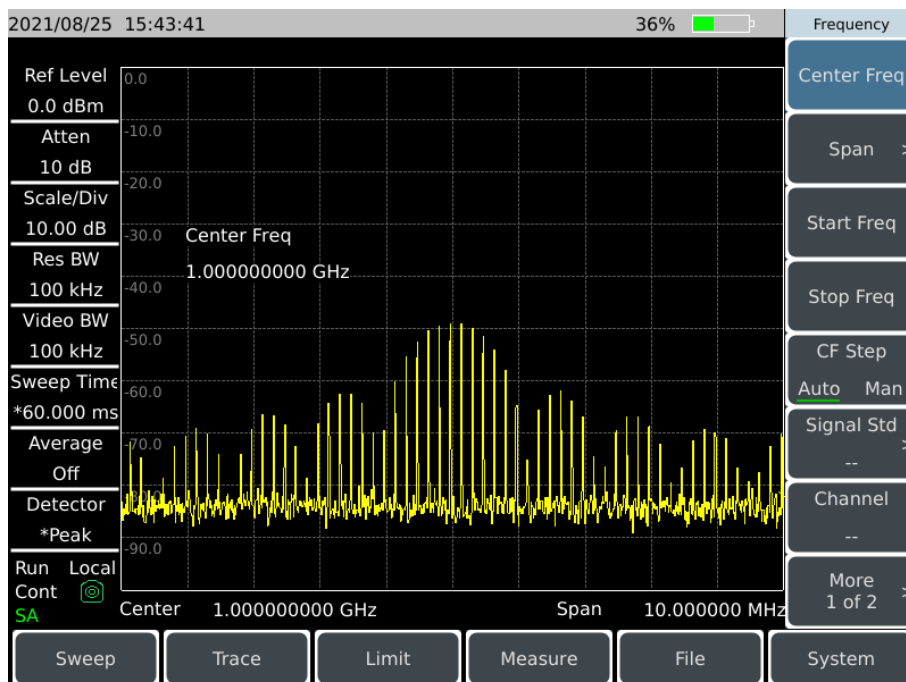


Figure 5-20 Main lobe and side lobe

Increase the scanning time (scanning slows down) until the figure is filled and becomes a solid line, as shown in Figure 5-21. If the spectral line cannot be filled in, the instrument is not in broadband mode. In this case, the following measurement steps for sidelobe ratio, pulse width and peak pulse

5 Spectrum Analyzer mode

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power are not applicable, and the resolution bandwidth needs to be set to greater than 1kHz.

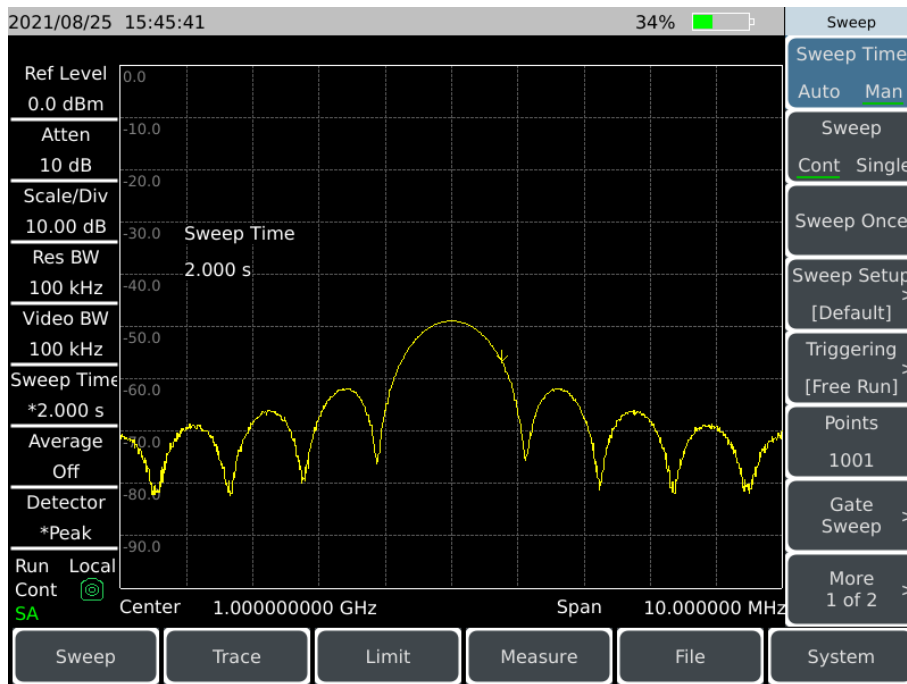


Figure 5-21 Solid-line trace

c) Read out the pulse center frequency and main lobe amplitude:

Press **Peak** .

The marker reading at this point is the pulse center frequency and the main flap amplitude.

d) Measure the side lobe ratio when the marker is at the center frequency of the main lobe:

Press **Peak** → **Marker** → [Delta] → **Peak** → [Next Peak].

The amplitude difference between the main lobe and the side lobe is the side lobe ratio, as shown in Figure 5-22.

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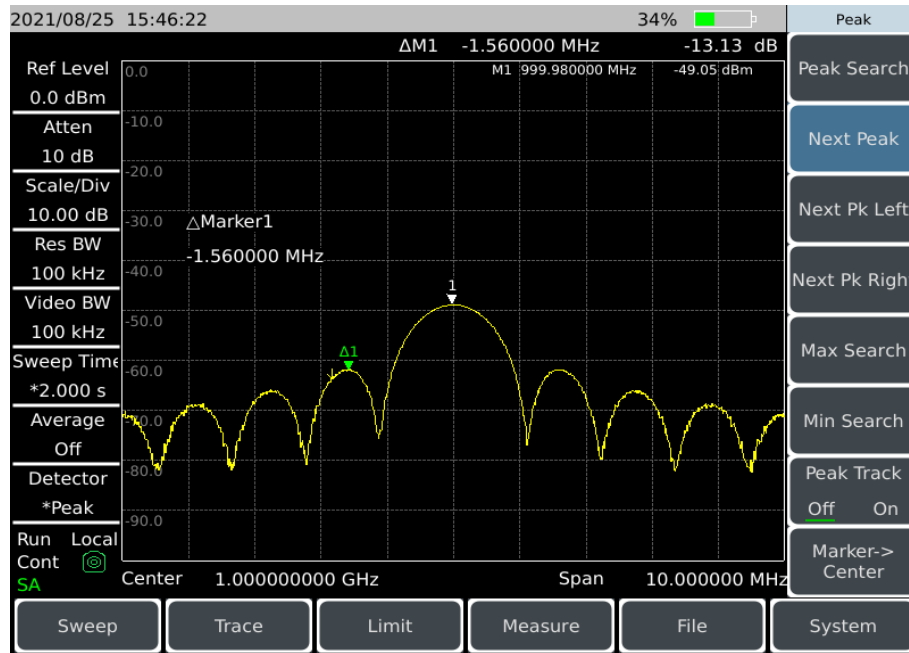


Figure 5-22 Side lobe ratio displayed by marker

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

Press **【Marker】** → **[Delta]** → **【Peak】** → **[Next pk Left]** → **[Next pk Left]**.

The reciprocal of the frequency difference of the delta marker read out at this point is the pulse width, as shown in Figure 5-23. To obtain the most accurate pulse width value, you can manually adjust the cursor position to measure the distance between two adjacent side lobes over the zero point. If the resolution bandwidth is reduced to make the over-zero point sharper, the measurement accuracy is higher.

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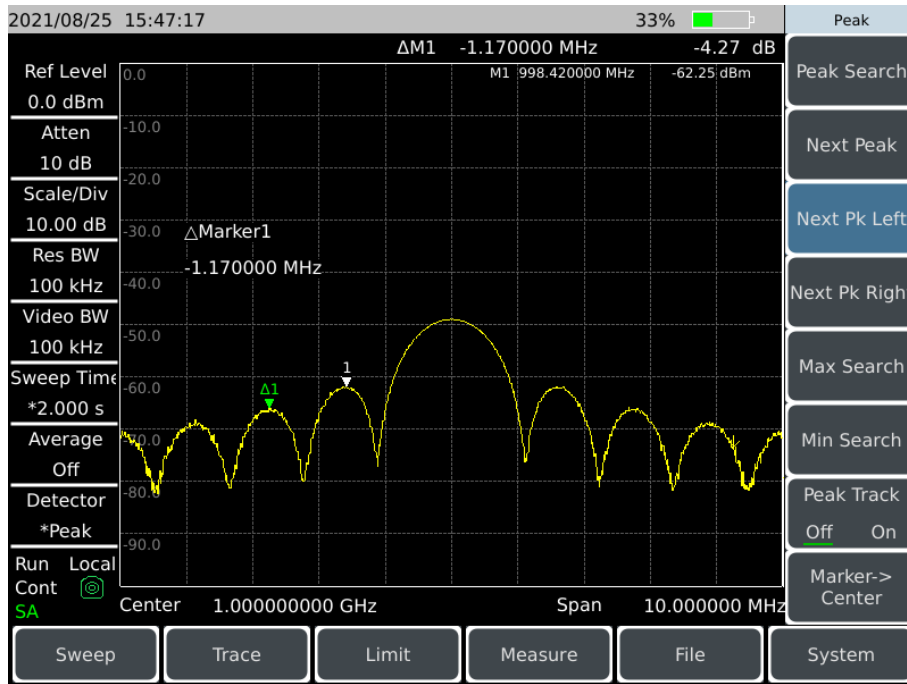


Figure 5-23 Pulse width displayed by marker

5.2.8.3 Pulse repetition frequency (PRF) measurement

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

a) Set the signal generator output signal:

Set the frequency of the signal generator to 1GHz and the power to - 20dbm, connect the output of the signal generator to the input port of the spectrum analyzer, set the pulse modulation to the repetition frequency of 1kHz and the pulse width of 900ns, and turn on the pulse modulation and enable the RF output.

b) Set the spectrum analyzer:

Press **[Preset]** .

Press **[Freq]** → 1 [GHz].

Press **[Freq]** →[Span]→ 10 [MHz], **[Sweep]** →[Sweep Time Auto Man] →1.705 [s].

Press **[BW]** → [Res BW Auto Man] → 1 [kHz] .

Press **[BW]** →[Video BW Auto Man]→ 3 [MHz].

Press **[BW]** →[Detector]→[Peak] to activate the positive peak detection.

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

Readjust the output amplitude of the signal generator so that it is on the screen, and reduce the

5.2 Introduction to typical measurements

scanning time (i.e. speed up the scanning speed) until the display is similar to Figure 5-24.

c) Measure the pulse repetition interval.

Press **【Sweep】** → **[Sweep Type Cont Single]**.

Press **【Peak】** → **【Marker】** → **[Delta]** → **【Peak】** → **[Next Peak]**. The difference between the two displayed markers is equal to the pulse repetition interval (PRI), and its reciprocal is the pulse repetition frequency (PRF).

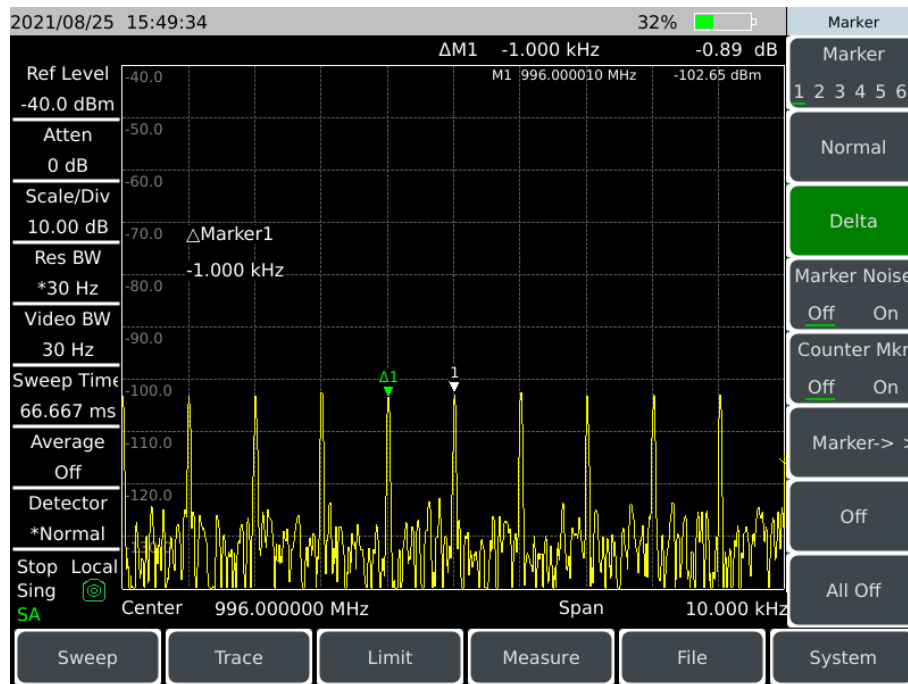


Figure 5-24 Measuring pulse repetition frequency

5.2.8.4 Peak pulse power measurement

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

When the spectrum analyzer is in broadband measurement mode:

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

Where:

T_{eff} -- pulse width, in second.

BW_i -- impact bandwidth, in Hz (value is $1.5 \times$ the resolution bandwidth used to measure the pulse width)

When the spectrum analyzer is in narrowband measurement mode:

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Peak pulse power = (Main lobe amplitude) - (20 log T_eff/ T)

Where:

T_eff -- pulse width, in Second

T -- pulse repetition frequency

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

Notice

Measuring main flap amplitude

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

5.2.9 Carrier-to-noise ratio

- Definition of carrier-to-noise ratio 76
• Measurement steps..... 77

5.2.9.1 Definition of carrier-to-noise ratio

The carrier-to-noise ratio (signal-to-noise ratio) is a standard measurement scale used to mark the relationship between carrier and carrier noise, which is usually noted as C/N (dB). A high carrier-to-noise ratio provides better network acceptance rate, better network communication quality, and better network reliability. In the carrier-to-noise ratio, the carrier power is denoted by PC and the noise power is denoted by PN. Then the decibel unit formula for the carrier-to-noise ratio is expressed as:

C/N = 10Log(Pc/Pn)

The above equation shows that the carrier-to-noise ratio is the ratio of the carrier power to the noise power.

5.2.9.2 Measurement steps

a) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

b) Set center frequency:

Press **【Freq】** →[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys, which is set to 875MHz.

c) Set carrier bandwidth (CBW):

Press **【Measure】** →[C/N]→[Noise BW] to set the carrier bandwidth of the spectrum analyzer to the bandwidth of the carrier signal with the numeric keys, up and down keys or scroll knob, which is set to 20MHz.

d) Set noise bandwidth (NBW):

Press **【Measure】** →[C/N]→[Noise BW] to set the noise bandwidth of the spectrum analyzer to the bandwidth of the noise signal with the numeric keys, up and down keys or scroll knob, which is set to 20MHz.

e) Set carrier frequency offset (CFO):

Press **【Measure】** →[C/N]→[Offset] to set the offset frequency of the spectrum analyzer to the offset of the noise signal relative to the carrier signal with the numeric keys, up and down keys or scroll knob, which is set to 20MHz.

f) Turn on CNR function:

Press **【Measure】** →[C/N]→[C/N Off On] to turn on the carrier-to-noise ratio measurement function, at this time, the measurement results of carrier power, noise power and carrier-to-noise ratio will be displayed at the bottom of the screen, as shown in the following figure.

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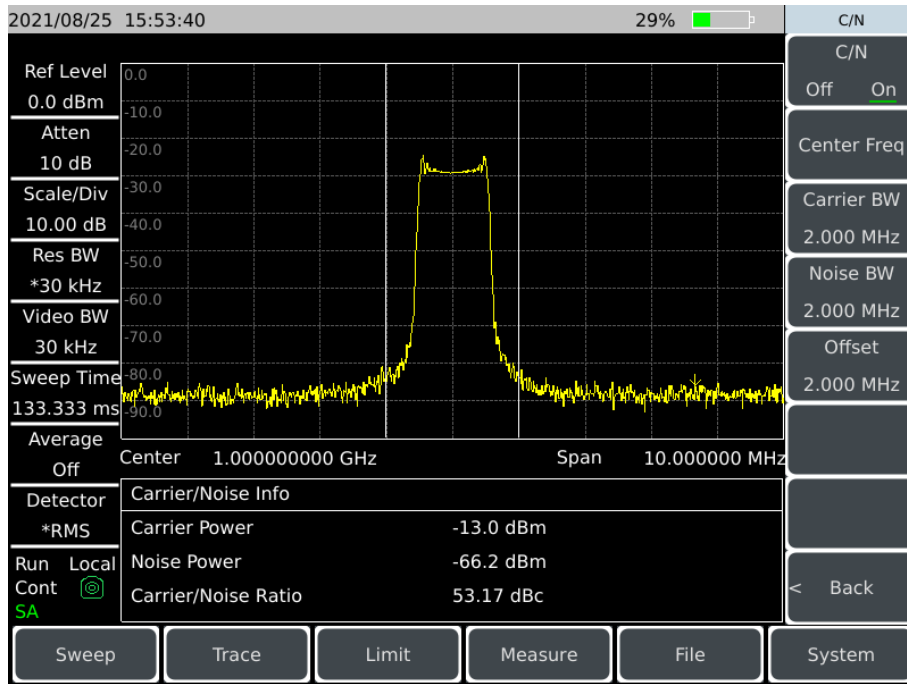


Figure 5-25 Carrier-to-noise ratio measurement

5.2.10 Outdoor map (option)

The outdoor map option can be used for RSSI test and ACPR test, and the test results can be marked on the map in real time according to time or distance. The test results marked on the map can be saved to the instrument and can be called for later viewing. Because the offline map is large, the map stored internally when the instrument leaves the factory is the map of the province or country where the user is. Maps of other provinces or countries can be downloaded by using the map download software through UKey (presented with options), and the downloaded maps can be placed in the offline map folder of the instrument.

- [RSSI measurement](#) 78
- [ACPR measurement](#) 80

5.2.10.1 RSSI measurement

RSSI measurements can be set up as follows:

a) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

b) Open outdoor map:

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Outdoor Map Off On]. By default, the measurement mode is RSSI after the outdoor map switch is turned on.

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c) Set center frequency:

Press **【Freq】** →[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys.

d) Set measurement standard:

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[RSSI] to set the colors marked on the map for different powers of the received signal.

e) Set marking method:

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Distance Time]→[Repeat Type Time Dist] to set the method according to time interval or moving distance when marking information on the map.

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Distance Time]→[Repeat Time] to set the time interval to mark the data once on the map.

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Distance Time]→[Repeat Dist] to set the distance to mark the data once on the map.

f) Start collection:

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Start Collection] to start RSSI test and mark the test result on the map.

The RSSI measurements for the interference maps are shown in Figure 5-26 below:

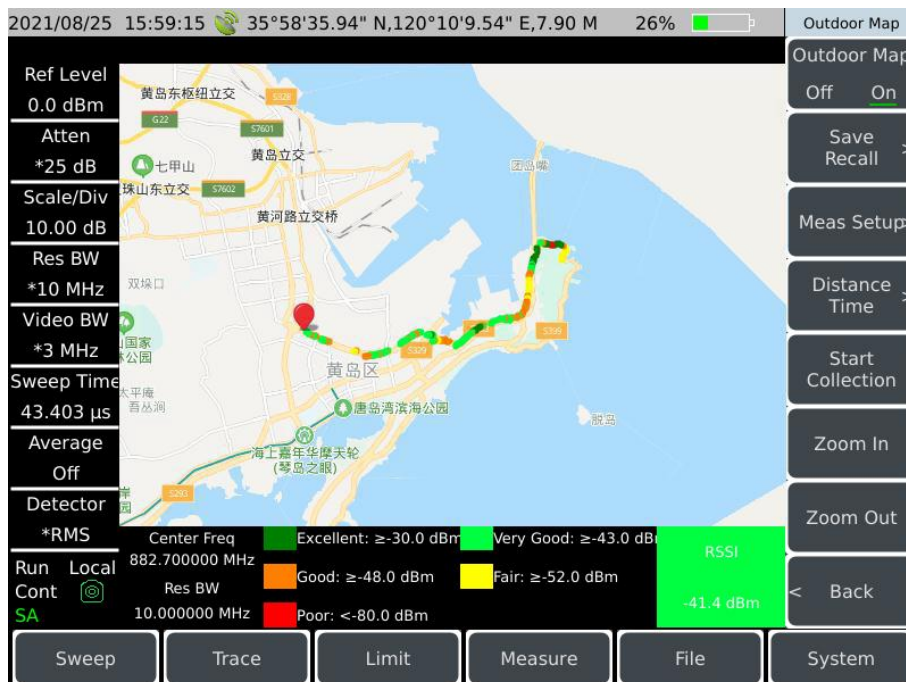


Figure 5-26 Schematic diagram of outdoor map RSSI measurement

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5.2.10.2 ACPR measurement

ACPR measurements can be set up as follows:

g) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

h) Open outdoor map:

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Outdoor Map Off On]. By default, the measurement mode is RSSI after the interference map switch is turned on;

i) Set center frequency:

Press **【Freq】** →[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys.

i) Switch measurement mode:

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[ACPR] to set it as adjacent channel power ratio measurement.

k) Set adjacent channel parameters and measurement standards:

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[ACPR]→[Main Ch BW] to set the main channel bandwidth.

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[ACPR]→[[Adj Ch BW] to set the adjacent channel bandwidth.

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[ACPR]→[Ch Spacing] to set the channel spacing.

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[ACPR]→[Adj Ch Offset] to set the adjacent channel limit.

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[ACPR]→[Good: ≥], the lower limit of good main channel power. In this case, the value of [Poor: <] will change accordingly.

l) Set marking method:

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Distance Time]→[Repeat Type Time Dist] to set the method according to time interval or moving distance when marking information on the map.

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Distance Time]→[Repeat Time] to set how often

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the data is marked once on the map

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Distance Time]→[Repeat Dist] to set how far to mark the data once on the map.

m) Start collection:

Press **【Measure】** →[More 1 of 3]→[Outdoor Map]→[Start Collection] to start ACPR test and mark the test result on the map.

The ACPR measurements for the interference maps are shown in Figure 5-27 below:

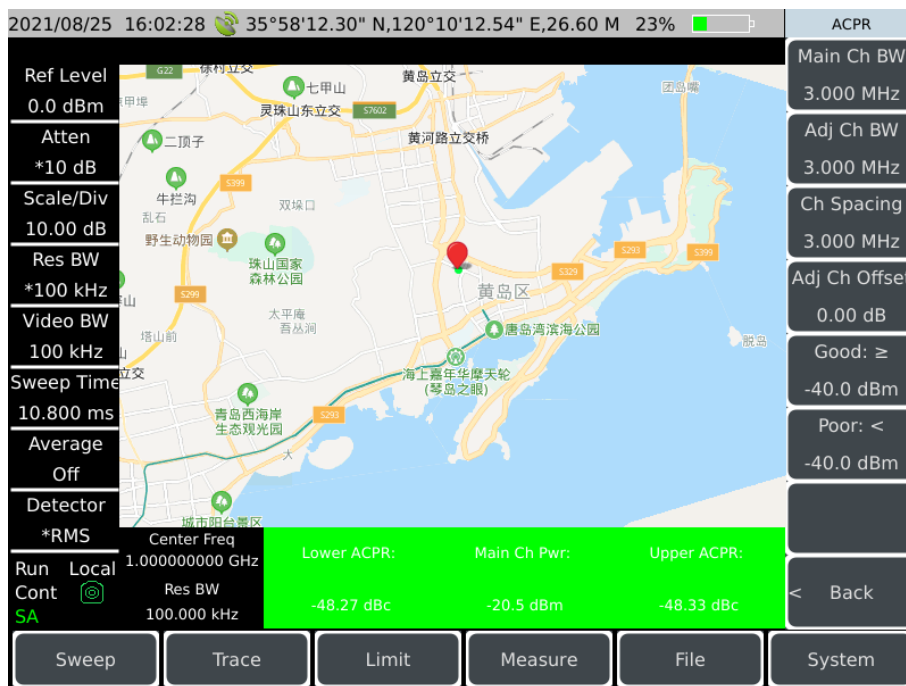


Figure 5-27 ACPR measurement

5.2.11 Indoor map (option)

The indoor map option can be used for RSSI test and ACPR test. Since the GPS signal cannot be received indoors, the user needs to manually move the position and mark the test results on the map. The test results marked on the map can be saved to the instrument and can be called for later viewing. Users can convert the plan in picture format into tile diagram and store it in the instrument through special software (presented with options).

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- [ACPR measurement](#) 83

5.2.11.1 RSSI measurement

RSSI measurements can be set up as follows:

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a) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

b) Open indoor map:

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Indoor Map Off On] to open the indoor map. By default, it is RSSI measurement mode.

c) Set center frequency:

Press **【Freq】** →[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys.

d) Set measurement standard:

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[More 1 of 2]→[Meas Setup]→[RSSI] to set the colors marked on the map for different powers of the received signal.

e) Move the marker:

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Up] to move the marker upward.

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Down] to move the marker downward.

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Left] to move the marker to the left.

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Right] to move the marker to the right.

f) Mark result and delete marking:

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Collection] to mark the test result of current marker point on the map.

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[More 1 of 2]→[Delete Collection] to delete the current marker point.

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[More 1 of 2]→[Clear Collection] to clear all marker points.

The RSSI measurements for the indoor map are shown in Figure 5-28 below:

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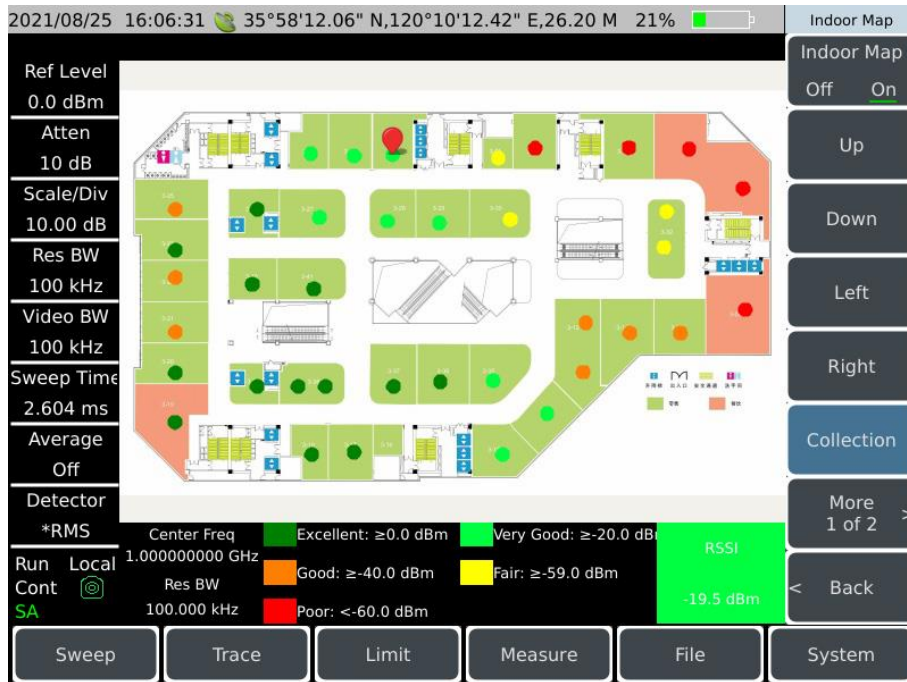


Figure 5-28 Indoor map RSSI measurement schematic

5.2.11.2 ACPR measurement

ACPR measurements can be set up as follows:

a) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

b) Open indoor map:

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Indoor Map Off On]. By default, the measurement mode is RSSI after the indoor map switch is turned on.

c) Set center frequency:

Press **【Freq】** →[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys.

d) Switch measurement mode:

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[More 1 of 2]→[Meas Setup]→[ACPR] to set it as adjacent channel power ratio measurement.

e) Move the marker:

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Up] to move the marker upward.

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Down] to move the marker downward.

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Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Left] to move the marker to the left.

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Right] to move the marker to the right.

f) Mark result and delete marking:

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[Collection] to mark the test result at the marker position on the map.

Press **【Measure】** →[More 1 of 3]→[Indoor Map]→[More 1 of 2]→[Delete Collection] to delete the current marker point.

Press **【Measure】**→[More 1 of 3]→[Indoor Map]→[More 1 of 2]→[Clear Collection] to clear all marker points.

The ACPR measurements for the indoor map are shown in Figure 5-29 below:

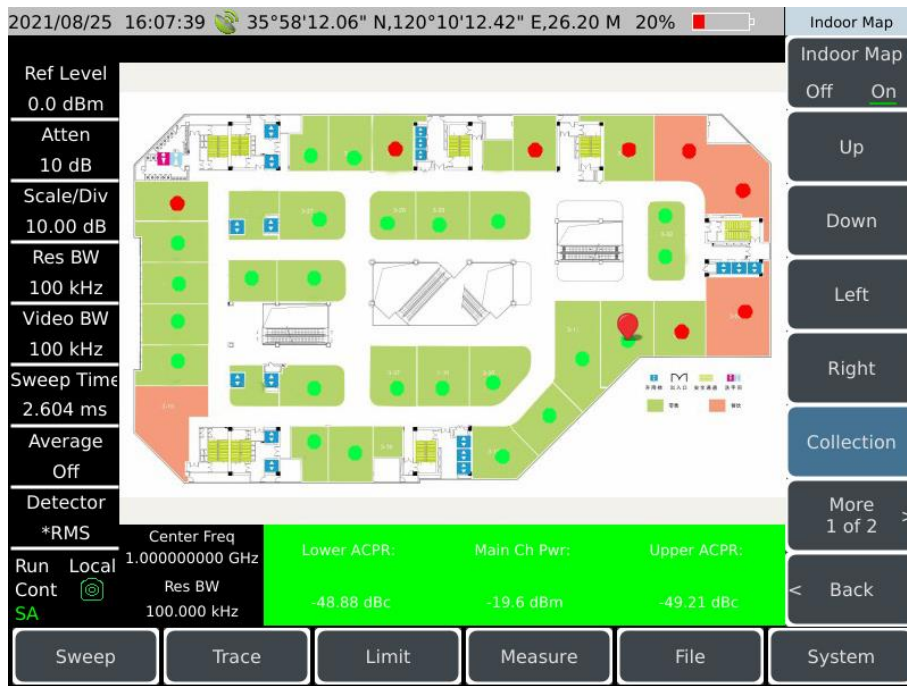


Figure 5-29 Indoor map ACPR measurement schematic

5.2.12 Spectrum emission mask

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- Measurement steps..... 85

5.2.12.1 Definition of spectrum emission mask

Spectral emission mask measurements include both in-band and out-of-band spurious emission, referred to as SEM. For the measurement of spurious signals in the frequency band close to the

5.2 Introduction to typical measurements

carrier signal, the analysis bandwidth of spurious measurement with different frequency range offset relative to the carrier may be different. To facilitate observation and judge the indicators, the spurious threshold level of each frequency range is given from the carrier signal according to the standard. All of these levels are connected to form the spectrum mask. The distribution of signal spurious must fall within this spectrum mask before it can be measured. Therefore, the spectrum mask can be very intuitive to observe and determine whether the spurious component of the signal exceeds the standard.

5.2.12.2 Measurement steps

Steps for measuring the spectrum emission mask using the 4024CA spectrum analyzer are as follows:

a) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

b) Edit the limit:

Press **【Limit】** →[Limit Upper Lower] to select the upper limit. The spectrum emission mask only calls the upper limit, so there is no need to edit the lower limit.

Press **【Limit】** →[Edit Limit] to pop up the Edit Limit soft menu, and determine the shape of the upper limit line by operations such as [Frequency]→[Amplitude]→[Add Point]→[Delete Point]. As shown in Figure 5-30:

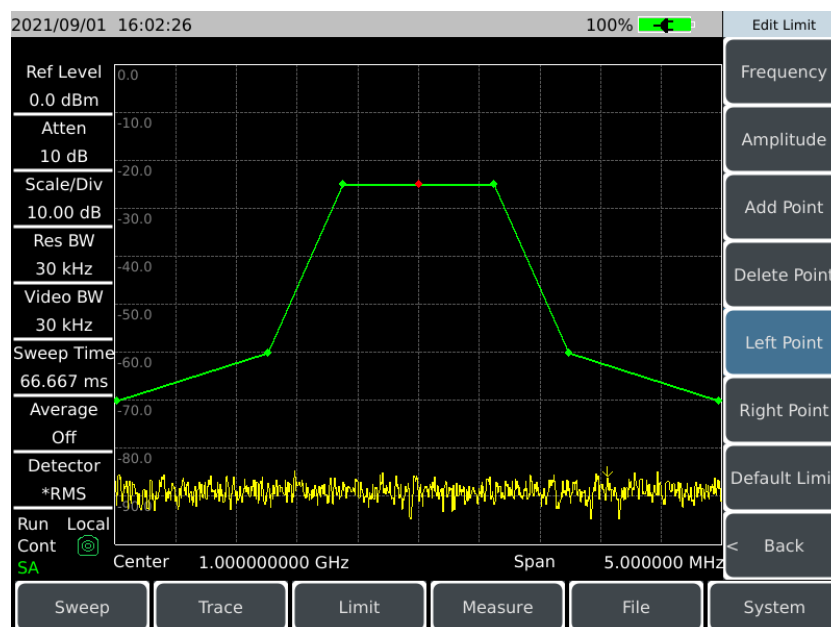


Figure 5-30 Limit line editing

c) Store limit:

Press **【Limit】** →[Save Limit] to save the set limit information.

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d) Recall Limit file to mask:

Press **【Measure】** → [Emission Mask] → [Recall Limit as Mask], select the limit in the pop-up table, and click [Done].

e) Turn on spectrum emission mask function:

Press **【Measure】** → [Emission Mask] → [Emission Mask Off On] to turn on the spectrum emission mask function, and then the called limit lines will be displayed on the main screen.

as shown in the following figure:

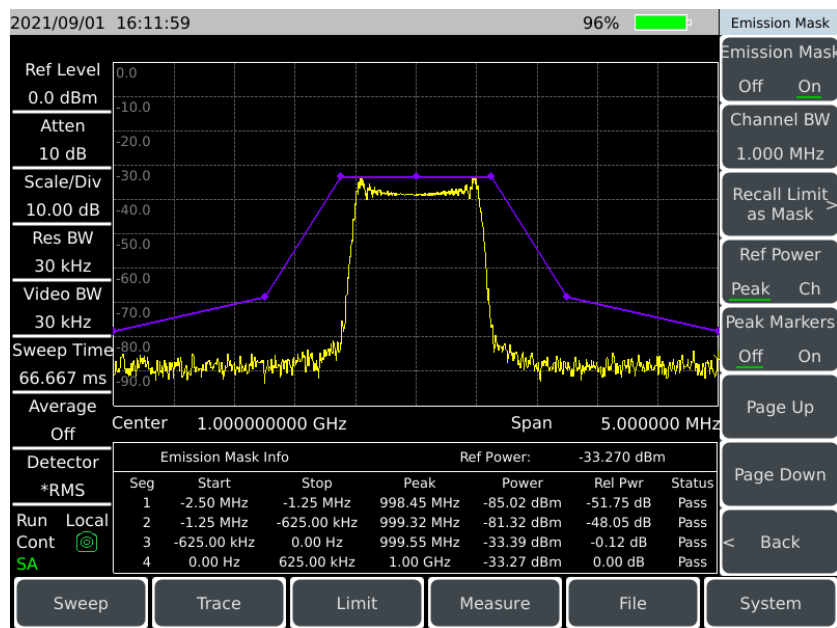


Figure 5-31 SEM measurement

f) Select reference power:

Press **【Measure】** → [Emission Mask] → [Ref Power peak Ch] to select the reference power type. When peak is selected, the limit center power is the peak power of the current frequency range; when channel is selected, the power at the limit line center is the maximum power in the channel.

g) Start test:

When the above steps are set up, the instrument will automatically start testing: when there is a signal exceeding the mask power, the status bar of the corresponding band in the table at the bottom of the main screen shows "Fail"; on the contrary, the signal power in the band does not exceed the mask power, the status bar of the corresponding band shows "Pass".

5.2.13 Audio demodulation

- Definition of audio demodulation 87

- **Measurement steps** 87

5.2.13.1 Definition of audio demodulation

Modulation is the conversion of low frequency or baseband signals (sound, music, data) into high frequency signals. During modulation, certain characteristics of the carrier signal (usually frequency or amplitude) change proportionally to the instantaneous change in the amplitude of the baseband signal. Demodulation is the conversion of high frequency signals into baseband signals that are played through the speaker.

5.2.13.2 Measurement steps

a) Connect the whip antenna to the RF input interface.

b) Reset the spectrum analyzer to its default state:

Press **[Preset]** .

c) Set center frequency:

Press **[Freq]** →[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys, which is set to 94.4MHz.

d) Set span:

Press **[Freq]** →[Span] to set the center frequency with the numeric keys, and set the span of the spectrum analyzer to 3MHz.

e) Select demodulation type:

Press **[Measure]** →[More 1 of 3]→[Tune Listen]→[Demod Type], select [FM]→[AM]→[USB] and [LSB] in the pop-up soft menu, and then click [Back]. Select [FM] in this example

f) Set demodulation time:

Press **[Measure]** →[More 1 of 3]→[Tune Listen]→[Listen Time] to set the demodulation time with the numeric keys, which is 100ms by default.

g) Set demodulation mode:

Press **[Measure]** →[More 1 of 3]→[Tune Listen]→[Listen Mode Int Cont]. When set to [Int], the instrument will demodulate according to the demodulation time, with sweep time as the interval; when set to [Cont], the instrument will demodulate continuously. Select [Cont].

h) Set volume:

Press **[Measure]** →[More 1 of 3]→[Tune Listen]→[Volume] to set the demodulation time with the

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numeric keys, which is 95 by default and can be appropriately adjusted by itself.

i) Turn on audio demodulation:

Press **【Measure】** →[More 1 of 3]→[Tune Listen]→[Tune&Listen Off On] to turn on the audio demodulation. At this time, the broadcast content of the current station can be received.

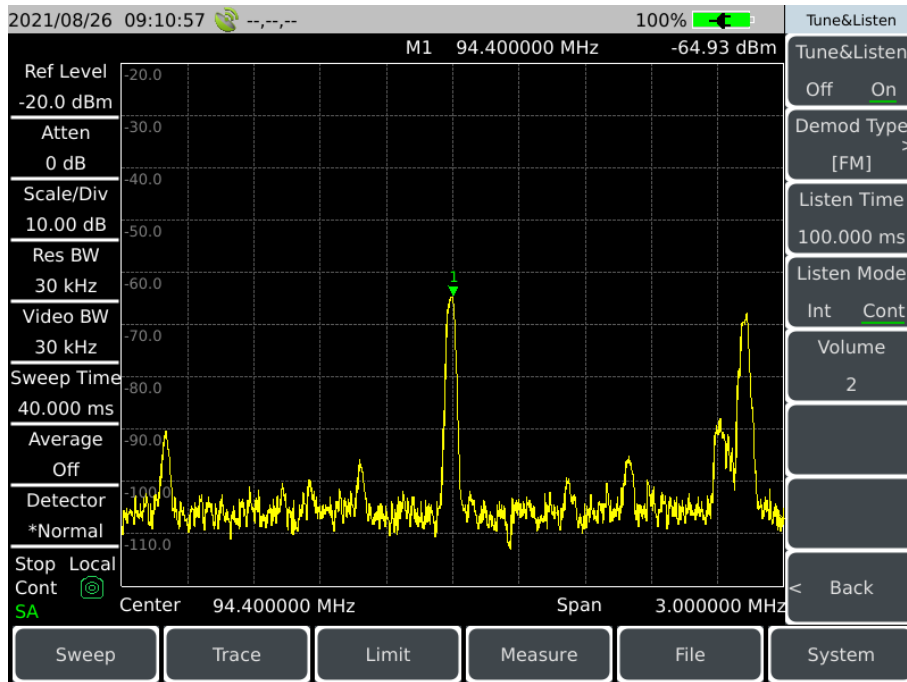


Figure 5-32 Audio demodulation

5.2.14 Harmonic distortion

Set the fundamental frequency and harmonic number. After the instrument measures the fundamental according to the current parameters, the harmonics are measured for each valid range table with the center frequency set to the frequency of the range table. If the current bandwidth is set to 0, the amplitude is calculated by averaging the power over the trace and is displayed in the list of results window. After the specified number and amplitude of harmonics are measured, the total harmonic distortion results (Harmonics & THD) are displayed in the lower part of the window. The instrument will continuously measure the difference in amplitude between the fundamental and harmonics.

- [Measurement steps](#)..... 88

5.2.14.1 Measurement steps

a) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

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b) Set fundamental frequency:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Harmonics]→[Fundamental] to set the fundamental frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys, which is set to 1GHz.

c) Set harmonic number:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Harmonics]→[Harmonics] to set the fundamental number with the numeric keys, which is set to 4.

d)Set RBW

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Harmonics]→[Res BW] to set the resolution bandwidth with the numeric keys, which is set to 3MHz.

e) Set video bandwidth:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Harmonics]→[Video BW] to set the video bandwidth with the numeric keys, which is set to 3MHz.

f) Set harmonic number:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Harmonics]→[Harmonics Off On] to turn on the harmonic distortion test function and get the following results.

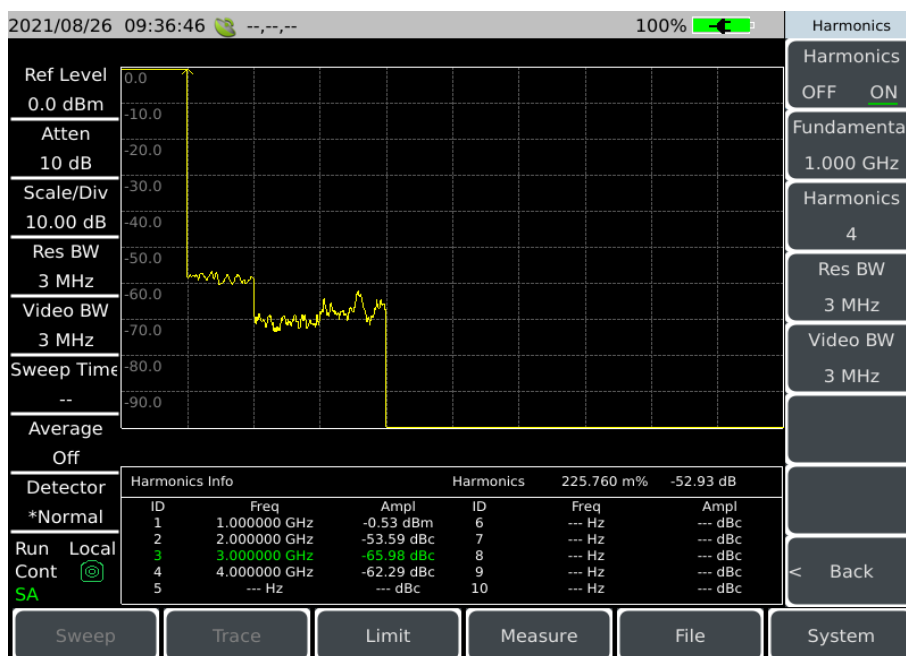


Figure 5-33 Harmonic distortion measurement

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5.2.15 Spurious emission mask

Up to eight bands can be set in the spurious emission mask, and the start frequency, stop frequency, resolution bandwidth, video bandwidth, start limit and end limit can be edited in each band. After the specified band is measured, the results will be displayed in the lower part of the window. The instrument will continuously measure whether the threshold value is exceeded in each band.

- [Measurement steps](#) 90

5.2.15.1 Measurement steps

a) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

b) Edit mask:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Spur Emissions]→[Emissions Edit] to pop up the mask editing window. You can set the number of bands and the start frequency, stop frequency, resolution bandwidth, video bandwidth, start limit and end limit of each band as required. After setting, click [Done].

c) Store mask:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Spur Emissions]→[Save Emissions] to save the current mask information.

d) Call mask:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Spur Emissions]→[Recall Emissions] to call the current mask information.

e) Set sweep type:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Spur Emissions]→[Sweep Type Cont Single] to set the continuous sweep mode or single sweep mode.

f) Set sweep mode:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Spur Emissions]→ [Sweep Mode Once All]. When set to single segment, this segment will be continuously swept according to [Segment ID]; when set to full segment, each segment set in the mask will be swept at one time.

g) Set current segment number:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Spur Emissions]→[Segment ID] to set the current band number with the numeric keys.

5.2 Introduction to typical measurements

h) Turn on/enable spurious emission mask function:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Spur Emissions]→[Spur Ems Off On] to turn on the spurious emission mask function. At this time, the measurement results of each band will be displayed at the bottom of the screen, as shown in the following figure:

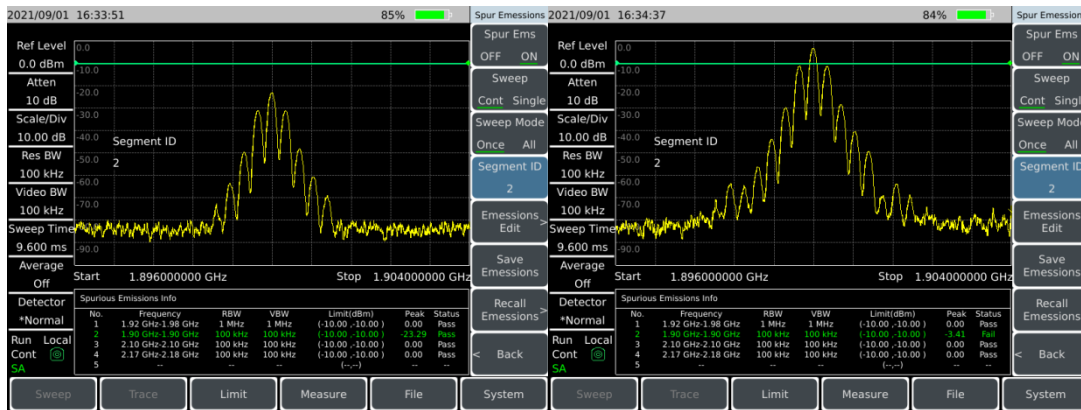


Figure 5-34 Spurious emission mask

5.2.16 Multi-carrier adjacent channel power

Unlike the adjacent channel power measurement mode, this mode can also be used to measure the adjacent channel power ratio of two carriers.

- [Measurement steps](#) 91

5.2.16.1 Measurement steps

a) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

b) Set center frequency:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys, which is set to 1GHz.

c) Select carrier number:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→[Carrier 1 2] to select the carrier number.

d) Set carrier frequency:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→[Carrier Freq] to set the carrier frequency with the numeric keys. Set the carrier frequency of the spectrum analyzer to be the

5.2 Introduction to typical measurements

frequency of signal under test, which is set to 800MHz, and set the carrier frequency of carrier 2 to 1.2GHz.

e) Set carrier bandwidth:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→[Carrier BW] to set the carrier bandwidth with the numeric keys. Set the carrier bandwidth of the spectrum analyzer to be the bandwidth of signal under test, which is set to 20MHz, and set the carrier bandwidth of carrier 2 to 20MHz.

f) Set adjacent channel:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→[Adj Ch Set>] to set [Offset Freq]→[Adj Ch BW]→[Upper Limit]→[Lower Limit] in the pop-up adjacent channel setting soft menu, and press [Limit Test Off On] to turn on the threshold test function.

g) Turn on multi-carrier adjacent channel power function:

Press **【Measure】** →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→[Multi-ACPR Off On] to turn on the multi-carrier adjacent channel power function. At this time, the measurement results of each adjacent channel will be displayed at the bottom of the screen, as shown in the following figure:

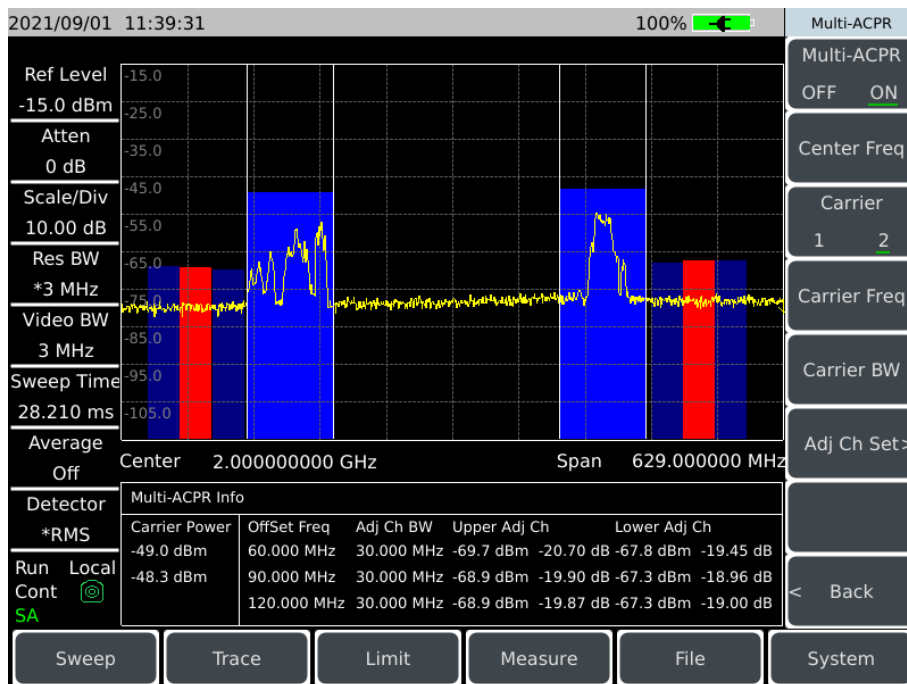


Figure 5-35 Multi-carrier adjacent channel power

5.2.17 IQ capture

IQ capture is used to capture and save the IQ data calculated by FPGA into the instrument, which is convenient for users to process by themselves.

- Measurement steps 93

5.2.17.1 Measurement steps

a) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

b) Set center frequency:

Press **【Freq】** →[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys, which is set to 1GHz.

c) Set capture time:

Press **【Measure】** →[More 1 of 3]→[IQ Capture]→[Capture Time] to set the capture time as required. The maximum capture time is 13.333ms and the minimum capture time is 1μs.

d) Set capture mode:

Press **【Measure】** →[More 1 of 3]→[IQ Capture]→[Capture Mode Single Cont] to set the IQ capture mode to single or continuous. If the capture mode is set to single, the capture will end only once, and if the capture mode is multiple, the scan thread will capture once after each scan, and it will stop only when the user sets stop capture.

e) Set sample rate and capture bandwidth:

Press **【Measure】** →[More 1 of 3]→[IQ Capture]→[Capture Rate] to select the appropriate sample rate and capture bandwidth in the pop-up table, and then click [Done].

f) Set trigger mode:

Press **【Measure】** →[More 1 of 3]→[IQ Capture]→[Triggering]. The trigger mode includes [Free Run] and [External(TTL) TTL]. Select external trigger to set [Slope Rising Falling] and [Delay].

g) Set storage file name:

Press **【Measure】** →[More 1 of 3]→[IQ Capture]→[Save Name IQ Capture], enter the file name of the captured data in the pop-up soft keyboard, and click [OK] to finish the setting.

h) Start capture:

Press **【Measure】** →[More 1 of 3]→[IQ Capture]→[Start Capture], the instrument will capture IQ data according to the current setting parameters and save it to the instrument according to [Save Name IQ Capture]. When the capture mode is continuous, the time information will be added in front of [Save Name IQ Capture] for easy differentiation.

5.3 Spectrum Analyzer menu structure

5.3 Spectrum Analyzer menu structure

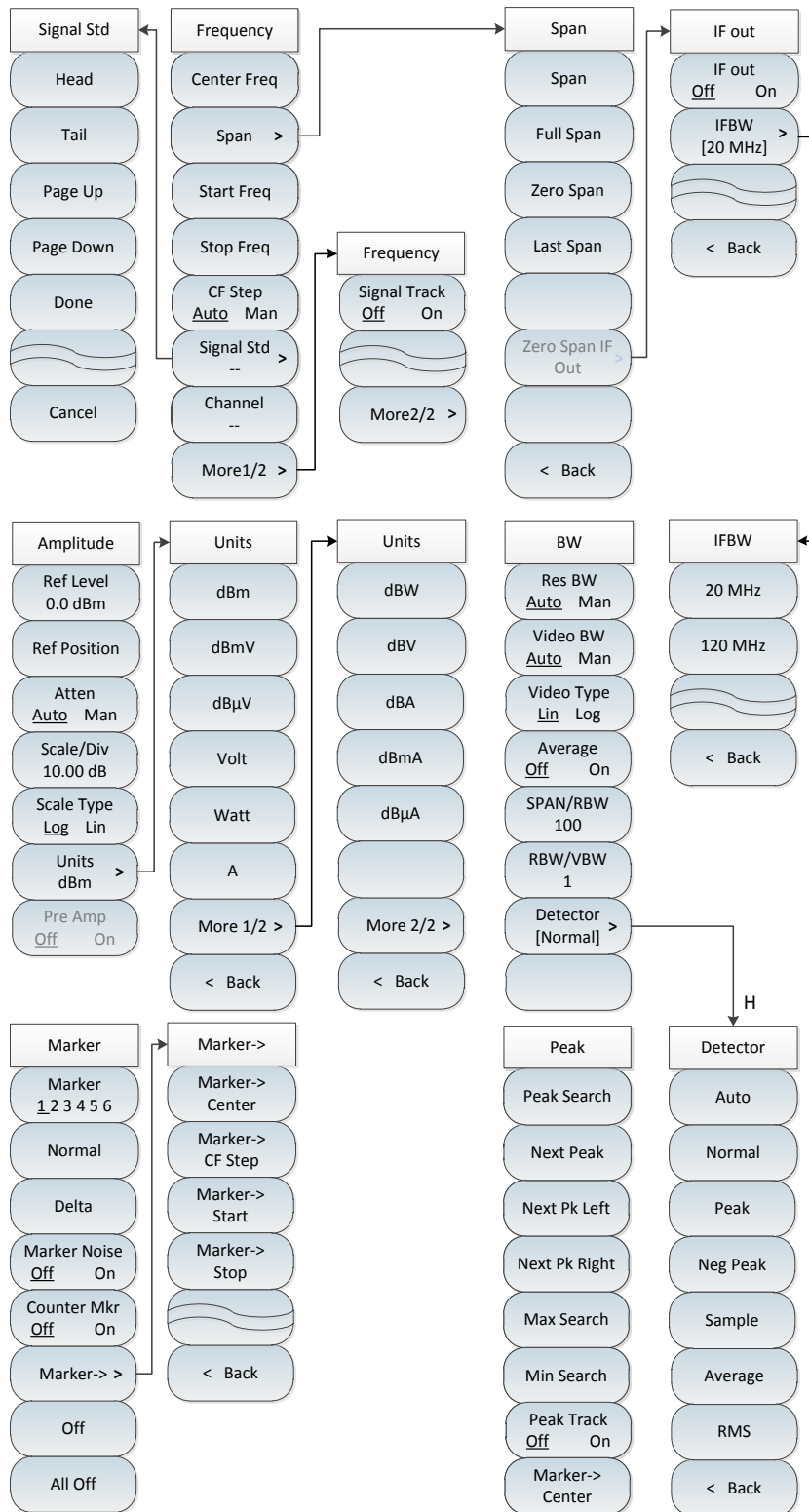


Figure 5-36 Block diagram of spectrum analyzer menu

5.3 Spectrum Analyzer menu structure

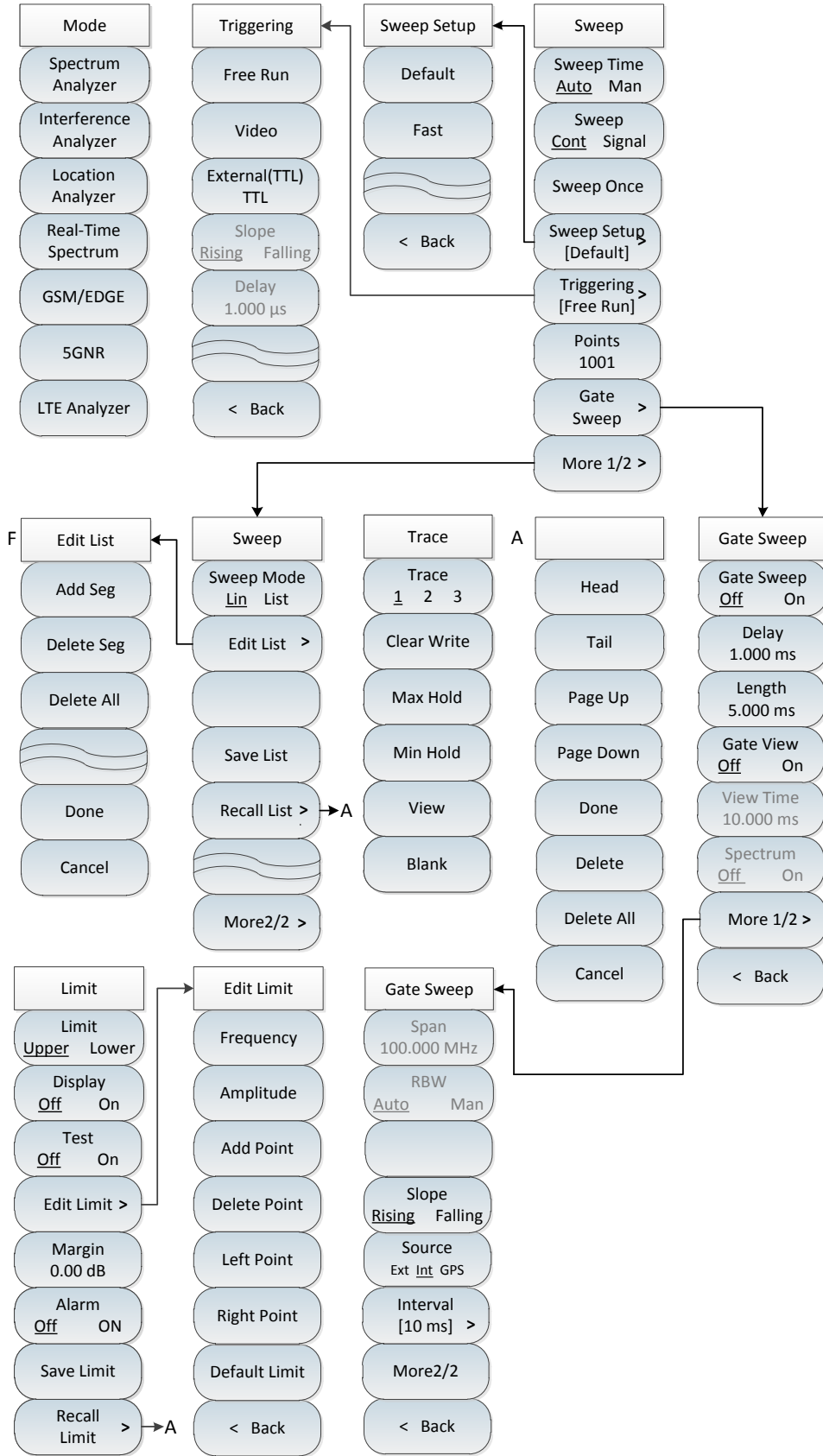


Figure 5-37 Block diagram of spectrum analyzer menu (CONT)

5.3 Spectrum Analyzer menu structure

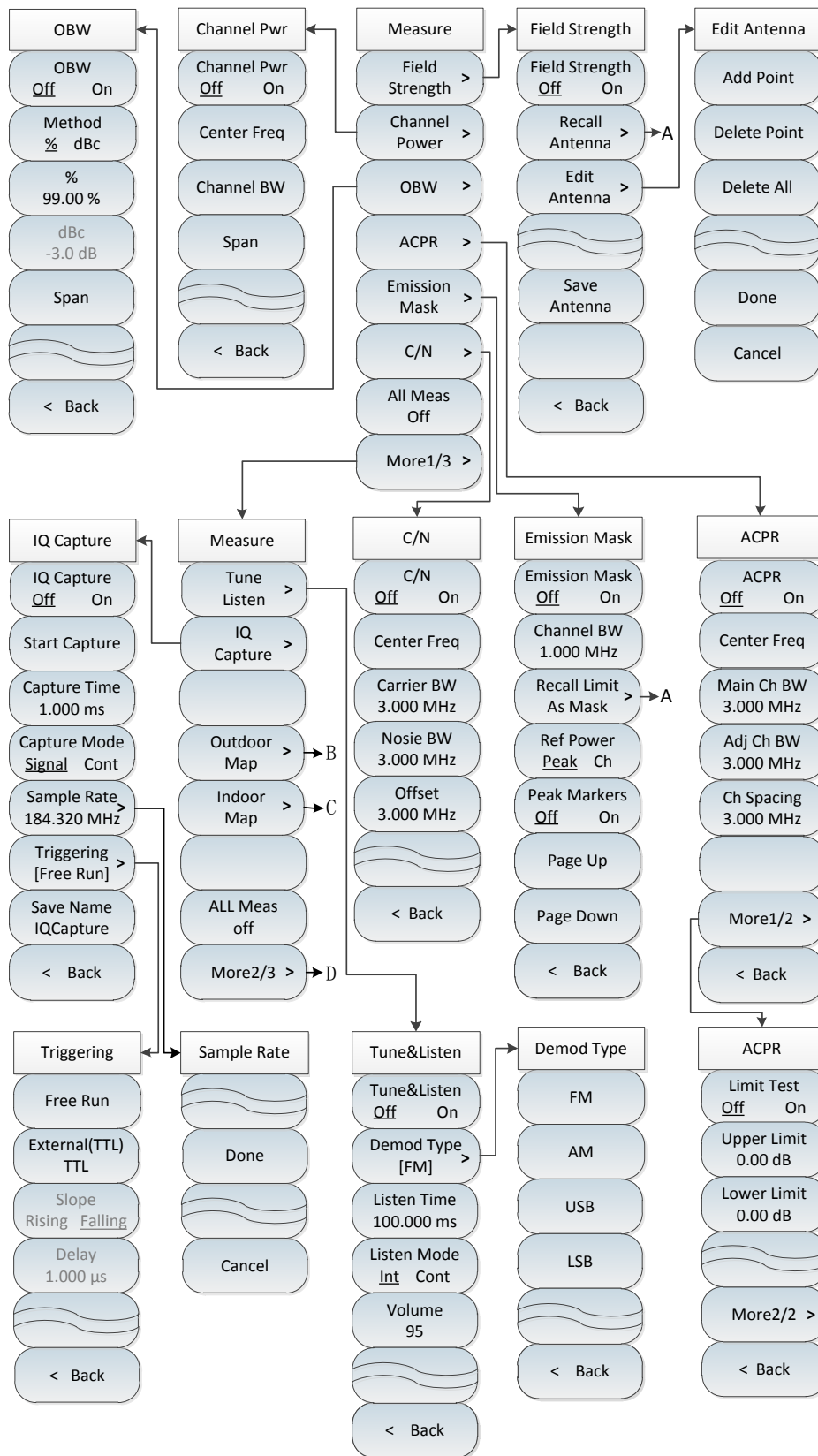


Figure 5-38 Block diagram of spectrum analyzer menu (CONT)

5.3 Spectrum Analyzer menu structure

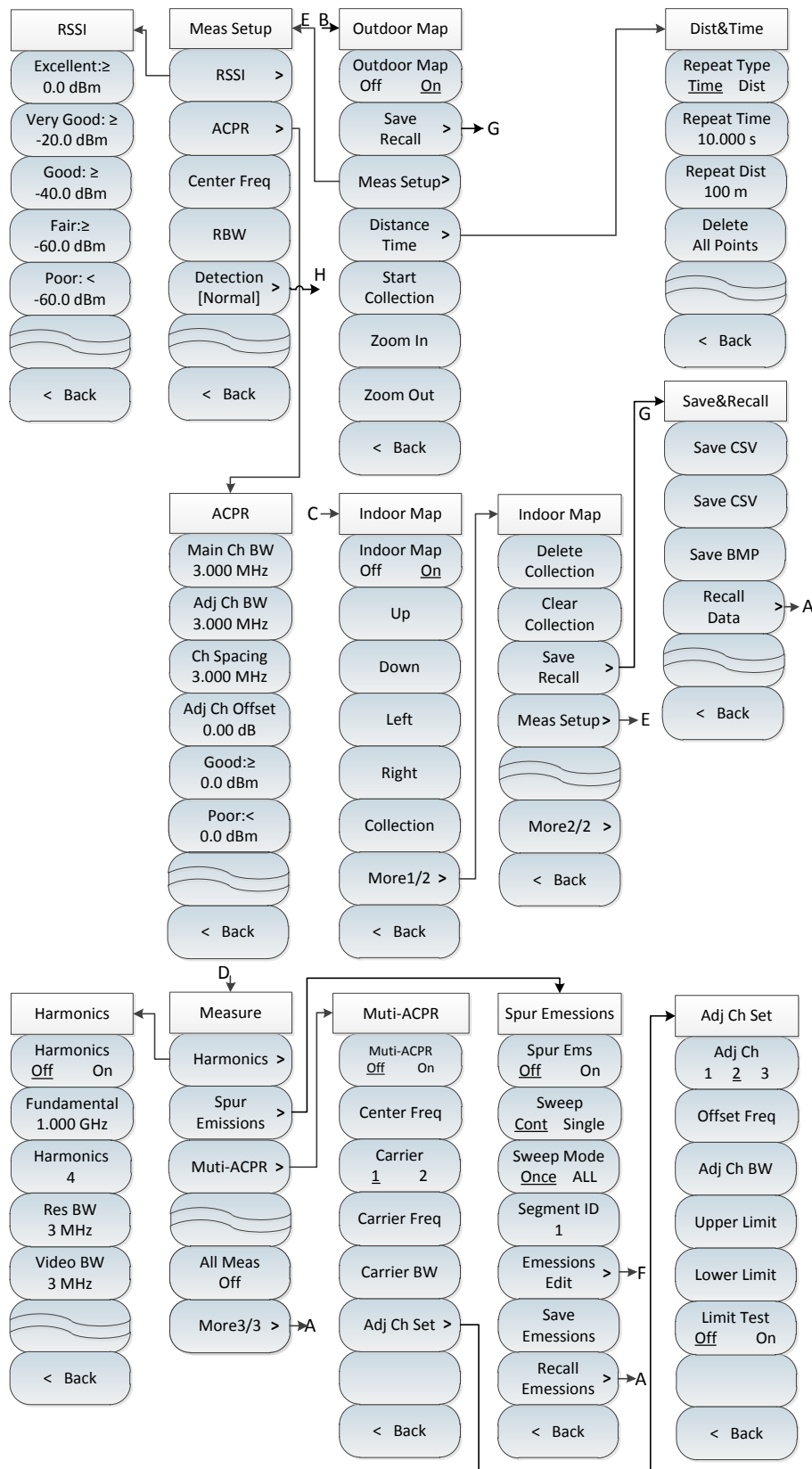


Figure 5-39 Block diagram of spectrum analyzer menu (CONT)

5 Spectrum Analyzer mode

5.3 Spectrum Analyzer menu structure

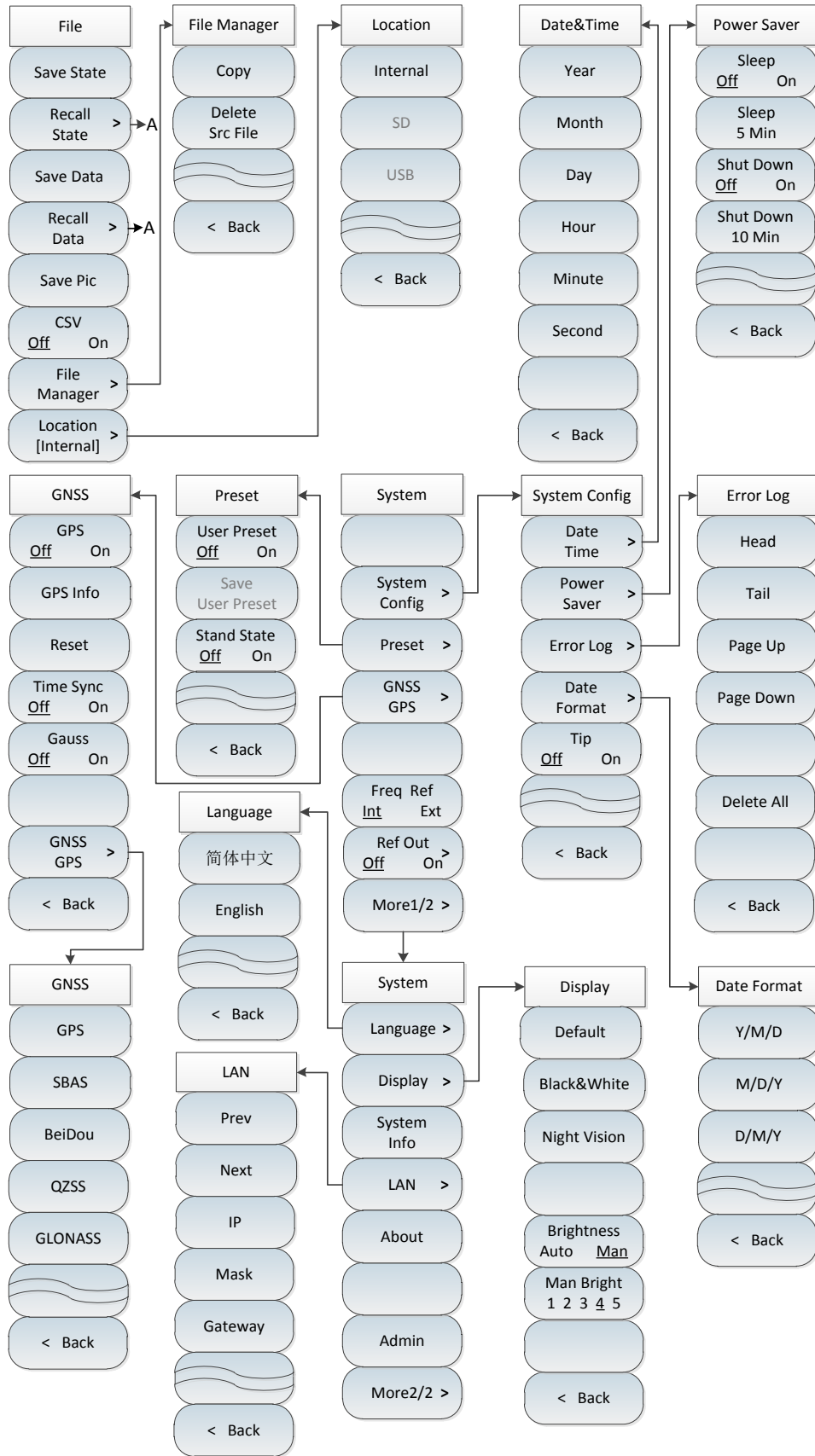


Figure 5-40 Block diagram of spectrum analyzer menu (CONT)

5.4 Spectrum Analyzer menu description

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

● Frequency menu	100
● Span menu	101
● IF output menu	102
● Amplitude menu	102
● Bandwidth menu	103
● Detection menu	104
● Marker menu	105
● Peak menu	106
● Mode menu	107
● Sweep menu	107
● Trigger menu	109
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● Trace menu	111
● Limit menu	113
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● Field strength measurement menu	116
● Channel power menu	117
● Occupied bandwidth menu	118
● Adjacent channel power menu	119
● Spectrum emission mask menu	121
● Carrier-to-noise ratio menu	122
● Audio demodulation menu	123
● IQ capture menu	124
● Outdoor map menu (option)	125

5.4 Spectrum Analyzer menu description

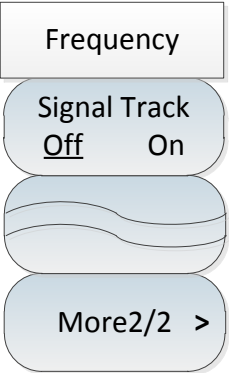
- Indoor map menu (option) 128
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- Spurious emission mask menu 130
- Multi-carrier adjacent channel power menu 131
- File menu 132
- System menu 133
- Reset menu 135

5.4.1 Frequency menu


<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Frequency</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Center Freq</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Span ></div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Start Freq</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Stop Freq</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">CF Step Auto Man</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Signal Std > --</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Channel --</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">More1/2 ></div>	<ul style="list-style-type: none"> · [Center Freq]: Press [Freq] →[Center Freq] to set the center frequency value by pressing the numeric keys on the front panel, and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or pressing [↑] or [↓] keys and rotary knob. · [Special Note]: When using the [↑] or [↓] key and the rotary knob, the size of the frequency step is the same as that set by [Freq Step], and you can use the numeric keys or the [↑] or [↓] key and the rotary knob to set the step frequency value after pressing [CF Step <u>Auto</u> Man] to switch to [CF Step <u>Auto</u> Man]. · [Span]: [Freq] →[Span] to activate the span submenu. You can use the number key and then select the frequency unit to change it, or change it with [↑] or [↓] keys and rotary knob. Refer to the description of [Span] menu for details. · [Start Freq]: Press [Freq] →[Start Freq] to set the set start frequency value by pressing the numeric keys on the front panel, and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or pressing [↑] or [↓] keys and rotary knob. · [Stop Freq]: Press [Freq] →[Stop Freq] to set the stop frequency value by pressing the numeric keys on the front panel, and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or pressing [↑] or [↓] keys and rotary knob. · [CF Step <u>Auto</u> Man]: Press [Freq] →[CF Step <u>Auto</u> Man] to set the step frequency value by pressing the numeric keys on the front panel, and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or pressing [↑] or [↓] keys and rotary knob. · [Signal Std]: Press [Freq] →[Signal Std] to pop up the Signal Standard menu, including [Head], [Tail], [Page Up], [Page Down], [Done] and other soft menus.
--	--

5.4 Spectrum Analyzer menu description

	<p>Select the desired signal standard file by [Done].</p> <ul style="list-style-type: none"> · [Channel]: Press [Freq] →[Channel] to display the content and number of the selected signal standard. · [Special Note]: The channel number should be set under the premise of loading the signal standard, otherwise a prompt “Unable to Set” will pop up.
--	--

	<ul style="list-style-type: none"> · [Signal Track <u>Off</u> On]: Press [Freq] →[Signal Track <u>Off</u> On] to select whether to track the signal. After each scan, the signal tracking function will place the activated marker on the peak point of the signal and set the peak frequency as the center frequency. Turning on [Signal Track <u>Off</u> On] will automatically keep the slowly drifting signal in the center of the display screen.
---	---

5.4.2 Span menu

	<ul style="list-style-type: none"> · [Span]: Press [Freq] →[Span] to set the span value in the current state by pressing the front panel numeric keys, then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or pressing [↑] & [↓] keys and rotary knob. The span is stepped by 1, 2 and 5. · [Full Span]: Press [Freq] →[Span]→[Full Span] to set the span in the current measurement state as the maximum span, and the span of 4024CA spectrum analyzer is set to 9GHz under full span. · [Zero Span]: Press [Freq] →[Span]→[Zero Span] to set the span in the current measurement state as the minimum span, and the span is set to 0Hz under full span. · [Last Span]: Press [Freq] →[Span]→[Last Span] to set the span in the current measurement state as the previous span. · [Zero Span IF OUT>]: Press [Freq] →[Span]→[Zero Span IF OUT>] to activate the IF Output submenu. · [Special Note]: The full span and zero span functions are not available when certain measurement functions are enabled. · [Special Note]: The IF output menu, as a function option, is only available in zero span mode.
---	---

5.4 Spectrum Analyzer menu description

5.4.3 IF output menu

The zero-span IF output function, as an option, enables the output of IF signals under zero-span conditions through the IF output interface to meet the measurement needs of users.

	<ul style="list-style-type: none"> · [Special Note]: The IF output menu, as a function option, is only available in zero span mode. · [IF OUT Off On]: Press [Freq] → [Span] → [Zero Span IF OUT>] → [IF OUT Off On] to turn on or off the IF output through key switching. · [IFBW]: Press [Freq] → [Span] → [Zero Span IF OUT>] → [IFBW] to select the IF output bandwidth.
--	---

5.4.4 Amplitude menu

	<ul style="list-style-type: none"> · [Ref Level]: Press [Ampt] → [Ref Level] to set it by pressing the numeric keys on the front panel, and then selecting [dBm], [-dBm], [mV] or [μV] in the frequency unit menu, or pressing the [↑] or [↓] key and the rotary knob. · [Ref Position]: Press [Ampt] → [Ref Position] to select the position of the reference line in the rectangular chart by clicking the corresponding numeric keys. · [Atten Auto Man]: Press [Ampt] → [Atten Auto Man] to adjust the input attenuation of the spectrum analyzer. In automatic mode, the input attenuator is associated with the reference level. In manual mode, the attenuation of the attenuator can be adjusted with a numeric keypad, a step key, or a rotary knob, and the attenuation ranges from 0dB to 30dB. · [Scale/Div]: Press [Ampt] → [Scale/Div] to adjust the size of the screen ordinate grid by pressing the numeric keys on the front panel, then selecting the frequency unit, or pressing the [↑] or [↓] key and the rotary knob. Select between 0.1dB/div and 20dB/div. It is 10dB/div by default. · [Units]: Press [Ampt] → [Units] to select the unit on the vertical axis including [dBm], [dBmV], [dBμV], [Volts] and [Watts]. · [Pre Amp Off On]: Press [Ampt] → [Pre Amp Off On] to control the switching status of the preamplifier, which will be activated only when the reference level is less than -40dBm. · [Special Note]: When the preamplifier is turned on, care should be taken not to input a signal greater than +13dBm, otherwise the instrument will be
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damaged.

5.4.5 Bandwidth menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">BW</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Res BW <u>A</u>uto <u>M</u>an</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Video BW <u>A</u>uto <u>M</u>an</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Video Type <u>L</u>in <u>L</u>og</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Average <u>O</u>ff <u>O</u>n</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">SPAN/RBW 100</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">RBW/VBW 1</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Detector [Normal] ></div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;"> </div>	<ul style="list-style-type: none"> · [Res BW <u>A</u>uto <u>M</u>an]: Press [BW] →[Res BW <u>A</u>uto <u>M</u>an] to adjust the resolution bandwidth, ranging from 1Hz-10MHz. In manual mode, the resolution bandwidth can be changed in 1, 3, or 10 steps with the numeric keys, step keys, or rotary knob. In automatic mode, it changes with the span according to the SPAN/RBW ratio. The 10 MHz resolution bandwidth is not automatically associated with the span and needs to be set manually. · [Video BW <u>A</u>uto <u>M</u>an]: Press [BW] →[Video BW <u>A</u>uto <u>M</u>an] to adjust the video bandwidth displayed in the active function area. The range from 1Hz to 10MHz. In manual mode, use the numeric keys, step keys or rotary knob to change the video bandwidth, and the step keys and the rotary knob change in steps of 1, 3, and 10. In the automatic mode, the RBW/VBW ratio changes based on the change of resolution bandwidth. · [Video Type <u>L</u>in <u>L</u>og]: Press [BW] →[Video Type <u>L</u>in <u>L</u>og] to select the vertical scale type logarithmic or linear scale. Log scale is generally in dBm, and linear scale is in mV by default. · [Average <u>O</u>ff <u>O</u>n]: Press [BW] →[Average <u>O</u>ff <u>O</u>n] to select the average function. This function continuously averages the traces to achieve a smooth trace. · [SPAN/RBW 100]: Press [BW] →[SPAN/RBW 100] to set the ratio of the current bandwidth to the resolution bandwidth, and display it in the input area. The default value is 100. This ratio is used in the association mode of the resolution bandwidth. · [RBW/VBW 1]: Press [BW] →[RBW/VBW 1] to set the ratio of the current video bandwidth to the resolution bandwidth. The default value is 1. When the resolution bandwidth changes, the video bandwidth will automatically change to meet the ratio when it is automatic. The ratio is displayed in the input area and used in the association mode of two bandwidths. If a new ratio is selected, the video bandwidth is changed to meet the new ratio, while the resolution bandwidth remains unchanged. · [Detector]: Press [BW] →[Detector] to pop up the soft menu for setting detection mode. Refer to the description of [Detector] menu for detail.
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5.4 Spectrum Analyzer menu description

5.4.6 Detection menu

Detector	<ul style="list-style-type: none"> · [Auto]: Press [BW] →[Detector]→[Auto] to enter the detection menu and automatically default to the standard mode.
Auto	<ul style="list-style-type: none"> · [Normal]: Press [BW] →[Detector]→[Normal]. In this mode, when noise is detected, the measurement results of positive and negative peaks are displayed simultaneously to achieve a similar display effect to the analog instrument. However, only positive peak is displayed when the signal is detected. This is the most common way to detect waves. The signal and noise base can be seen simultaneously without losing any signal.
Normal	<ul style="list-style-type: none"> · [Peak]: Press [BW] →[Detector]→[Peak] to select the positive peak detection mode. This mode can ensure that no peak signals are missed, which is suitable for measuring signals that are very close to the noise base. The one selected at [Max Hold] is the positive peak detector.
Peak	<ul style="list-style-type: none"> · [Neg Peak]: Press [BW] →[Detector]→[Neg Peak] to select the negative peak detection mode. This mode enables the trace to display a negative peak level. In most cases, it is used in the self-test of broadband millimeter wave spectrum analyzer, but rarely in measurement. It can fully reproduce the modulation envelope of the AM signal. The one selected at [Min Hold] is the negative peak detector.
Neg Peak	<ul style="list-style-type: none"> · [Sample]: Press [BW] →[Detector]→[Sample] to set the detector to sampling detection mode. This mode is suitable for measuring noise signals and can measure noise better than normal detection methods. It is usually used for video averaging and noise marker functions.
Sample	<ul style="list-style-type: none"> · [Average]: Press [BW] →[Detector]→[Average] to set the detector to average detection mode. The average detection mode displays the average of the sampled data of the trace in each sampling interval.
Average	<ul style="list-style-type: none"> · [RMS]: Press [BW] →[Detector]→[RMS] to set the detector to root mean square detection mode. The root mean square detection mode displays the root mean square value of the sampled data of the trace in each sampling interval.
RMS	
< Back	

5.4.7 Marker menu

Marker	<ul style="list-style-type: none"> · [Marker 1 2 3 4 5 6]: Press 【Marker】 →[Marker 1 2 3 4 5 6] to select a different marker, activate a single marker, and place the marker in the center of the trace and display the values in the marker display area in the upper right corner of the screen.
Marker <u>1</u> 2 3 4 5 6	<ul style="list-style-type: none"> · [Normal]: Press 【Marker】 →[Normal] to display the frequency and amplitude of the marker. The active marker can be moved with the rotary knob, step keys or numeric keys. The displayed amplitude is in dB by default.
Normal	<ul style="list-style-type: none"> · [Delta]: Press 【Marker】 →[Delta] to display the amplitude difference and frequency difference between two markers (time difference in case of zero frequency width). The active marker can be moved with the rotary knob, step keys or numeric keys. The displayed amplitude difference is in dB by default.
Delta	<ul style="list-style-type: none"> · [Marker Noise <u>Off</u> On]: Press 【Marker】 →[Marker Noise <u>Off</u> On] to turn on or off the noise marker. When the menu is ON, the noise marker is activated. Read the noise power normalized to the 1Hz bandwidth near the activated marker, at which point the detector is in root mean square detection mode automatically.
Marker Noise <u>Off</u> On	<ul style="list-style-type: none"> · [Counter Mkr <u>Off</u> On]: Press 【Marker】 →[Counter Mkr <u>Off</u> On] to turn on the marker counter function. If the marker is not currently activated, an active marker will be activated in the middle of the screen when the marker count function is turned on.
Counter Mkr <u>Off</u> On	<ul style="list-style-type: none"> · [Marker->>]: Press 【Marker】 →[Marker->Center] to pop up a soft menu related to the marker function, which is related to whether the frequency, bandwidth and marker are in normal or delta marker mode. These marker functions allow the user to change the spectrum analyzer setting with the marker as a reference.
Marker-> >	<ul style="list-style-type: none"> · [Off]: Press 【Marker】 →[Off] to turn off the currently selected marker and functions related to the selected marker such as [Marker Noise].
Off	<ul style="list-style-type: none"> · [All Off]: Press 【Marker】 →[All Off] to turn off all markers and marker-related functions such as [Marker Noise].
All Off	

5.4 Spectrum Analyzer menu description

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Marker-></div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Marker-> Center</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Marker-> CF Step</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Marker-> Start</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Marker-> Stop</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">< Back</div>	<ul style="list-style-type: none"> · [Marker->Center]: Press [Marker] →[Marker->Center]→[Marker->Center] to move the marker to the center frequency and display the reading at the center frequency on the screen. · [Marker->CF Step]: Press [Marker] →[Marker->Center]→[Marker->CF Step] to set the step size of the center frequency, i.e., the value of the frequency step is equal to the marker frequency, and the value of the frequency step is equal to the frequency of the delta marker when the delta marker function is activated. · [Marker ->Start]: Press [Marker] →[Marker->Center]→[Marker ->Start] to set the start frequency equal to the marker frequency. · [Marker ->Stop]: Press [Marker] →[Marker->Center]→[Marker ->Stop] to set the stop frequency equal to the marker frequency.
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5.4.8 Peak menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Peak</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Peak Search</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Next Peak</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Next Pk Left</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Next Pk Right</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Max Search</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Min Search</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Peak Track <u>Off</u> On</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Marker-> Center</div>	<ul style="list-style-type: none"> · [Peak Search]: Press [Peak] →[Peak Search] to place a marker to the highest peak point of the trace and display the frequency and amplitude of this marker in the upper right corner of the screen. · [Next Peak]: Press [Peak] →[Next Peak] to move the active marker to the next highest peak point on the trace that is associated with the current marker position. When this key is pressed repeatedly, a lower peak point can be found quickly. · [Next pk Left]: Press [Peak] →[Next pk Left] to find the next peak on the left of the current marker position. · [Next pk Right]: Press [Peak] → [Next pk Right] to find the next peak on the right of the current marker position. · [Max Search]: Press [Peak] →[Max Search] to place a marker to the highest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen. · [Min Search]: Press [Peak] →[Min Search] to place a marker to the lowest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen. · [Peak Track <u>Off</u> On]: Press [Peak] →[Peak Track <u>Off</u> On].When the peak tracking is on, the current marker will perform a peak search operation at the end of each sweep. When peak tracking is off, no operation is performed.
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5.4 Spectrum Analyzer menu description

· **[Marker->Center]:** Press **【 Peak 】** →[Marker->Center] to set the marker frequency equal to the center frequency. This function quickly moves the signal to the center of the screen.

5.4.9 Mode menu

The default function mode in the mode menu is spectrum analysis mode. According to user requirements, the following function options can be added: Interference Analyzer, demodulation analysis, power measurement, channel scan, and field strength measurement.

Mode	· [Spectrum Analyzer]: Press 【 Mode 】 →[Spectrum Analyzer] to select the spectrum analysis mode.
Spectrum Analyzer	· [Interference Analyzer]: Press 【 Mode 】 →[Interference Analyzer] to select the Interference Analyzer mode. See the section of Interference Analyzer Measurement Mode in Chapter V for details.
Interference Analyzer	· [Location Analyzer]: Press 【 Mode 】 →[Location Analyzer] to select the Location Analyzer mode. See the section of Location Analyzer Measurement Mode in Chapter VI for details.
Location Analyzer	· [Real-Time Spectrum]: Press 【 Mode 】 →[Real-Time Spectrum] to select the Real-Time Spectrum mode. See the section of Real-Time Spectrum Measurement Mode in Chapter VII for details.
Real-Time Spectrum	· [GSM/EDGE]: Press 【 Mode 】 →[GSM/EDGE] to select the GSM/EDGE mode. See the section of GSM/EDGE Measurement Mode in Chapter VIII for details.
GSM/EDGE	· [5G NR]: Press 【 Mode 】 →[5G NR] to select the 5G NR mode. See the section of 5G NR Measurement Mode in Chapter X for details.
5G NR	· [LTE Analyzer]: Press 【 Mode 】 →[LTE Analyzer] to select the LTE Analyzer mode. See the section of LTE Analyzer Measurement Mode in Chapter IX for details.
LTE Analyzer	

5.4.10 Sweep menu

The sweep time is the time required for the spectrum analyzer to tune to the selected frequency interval. The sweep time directly affects the time used to complete a test, and the sweep time usually varies with the span, resolution bandwidth, and video bandwidth. In automatic mode, the spectrum analyzer will use the quickest sweep time after the measurement setup is completed. In the manual mode, the sweep time can be increased to meet specific measurement needs.

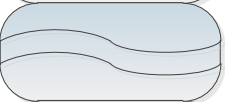
In the sweep mode, the default mode is linear sweep, while the list sweep function, as an option, enables continuous sweep measurement of multiple frequency bands, including edit list, store list, and recall list functions for user convenience.

5.4 Spectrum Analyzer menu description

<p>Sweep</p> <p>Sweep Time <u>Auto</u> Man</p> <p>Sweep <u>Cont</u> Signal</p> <p>Sweep Once</p> <p>Sweep Setup [Default]</p> <p>Triggering > [Free Run]</p> <p>Points 1001</p> <p>Gate Sweep ></p> <p>More 1/2 ></p>	<ul style="list-style-type: none"> · [Sweep Time <u>Auto</u> Man]: Press [Sweep] → [Sweep Time <u>Auto</u> Man] to adjust the sweep time of the spectrum analyzer. It can be adjusted by the numeric keys, step keys or the rotary knob. The underlined Manual indicates that the sweep time can be set manually. When Auto is selected, the sweep time will be automatically associated with the resolution bandwidth, frequency span and video bandwidth settings. · [Sweep Type <u>Cont</u> Single]: Press [Sweep] → [Sweep Type <u>Cont</u> Single] to set continuous sweep mode or single sweep mode. · [Sweep Once]: Press [Sweep] → [Sweep Once] to re-sweep. · [Sweep Setup]: Press [Sweep] → [Sweep Setup] to set rapid sweep or default sweep. · [Triggering]: Press [Sweep] → [Triggering] to select the sweep trigger mode, including [Free Run]→[Video]→[External(TTL)TTL], etc. Refer to the Trigger menu for details. · [Points]: Press [Sweep] → [Points] to set the number of sweep points. The number of sweep points can be set to 201, 501, 1001, 2001 and 4001. · [Gate Sweep]: Press [Sweep] → [Gate Sweep] to set the gate sweep parameters. The gate sweep function implements spectral analysis of pulse RF signals, time division multiple access (TDMA) signals, intermittent signals, etc. The user is able to define the time window for performing the measurement. The gate sweep allows the signal to be measured within a specified time period and to exclude or block interfering signals.
<p>Sweep</p> <p>Sweep Mode <u>Lin</u> List</p> <p>Edit List ></p> <p>Save List</p> <p>Recall List ></p> <p>More2/2 ></p>	<ul style="list-style-type: none"> · [Sweep Mode <u>Lin</u> List]: Press [Sweep] → [Sweep Setup] to select whether it is the linear mode or the list mode. Linear sweep refers to sweep at linear frequency spacings with equal frequency spacing between adjacent measurement points. The list mode is optional. In the list sweep mode, it is scanned with the frequency range and other parameters set by the edited list. · [Edit List]: This function is a list sweep option. Press [Sweep] → [Edit List] to open the list edit soft menu. You can use [Add Seg]→[Delete Seg]→[Delete All] and other soft keys to manage and edit the sweep list. The selected sweep segment is indicated by green font; after editing the sweep segment, press [Done] soft key to confirm back to the sweep sub-menu. · [Save List]: This function is a list sweep option. Press [Sweep] → [Save List] to save the currently edited list in the spectrum analyzer for easy recall later. · [Recall List]: This function is a list sweep option. Press [Sweep] → [Recall List] to pop up the sweep list dialog box for calling or deleting the desired sweep list.

5.4.11 Trigger menu

The trigger menu is used to select the trigger mode for sweep or measurement, including [Free Run]→[Video]→[External(TTL)TTL]→[Slope Rising Falling]→[Delay]. Users can choose the appropriate trigger mode according to different needs.

Triggering	<ul style="list-style-type: none"> • [Free Run]: Press [Sweep] →[Triggering]→[Free Run] to set the free trigger to start a new sweep or measurement when the last continuous sweep or single sweep is finished.
Free Run	<ul style="list-style-type: none"> • [Video]: Press [Sweep] →[Triggering]→[Video] to set the trigger mode to video trigger. The sweep is triggered whenever the input signal exceeds the set video trigger level. The trigger level value can be set with the numeric keys, step keys or rotary knob, and the green line on the screen indicates the selected trigger level.
Video	<ul style="list-style-type: none"> • [External(TTL)TTL]: Press [Sweep] →[Triggering]→[External(TTL)TTL] to set the spectrum analyzer to external trigger mode. Select the sweep and measurement to synchronize with the next voltage cycle.
External(TTL) TTL	<ul style="list-style-type: none"> • [Slope <u>Rising</u> Falling]: Press [Sweep] →[Triggering]→[Slope <u>Rising</u> Falling] to control the positive and negative slope of the level trigger. The positive slope is triggered by the rising edge, and the negative slope is triggered by the falling edge.
Slope <u>Rising</u> Falling	<ul style="list-style-type: none"> • [Delay]: Press [Sweep] →[Triggering]→[Delay] to set the time delay of the level trigger. The spectrum analyzer will wait for this time period after receiving the external trigger signal before sweeping.
Delay 1.000 μs	
	
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5.4 Spectrum Analyzer menu description

5.4.12 Gate Sweep menu (option)

The gate sweep function implements spectral analysis of pulse RF signals, time division multiple access (TDMA) signals, intermittent signals, etc. The user is able to define the time window for performing the measurement. The gate sweep allows the signal to be measured within a specified time period and to exclude or block interfering signals.

Gate Sweep	<ul style="list-style-type: none"> • [Gate Sweep <u>Off</u> On]: Press [Sweep] → [Gate Sweep] → [Gate Sweep <u>Off</u> On] to turn on or off the gate sweep function.
Gate Sweep <u>Off</u> On	<ul style="list-style-type: none"> • [Special Note]: When the gate sweep function is turned on, the span is automatically set to 0 and the horizontal coordinate changes to time.
Delay 1.000 ms	<ul style="list-style-type: none"> • [Delay]: Press [Sweep] → [Gate Sweep] → [Delay] to set the delay time of the gate sweep. When the trigger signal is received, the gate sweep is opened after a certain delay time.
Length 5.000 ms	<ul style="list-style-type: none"> • [Length]: Press [Sweep] → [Gate Sweep] → [Length] to set the width of the gate sweep, that is, the opening time of the gate sweep.
Gate View <u>Off</u> On	<ul style="list-style-type: none"> • [Gate View <u>Off</u> On]: Press [Sweep] → [Gate Sweep] → [Gate View <u>Off</u> On] to turn on or off the gate view. When the gate view is ON, the green gate start line and gate end line will be displayed on the screen, with the gate length as the time interval.
View Time 10.000 ms	<ul style="list-style-type: none"> • [View Time]: Press [Sweep] → [Gate Sweep] → [View Time] to set the length of the view time.
Spectrum <u>Off</u> On	<ul style="list-style-type: none"> • [Special Note]: When [Gate View <u>Off</u> On] is set to ON, [gate sweep <u>Off</u> On] will close automatically; similarly, when [gate sweep <u>Off</u> On] is set to ON, [Gate View <u>Off</u> On] will close automatically.
More 1/2 >	<ul style="list-style-type: none"> • [Spectrum <u>Off</u> On]: Press [Sweep] → [Gate Sweep] → [Spectrum <u>Off</u> On] to turn on or off the Spectrum. When the Spectrum function is turned on, it will display center frequency and span.
< Back	<ul style="list-style-type: none"> • [Special Note]: [View Time] can be set only when [Gate View <u>Off</u> On] is turned on, and the sweep time will be consistent with the view time.

<p>Gate Sweep</p> <p>Span 100.000 MHz</p> <p>RBW Auto Man</p> <p>Slope Rising Falling</p> <p>Source Ext Int GPS</p> <p>Interval [10 ms] ></p> <p>More2/2</p> <p>< Back</p>	<ul style="list-style-type: none"> · [Span 100.000MHz]: Press [Sweep] → [Gate Sweep] → [Span] to set the span. · [Special Note]: When [Spectrum Off On] is set to ON, [Span] can be setup. · [RBW Auto Man]: Press [Sweep] → [Gate Sweep] → [RBW Auto Man] to automatically or manually set the RBW. · [Special Note]: When [Spectrum Off On] is set to ON, [RBW Auto Man] can be turn on or off. · [Slope Rising Falling]: Press [Sweep] → [Gate Sweep] → [Slope Rising Falling] to set the edge slope of the trigger gate sweep. The positive slope is triggered by the rising edge, and the negative slope is triggered by the falling edge. · [Source Ext Int GPS]: Press [Sweep] → [Gate Sweep] → [Source Ext Int GPS] to set the external trigger, internal trigger or GPS trigger. · [Interval [10ms]]: Press [Sweep] → [Gate Sweep] → [Interval [10ms]] to set the trigger interval, trigger interval can be set to 10ms、20ms、50ms、100ms、200ms、500ms and 1s.
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5.4.13 Trace menu

The trace menu is used to set the display of trace, and select relevant settings such as refresh trace, maximum hold, minimum hold, etc. according to different needs of user testing. For example, when measuring the drift signal, use the track maximum hold function to display the maximum peak amplitude and frequency drift of the input signal.

5.4 Spectrum Analyzer menu description

Trace	<ul style="list-style-type: none"> · [Trace 1 2 3]: Press [Trace] → [Trace 1 2 3] to select a trace. The spectrum analyzer provides traces 1, 2 and 3, and the selected trace serial number and the status menu item where its trace is located will be marked with an underline.
Trace <u>1</u> 2 3	<ul style="list-style-type: none"> · [Clear Write]: Press [Trace] → [Clear Write] to refresh all the data of the previously displayed trace and continuously display the signal received by the spectrum analyzer in the sweep state.
Clear Write	<ul style="list-style-type: none"> · [Max Hold]: Press [Trace] → [Max Hold] to hold the maximum value of the points on the selected trace and update it with the new maximum detected in each sweep. If the detection is automatic, it will switch to the positive peak detection mode.
Max Hold	<ul style="list-style-type: none"> · [Min Hold]: Press [Trace] → [Min Hold] to hold the maximum value of the points on the selected trace and update it with the new minimum detected in each sweep. If the detection is automatic, it will switch to the positive peak detection mode.
Min Hold	<ul style="list-style-type: none"> · [View]: Press [Trace] → [View] to hold and display the amplitude data of the selected trace, but it will not be updated during the spectrum analyzer sweeps.
View	<ul style="list-style-type: none"> · [Blank]: Press [Trace] → [Blank] to perform background processing on the signal instead of displaying it on the screen.
Blank	

5.4.14 Limit menu


Limit	<ul style="list-style-type: none"> · [Limit Upper Lower]: Press 【Limit】 → [Limit <u>Upper</u> Lower] to select the current limit line as the upper limit line or the lower limit line.
Limit Upper Lower	<ul style="list-style-type: none"> · [Display Off On]: Press 【Limit】 → [Display <u>Off</u> On] to select whether to turn on the limit function.
Display Off On	<ul style="list-style-type: none"> · [Test Off On]: Press 【Limit】 → [Test <u>Off</u> On] to turn on or off the limit test.
Test Off On	<ul style="list-style-type: none"> · [Edit Limit>]: Press 【Limit】 → [Edit Limit>], including [Frequency], [Amplitude], [Add Point], [Delete Point], [Left Point], [Right Point], [Default Limit] and other soft menus to view the frequency and amplitude of the limit points, as well as add or delete limit points.
Edit Limit >	<ul style="list-style-type: none"> · [Margin]: Press 【Limit】 → [Margin] to set the offset allowance.
Margin 0.00 dB	<ul style="list-style-type: none"> · [Alarm Off On]: Press 【Limit】 → [Alarm <u>Off</u> On] to set the sound alarm switch. When the audible alarm is turned on, it is effective when the upper and lower limit line test switch is turned on. When the upper and lower limit lines are swept on the current screen, the buzzer will give a short sound if there is an out of range condition.
Alarm Off ON	<ul style="list-style-type: none"> · [Save Limit]: Press 【Limit】 → [Save Limit] to store the limit.
Save Limit	<ul style="list-style-type: none"> · [Recall Limit]: Press 【Limit】 → [Recall Limit], including [Head], [Tail], [Page Up], [Page Down], [Done], [Delete], [Cancel], and other soft menus to call or delete the saved limits.
Recall Limit >	

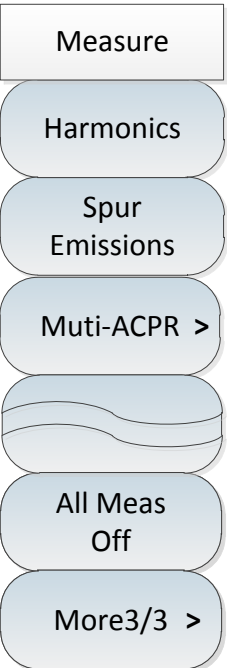
5.4 Spectrum Analyzer menu description

5.4.15 Measurement menu

Measure	<ul style="list-style-type: none"> ·[Field Strength]: Press [Measure] →[Field Strength] to select the field strength measurement function and call up the related function menu. Refer to the description of [Field Strength] menu for detail.
Field Strength >	<ul style="list-style-type: none"> ·[Channel Power]: Press [Measure] →[Channel Power] to select the channel power function and call up the related function menu. Refer to the description of [Channel Power] menu for detail.
Channel Power >	<ul style="list-style-type: none"> ·[OBW]: Press [Measure] →[OBW] to select the occupied bandwidth function to call up the related function menu. Refer to the description of [OBW] menu for detail.
OBW >	<ul style="list-style-type: none"> ·[ACPR]: Press [Measure] →[ACPR] to select the adjacent channel power function and call up the related function menu. Refer to the description of [ACPR] menu for detail.
ACPR >	<ul style="list-style-type: none"> ·[Emission Mask]: Press [Measure] →[Emission Mask] to select the spurious function to call up the related function menu. Refer to the description of [Emission Mask] menu for detail.
Emission Mask >	<ul style="list-style-type: none"> ·[C/N]: Press [Measure] →[C/N] to select the carrier-to-noise ratio measurement function and call up the related function menu. Refer to the description of [C/N] menu for detail.
C/N >	<ul style="list-style-type: none"> ·[All Meas Off]: Press [Measure] →[All Meas Off] to close the measurement.
All Meas Off	
More1/3 >	

5.4 Spectrum Analyzer menu description

	<ul style="list-style-type: none"> ·[Tune&Listen]: Press [Measure] →[More 1 of 3]→[Tune&Listen] to enable the audio demodulation function. Refer to the description of [Tune&Listen] menu for detail. ·[IQ Capture]: Press [Measure] →[More 1 of 3]→[IQ Capture] to enable the IQ capture function. Refer to the description of [IQ Capture] menu for detail. ·[Outdoor Map]: Press [Measure] →[More 1 of 3]→[Outdoor Map] to enable the outdoor map function. Refer to the description of [Outdoor Map] menu for detail. ·[Indoor Map]: Press [Measure] →[More 1 of 3]→[Indoor Map] to enable the indoor map function. Refer to the description of [Indoor Map] menu for detail. ·[All Meas Off]: Press [Measure] →[More 1 of 3]→[All Meas Off] to close the measurement.
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	<ul style="list-style-type: none"> ·[Harmonics]: Press [Measure] →[More 1 of 3]→[Harmonics], it is used to turn on harmonics function. Refer to the description of [Harmonics] menu for details. ·[Spur Emission]: Press [Measure] →[More 1 of 3]→[Spur Emission], it is used to turn on spur emission function. Refer to the description of [Spur Emission] menu for details. ·[Muti-ACPR>]: Press [Measure] →[More 1 of 3]→[Muti-ACPR>], it is used to turn on Muti-ACPR function. Refer to the description of [Muti-ACPR] menu for details. [All Meas Off]: Press [Measure] →[More 1 of 3]→[All Meas Off], it is used to turn off measure.
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5.4 Spectrum Analyzer menu description


5.4.16 Field strength measurement menu

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

Field Strength	<ul style="list-style-type: none"> · [Field Strength <u>Off On</u>]: Press [Measure] →[Field Strength]→[Field Strength <u>Off On</u>] to turn on or off the field strength measurement function.
Field Strength <u>Off</u> On	<ul style="list-style-type: none"> · [Recall Antenna]: Press [Measure] →[Field Strength]→[Recall Antenna] to pop up soft menus such as [Head], [Tail], [Page Up], [Page Down], [Done] and [Delete], to select the saved antenna factor file in spectrum analyzer and call it.
Recall Antenna >	<ul style="list-style-type: none"> · [Edit Antenna]: Press [Measure] →[Field Strength]→[Edit Antenna] to pop up soft menus such as [Add Pt], [DEL Point], [Clear Point], [Finish] and [Cancel] to edit the antenna factor.
Edit Antenna >	<ul style="list-style-type: none"> · [Save Antenna]: Press [Measure] →[Field Strength]→[Save Antenna] to save the antenna factor.
Save Antenna	
Save Antenna	
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5.4.17 Channel power menu

The spectrum analyzer provides a channel power measurement function. By setting the relevant parameters in the function menu and selecting the appropriate resolution bandwidth and span/span, the channel power of the signal can be measured. Refer to Section 1 Channel power measurement of this chapter for specific operation.

Channel Pwr	· [Channel Pwr <u>Off</u> On] : Press 【Measure】 →[Channel Power]→[Channel Pwr <u>Off</u> On] to turn on or off the channel power measurement function.
Channel Pwr <u>Off</u> On	· [Center Freq] : Press 【Measure】 →[Channel Power]→[Center Freq] to set the center frequency with the numeric keys.
Center Freq	· [Channel BW] : Press 【Measure】 →[Channel Power]→[Channel BW] to set the channel bandwidth with the numeric keys.
Channel BW	· [Span] : Press 【Measure】 →[Channel Power]→[Span] to set the channel span with the numeric keys.
Span	· [Special Note] : The channel power bandwidth represents a frequency width at which the spectrum analyzer displays the frequency span of power, and the channel power span is the frequency range over which the spectrum analyzer sweeps. The channel power span should be set to be greater than or equal to the channel power bandwidth. Otherwise, the spectrum analyzer will automatically set the channel bandwidth equal to the channel power span. The ratio of channel power span to channel power bandwidth remains constant. This ratio remains constant as the channel power span changes. Changing the channel power bandwidth can change this ratio. For example, when the channel power span is doubled, the spectrum analyzer will also increase the channel power bandwidth by the same factor.
	
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5.4 Spectrum Analyzer menu description

5.4.18 Occupied bandwidth menu

The occupied bandwidth measurement of the spectrum analyzer can present the measurement results in a quick, clear and accurate manner. There are two methods for calculating the occupied bandwidth depending on the modulation method: power percentage and Power reduction XdB. Users may choose an appropriate bandwidth measurement method according to their own needs. Refer to Section 1 OBW measurement of this chapter for specific operation.

OBW	<ul style="list-style-type: none"> ·[OBW Off On]: Press [Measure] →[OBW]→[OBW Off On] to turn on or off the occupied bandwidth measurement function.
OBW Off On	<ul style="list-style-type: none"> ·[Method % dBc]: Press [Measure] →[OBW]→[Method % dBc] to select the corresponding measurement method, including percentage or drop XdB.
Method % dBc	<p>Percentage method is occupied bandwidth of the signal is obtained by calculating the bandwidth of the portion of the frequency containing a certain percentage of the total transmitted signal power, and the percentage of power can be set by the user.</p>
% 99.00 %	<p>Drop XdB calculation method defines the occupied bandwidth as the distance between the two frequency points when the signal power drops by XdB on both sides of the frequency point where the peak power of the signal is located. The X dB of the signal power drop is set by the user.</p>
dBc -3.0 dB	<ul style="list-style-type: none"> ·[%]: Press [Measure] →[OBW]→[%] to set the percentage of power when the percentage measurement method is selected.
Span	<ul style="list-style-type: none"> ·[dBc]: Press [Measure] →[OBW]→[dBc] to set the XdB of signal power drop when the drop XdB method is selected.
[Wavy Line]	<ul style="list-style-type: none"> ·[Span]: Press [Measure] →[OBW]→[Span] to set the occupied bandwidth measurement span.
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5.4.19 Adjacent channel power menu

The spectrum analyzer provides the measurement function of adjacent channel power ratio. Users can obtain the measurement results of adjacent channel power ratio by setting channel related parameters. The user can use the threshold test function to customize the adjacent channel limit, which is convenient to observe whether the adjacent channel power exceeds the set range. Refer to Section 1 ACPR measurement of this chapter for specific operation.

ACPR	· [ACPR Off On] : Press 【Measure】 → [Channel Power] → [ACPR Off On] to turn on or off the adjacent channel power measurement function.
ACPR Off On	· [Center Freq] : Press 【Measure】 → [Channel Power] → [Center Freq] to set the center frequency with the numeric keys.
Center Freq	· [Main Ch BW] : Press 【Measure】 → [Channel Power] → [Main Ch BW] to set the main channel measurement bandwidth with the numeric keys.
Main Ch BW 3.000 MHz	· [Adj Ch BW] : Press 【Measure】 → [Channel Power] → [Adj Ch BW] to set the adjacent channel measurement bandwidth with the numeric keys.
Adj Ch BW 3.000 MHz	· [Ch Spacing] : Press 【Measure】 → [Channel Power] → [Ch Spacing] to set the channel offset with the numeric keys.
Ch Spacing 3.000 MHz	
More1/2 >	
< Back	

5.4 Spectrum Analyzer menu description



- **[Limit Test Off On]:** Press **【Measure】** →[Channel Power]→[TH Test Off On] to turn on or off the test for the upper and lower adjacent channel power thresholds.
- **[Upper Limit]:** Press **【Measure】** →[Channel Power]→[Upper Limit] to set the power threshold for the upper adjacent channel test.
- **[Lower Limit]:** Press **【Measure】** →[Channel Power]→[Lower Limit] to set the power threshold for the lower adjacent channel test.
- **[Special Note]:** When the threshold test function is turned on, if the adjacent channel power ratio exceeds the set threshold, the screen will be marked with a red background.

5.4.20 Spectrum emission mask menu

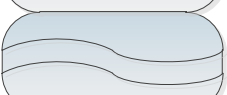
The function of spectrum emission mask is to call the limit line as a mask to measure whether the signal power is limited by the mask. The mask can move up and down, left and right according to the center frequency and reference power. The mask always moves the center point of the limit line left and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

Emission Mask	· [Emission Mask <u>Off</u> On] : Press 【Measure】 →[Emission Mask]→[Emission Mask <u>Off</u> On] to turn on or off the spectrum emission mask function.
Emission Mask <u>Off</u> On	· [Channel BW] : Press 【Measure】 →[Emission Mask]→[Channel BW] to set the reference channel bandwidth with the numeric keys.
Channel BW 1.000 MHz	· [Recall Limit as Mask] : Press 【Measure】 →[Emission Mask]→[Recall Limit as Mask] to pop up the relevant soft menus, including [Head], [Tail], [Page Up], [Page Down], [Done] and [Delete]. The user can select the limit file to be called.
Recall Limit As Mask >	· [Ref Power] : Press 【Measure】 →[Emission Mask]→ [Ref Power] to set the reference power setting mode, including peak power as the reference power, or channel power as the reference power.
Ref Power <u>Peak</u> Ch	· [Peak Marker <u>Off</u> On] : Press 【Measure】 →[Emission Mask]→[Peak Marker <u>Off</u> On] to select whether to turn on the peak marker.
Peak Markers <u>Off</u> On	· [Page Up] : Press 【Measure】 →[Emission Mask]→[Page Up] to view the previous page information.
Page Up	· [Page Down] : Press 【Measure】 →[Emission Mask]→[Page Down] to view the next page information.
Page Down	
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5.4 Spectrum Analyzer menu description


5.4.21 Carrier-to-noise ratio menu

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

C/N	<ul style="list-style-type: none"> · [C/N Off On]: Press 【Measure】 → [C/N] → [C/N <u>Off</u> On] to turn on or off the carrier-to-noise ratio function.
C/N <u>Off</u> On	<ul style="list-style-type: none"> · [Center Freq]: Press 【Measure】 → [C/N] → [Center Freq] to set the center frequency with the numeric keys.
Center Freq	<ul style="list-style-type: none"> · [Carrier BW]: Press 【Measure】 → [C/N] → [Carrier BW] to set the carrier bandwidth with the numeric keys, which is 3MHz by default.
Carrier BW 3.000 MHz	<ul style="list-style-type: none"> · [Noise BW]: Press 【Measure】 → [C/N] → [Noise BW] to set the noise bandwidth with the numeric keys, which is 3MHz by default.
Nosite BW 3.000 MHz	<ul style="list-style-type: none"> · [Offset]: Press 【Measure】 → [C/N] → [Offset] to set the frequency offset with the numeric keys, which is 3MHz by default.
Offset 3.000 MHz	
	
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5.4.22 Audio demodulation menu

The spectrum analyzer provides audio demodulation function.

Tune&Listen	<ul style="list-style-type: none"> •[Tune&Listen <u>Off</u> On]: Press [Measure] →[More 1 of 2]→[Tune&Listen]→[Tune&Listen <u>Off</u> On] to turn on or off the audio demodulation function.
Tune&Listen <u>Off</u> On	<ul style="list-style-type: none"> •[Demod Type]: Press [Measure] →[More 1 of 2]→[Tune&Listen]→[Demod Type] to set the demodulation type, such as [FM]→[AM]→[USB] or [LSB].
Demod Type [FM] >	<ul style="list-style-type: none"> •[Listen Time]: Press [Measure] →[More 1 of 2]→[Tune&Listen]→[Listen Time] to set the demodulation time.
Listen Time 100.000 ms	<ul style="list-style-type: none"> •[Listen Mode]: Press [Measure] →[More 1 of 2]→[Tune&Listen]→[Listen Mode] to set the demodulation mode. The default state is intermittent demodulation mode. The intermittent mode is that the data is scanned after one screen and then demodulated intermittently for a period of time according to the demodulation time, then the data is scanned again after one screen and then demodulated intermittently for a period of time according to the demodulation time, and so on and so forth; the continuous mode is that the data is continuously demodulated after one screen is scanned and the data is not scanned anymore.
Listen Mode <u>Int</u> Cont	<ul style="list-style-type: none"> •[Volume]: Press [Measure] →[Tune&Listen]→[Volume] to set the volume of the speaker in demodulation function mode.
Volume 95	
	
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5.4 Spectrum Analyzer menu description

5.4.23 IQ capture menu

The IQ capture function enables raw IQ data to be captured and saved as data files for data analysis through user-set parameters such as capture time, sample rate, and capture mode.

<p>IQ Capture</p>	<p>·[IQ Capture Off On]: Press 【Measure】 →[More 1 of 2]→[IQ Capture]→[IQ Capture <u>Off</u> On] to turn on or off the IQ capture function.</p>
<p>IQ Capture <u>Off</u> On</p>	<p>·[Start Capture]: Press 【Measure】 →[More 1 of 2]→[IQ Capture]→[Start Capture] to start IQ capture.</p>
<p>Start Capture</p>	<p>·[Capture Time]: Press 【Measure】 →[More 1 of 2]→[IQ Capture]→[Capture Time] to set the IQ capture time.</p>
<p>Capture Time 1.000 ms</p>	<p>·[Capt Mode]: Press 【Measure】 →[More 1 of 2]→[IQ Capture]→[Capt Mode] to set the IQ capture mode to single or continuous. If the capture mode is set to single, the capture will end only once, and if the capture mode is multiple, the scan thread will capture once after each scan, and it will stop only when the user sets stop capture.</p>
<p>Capture Mode <u>Signal</u> Cont</p>	<p>·[Sample Rate]: Press 【Measure】 →[More 1 of 2]→[IQ Capture]→[Sample Rate] to set the sample rate for IQ capture.</p>
<p>Sample Rate 184.320 MHz</p>	<p>·[Triggering]: Press 【Measure】 →[More 1 of 2]→[IQ Capture]→[Triggering]. The trigger mode includes [Free Run]→[External(TTL)TTL]. Select external trigger to set [Slope Rising Falling]→[Delay].</p>
<p>Triggering [Free Run] ></p>	<p>·[Save Name IQCapture]: Press 【Measure】 →[More 1 of 2]→[IQ Capture]→[Save Name IQCapture] to set the file name of the captured data.</p>
<p>Save Name IQCapture</p>	
<p>< Back</p>	

5.4.24 Outdoor map menu (option)

<p>Outdoor Map</p> <p>Outdoor Map Off <u>On</u></p> <p>Save Recall ></p> <p>Meas Setup></p> <p>Distance Time ></p> <p>Start Collection</p> <p>Zoom In</p> <p>Zoom Out</p> <p>< Back</p>	<ul style="list-style-type: none"> ·[Outdoor Map Off On]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Outdoor Map Off <u>On</u>] to turn on or off the outdoor map. ·[Save Recall]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Save Recall] to turn on the Store and Call submenu. ·[Meas Setup]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]to turn on the measurement submenu. ·[Distance/Time]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Distance/Time] to turn on the distance/time submenu. ·[Start Collection]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Start Collection]. Start measuring data and mark the location and measurement results on the map. The interval between each two annotations can be set via the [Distance Time] menu. ·[Zoom In]: Press 【 Measure 】→[More 1 of 3]→[Outdoor Map]→[Zoom In] to set the map zoom-in display. ·[Zoom Out]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Zoom Out] to set the map zoom-out display.
<p>Save&Recall</p> <p>Save CSV</p> <p>Save CSV</p> <p>Save BMP</p> <p>Recall Data</p> <p>< Back</p>	<ul style="list-style-type: none"> ·[Save Data]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Save Recall]→[Save Data] to store the collection data to the instrument. ·[Save CSV]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Save Recall]→[Save CSV] to store the collection data as a file in CSV format. ·[Save BMP]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Save Recall] to open the STO/CAL soft menu. Users can select [Save Data]→[Save CSV]→[Save BMP]→[CAL Data] as needed, where CSV file is in text format and BMP file is in picture format. [CAL Data] is used to call out the stored historical collection data for viewing. ·[Recall Data]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Save Recall]→[Recall Data] to call the stored historical collection data for viewing.

5.4 Spectrum Analyzer menu description

<p>Meas Setup</p> <p>RSSI ></p> <p>ACPR ></p> <p>Center Freq</p> <p>RBW</p> <p>Detection [Normal] ></p> <p>< Back</p>	<ul style="list-style-type: none"> • [RSSI]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[RSSI] to turn on the RSSI measurement submenu. • [ACPR]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[ACPR] to turn on the adjacent channel power ratio measurement submenu. • [Center Freq]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[Center Freq] to set the center frequency. • [RBW]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[RBW] to set the resolution bandwidth. • [Detection]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[Detection] to turn on the detection submenu.
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<p>RSSI</p> <p>Excellent: ≥ 0.0 dBm</p> <p>Very Good: ≥ -20.0 dBm</p> <p>Good: ≥ -40.0 dBm</p> <p>Fair: ≥ -60.0 dBm</p> <p>Poor: < -60.0 dBm</p> <p>< Back</p>	<ul style="list-style-type: none"> • [Excellent]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[RSSI]→[Excellent] to set the color when the measurement signal is greater than this value. • [Very Good]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[RSSI]→[Very Good] to set the color when the measurement signal is greater than this value. • [Good]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[RSSI]→[Good] to set the color when the measurement signal is greater than this value. • [Fair]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[RSSI]→[Fair] to set the color when the measurement signal is greater than this value. • [Poor]: Press 【 Measure 】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[RSSI]→[Poor] to set the color when the measurement signal is less than this value.
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5.4 Spectrum Analyzer menu description

<p>ACPR</p> <p>Main Ch BW 3.000 MHz</p> <p>Adj Ch BW 3.000 MHz</p> <p>Ch Spacing 3.000 MHz</p> <p>Adj Ch Offset 0.00 dB</p> <p>Good:≥ 0.0 dBm</p> <p>Poor:< 0.0 dBm</p> <p>< Back</p>	<ul style="list-style-type: none"> ·[Main Ch BW]: Press 【Measure】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[ACPR]→[Main Ch BW] to set the main channel bandwidth. ·[Adj Ch BW]: Press 【Measure】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[ACPR]→[[Adj Ch BW] to set the adjacent channel bandwidth. ·[Ch Spacing]: Press 【Measure】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[ACPR]-[Ch Spacing] to set the channel spacing. ·[Adj Ch Offset]: Press 【Measure】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[ACPR]→[Adj Ch Offset] to set the adjacent channel limit. ·[Good]: Press 【Measure】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[RSSI]→[Good] to set the color when the measurement signal is greater than or equal to this value. ·[Poor]: Press 【Measure】 →[More 1 of 3]→[Outdoor Map]→[Meas Setup]→[RSSI]→[Poor] to set the color when the measurement signal is less than this value.
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<p>Dist&Time</p> <p>Repeat Type <u>Time</u> Dist</p> <p>Repeat Time 10.000 s</p> <p>Repeat Dist 100 m</p> <p>Delete All Points</p> <p>< Back</p>	<ul style="list-style-type: none"> ·[Repeat Type]: Press 【Measure】 →[More 1 of 3]→[Outdoor Map]→[Distance&Time]→[Repeat Type] to set the repeat type. ·[Repeat Time]: Press 【Measure】 →[More 1 of 3]→[Outdoor Map]→[Distance&Time]→[Repeat Time] to set the time between two acquisitions, which is valid when and only when the repeat type is set to time. ·[Repeat Dist]: Press 【Measure】 →[More 1 of 3]→[Outdoor Map]→[Distance&Time]→[Repeat Dist] to set the repeat distance two acquisitions, which is valid when and only when the repeat type is set to distance. ·[Delete All Point]: Press 【Measure】 →[More 1 of 3]→[Outdoor Map]→[Distance &Time]→[Delete All Point] to delete all the collection data on the map.
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5.4 Spectrum Analyzer menu description

5.4.25 Indoor map menu (option)

<p>Indoor Map</p> <p>Indoor Map Off <u>On</u></p> <p>Up</p> <p>Down</p> <p>Left</p> <p>Right</p> <p>Collection</p> <p>More1/2 ></p> <p>< Back</p>	<ul style="list-style-type: none">• [Indoor Map Off <u>On</u>]: Press [Measure] → [More 1 of 3] → [Indoor Map] → [Indoor Map Off <u>On</u>] to turn on or off the indoor map.• [Up]: Press [Measure] → [More 1 of 3] → [Indoor Map] → [Up] to move the marker up on the map.• [Down]: Press [Measure] → [More 1 of 3] → [Indoor Map] → [Down] to move the marker down on the map.• [Left]: Press [Measure] → [More 1 of 3] → [Indoor Map] → [Left] to move the marker to the left on the map.• [Right]: Press [Measure] → [More 1 of 3] → [Indoor Map] → [Right] to move the marker to the right on the map.• [Collection]: Press [Measure] → [More 1 of 3] → [Indoor Map] → [Collection] to mark the test result of current mark point on the map.
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5.4 Spectrum Analyzer menu description

<p>Indoor Map</p> <p>Delete Collection</p> <p>Clear Collection</p> <p>Save Recall ></p> <p>Meas Setup ></p> <p>More2/2 ></p> <p>< Back</p>	<ul style="list-style-type: none"> • [Delete Collection]: Press 【Measure】 →[More 1 of 3]→[Indoor Map]→[More 1 of 2]→[Delete Collection] to delete the current mark point. • [Clear Collection]: Press 【Measure】 →[More 1 of 3]→[Indoor Map]→[More 1 of 2]→[Clear Collection] to clear all flag points. • [Save Recall]: Press 【Measure】 →[More 1 of 3]→[Indoor Map]→[More 1 of 2]→[Save Recall] to open the STO/CAL soft menu. Users can select [Save Data]→[Save CSV]→[Save BMP]→[Recall Data] as needed, where CSV file is in text format and BMP file is in picture format. [Recall Data] is used to call out the stored historical collection data for viewing. • [Meas Setup]: Press 【Measure】 →[More 1 of 3]→[Indoor Map]→[More 1 of 2]→[Meas Setup] to turn on the measurement submenu. For details, please refer to the measurement menu of outdoor map in this chapter.
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5.4.26 Harmonic distortion menu

<p>Harmonics</p> <p>Harmonics <u>Off</u> On</p> <p>Fundamental 1.000 GHz</p> <p>Harmonics 4</p> <p>Res BW 3 MHz</p> <p>Video BW 3 MHz</p> <p>< Back</p>	<ul style="list-style-type: none"> • [Harmonics <u>Off</u> On]: Press 【Measure】 →[More 1 of 3]→[More 2 of 3]→[Harmonics]→[Harmonics <u>Off</u> On] to turn on or off the harmonic distortion. • [Fundamental]: Press 【Measure】 →[More 1 of 3]→[More 2 of 3]→[Harmonics]→[Fundamental] to set the fundamental frequency of the harmonics. • [Harmonics]: Press 【Measure】 →[More 1 of 3]→[More 2 of 3]→[Harmonics]→[Harmonics] to set the number of harmonics. • [Res BW]: Press 【Measure】 →[More 1 of 3]→[More 2 of 3]→[Harmonics]→[Res BW] to set the resolution bandwidth. • [Video BW]: Press 【Measure】 →[More 1 of 3]→[More 2 of 3]→[Harmonics]→[Video BW] to set the video bandwidth.
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5.4 Spectrum Analyzer menu description

5.4.27 Spurious emission mask menu

<p>Spur Emissions</p>	<ul style="list-style-type: none"> • [Spur Ems <u>Off</u> On]: Press 【Measure】 →[More 1 of 3]→[More 2 of 3]→[Emission Mask]→[Spur Ems <u>Off</u> On] to turn on or off the spurious emission mask function. • [Sweep <u>Cont</u> Single]: Press 【Measure】 →[More 1 of 3]→[More 2 of 3]→[Emission Mask]→ [Sweep <u>Cont</u> Single] to set the sweep type. • [Sweep Mode <u>Once</u> All]: Press 【Measure】 →[More 1 of 3]→[More 2 of 3]→[Emission Mask]→ [Sweep Mode <u>Once</u> All] to set the sweep mode. • [Segment]: Press 【Measure】→[More 1 of 3]→[More 2 of 3]→[Emission Mask]→ [Segment] to set the sweep band number. • [Emissions Edit]: Press 【Measure】 →[More 1 of 3]→[More 2 of 3]→[Emission Mask]→[Emissions Edit] to open the Mask Edit soft menu, which contains [Add Seg]→[Delete Seg]→[Delete All] functions, in which up to 8 bands can be set. • [Save Emissions]: Press 【Measure】 →[More 1 of 3]→[More 2 of 3]→[Emission Mask]→[Save Emissions] to save the current mask. • [Recall Emissions]: Press 【Measure】 →[More 1 of 3]→[More 2 of 3]→[Emission Mask]→[Recall Emissions] to call the saved template.
<p>Spur Ems <u>Off</u> On</p>	
<p>Sweep <u>Cont</u> Single</p>	
<p>Sweep Mode <u>Once</u> ALL</p>	
<p>Segment ID 1</p>	
<p>Emissions Edit ></p>	
<p>Save Emissions</p>	
<p>Recall Emissions ></p>	
<p>< Back</p>	

5.4.28 Multi-carrier adjacent channel power menu

Muti-ACPR <u>Off</u> On	· [Multi-ACPR <u>Off</u> On] : Press 【 Measure 】 →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→[Multi-ACPR <u>Off</u> On] to turn on or off the multi-carrier adjacent channel power function.
Center Freq	· [Center Freq] : Press 【 Measure 】 →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→[Center Freq] to set the center frequency.
Carrier <u>1</u> 2	· [Carrier <u>1</u> 2] : Press 【 Measure 】 →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→ [Carrier 1 2] to set the carrier number.
Carrier Freq	· [Carrier Freq] : Press 【 Measure 】 →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→[Carrier Freq] to set the carrier frequency under the current carrier number.
Carrier BW	· [Carrier BW] : Press 【 Measure 】 →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→[Carrier BW] to set the carrier bandwidth under the current carrier number.
Adj Ch Set >	· [Adj Ch Set>] : Press 【 Measure 】 →[More 1 of 3]→[More 2 of 3]→[Multi-ACPR]→→[Adj Ch Set>] to open the [Adj Ch Set>] soft menu, in which the offset, bandwidth, upper and lower threshold for up to 3 adjacent channels can be set and whether the threshold test is turned on.
< Back	


5.4 Spectrum Analyzer menu description

5.4.29 File menu

File	<ul style="list-style-type: none"> •[Save State]: Press [File] →[Save State] to save the current sweep status parameters.
Save State	<ul style="list-style-type: none"> •[Recall State]: Press [File] →[Recall State] to pop up the list of status files, to read the existing status file and call the corresponding status parameters for the current sweep via [Head], [Tail], [Page Up], [Page Down], [Done], [Delete] and other related soft menus.
Recall State >	<ul style="list-style-type: none"> •[Save Data]: Press [File]]→[Save Data] to save the trace data.
Save Data	<ul style="list-style-type: none"> •[Recall Data]: Press [File] →[Recall Data] to pop up the list of data files, to read the existing data file and recall the corresponding data parameters for the current sweep via [Head], [Tail], [Page Up], [Page Down], [Done], [Delete] and other related soft menus.
Recall Data >	<ul style="list-style-type: none"> •[Save Pic]: Press [File] →[Save Pic] to capture the current screen image, or directly take a quick screen capture through the camera button at the bottom left of the information area at the bottom of the operation interface.
Save Pic	<ul style="list-style-type: none"> •[CSV Off On]: Press [File] →[CSV Off On] to set whether the saving format of the instrument is CSV. When the status is OFF, the instrument saves the file format in binary format; when the status is ON, the instrument saves the file in CSV format, which is convenient for users to view directly.
CSV Off On	<ul style="list-style-type: none"> •[File Manager]: Press [File] →[File Manager] to pop up the file management menu, including [Source File]→[Destination]→[Copy]→[Delete Src File] and other related soft menus for copying and deleting files.
File Manager >	<ul style="list-style-type: none"> •[Location]: Press [File] →[Location] to select the storage location. The internal memory is the internal memory of the instrument. Other optional locations are the memory and SD card of USB interface. When the safety feature option is selected, the internal memory cannot be selected.
Save Pic	
Location [Internal] >	
Location [Internal] >	

When the secure data option is selected, the spectrum analyzer will not be able to select the internal memory, only the memory of USB interface, SD card can be selected as the storage location.

5.4 Spectrum Analyzer menu description

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Location</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Internal</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">SD</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">USB</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">  </div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center;">< Back</div>	<ul style="list-style-type: none"> · [Internal]: Press [File] →[Location]→[Internal]. When [Internal] is grayed out, it cannot be saved internally. · [SD]: Press [File] →[Location]→[SD] to store data to SD card. · [USB]: Press [File] →[Location]→[USB] to store data to USB.
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5.4.30 System menu

The system menu lists the 4024CA spectrum analyzer settings which are related to system operation. In addition to date and time, date format, system language, network settings, frequency reference, etc., there are also special menus such as GPS function (option) and power saving mode.

As an option of the 4024CA spectrum analyzer, Global Navigation Satellite System (GNSS) can realize the positioning function through external antenna. The system provides five kinds of global navigation satellite positioning systems or augmented positioning systems (GPS, SBAS, Beidou, QZSS and GLONASS). Users can select the appropriate positioning system according to the local environment. Users can view the number of satellites currently in use, longitude and latitude, Gaussian coordinates and altitude information, which is suitable for precise positioning in the field site.

If no operations are conducted in the sleep time set with the power saving mode, the spectrum analyzer will enter the sleep status, including such operations as closing the LED display and cutting off internal module power supply. Press any key to let the spectrum analyzer exit from the sleep mode and switch to the normal operation mode.

5.4 Spectrum Analyzer menu description

System	<ul style="list-style-type: none"> · [System Config]: Press [System] → [System Config] to pop up the soft menu related to system configuration to set the date and time. [Date/Time] is used to set the date and time; [Power Saver] to set the options of Auto Sleep and Auto Shutdown; [Error Log] to view relevant error messages; [Date Format]] to set the format of the date display; [Tip <u>Off</u> <u>On</u>] to add or edit titles in the screen display area.
	<ul style="list-style-type: none"> · [Preset] : Press [System] → [Preset] to pop up the menu related to system reset. Refer to the reset menu in the next section for details.
System Config >	<ul style="list-style-type: none"> · [GNSS GPS]: Press [System] → [GNSS GPS] to pop up the soft menu related to the positioning system, including [GPS <u>Off</u> <u>On</u>] → [GPS Info] → [Reset] → [Time Sync <u>Off</u> <u>On</u>] → [Gauss <u>Off</u> <u>On</u>] → [GNSS GPS], which is used to select the positioning system and view the position details, as well as start and reset.
Preset >	<ul style="list-style-type: none"> · [Special Note]: The positioning system function is an option function.
GNSS GPS >	<ul style="list-style-type: none"> · [Freq Ref <u>Int</u> <u>Ext</u>]: Press [System] → [Freq Ref <u>Int</u> <u>Ext</u>]. The user can select internal frequency reference or external frequency reference as required.
	<ul style="list-style-type: none"> · [Ref Out <u>Off</u> <u>On</u>]: Press [System] → [Ref Out <u>Off</u> <u>On</u>] to select whether to turn on the internal reference function according to the user's demand when the frequency reference is internal reference.
Freq Ref <u>Int</u> <u>Ext</u>	<ul style="list-style-type: none"> · [Special Note]: The external reference frequency must be 10MHz ± 100Hz, amplitude 0dBm (limit range: -2dBm to +10dBm). The external reference frequency must be entered from the "10 MHz reference input" connector on the cover.
Ref Out <u>Off</u> <u>On</u> >	
More1/2 >	

5.4 Spectrum Analyzer menu description

<p>System</p> <p>Language ></p> <p>Display ></p> <p>System Info</p> <p>LAN ></p> <p>About</p> <p>Admin</p> <p>More2/2 ></p>	<ul style="list-style-type: none"> · [Language]: Press [System] → [Language] to select the language type, including [简体中文] and [English] two options. · [Display]: Press [System] → [Display] to set the display mode, including [Default]→[Black&Write]→[Night Vision], and [Brightness]. · [System Info]: Press [System] → [System Info] to view system-related information, including application software version, image customization version and other related information. · [LAN]: Press [System] → [LAN] to select the network settings of the spectrum analyzer, including [prev], [Next], [IP], [Mask], [Gateway] and other soft menus. · [About]: Press [System] → [About] to see the software version of the instrument, the company's phone number, email address and website. · [Admin]: Press [System] → [Admin] to enter the administrator password for system-related management and settings. · [Special Note]: The system management function is limited to factory commissioning staff or technical support staff rather than users. Otherwise, the instrument can be damaged.
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5.4.31 Reset menu

The reset menu lists the 4024CA spectrum analyzer settings which are related to reset operation. In addition to reset and mode reset, there are user reset and save user reset menus, which can be used to reset it to the working state when the user saves the reset.

<p>Preset</p> <p>User Preset <u>Off</u> On</p> <p>Save User Preset</p> <p>Stand State <u>Off</u> On</p> <p>< Back</p>	<ul style="list-style-type: none"> · [Preset] : Press [System] → [Preset] to reset to the spectrum analysis mode. · [User Preset]: Press [System] → [Preset] → [User Preset <u>Off</u> On] to turn on or off [User Preset]. When [User Preset] is turned on, select [Save User Preset] to save the current working state before the reset. · [Save User Preset]: Press [System] → [Preset] → [Save User Preset]. When [User Preset] is enabled, it can be used to save the current working state before reset. After reset, it is reset to the state when [Save User Preset] is enabled by default. · [Stand State <u>Off</u> On]: Press [System] → [Preset] → [Stand State <u>Off</u> On] to automatically save the state before power off, and automatically recall the state parameters automatically saved before shutdown to reset to the current mode when power on again.
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6 Interference Analyzer Measurement Mode(Optional)

This chapter briefly describes the Spectrogram measurement and RSSI measurement in the Interference Analyzer measurement mode, gives the menu structure of the Interference Analyzer and explains it.

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- [Interference Analyzer menu structure](#) 141
- [Interference Analyzer menu description](#) 142

6.1 Introduction to typical measurements

Interference Analyzer measurement mode is an extension of the spectrum measurement mode. The Interference Analyzer mode of 4024CA spectrum analyzer is divided into three different measurement modes as follows:

Spectral measurements (specific operations can be found in the chapter on spectral analysis, which will not be repeated in this section);

Spectrogram measurement;

Received signal strength indication (RSSI) measurement.

Notice

All operations in this section are based on the premise that the Interference Analyzer mode has been selected, and will not be described separately later.

- [Spectrogram measurement](#) 137
- [RSSI measurement](#) 139

6.1.1 Spectrogram measurement

The Spectrogram is displayed in the mode of three dimensions: frequency–amplitude–time, allowing easy observation of periodic or intermittent signals. Different colors in the Spectrogram reflect the strength of signal amplitude.

To facilitate better observation of the measurement signal, the following steps should be followed:

a) Reset the spectrum analyzer to its default state:

6.1 Introduction to typical measurements

Press **【Preset】** .

b) Set center frequency:

Press **【Freq】** →[Span]→[Full Span], then press **【Peak】** to get the maximum point of the current measurement signal, then press [Marker-> Center] to set the current peak point as the center frequency, then the maximum value will be displayed at the center of the trace area.

c) Set bandwidth:

Press **【BW】**→[Res BW Auto Man] to set the appropriate resolution bandwidth with the numeric keys or [↑] & [↓] keys or the rotary knob, and to set the appropriate video bandwidth in the same way.

d) Set reference level:

Press **【Ampt】** →[Ref Level] to bring the current maximum point close to the uppermost position of the display area, and press [Scale/Div] to set the appropriate scale/grid value for viewing.

e) Set Auto Save parameters:

Press [Record]→[Swp Interval] to set the sweep interval value.

Notice

When the sweep interval is greater than 0, the trace is set to the maximum hold state to ensure that the maximum value of the signal obtained from each sweep is displayed on the interface.

Press [Sweep Time] to set the required recording time, and then [Record Off On] to set Auto Save. It is automatically saved after each completed screen.

Press [Record]→[Time Cursor], and move the horizontal straight line in the vertical direction of the Spectrogram by the numeric keys or [↑] [↓] or the rotary knob. The following spectrum chart will display the trace information on the straight line position.

Notice

When the time marker value is greater than 0, the trace is no longer refreshed and the Spectrogram area will not be updated.

f) Set marker:

The 4024CA spectrum analyzer provides six independent markers for Interference Analyzer to read

6.1 Introduction to typical measurements

out the amplitude and frequency values at the marker position, which can be used as follows:

【Marker】 → [Marker 1 2 3 4 5 6].

g) Save images.

To save the current Spectrogram measurement information as images, press 【File】 → [Save Pic].

The structure of Spectrogram test is shown in Figure 6-1 (the display is different under different parameter settings, and Figure 6-1 is only an example):

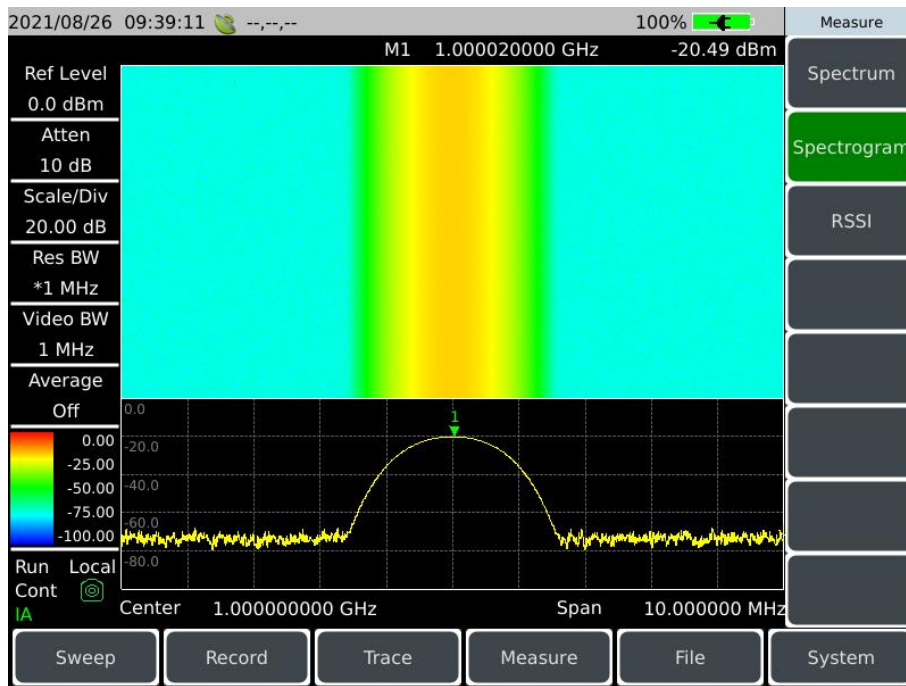


Figure 6-1 Interference Analyzer Spectrogram

6.1.2 RSSI measurement

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

To facilitate better observation of the measurement signal, the following steps should be followed:

a) Set sweep interval:

Press [Record] → [Swp Interval]. The sweep interval time characterizes the sweep time of two adjacent points for each sweep.

b) Set span recording time:

Press [Record] → [Sweep Time] to set the time that needs to be recorded for display. After reaching the set span time, the display interface will no longer refresh the display.

6.1 Introduction to typical measurements

c) Turn on Auto Save ON/OFF:

Press [Record]→[Record Off On]. The data will be saved to the file automatically after each completed screen.

Notice

After setting the span time, the data points displayed on the screen are recorded only for the most recent time, not for the entire span time.

The structure of RSSI test is shown in Figure 6-2 (the display is different under different parameter settings, and Figure 6-2 is only an example):

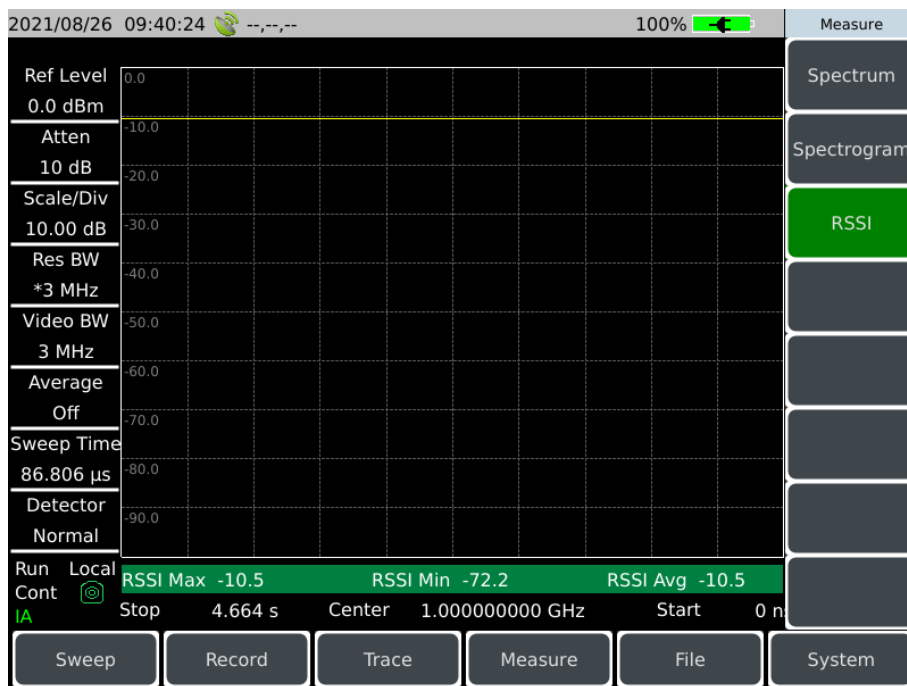


Figure 6-2 Interference Analyzer RSSI test chart

6.2 Interference Analyzer menu structure

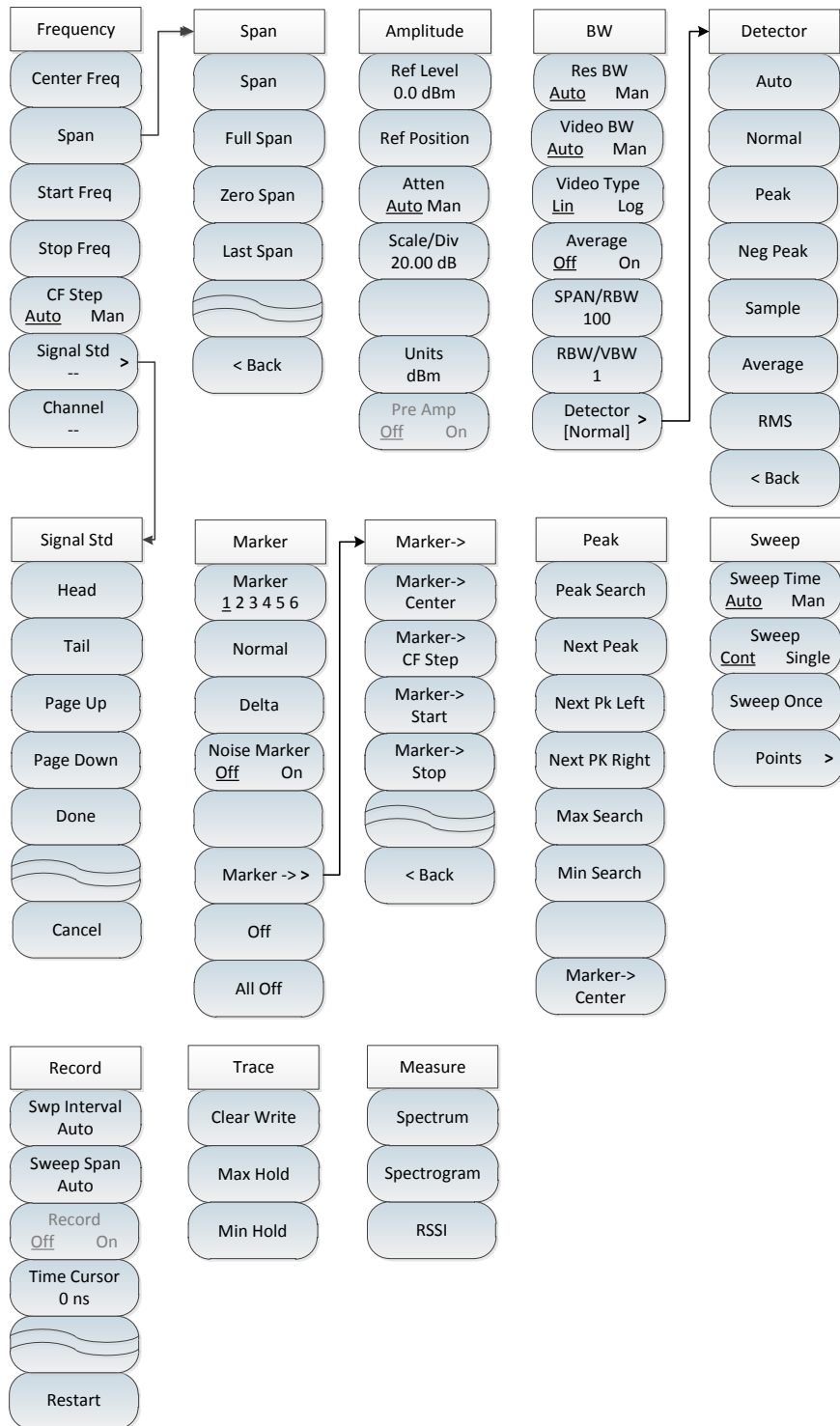


Figure 6-3 Interference Analyzer menu block diagram

6.3 Interference Analyzer menu description

6.3 Interference Analyzer menu description


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- Span menu 144
- Amplitude menu 144
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- Marker menu 147
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- Sweep menu 149
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6.3.1 Frequency menu


Frequency	<ul style="list-style-type: none"> · [Center Freq]: Press [Freq] →[Center Freq] to set it by pressing the numeric keys on the front panel and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or the [↑] & [↓] keys and the rotary knob.
Center Freq	<ul style="list-style-type: none"> · [Special Note]: When using the [↑] or [↓] key and the rotary knob, the size of the frequency step is the same as that set by [Step Freq], and you can use the numeric keys or the [↑] or [↓] key and the rotary knob to set the step frequency value after pressing [CF Step <u>Auto</u> Man] to switch to [CF Step <u>Auto</u> Man].
Span	<ul style="list-style-type: none"> · [Span]: Press [Freq] →[Span] to activate the span submenu. You can use the numeric keys and then select the frequency unit to change it, or change it with [↑] & [↓] keys and rotary knob. Refer to the description of [Span] menu for details.
Start Freq	<ul style="list-style-type: none"> · [Special Note]: Change the span with the [↑] [↓] keys and the rotary knob, following the steps 1-2-5 (in RSSI mode, it can only be zero span mode).
Stop Freq	<ul style="list-style-type: none"> · [Start Freq]: Press [Freq] →[Start Freq] to set it by pressing the numeric keys on the front panel, and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or pressing [↑] & [↓] keys and rotary knob.
CF Step Auto Man	<ul style="list-style-type: none"> · [Stop Freq]: Press [Freq] →[Stop Freq] to set it by pressing the numeric keys on the front panel, and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or pressing [↑] & [↓] keys and rotary knob.
Signal Std -- >	<ul style="list-style-type: none"> · [CF Step <u>Auto</u> Man]: Press [Freq] →[CF Step <u>Auto</u> Man] to set the step frequency value by pressing the numeric keys on the front panel, and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or pressing [↑] or [↓] keys and rotary knob.
Channel --	<ul style="list-style-type: none"> · [Signal Std]: Press [Freq] →[Signal Std] to select the signal standard by the [↑] or [↓] key and the rotary knob, and recall it by the [Done] or [OK] key in the dialog menu. Refer to dialog box menu for details.
	<ul style="list-style-type: none"> · [Special Note]: After loading the signal standard, the center frequency and span will be set to the center frequency and span values defined in the signal standard.
	<ul style="list-style-type: none"> · [Channel]: Press [Freq] →[Channel] to pop up the channel number setting dialog box, to set the channel number with the numeric keys or the [↑] & [↓] keys and the rotary knob.
	<ul style="list-style-type: none"> · [Special Note]: The channel number should be set under the premise of loading the signal standard, otherwise a prompt “Unable to Set” will pop up.

6.3 Interference Analyzer menu description

6.3.2 Span menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Span</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Span</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Full Span</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Zero Span</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Last Span</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">  </div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center;">< Back</div>	<ul style="list-style-type: none"> · [Span]: Press [Freq] →[Span] to activate the span submenu. You can use the numeric keys and then select the frequency unit to change it, or change it with [↑] & [↓] keys and rotary knob. Refer to the description of [Span] menu for details. · [Special Note]: Change the span with the [↑] [↓] keys and the rotary knob, following the steps 1-2-5. · [Full Span]: Press [Freq] →[Span]→[Full Span] to set the current span to 9.1GHz. · [Zero Span]: Press [Freq] →[Span]→[Zero Span] to set the current span to 0Hz. · [Last Span]: Press [Freq] →[Span]→[Last Span] to restore the span to the previous set value. · [Special Note]: Only zero span mode is available in RSSI mode.
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6.3.3 Amplitude menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Amplitude</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Ref Level 0.0 dBm</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Ref Position</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Atten <u>Auto</u> Man</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Scale/Div 20.00 dB</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">  </div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Units dBm</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center;">Pre Amp <u>Off</u> On</div>	<ul style="list-style-type: none"> · [Ref Level]: Press [Ampt] →[Ref Level] to set it by pressing the numeric keys on the front panel, then selecting [dBm], [-dBm], [mV] or [μV] in the frequency unit menu, or pressing [↑] & [↓] keys and the rotary knob. · [Special Note]: The step is 10dB when using the [↑] [↓] keys and the rotary knob. · [Ref Position]: Press [Ampt] →[Ref Position] to change with the numeric keys, or the [↑] & [↓] keys and the rotary knob. · [Atten <u>Auto</u> Man]: Press [Ampt] →[Atten <u>Auto</u> Man] to switch the attenuator to auto or manual through the menu, by the numeric keys or the [↑] & [↓] keys and the rotary knob. · [Special Note]: The setting range of the attenuation value is 0dB - 30dB, with a step value of 5dB. · [Scale/Div]: Press [Ampt] →[Scale/Div] to set it with the numeric keys, or [↑] & [↓] keys and rotary knob. The setting range of scale/grid is 0.01dB-100dB. · [Units]: In the Interference Analyzer mode, the amplitude is displayed in dBm. · [<u>Pre Amp Off</u> On]: Press [Ampt] →[Pre Amp <u>Off</u> On] to turn on or off the preamplifier.
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6.3.4 Bandwidth menu

BW	<ul style="list-style-type: none"> · [Res BW <u>Auto</u> Man]: Press [BW] → [Res BW Auto <u>Man</u>] to set it by pressing the numeric keys on the front panel, or pressing [<u>↑</u>] & [<u>↓</u>] keys and the rotary knob.
Res BW <u>Auto</u> Man	<ul style="list-style-type: none"> · [Special Note]: The resolution bandwidth is determined by the IF filter bandwidth, and the shape of the traces depends on the IF bandwidth filter. This instrument supports variable resolution bandwidth settings in the range of 1Hz-10MHz, changing in steps of 1-3-10.
Video BW <u>Auto</u> Man	<ul style="list-style-type: none"> · [Video BW <u>Auto</u> Man]: Press [Ampt] → [Video BW Auto <u>Man</u>] to change it with the numeric keys or the [<u>↑</u>] & [<u>↓</u>] keys and the rotary knob.
Video Type <u>Lin</u> Log	<ul style="list-style-type: none"> · [Special Note]: The video bandwidth filter is used to smooth the traces to improve the ability to detect weak signals in noisy signals. This instrument supports variable resolution bandwidth settings in the range of 1Hz-10MHz, changing in steps of 1-3-10.
Average <u>Off</u> On	<ul style="list-style-type: none"> · [Video Type <u>Lin</u> Log]: Press [BW] → [Video Type <u>Lin</u> Log] to select the vertical scale type logarithmic or linear scale. Logarithmic scale is in dBm by default, and linear scale is in mV by default.
SPAN/RBW 100	<ul style="list-style-type: none"> · [Average <u>Off</u> On]: Press [BW] → [Average Off <u>On</u>] to smooth the display trace without changing the video bandwidth filter, which can be changed by using the numeric keys, or by using the [<u>↑</u>] & [<u>↓</u>] keys and the rotary knob.
RBW/VBW 1	<ul style="list-style-type: none"> · [SPAN/RBW 100]: Press [BW] → [SPAN/RBW 100] to set the ratio of span to resolution bandwidth. In the automatic mode, the resolution bandwidth will change automatically with span, which can be changed by using the numeric keys, or by using the [<u>↑</u>] & [<u>↓</u>] keys and the rotary knob.
Detector [Normal] >	<ul style="list-style-type: none"> · [RBW/VBW]: Press [BW] → [RBW/VBW]. In the automatic mode, the video bandwidth will change automatically with the resolution bandwidth, which can be changed by using the numeric keys, or by using the [<u>↑</u>] & [<u>↓</u>] keys and the rotary knob.
	<ul style="list-style-type: none"> · [Detector]: Press [BW] → [Detector] to open the detection function submenu. Refer to [Detector] menu for details.

6.3 Interference Analyzer menu description

6.3.5 Detection menu

Detector	· [Auto] : Press 【BW】 →[Detector]→[Auto]. The detection is in the same spectrum analysis mode.
Auto	· [Normal] : Press 【BW】 →[Detector]→[Normal]. The most commonly used detection method shows the signal and noise base at the same time without losing any signal.
Normal	· [Peak] : Press 【BW】 →[Detector]→[Peak] to ensure that no peak signal is missed, and can be used to measure signals that are very close to the noise base.
Peak	· [Neg Peak] : Press 【BW】 →[Detector]→[Neg Peak], which is used in most cases in the self-test of the bandwidth millimeter wave integrated tester, and rarely used in the test, which can well reproduce the modulation envelope of the AM signal.
Neg Peak	· [Sample] : Press 【BW】 →[Detector]→[Sample], which is good for measuring noise signals, and can better measure noise compared with standard detection.
Sample	· [Average] : Press 【BW】 →[Detector]→[Average] to average the data in the sampling interval.
Average	· [RMS] : Press 【BW】 →[Detector]→[RMS] to perform root mean square averaging on the data within the sampling interval.
RMS	
< Back	

6.3.6 Marker menu

Marker	<ul style="list-style-type: none"> · [Marker <u>1</u> 2 3 4 5 6]: Press 【Marker】 → [Marker <u>1</u> 2 3 4 5 6] to switch between different marker displays, and the selected marker will be underlined.
Marker <u>1</u> 2 3 4 5 6	<ul style="list-style-type: none"> · [Normal]: Press 【Marker】 → [Normal] to set the currently selected marker display mode as normal mode.
Normal	<ul style="list-style-type: none"> · [Delta]: Press 【Marker】 → [Delta] to display the amplitude difference and frequency difference between two markers (time difference in case of zero frequency width). The active marker can be moved with the rotary knob, step keys or numeric keys. The displayed amplitude difference is in dB by default.
Delta	<ul style="list-style-type: none"> · [Marker Noise <u>Off</u> On]: Press 【Marker】 → [Marker Noise <u>Off</u> On]. The noise marker shows the noise power normalized to the 1Hz bandwidth near the activated marker, at which point the detector is set to the root-mean-square detection mode. By default, when the noise marker is turned on, the unit of the marker reading is automatically switched to dBm/Hz.
Noise Marker <u>Off</u> On	<ul style="list-style-type: none"> · [Marker->>]: Press 【Marker】 → [Marker->>] to open the marker function submenu. These marker functions allow the user to change the instrument display using the marker as a reference, which can be found in the [Marker->>] function menu.
Marker ->>	<ul style="list-style-type: none"> · [Off]: Press 【Marker】 → [Off] to turn off the currently active marker.
Off	<ul style="list-style-type: none"> · [All Off]: Press 【Marker】 → [All Off] to turn off all the markers that have been turned on.
All Off	<ul style="list-style-type: none"> · [Special Note]: The marker function is not available in RSSI measurement mode.

6.3 Interference Analyzer menu description

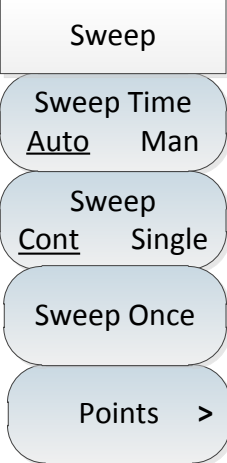
Marker->	· [Marker->Center] : Press 【Marker】 →[Marker->>]→[Marker->Center] to move the marker to the center frequency and display the reading at the center frequency on the screen.
Marker-> Center	· [Marker->CF Step] : Press 【Marker】 →[Marker->>]→[Marker->CF Step] to set the step size of the center frequency, i.e., the value of the frequency step is equal to the marker frequency, and the value of the frequency step is equal to the frequency of the delta marker when the delta marker function is activated.
Marker-> CF Step	· [Marker ->Start] : Press 【Marker】 →[Marker->>]→[Marker ->Start] to set the start frequency equal to the marker frequency.
Marker-> Start	· [Marker ->Stop] : Press 【Marker】 →[Marker->>]→[Marker ->Stop] to set the stop frequency equal to the marker frequency.
Marker-> Stop	· [Back] : return to the previous menu.
< Back	(not available in RSSI measurement mode)

6.3.7 Peak menu


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

(not available in RSSI measurement mode)

6.3.8 Sweep menu

	<ul style="list-style-type: none"> · [Sweep Time Auto Man]: Press [Sweep] → [Sweep Time <u>Auto</u> Man] to switch the sweep time between Auto and Manual. When the sweep time is set to Auto, the sweep time is automatically set to the fastest according to the current instrument status, and the screen shows the fastest sweep time under the current setting; when the sweep time is set to Manual, you can enter the sweep time value at this time, with the numeric keys and press the corresponding soft key to select the time unit. If the sweep time is set to Auto, the sweep speed may change depending on the change of RBW and VBW. The larger the values of RBW and VBW, the faster the sweeping speed and vice versa. The 4024CA spectrum analyzer sweep time can be set up to 8000 seconds for non-zero span and 6000 seconds for zero span when the minimum sweep time limit is met. · [Sweep Type Cont Single]: Press [Sweep] → [Sweep Type <u>Cont</u> Single]. The sweep type setting determines how the instrument sweeps and when it stops sweeping to enter the hold state. Two sweep modes are provided in the Interference Analyzer mode: continuous sweep and single sweep. · [Sweep Once]: Press [Sweep] → [Sweep Once] to restart sweeping. · [Points]: Press [Sweep] → [Points] to set the sweep points to be 201, 501, 1001, 2001, 4001.
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6.3.9 AutoSave menu

	<ul style="list-style-type: none"> · [Swp Interval]: Press [Record]→[Swp Interval] to set the sweep interval time. After setting the sweep time, the trace will switch to the maximum hold state by default to ensure that all signals measured during the sweep interval time can be recorded. · [Sweep Span]: Press [Record]→[Sweep Span] to set the time that needs to be recorded for display. After reaching the set span time, the display interface will no longer refresh the display. · [Record Off On]: Press [Record]→[Record <u>Off</u> On] to turn on or off the AutoSave. · [Special Note]: The AutoSave function cannot be turned on until the sweep time is set. · [Time Cursor]: Press [Record]→[Time Cursor] to view the historical data. · [Special Note]: It can only be used in Spectrogram measurement mode.
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6.3 Interference Analyzer menu description

	<ul style="list-style-type: none"> · [Restart]: Press [Record]→[Restart] to restart sweeping. · [Special Note]: This menu is not available for spectrum measurement. <p>The time marker menu function cannot be used for RSSI.</p>
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6.3.10 Trace menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: fit-content; margin: 0 auto;">Trace</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; width: fit-content; margin: 0 auto;">Clear Write</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; width: fit-content; margin: 0 auto;">Max Hold</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; width: fit-content; margin: 0 auto;">Min Hold</div>	<ul style="list-style-type: none"> · [Clear Write]: Press 【Trace】 →[Clear Write] to refresh all the data of the previously displayed trace and continuously display the signal received by the spectrum analyzer in the sweep state. · [Max Hold]: Press 【Trace】 →[Max Hold] to hold the maximum value of the points on the selected trace and update it with the new maximum detected in each sweep. If the detection is automatic, it will switch to the positive peak detection mode. · [Min Hold]: Press 【Trace】 →[Min Hold] to hold the maximum value of the points on the selected trace and update it with the new minimum detected in each sweep. If the detection is automatic, it will switch to the positive peak detection mode.
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6.3.11 Measurement menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: fit-content; margin: 0 auto;">Measure</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; width: fit-content; margin: 0 auto;">Spectrum</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; width: fit-content; margin: 0 auto;">Spectrogram</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; width: fit-content; margin: 0 auto;">RSSI</div>	<ul style="list-style-type: none"> · [Spectrum]: Press 【Measure】 →[Spectrum] to switch the measurement mode to spectrum measurement. · [Spectrogram]: Press 【Measure】 →[Spectrogram] to switch the measurement mode to Spectrogram. · [RSSI]: Press 【Measure】 →[RSSI] to switch the measurement mode to RSSI.
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6.3.12 File menu

Please refer to the file menu description in spectrum analysis mode.

6.3.13 System menu

Please refer to the system menu description in spectrum analysis mode.

7 Location Analyzer Mode (Option)

The Location Analyzer measurement mode is used for the positioning function of interference source or unknown signal source. The directional positioning of interference signal can be quickly realized by using external receiving antenna and electronic compass.

Notice

The Location Analyzer measurement mode requires a receiving antenna option and an electronic compass option. Since the azimuth measurement of the electronic compass used in Location Analyzer is based on the geomagnetic principle, please keep a distance from the magnetic object as far as possible during the test.

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7.1 Introduction to typical measurements

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- [Map location](#) 153

7.1.1 Point scan

The operation steps for Point scan measurement are as follows:

a) Set measurement mode:

Press **【Measure】** → [Point Scan] to select the direct search measurement mode.

b) Set center frequency:

Press **【Freq】** → [Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys.

c) Set bandwidth:

Press **【BW】** → **【BW】** to set the bandwidth value, which is set to 150Hz, 300Hz, 600Hz, 1.5kHz, 2.4kHz, 6kHz, 9kHz, 15kHz, 30kHz, 50kHz, 120kHz or 150kHz.

d) Select antenna parameters:

7 Location Analyzer Mode (Option)

7.1 Introduction to typical measurements

Press [Swp/Ant]→[Recall Antenna] to select the antenna factor file.

e) Start demodulation:

Press [Demod] to set the demodulation type and demodulation volume.

The schematic diagram of Point scan measurement is shown below (for example only)

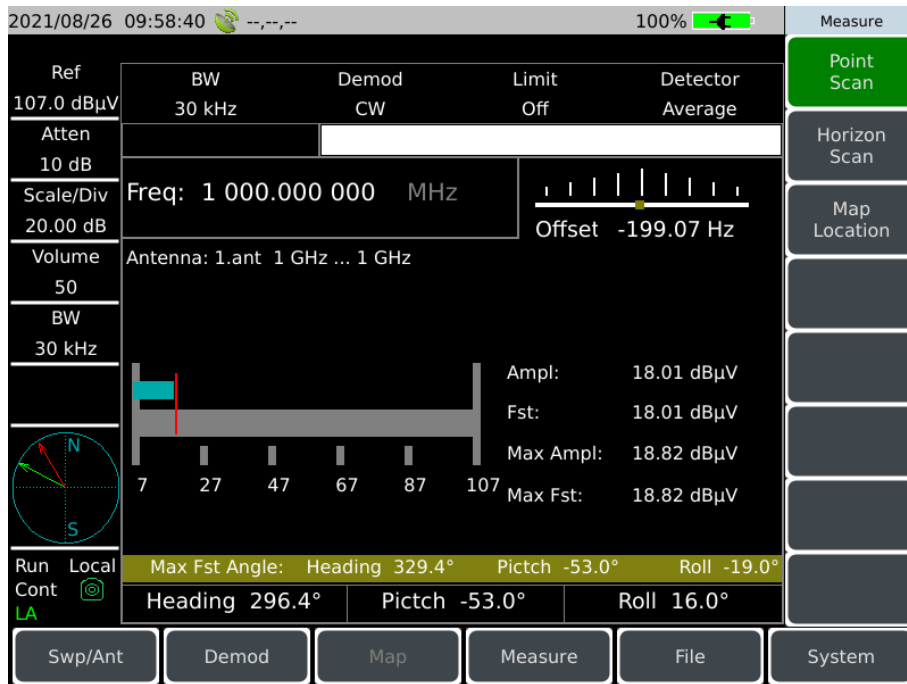


Figure 7-1 Schematic diagram of Point scan measurement mode

7.1.2 Horizon scan

Horizon scan is to display the measured value information of the current measuring point after one revolution on a horizontal disc. The operation steps of Horizon scan measurement are as follows:

a) Set measurement mode:

Press **[Measure]** →[Horizon scan] to select the Horizon scan measurement mode.

b) Set center frequency:

Press **[Freq]** →[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys.

c) Set bandwidth:

Press **[BW]** → **[BW]** to set the bandwidth value, which is set to 150Hz, 300Hz, 600Hz, 1.5kHz, 2.4kHz, 6kHz, 9kHz, 15kHz, 30kHz, 50kHz, 120kHz or 150kHz.

d) Set antenna parameters:

Press [Swp/Ant]→[Recall Antenna] to select the antenna factor file.

7.1 Introduction to typical measurements

e) Start demodulation:

Press [Demod] to set the demodulation type and demodulation volume.

The Horizon scan measurement schematic is shown below (for example only)

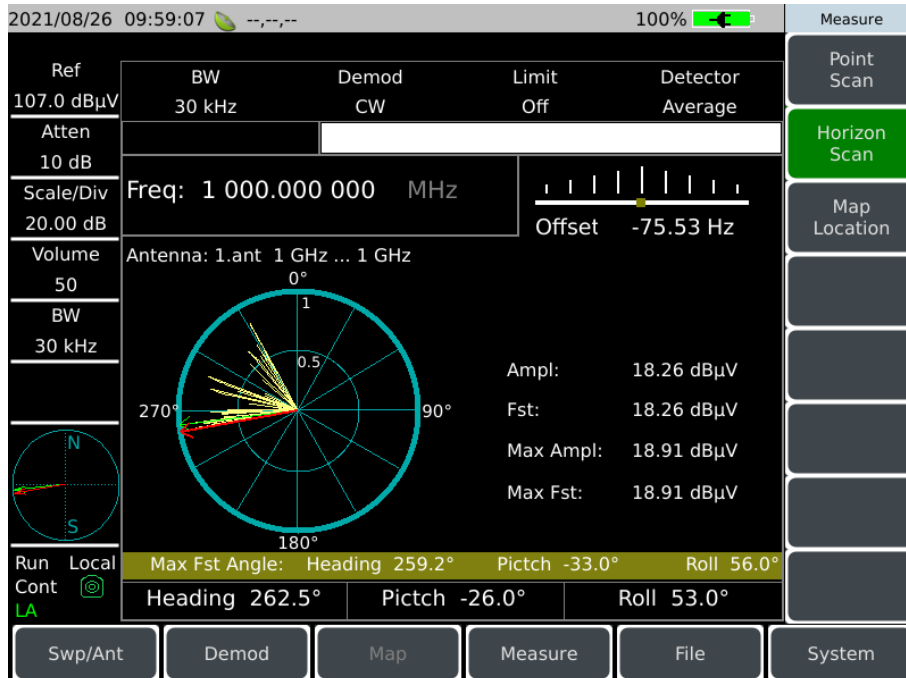


Figure 7-2 Schematic diagram of Horizon scan measurement mode

7.1.3 Map location

Map positioning is to display the test information on the current measurement position on the map. Using map positioning can directly display the position information of interference source. The operation steps of Map location are as follows:

f) Set measurement mode:

Press **[Measure]** →[Map location] to select the Map location mode.

g) Set center frequency:

Press **[Freq]** →[Center Freq] to set the center frequency of the spectrum analyzer to be the frequency of signal under test with the numeric keys.

h) Set bandwidth:

Press **[BW]** →[BW] to set the bandwidth value, which is set to 150Hz, 300Hz, 600Hz, 1.5kHz, 2.4kHz, 6kHz, 9kHz, 15kHz, 30kHz, 50kHz, 120kHz or 150kHz.

i) Set antenna parameters:

Press [Swp/Ant]→[Recall Antenna] to select the antenna factor file.

7 Location Analyzer Mode (Option)

7.1 Introduction to typical measurements

j) Start demodulation:

Press [Demod] to set the demodulation type and demodulation volume.

The schematic diagram of Map location is shown below (for example only)



Figure 7-3 Schematic diagram of Map location mode

7.2 Location Analyzer menu structure

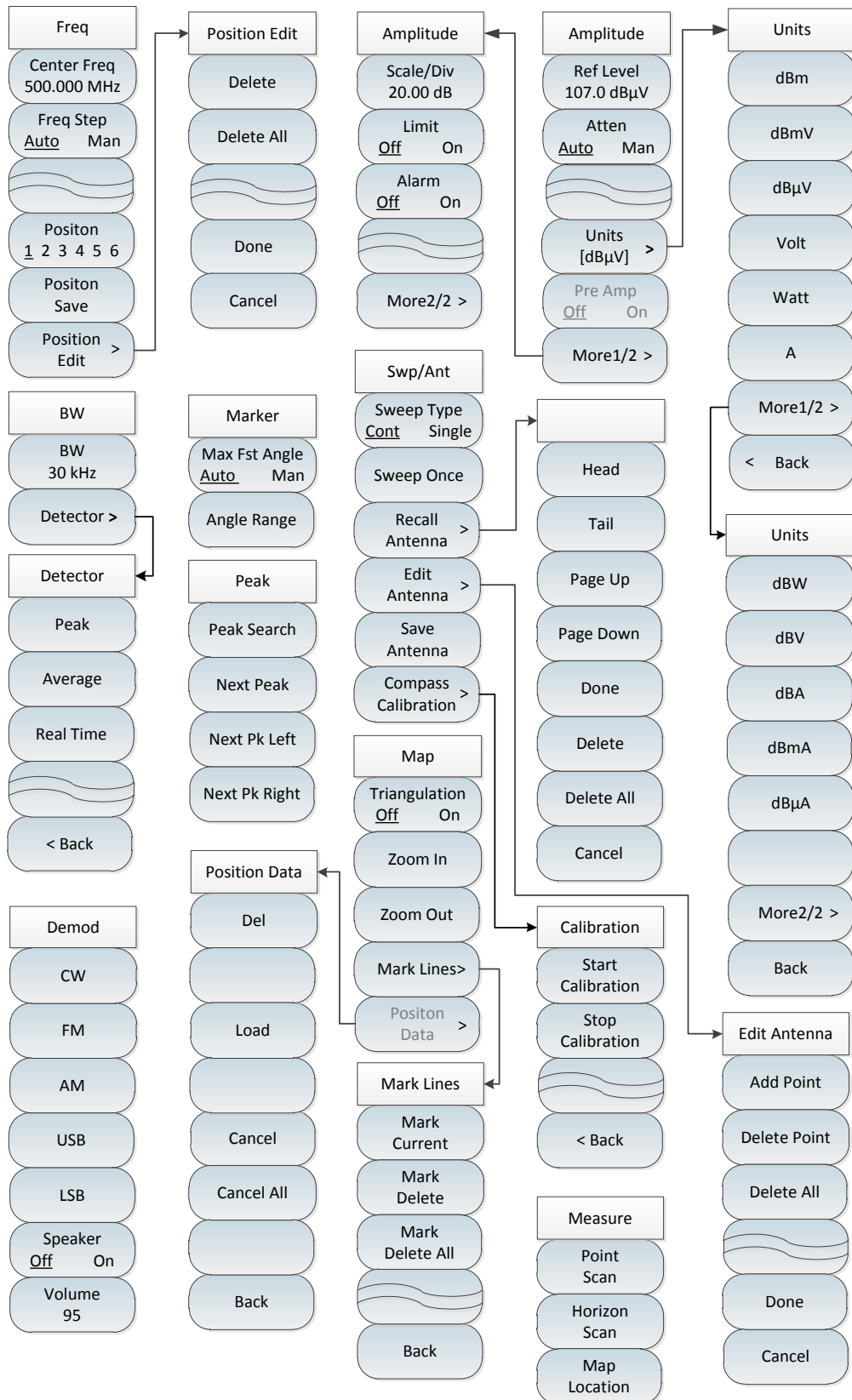


Figure 7-4 Block diagram of Location Analyzer mode menu

7.3 Location Analyzer menu description

7.3 Location Analyzer menu description

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- Amplitude menu 157
- Bandwidth menu 158
- Marker menu 158
- Peak menu 158
- Sweep/antenna menu 159
- Demodulation menu 159
- Map menu 160
- Measurement menu 160
- File menu 160
- System menu 160

7.3.1 Frequency menu

	<ul style="list-style-type: none"> · [Center Freq]: Press 【Freq】 →[Center Freq] to set it by pressing the numeric keys on the front panel and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or the [↑] & [↓] keys and the rotary knob. · [Special Note]: When using the [↑] or [↓] key and the rotary knob, the size of the frequency step is the same as that set by [Step Freq], and you can use the numeric keys or the [↑] or [↓] key and the rotary knob to set the step frequency value after pressing [CF Step <u>Auto</u> Man] to switch to [CF Step <u>Auto</u> Man]. · [Freq Step <u>Auto</u> Man]: Press 【Freq】 →[Freq Step <u>Auto</u> Man] to set it by pressing the numeric keys on the front panel and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or the [↑] & [↓] keys and the rotary knob. · [Position <u>1 2 3 4 5 6</u>]: Press 【Freq】 →[Position <u>1 2 3 4 5 6</u>] to save the data at 6 different positions by switching the menu label. · [Position Save]: Press 【Freq】 →[Position Save] to save the data of current positioning. · [Position Edit]: Press 【Freq】 →[Position Edit] to open the positioning data editing submenu, to perform [Edit Position Point]→[Delete] and [Done].
--	---

7.3.2 Amplitude menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Amplitude</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px;">Ref Level 107.0 dBμV</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px;">Atten <u>Auto</u> Man</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px;">Units [dBμV] ></div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px;">Pre Amp <u>Off</u> On</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px;">More1/2 ></div>	<ul style="list-style-type: none"> • [Ref Level 107.0dBμV]: Press 【Ampt】 →[Ref Level 107.0dBμV] to set it by pressing the numeric keys on the front panel, then selecting [dBm], [-dBm], [mV] or [μV] in the frequency unit menu, or pressing [\uparrow] & [\downarrow] keys and the rotary knob. • Special Note]: The step is 10dB when using the [\uparrow] [\downarrow] keys and the rotary knob. • [Atten Auto Man]: Press 【Ampt】 →[Atten Auto <u>Man</u>] to switch the attenuator to auto or manual through the menu, by the numeric keys or the [\uparrow] & [\downarrow] keys and the rotary knob. • [Special Note]: The setting range of the attenuation value is 0dB - 30dB, with a step value of 5dB. • [Unit] to select the unit of the vertical axis, including [dBm], [dBmV], [dBμV], Volt], [Watt], [A], [dBW], [dBV], [dBA], [dBmA] and [dBμA]. • [Pre Amp Off On]: Press 【Ampt】 →[Pre Amp <u>Off</u> On] to select whether to turn on the preamplifier through the menu.
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Amplitude</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px;">Scale/Div 20.00 dB</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px;">Limit <u>Off</u> On</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px;">Alarm <u>Off</u> On</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px;">More2/2 ></div>	<ul style="list-style-type: none"> • [Scale/Div]: Press 【Ampt】 →[More 1 of 2]→[Scale/Div] to set it with the numeric keys, or [\uparrow] & [\downarrow] keys and rotary knob. The setting range of scale/grid is 1dB-40dB. • [Limit Off On]: Press 【Ampt】 →[More 1 of 2]→[Limit <u>Off</u> On] to select whether to turn on the limit function. • [Alarm Off On]: Press 【Ampt】 →[More 1 of 2]→[Alarm <u>Off</u> On] to select whether to turn on the audible alarm function.

7.3 Location Analyzer menu description

7.3.3 Bandwidth menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">BW</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">BW 30 kHz</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center;">Detector ></div>	<ul style="list-style-type: none"> · [BW 30kHz]: Press [BW] → [BW 30kHz] to set it by pressing the numeric keys on the front panel, or pressing [↑] & [↓] keys and the rotary knob. · [Special Note]: The resolution bandwidth is determined by the IF filter bandwidth, and the shape of the traces depends on the IF bandwidth filter. This instrument supports variable resolution bandwidth settings in the range of 150Hz, 300Hz, 600Hz, 1.5kHz, 2.4kHz, 6kHz, 9kHz, 15kHz, 30kHz, 50kHz, 120kHz and 150KHz. · [Detector]: Press [BW] → [Detector] to select [Peak] → [Average] and [Real Time] detection modes.
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7.3.4 Marker menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Marker</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Max Fst Angle <u>Auto</u> Man</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center;">Angle Range</div>	<ul style="list-style-type: none"> · [Max Fst Angle <u>Auto</u> Man]: Press [Marker] → [Max Fst Angle <u>Auto</u> Man] to select the current mode for judging the maximum field strength angle. · [Angle Range]: Press [Marker] → [Angle Range] to select the display range of the current local direction diagram. · [Special Note]: The marker menu is only available in Horizon scan mode; the local direction map pops up when you select to manually judge the maximum field strength angle.
---	---

7.3.5 Peak menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Peak</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Peak Search</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Next Peak</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Next Pk Left</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center;">Next Pk Right</div>	<ul style="list-style-type: none"> · [Peak Search]: Press [Peak] → [Peak Search] to set the currently active cursor to the maximum peak point of the field strength in the measurement direction diagram. · [Next Peak]: Press [Peak] → [Next Peak] to move the active marker to the next highest point on the direction diagram associated with the current marker position. · [Next pk Left]: Press [Peak] → [Next Pk Left] to find the next peak on the left of the current marker position. · [Next pk Right]: Press [Peak] → [Next Pk Right] to find the next peak on the right of the current marker position. · [Special Note]: The marker menu is only available in Horizon scan mode.
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7.3.6 Sweep/antenna menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Swp/Ant</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Sweep Type <u>Cont</u> Single</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Sweep Once</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Recall Antenna ></div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Edit Antenna ></div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Save Antenna</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Compass Calibration ></div>	<ul style="list-style-type: none"> · [Sweep Type <u>Cont</u> Single]: Press [Swp/Ant]→[Sweep Type <u>Cont</u> Single]. The sweep type setting determines how the instrument sweeps and when it stops sweeping to enter the hold state. Two sweep modes are provided in the Interference Analyzer mode: continuous sweep and single sweep. · [Sweep Once]: Press [Sweep] →[Sweep Once] to restart sweeping. · [Recall Antenna]: Press [Swp/Ant] → [Recall Antenna] to pop up soft menus such as [Head], [Tail], [Page Up], [Page Down], [Done] and [Delete], to select the saved antenna factor file and call it. · [Edit Antenna]: Press [Swp/Ant]→[Recall Antenna] to pop up such soft menus as [Add Point]→[Delete Point]→[Delete All]→[Done]→[Cancel], etc. They are used to edit the antenna factor file. · [Save Antenna]: Press [Swp/Ant]→[Save Antenna] to open the Antenna Save dialog box to save antenna factor file. · [Compass Calibration]: Press [Swp/Ant]→[Compass Calibration] to open the Compass Calibration menu and pop up the [Start Calibration] and [Stop Calibration] soft menus to start and stop the calibration of the compass.
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7.3.7 Demodulation menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Demod</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">CW</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">FM</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">AM</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">USB</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">LSB</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Speaker <u>Off</u> On</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Volume 95</div>	<ul style="list-style-type: none"> · [CW]: Press [Demod]→[CW] to turn off the demodulation method. · [FM]: Press [Demod]→[FM] to switch the demodulation to FM mode. · [AM]: Press [Demod]→[AM] to switch the demodulation to AM mode. · [USB]: Press [Demod]→[USB] to switch the demodulation to USB mode. · [LSB]: Press [Demod]→[LSB] to switch the demodulation to LSB mode. · [Speaker <u>Off</u> On]: Press [Demod]→[Speaker <u>Off</u> On] to turn on or off the audio speaker function. · [Special Note]: After the audio speaker is turned on, the demodulation mode [FM]→[AM]→[USB]→[LSB] and other demodulation modes no longer work. · [Volume 95]: Press [Demod]→[Volume 95] to set the desired demodulation volume, by the numeric keys or [↑] & [↓] keys or the rotary knob.
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7.3 Location Analyzer menu description

7.3.8 Map menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Map</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Triangulation <u>Off</u> On</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Zoom In</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Zoom Out</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Mark Lines></div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Positon Data ></div>	<ul style="list-style-type: none"> · [Triangulation <u>Off</u> On]: Press [Map]→[Triangulation <u>Off</u> On]. The real-time positioning mode means that the current measurement is refreshed in real time with GPS and compass, and the calling positioning mode is to display the positioning data measured on different positioning points to the current map. · [Zoom In]: Press [Map]→[Zoom In] to display the currently called map at a larger scale. · [Zoom Out]: Press [Map]→[Zoom Out] to display the currently called map at a smaller scale. · [Mark Lines]: Press [Map]→[Mark Lines] to open the mark sub-menus, such as [Mark Current]→[Mark Delete]→[Mark Delete All]. The mark submenu allows you to display measurement information on the map at different locations and in different directions. · [Position Data]: Press [Map]→[Position Data] to open the positioning data table on the selected positioning point, and select [Delete]→[Cancel]→[Cancel All]. · [Special Note]: The [Position Data] menu needs to be used only when the positioning method is invoked.
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7.3.9 Measurement menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Measure</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Point Scan</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Horizon Scan</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Map Location</div>	<ul style="list-style-type: none"> · [Point Scan]: Press [Measure] →[Point Scan] to select the current measurement method as the direct search mode. · [Horizon scan]: Press [Measure] →[Horizon scan] to select the current measurement mode as Horizon scan mode. · [Map location]: Press [Measure] →[Map location] to select the current measurement method as the map positioning mode.
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7.3.10 File menu

Please refer to the file menu description in spectrum analysis mode.

7.3.11 System menu

Please refer to the system menu description in spectrum analysis mode.

8 Real-Time Spectrum Mode (Option)

This chapter describes typical measurement methods in demodulation analysis measurement mode and demodulation analysis result graphs, gives the demodulation analysis menu structure and explains it.

Real-Time Spectrum measurement mode is an extension of the spectrum measurement mode. The Real-Time Spectrum measurement mode of 4024CA spectrum analyzer is used to capture and analyze transient signals and burst signals. This function can help users solve a variety of transient signal measurement problems. The band width of Real-Time Spectrum analysis is up to 120MHz.

Notice

All operations in this section are based on the premise that the Real-Time Spectrum measurement mode has been selected, and will not be described separately later.

The signal environment is becoming increasingly complex as the signal is more and more variable. It is also becoming increasingly practical to display large amounts of measurement data on a single screen. The DPX and Spectrograms are one of the most important functions in the Real-Time Spectrum analysis mode, forming a three-dimensional map that allows users to easily observe the frequency of occurrence of special measurement values based on the collected statistics and display. It is a display interface with a large amount of information.

There are two main types of spectrum display and measurement functions in the Real-Time Spectrum measurement mode, namely: DPX and Spectrograms.

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8.1 Introduction to typical measurements

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- [Spectrogram](#) 164

8.1.1 DPX

- [Definition of DPX](#) 162

8.1 Introduction to typical measurements

- **Measurement steps** 162

8.1.1.1 Definition of DPX

The DPX is shown in the figure, indicating the probability of the spectrum at a fixed time. In the spectrum display area, the horizontal axis represents the frequency, the vertical axis represents the amplitude, and the color represents the probability of signal. The information display area at the bottom left of the screen identifies the color display description. Red represents that the probability of spectrum is 100%, blue represents that the probability is 0, and the color gradient from red to blue decreases according to the probability level shown in the figure. In the spectrum display area, you can use the marker function to mark and view the three-dimensional information at any position in the image.

The DPX in Real-Time Spectrum analysis mode demonstrates the density of each frequency and amplitude corresponding position in different color levels. The color represents the probability of signal, and we can easily view the weak signal hidden under the strong signal from the DPX by the color difference, which can show the trend and frequency of signal change more intuitively and specifically.

By default, there is a yellow trace in the DPX, which represents the detection trace of all spectrum tracks contained in the current DPX. By default, it is positive peak detection, which is the peak envelope of the current DPX spectrum. The DPX spectrum display can be turned on and hidden through the change of the detection mode of the detection trace and the operation of trace functions such as refreshing, hiding and holding in the **【Trace】** menu. In the **【Measure】** menu, the DPX spectrum display can be turned on and hidden. After the DPX spectrum display is hidden, the Real-Time Spectrum trace line will be displayed.

When the DPX is used for Real-Time Spectrum measurement, it is sometimes difficult to distinguish signals because of the close color probability in the image. It can be observed from the figure that the large-scale color range of high probability in the default state is yellow green and small-scale orange yellow, which is difficult to distinguish. The maximum frequency of observable signals in the color range is orange yellow, and the probability is less than 30%. In order to more accurately display the frequency of signal, the upper and lower limits of color probability in the **【Measure】** menu can be changed. Here, the upper limit of probability is changed from 100% to 30%. The DPX after changing the upper limit of probability is shown in the figure. The frequency of real-time data of the test signal can be displayed more intuitively and accurately, and the level is more obvious.

8.1.1.2 Measurement steps

a) Install the antenna:

Connect the spectrum input interface of the spectrum analyzer to the receiving antenna to receive the space electromagnetic signal.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Set center frequency:

Press **【Freq】** →[Center Freq] to set the frequency to be measured with the numeric keys or the [↑] & [↓] keys or the rotary knob, or to press **【Freq】** , then set [Start Freq] and [Stop Freq] respectively to select the frequency band to be measured. Set to 1GHz.

d) Set span:

Press **【Freq】** →[Span] to set the span with the numeric keys or [↑] & [↓] keys or rotary knob, to 10MHz. The maximum span is 120MHz.

e) Set reference level and resolution bandwidth:

Press **【Ampt】** →[Ref Level] to set the reference level by the numeric keys or [↑] & [↓] keys or the rotary knob.

Press **【BW】** →[Res BW] to set the resolution bandwidth by the numeric keys or the [↑] & [↓] keys and the rotary knob.

Notice

The resolution bandwidth is generally set to automatic by default. If you need to set it, please switch the resolution bandwidth to manual first, and then set the resolution bandwidth by the numeric keys or [↑] & [↓] keys or the rotary knob.

f) Set marker:

Press **【Marker】** to open the marker flag, and use the numeric keys or [↑] & [↓] keys or the rotary knob to move the marker to your desired position so that the marker data will be displayed in the upper right corner of the screen.

g) Switch measurement mode:

Press **【Measure】** →[Meas Mode] to open the DPX, and turn on or off the DPX spectrum display, as well as set the upper and lower limits of the color scale in the DPX to optimize the display effect.

h) Set detection mode:

Press **【Trace】** →[Detector Auto] to change the DPX detection method and perform related operations on the spectrum trace in the measurement menu.

8.1 Introduction to typical measurements

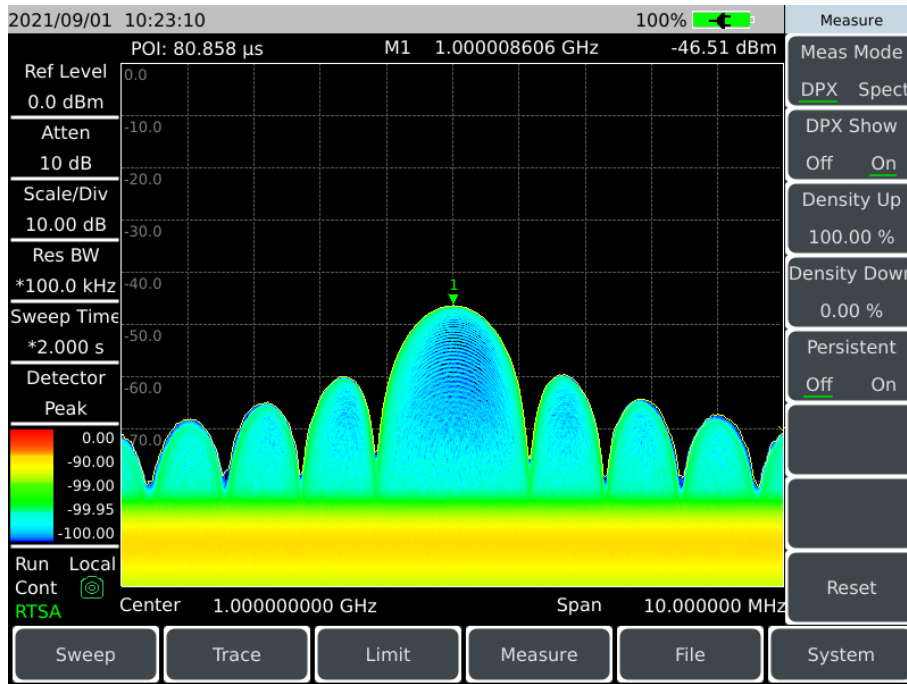


Figure 8-1 DPX measurement interface

8.1.2 Spectrogram

- Definition of Spectrogram 164
- Measurement steps 164

8.1.2.1 Definition of Spectrogram

The Spectrogram is a way to display all spectrum diagrams over time, which can seamlessly show the process of spectrum changes in real time. As shown in Figure 8-2, the horizontal axis represents frequency, the vertical axis represents time, and the color display represents amplitude. The Spectrogram scrolls up continuously, and the latest spectrum data is always displayed at the bottom of the Spectrogram.

Both the Spectrogram and DPX have four detection modes, and the default is positive peak detection. The **【Trace】** menu allows you to select the detection method as well as the display ON/OFF and the setting of the time marker. In the **【Measure】** menu, the upper and lower limits of the color scale can be set to achieve the best display effect.

8.1.2.2 Measurement steps

a) Install the antenna:

Connect the spectrum input interface of the spectrum analyzer to the receiving antenna to receive the space electromagnetic signal.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Set center frequency:

Press **【Freq】** →[Center Freq] to set the frequency to be measured with the numeric keys or the [↑] & [↓] keys or the rotary knob, or to press **【Freq】** , then set [Start Freq] and [Stop Freq] respectively to select the frequency band to be measured.

d) Set span:

Press **【Freq】** →[Span] to set the span with the numeric keys or [↑] & [↓] keys or rotary knob. The maximum span is 120MHz.

e) Set reference level and resolution bandwidth:

Press **【Ampt】** →[Ref Level] to set the reference level by the numeric keys or [↑] & [↓] keys or the rotary knob.

Press **【BW】** →[Res BW] to set the resolution bandwidth by the numeric keys or the [↑] & [↓] keys and the rotary knob.

Notice

The resolution bandwidth is generally set to automatic by default. If you need to set it, please switch the resolution bandwidth to manual first, and then set the resolution bandwidth by the numeric keys or [↑] & [↓] keys or the rotary knob.

f) Set marker:

Press **【Marker】** to open the marker flag, and use the numeric keys or [↑] & [↓] keys or the rotary knob to move the marker to your desired position so that the marker data will be displayed in the upper right corner of the screen.

g) Switch measurement mode:

Press **【Measure】** →[Meas Mode] to open the Spectrogram, and set the upper and lower limits of the color scale in the Spectrogram to optimize the display effect.

h) Set detection mode:

Press **【Trace】** →[Detector Auto] to change the Spectrogram detection method and perform related operations on the spectrum trace in the measurement menu. The time marker ON/OFF and specific value can be set in Spectrogram mode.

8.1 Introduction to typical measurements

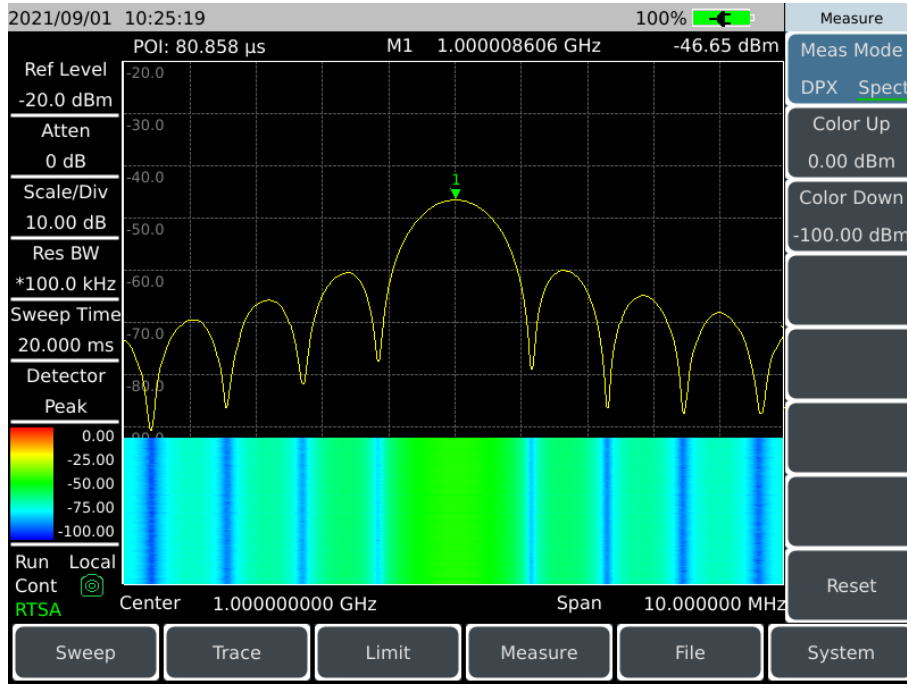


Figure 8-2 Spectrogram measurement interface

Similar to the DPX, the Spectrogram suffers from the problem of indistinguishability due to the close color of signal amplitudes in the image during Real-Time Spectrum measurement. It can be observed in the figure that the large color range in the default state is yellow green and blue-green, which are difficult to distinguish, and the colors corresponding to the maximum yellow-green are lower than -30dB. Change the upper and lower limits of the color scale in the **【Measure】** menu. Here the upper limit of the color scale is changed from 0dBm to -30dBm, and the lower limit of the color scale is changed from -100dBm to -95dBm, which can more clearly distinguish the signals of different frequencies and amplitudes. The time marker function can be opened in the **【Trace】** menu for easy reading of the frequency and amplitude values at any moment.

8.2 Real-Time Spectrum menu structure

8.2 Real-Time Spectrum menu structure

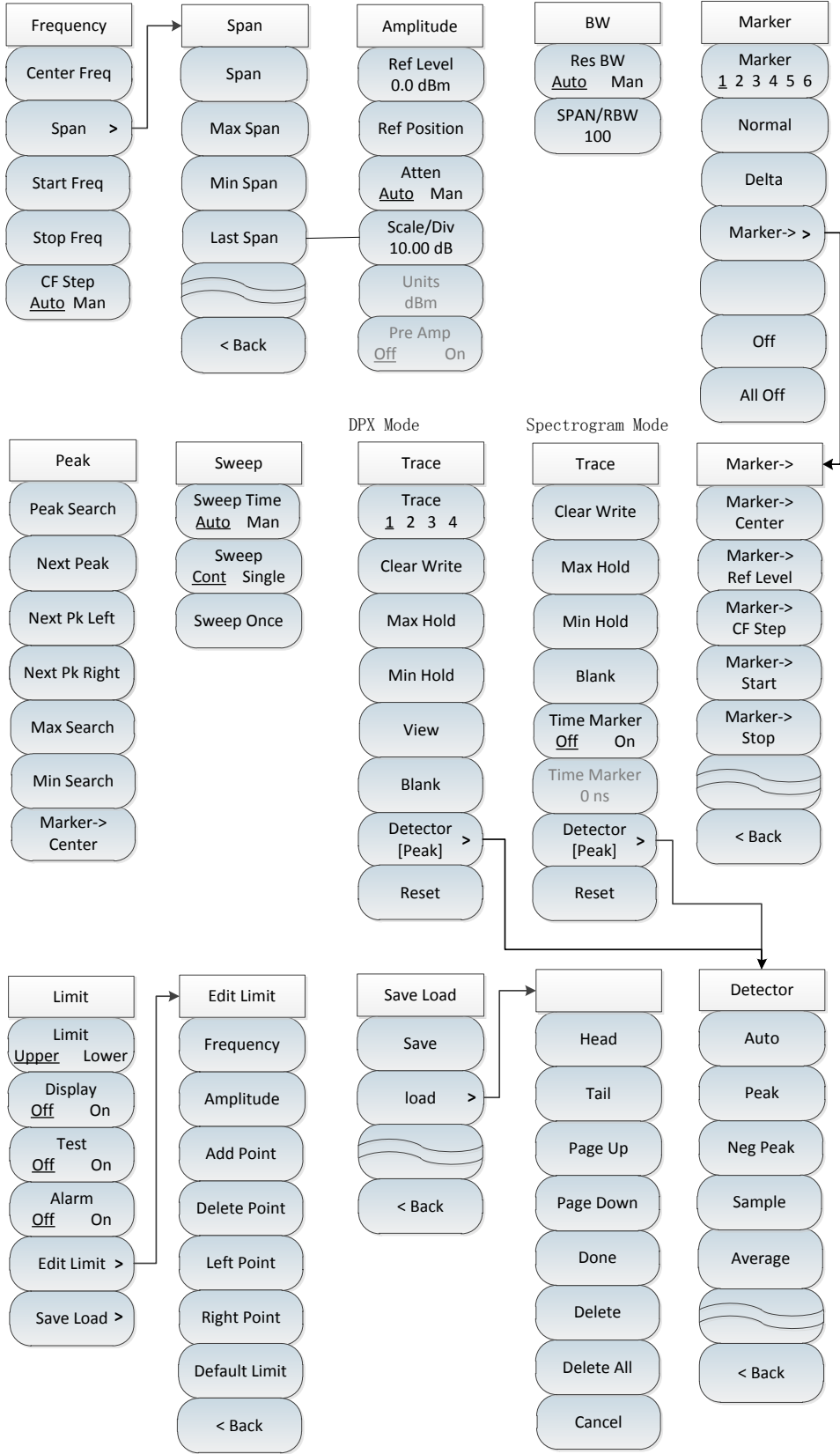


Figure 8-3 Block diagram of Real-Time Spectrum menu

8.3 Real-Time Spectrum menu description

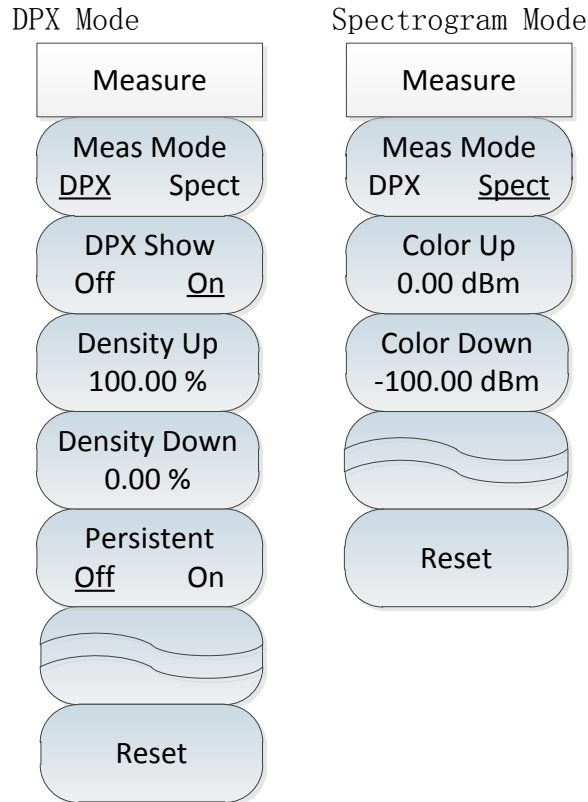


Figure 8-4 Block diagram of Real-Time Spectrum menu (CONT)

8.3 Real-Time Spectrum menu description

- Frequency menu 169
- Amplitude menu 170
- Bandwidth menu 170
- Marker menu 171
- Peak menu 172
- Sweep menu 172
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- Trace menu in Spectrogram mode 175
- Limit menu 176
- Measurement menu in DPX mode 176
- Measurement menu in Spectrogram mode 177
- File menu 177
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8.3.1 Frequency menu

Frequency	<ul style="list-style-type: none"> · [Center Freq]: Press 【Freq】 → [Center Freq] to enter the numbers through the numeric keys on the front panel, then select [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or set it via the [↑] & [↓] keys and the rotary knob.
Center Freq	<ul style="list-style-type: none"> · [Special Note]: When using the [↑] or [↓] key and the rotary knob, the size of the frequency step is the same as that set by [Freq Step], and you can use the numeric keys or the [↑] or [↓] key and the rotary knob to set the step frequency value after pressing [CF Step <u>Auto Man</u>] to switch to [CF Step <u>Auto Man</u>].
Span >	<ul style="list-style-type: none"> · [Span]: Press 【Freq】 → [Span] to change it by pressing the numeric keys on the front panel, then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or by pressing the [↑] & [↓] keys and the rotary knob, or to set the span by directly pressing [Max Span]→[Min Span] or [PREV Span] under the menu bar corresponding to the span, where the maximum span is 120MHz, the minimum span is 3.662kHz, and the previous span is the last span setting value of the current span setting.
Start Freq	<ul style="list-style-type: none"> · [Start Freq]: Press 【Freq】 → [Start Freq] to enter the numbers through the numeric keys on the front panel, then select [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or set it through the [↑] & [↓] keys and the rotary knob.
Stop Freq	<ul style="list-style-type: none"> · [Stop Freq]: Press 【Freq】 → [Stop Freq] to enter the numbers through the numeric keys on the front panel, then select [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or set it through the [↑] & [↓] keys and the rotary knob.
CF Step <u>Auto Man</u>	<ul style="list-style-type: none"> · [CF Step <u>Auto Man</u>]: Press 【Freq】 → [CF Step <u>Auto Man</u>] to set it by pressing the numeric keys on the front panel and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or change the step value of the frequency via the [↑] & [↓] keys and the rotary knob.

8.3 Real-Time Spectrum menu description

8.3.2 Amplitude menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Amplitude</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Ref Level 0.0 dBm</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Ref Position</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Atten <u>Auto</u> Man</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Scale/Div 10.00 dB</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Units dBm</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Pre Amp <u>Off</u> On</div>	<ul style="list-style-type: none"> · [Ref Level]: Press 【Ampt】 → [Ref Level] to set it by pressing the numeric keys on the front panel, then selecting [dBm] → [-dBm], or pressing the [↑] & [↓] keys and the rotary knob. · [Special Note]: The step is 5dB when using the [↑] [↓] keys, and 1dB when using the rotary knob. · [Ref Position]: Press 【Ampt】 → [Ref Position] to set the integer value via the numeric keys on the front panel, tap to confirm, or set via the [↑] & [↓] keys and the rotary knob. The final reference level is the set value of the reference position multiplied by 10 plus the set value of the reference level. · [Atten <u>Auto</u> Man]: Press 【Ampt】 → [Atten <u>Auto</u> Man] to adjust the input attenuation of the spectrum analyzer. In automatic mode, the input attenuator is associated with the reference level. In manual mode, the attenuation of the attenuator can be adjusted with a numeric keypad, a step key, or a rotary knob, and the attenuation ranges from 0dB to 30dB with a step of 5dB. · [Special Note]: The setting range of the attenuation value is 0dB - 30dB, with a step value of 5dB. · [Scale/Div]: Press 【Ampt】 → [Scale/Div] to set it with the numeric keys, or [↑] & [↓] keys and rotary knob. The setting range of scale/grid is 0.01dB-100dB. · [Units]: The amplitude in the Real-Time Spectrum measurement mode is displayed in dBm. The menu is grayed out by default and cannot be changed. · [Pre Amp <u>Off</u> On]: The preamplifier is off by default in the Real-Time Spectrum measurement mode, and the menu is grayed out by default and cannot be changed.
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8.3.3 Bandwidth menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">BW</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Res BW <u>Auto</u> Man</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">SPAN/RBW 100</div>	<ul style="list-style-type: none"> · [Res BW <u>Auto</u> Man]: Press 【BW】 → [Res BW <u>Auto</u> Man] to set the resolution bandwidth to manual or automatic. The resolution bandwidth is automatically set according to the span and SPAN/RBW ratio in auto mode. The desired resolution bandwidth can be set in manual mode using the numeric keys, step keys and the rotary knob. The resolution bandwidth can be set in the range of 1 kHz to 20 MHz. · [SPAN/RBW 100]: Press 【Measure】 → [SPAN/RBW 100] to set the ratio of current bandwidth to resolution bandwidth, which is 100 by the default. Enter the value with the numeric keys on the front panel and then press OK to confirm the input, or change it by [↑] & [↓] keys and rotary knob.
--	--

8.3.4 Marker menu

<p>Marker</p> <p>Marker <u>1</u> 2 3 4 5 6</p> <p>Normal</p> <p>Delta</p> <p>Marker-> ></p> <p>Off</p> <p>All Off</p>	<ul style="list-style-type: none"> · [Marker 1 2 3 4 5 6]: Press 【Marker】 → [Marker 1 2 3 4 5 6] to switch between different marker displays, and the selected marker will be underlined. · [Normal]: Press 【Marker】 → [Normal] to set the currently selected marker display mode as normal mode. · [Delta]: Press 【Marker】 → [Delta] to display the amplitude difference and frequency difference between two markers (time difference in case of zero frequency width). The active marker can be moved with the rotary knob, step keys or numeric keys. The displayed amplitude difference is in dB by default. · [Marker->>]: Click to enter the next level submenu related to the marker function. · [Off]: Press 【Marker】 → [Off] to turn off the currently active marker. · [All Off]: Press 【Marker】 → [All Off] to turn off all the markers that have been turned on.
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<p>Marker-></p> <p>Marker-> Center</p> <p>Marker-> Ref Level</p> <p>Marker-> CF Step</p> <p>Marker-> Start</p> <p>Marker-> Stop</p> <p>< Back</p>	<ul style="list-style-type: none"> · [Marker-> Center]: Press 【Marker】 → [Marker->>] → [Marker-> Center] to set the center frequency equal to the marker frequency. This function quickly moves the signal to the center of the screen. · [Marker->Ref Level]: Press 【Marker】 → [Marker->Ref Level] to set the current reference level as the amplitude value of the marker. · [Marker->CF Step]: Press 【Marker】 → [Marker->>] → [Marker->CF Step] to set the step size of the center frequency, i.e., the value of the frequency step is equal to the marker frequency, and the value of the frequency step is equal to the frequency of the delta marker when the delta marker function is activated. · [Marker ->Start]: Press 【Marker】 → [Marker->>] → [Marker ->Start] to set the start frequency equal to the marker frequency or the frequency of the delta marker. · [Marker ->Stop]: Press 【Marker】 → [Marker->>] → [Marker ->Stop] to set the stop frequency equal to the marker frequency.
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8.3 Real-Time Spectrum menu description

8.3.5 Peak menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Peak</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Peak Search</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Next Peak</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Next Pk Left</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Next Pk Right</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Max Search</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Min Search</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Marker-> Center</div>	<ul style="list-style-type: none"> · [Peak Search]: Press 【Peak】 →[Peak Search] to set the currently active marker to the maximum peak point of the measurement trace and display the frequency and amplitude of this marker in the upper middle position of the screen. · [Next Peak]: Press 【Peak】 →[Next Peak] to move the active cursor to the next highest point on the trace that is associated with the current marker position. · [Next pk Left]: Press 【Peak】 →[Next pk Left] to find the next peak on the left of the current marker position. · [Next pk Right]: Press 【Peak】 → [Next pk Right] to find the next peak on the right of the current marker position. · [Max Search]: to place a marker at the highest point of the trace and display the frequency and amplitude of the marker in the upper right corner of the screen. Pressing this button will not change the activated functions. · [Min Search]: Press 【Peak】 →[Min Search] to place a marker to the lowest point of the trace and display the frequency and amplitude of this marker in the upper right corner of the screen. Pressing this button will not change the activated functions. · [Marker-> Center]: Press 【Peak】 →[Marker-> Center] to set the center frequency equal to the marker frequency. This function quickly moves the signal to the center of the screen.
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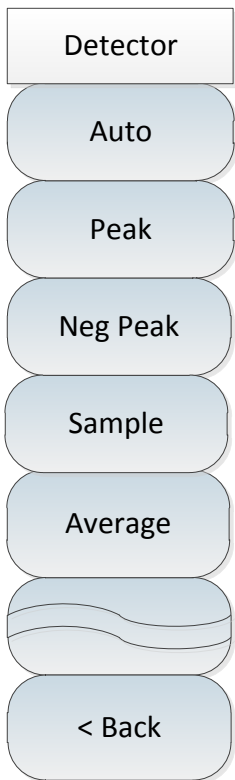
8.3.6 Sweep menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Sweep</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Sweep Time <u>A</u>uto <u>M</u>an</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Sweep <u>C</u>ont <u>S</u>ingle</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Sweep Once</div>	<ul style="list-style-type: none"> · [Sweep Time <u>A</u>uto <u>M</u>an]: Press 【Sweep】 →[Sweep Time <u>A</u>uto <u>M</u>an] to adjust the sweep time of the spectrum analyzer, by entering the value via the numeric keys on the front panel, and then selecting the time unit to confirm the input, or by pressing the [↑] & [↓] keys and the rotary knob. When Auto is selected, the sweep time will be automatically associated with the resolution bandwidth, frequency span and video bandwidth settings. · [Sweep <u>C</u>ont <u>S</u>ingle]: Press 【Sweep】 →[Sweep <u>C</u>ont <u>S</u>ingle]. The sweep type setting determines how the instrument sweeps and when it stops sweeping to enter the hold state. Two sweep modes are provided in the Real-Time Spectrum measurement mode: continuous sweep and single sweep. · [Sweep Once]: Press 【Sweep】 →[Sweep Once] to re-sweep.
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8.3.7 Trace and detector menu in DPX mode

Trace	<ul style="list-style-type: none"> · [Trace <u>1</u> 2 3 4]: Press [Trace] → [Trace <u>1</u> 2 3 4] to select a trace. The spectrum analyzer provides traces 1, 2, 3 and 4, and the selected trace serial number and the status menu item where its trace is located will be marked with an underline.
Trace <u>1</u> 2 3 4	<ul style="list-style-type: none"> · [Clear Write]: Press [Trace] → [Clear Write] to refresh all the data of the previously displayed trace and continuously display the signal received by the spectrum analyzer in the sweep state.
Clear Write	<ul style="list-style-type: none"> · [Max Hold]: Press [Trace] → [Max Hold] to hold the maximum value of the points on the selected trace and update it with the new maximum detected in each sweep. If the detection is automatic, it will switch to the positive peak detection mode.
Max Hold	<ul style="list-style-type: none"> · [Min Hold]: Press [Trace] → [Min Hold] to hold the minimum value of the points on the selected trace and update it with the new minimum detected in each sweep. If the detection is automatic, it will switch to the positive peak detection mode.
Min Hold	<ul style="list-style-type: none"> · [View]: Press [Trace] → [View] to hold and display the amplitude data of the selected trace, but it will not be updated during the spectrum analyzer sweeps.
View	<ul style="list-style-type: none"> · [Blank]: Press [Trace] → [Blank] to perform background processing on the signal instead of displaying it on the screen.
Blank	<ul style="list-style-type: none"> · [Detector]: Press [Trace] → [Detector] to activate the detection mode submenu. Refer to DETE menu for details.
Detector [Peak] >	<ul style="list-style-type: none"> · [Reset]: Press [Trace] → [Reset] to return the trace settings to the default state.
Reset	

8.3 Real-Time Spectrum menu description



- **[Auto]:** Press **[Trace]** →[Detector]→[Auto] to enter the detection menu and automatically default to the positive peak detection mode.
- **[Peak]:** Press **[Trace]** →[Detector]→[Peak] to select the positive peak detection mode and take a maximum value from the sampling data of each track point. This mode can ensure that no peak signals are missed, which is suitable for measuring signals that are very close to the noise base.
- **[Neg Peak]:** Press **[Trace]** →[Detector]→[Neg Peak] to select the negative peak detection mode and take a minimum value from the sampling data of each track point. This mode enables the trace to display a negative peak level. In most cases, it is used in the self-test of broadband millimeter wave spectrum analyzer, but rarely in measurement. It can fully reproduce the modulation envelope of the AM signal.
- **[Sample]:** Press **[Trace]** →[Detector]→[Sample] to set the detector to sampling detection mode. This mode is suitable for measuring noise signals and can measure noise better than normal detection methods. It is usually used for video averaging and noise marker functions.
- **[Average]:** Press **[Trace]** →[Detector]→[Average] to set the detector to average detection mode. The average detection mode displays the average of the sampled data of the trace in each sampling interval.

8.3.8 Trace menu in Spectrogram mode

Trace	<ul style="list-style-type: none"> · [Clear Write]: Press 【Trace】 → [Clear Write] to refresh all the data of the previously displayed trace and continuously display the signal received by the spectrum analyzer in the sweep state.
Clear Write	<ul style="list-style-type: none"> · [Max Hold]: Press 【Trace】 → [Max Hold] to hold the maximum value of the points on the selected trace and update it with the new maximum detected in each sweep.
Max Hold	<ul style="list-style-type: none"> · [Min Hold]: Press 【Trace】 → [Min Hold] to hold the maximum value of the points on the selected trace and update it with the new minimum detected in each sweep.
Min Hold	<ul style="list-style-type: none"> · [Blank]: Press 【Trace】 → [Blank] to perform background processing on the signal instead of displaying it on the screen.
Blank	<ul style="list-style-type: none"> · [Time Marker <u>Off</u> On]: Press 【Sweep】 → [Time Marker <u>Off</u> On] to turn on or off the time marker function.
Time Marker <u>Off</u> On	<ul style="list-style-type: none"> · [Time Marker]: Press 【Trace】 → [Time Marker <u>Off</u> On] → [Time Marker 0 ns] to set the time marker. When the time marker is off, the default display of the menu is gray not available for setting; when the time marker function is on, it can be set and changed by the numeric keys, step keys or rotary knob.
Time Marker 0 ns	<ul style="list-style-type: none"> · [Detector Peak>]: Press 【Trace】 → [Detector Peak>] to activate the detection mode submenu, which is the same as the detection menu in DPX mode.
Detector [Peak] >	<ul style="list-style-type: none"> · [Reset]: Press 【Trace】 → [Reset] to return the trace settings to the default state.
Reset	

8.3 Real-Time Spectrum menu description

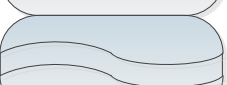
8.3.9 Limit menu

<p>Limit</p> <p>Limit Upper Lower</p> <p>Display Off On</p> <p>Test Off On</p> <p>Alarm Off On</p> <p>Edit Limit ></p> <p>Save Load ></p>	<ul style="list-style-type: none"> · [Limit Upper Lower]: Press [Limit] → [Limit Upper Lower] to select the current limit line as the upper limit line or the lower limit line. · [Display Off On]: Press [Limit] → [Display Off On] to select whether to turn on the limit function. · [Test Off On]: Press [Limit] → [Test Off On] to turn on or off the limit test. · [Alarm Off On]: Press [Limit] → [Alarm Off On] to set the sound alarm switch. When the audible alarm is turned on, it is effective when the upper and lower limit line test switch is turned on. When the upper and lower limit lines are swept on the current screen, the buzzer will give a short sound if there is an out of range condition. · [Edit Limit]: Press [Limit] → [Edit Limit], including [Frequency], [Amplitude], [Add Point], [Delete Point], [Left Point], [Right Point], [Default Limit] and other soft menus to view the frequency and amplitude of the limit points, as well as add or delete limit points. · [Save Load]: Press [Limit] → [Save Load] → [Save] to store the limit; Press [Limit] → [Save Load] → [Load], including [Head], [Tail], [Page Up], [Page Down], [Done], [Delete], [Cancel], and other soft menus to recall or delete the saved limits.
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8.3.10 Measurement menu in DPX mode

<p>Measure</p> <p>Meas Mode DPX Spect</p> <p>DPX Show Off On</p> <p>Density Up 100.00 %</p> <p>Density Down 0.00 %</p> <p>Persistent Off On</p> <p>Reset</p>	<ul style="list-style-type: none"> · [Meas Mode DPX Spect]: Press [Measure] → [Meas Mode DPX Spect] to select the measurement mode and activate the DPX mode display. · [DXP Show Off On]: Press [Measure] → [Meas Mode DPX Spect] → [DXP Show Off On] to open or hide the DPX spectrum display. The default state is On. · [Density Up 100.00%]: Press [Measure] → [Meas Mode DPX Spect] → [Density Up 100.00%] to set the upper limit of probability in the DPX measurement mode, by entering the value via the numeric keys on the front panel, then pressing % to confirm the input, or to set it via the [↑] & [↓] keys and the rotary knob. · [Density Down 0.00%]: Press [Measure] → [Meas Mode DPX Spect] → [Density Down 0.00%] to set the lower limit of probability in the DPX measurement mode, by entering the value via the numeric keys on the front panel, then pressing % to confirm the input, or to set it via the [↑] & [↓] keys and the rotary knob. · [Persistent Off On]: Press [Measure] → [Meas Mode DPX Spect] → [Persistent Off On] to turn on or off the DPX Hold function. The default state is Off. · [Reset]: Press [Measure] → [Meas Mode DPX Spect] → [Reset] to reset the system default setting in the DPX mode.
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8.3.11 Measurement menu in Spectrogram mode

Measure	<ul style="list-style-type: none"> ·[Meas Mode DPX Spect]: Press 【Measure】 →[Meas Mode DPX Spect] to select the measurement mode and activate the Spectrogram mode display.
Meas Mode DPX Spect	<ul style="list-style-type: none"> ·[Color Up 0.00dBm]: Press 【Measure】 →[Meas Mode DPX Spect]→[Color Up 0.00dBm] to set the upper limit of color scale in the Spectrogram measurement mode, by entering the value via the numeric keys on the front panel, then pressing [dBm] or [-dBm] to confirm the input, or to set it via the [↑] & [↓] keys and the rotary knob.
Color Up 0.00 dBm	
Color Down -100.00 dBm	<ul style="list-style-type: none"> ·[Color Down -100.00dBm]: Press 【Measure】 →[Meas Mode DPX Spect]→[Color Down -100.00dBm] to set the lower limit of color scale in the Spectrogram measurement mode, by entering the value via the numeric keys on the front panel, then pressing [dBm] or [-dBm] to confirm the input, or to set it via the [↑] & [↓] keys and the rotary knob.
	
Reset	<ul style="list-style-type: none"> ·[Reset]: Press 【Measure】→[Meas Mode DPX Spect]→[Reset] to reset the system default setting in the Spectrogram mode.

8.3.12 File menu

Please refer to the file menu description in spectrum analysis mode.

8.3.13 System menu

Please refer to the system menu description in spectrum analysis mode.

9 GSM/EDGE Mode (Option)

GSM/EDGE measurement mode is an extension of spectrum measurement mode. The 4024CA spectrum analyzer GSM/EDGE measurement mode is mainly for demodulation and analysis of GSM/EDGE signals, which can get information of signal modulation mode, channel power, BSIC, carrier-to-interference ratio, frequency error, phase error, EVM, origin drift and amplitude error, etc. It is mainly applied to measure, analyze and display the signals from GSM/EDGE base stations.

This manual is designed to make the measurement setting as simple as possible. Simply refer to the specifications of your ongoing measurement and base station setting, then enter the parameters of base station measurement setting to get the desired measurement data for GSM/EDGE signals.

GSM/EDGE measurements are typically 3GPP and device manufacturer compliant, with a fixed bandwidth of 200 kHz per channel, so only the center frequency needs to be set in this mode, and they can be configured manually or based on existing frequency bands. There are two ways to set the band for GSM/EDGE signals:

1. Manual mode: Manually set the band to be measured;
2. Import method: Select the band of signal standard already in the system.

The user can also change the test items and the criteria for passing the test according to the test needs.

The bandwidth of the channel and the number of channels to be measured can be set for each of the two measurement methods.

Notice

All operations in this section are based on the premise that the GSM/EDGE measurement mode has been selected, and will not be described separately later.

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9.1 Introduction to typical measurements

- [GSM/EDGE signal measurement](#) 180

9.1 Introduction to typical measurements

9.1.1 GSM/EDGE signal measurement

The operation steps for GSM/EDGE signal measurement are as follows:

a) Set the signal generator to output GSM/EDGE signals:

Use the signal generator to generate a GSM/EDGE signal, set the frequency to 1GHz, power to -30dBm, modulation mode 8PSK, and connect the output of the signal generator to the RF input of the spectrum analyzer through a cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Manually set center frequency:

Press **【Freq】** → [Center Freq] to set the frequency to be measured with the numeric keys or [↑] & [↓] keys or rotary knob to 1GHz.

Notice

In GSM/EDGE measurement mode, click **【Freq】** and select [Center Freq] by default. You can directly enter the frequency without clicking [Center Freq] repeatedly.

d) Import from the list of signal standards:

Press **【Freq】** → [Signal Std] to call up the list of signal standards, select the standard of GSM/EDGE signal to be measured in the list, then press [Done]. The instrument has been equipped with the GSM/EDGE signal standard configuration. You can change the channel as required.

Notice

Each operator or GSM/EDGE band has a fixed standard or configuration. When selecting a signal standard, it is important to pay attention to the correctness of the selected standard and channel, otherwise the required data will not be measured.

GSM/EDGE signal measurement results are shown in Figure 9-1 (the display results are different under different parameter settings, and Figure 9-1 is only an example):

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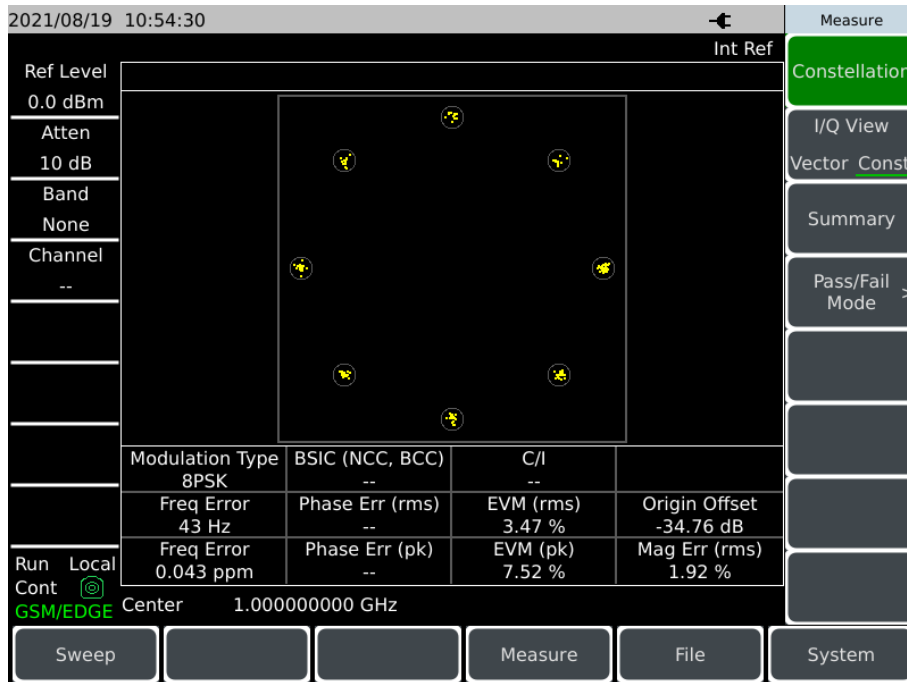


Figure 9-1 GSM/EDGE measurement interface

e) View demodulation summary:

Press **【Measure】**→**【Summary】** to view the demodulation information in tabular form, as shown in the following figure:



Figure 9-2 Demodulation summary interface

f) Check whether it passes the test criteria:

Press **【Measure】** → **【Pass/Fail Mode】**. When the test item shows green, it means that the test item

9.1 Introduction to typical measurements

passes the test; if it shows red, it means the test item fails to pass the test, as shown in the following figure:



Figure 9-3 Test-pass interface

g) Change test standard:

Press **【Measure】** →[Pass/Fail Mode]→[Pass/Fail Config] to turn off unwanted test items or change the criteria for passing the test.

Press **【Measure】** →[Pass/Fail Mode]→[Pass/Fail Save] to save the current test item and test standard to local for direct recall next time. When the next recall is made, Press **【Measure】** →[Pass/Fail Mode]→[Pass/Fail Load] to select from the stored test scenarios and click [Done]. The instrument has been set up with this test scenario.

Press **【Measure】** →[Pass/Fail Mode]→[Pass/Fail Reset] to restore the test items and test standard to the default settings.

9.2 GSM/EDGE mode menu structure

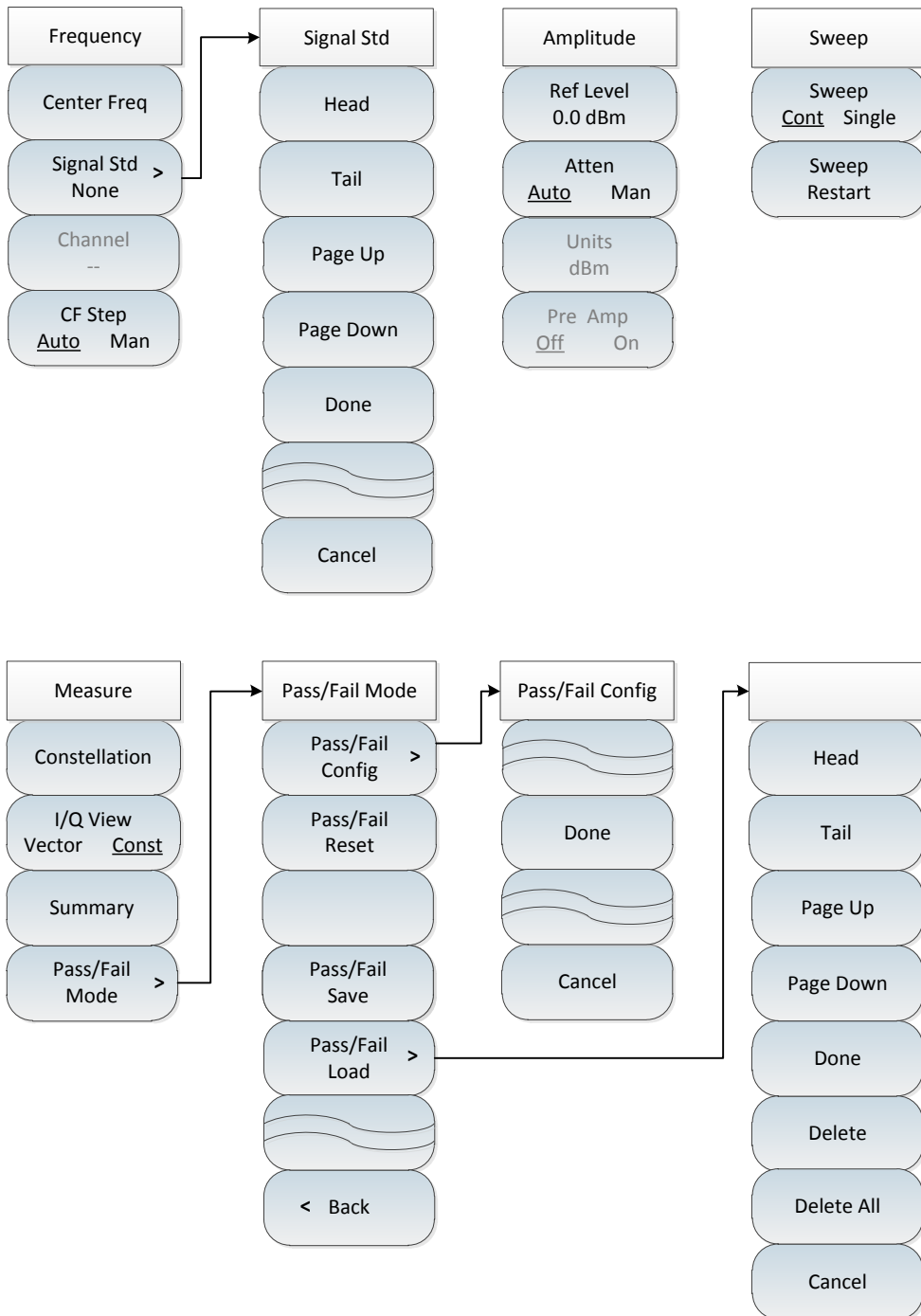


Figure 9-4 Block diagram of GSM/EDGE mode menu

9.3 GSM/EDGE mode menu description

- Frequency menu 184
- Amplitude menu 185
- Measurement menu 185

9.3 GSM/EDGE mode menu description

- Test pass menu 186
- Sweep menu 186
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9.3.1 Frequency menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Frequency</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Center Freq</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Signal Std > None</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Channel --</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center;">CF Step <u>Auto</u> Man</div>	<ul style="list-style-type: none"> · [Center Freq]: Press 【Freq】 →[Center Freq] to set it by pressing the numeric keys on the front panel and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or the [↑] & [↓] keys and the rotary knob. · [Special Note]: When using the [↑] or [↓] key and the rotary knob, the size of the frequency step is the same as that set by [CF Step], and you can use the numeric keys or the [↑] or [↓] key and the rotary knob to set the step frequency value after pressing [CF Step <u>Auto</u> Man] to switch to [CF Step <u>Auto</u> Man]. · [Signal Std]: Press 【Freq】 →[Signal Std] to pop up the corresponding list of signal standards, select the desired signal standard via [Head]→[Tail]→[Page Up]→[Page Down], and click [Done]. · [Special Note]: After loading the signal standard, the center frequency and span will be set to the center frequency and span values defined in the signal standard. · [Channel]: Press 【Freq】 →[Channel] to pop up the channel number setting dialog box, to set the channel number with the numeric keys or the [↑] & [↓] keys and the rotary knob. · [Special Note]: The channel number should be set under the premise of loading the signal standard, otherwise it is unable to set. · [CF Step <u>Auto</u> Man]: Press 【Freq】 →[CF Step <u>Auto</u> Man] to set it by pressing the numeric keys on the front panel and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or change the step value of the frequency via the [↑] & [↓] keys and the rotary knob.
---	--

9.3.2 Amplitude menu

Amplitude	<ul style="list-style-type: none"> · [Ref Level]: Press 【Ampt】 →[Ref Level] to set it by pressing the numeric keys on the front panel, and then selecting [dBm], [-dBm], [mV] or [μV] in the frequency unit menu, or pressing the [\uparrow] or [\downarrow] key and the rotary knob.
Ref Level 0.0 dBm	<ul style="list-style-type: none"> · [Atten <u>Auto</u> Man]: Press 【Ampt】 →[Atten <u>Auto</u> Man] to adjust the input attenuation of the spectrum analyzer. In automatic mode, the input attenuator is associated with the reference level. In manual mode, the attenuation of the attenuator can be adjusted with a numeric keypad, a step key, or a rotary knob, and the attenuation ranges from 0dB to 30dB.
Atten <u>Auto</u> Man	<ul style="list-style-type: none"> · [Special Note]: The setting range of the attenuation value is 0dB - 30dB, with a step value of 5dB.
Units dBm	<ul style="list-style-type: none"> · [Units dBm]: The amplitude in GSM/EDGE mode is displayed in dBm.
Pre Amp <u>Off</u> On	<ul style="list-style-type: none"> · [Pre Amp <u>Off</u> On]: Press 【Ampt】 →[Pre Amp <u>Off</u> On] to turn on or off the preamplifier.
	<ul style="list-style-type: none"> · [Special Note]: The preamplifier ON/OFF is grayed out and not selectable in the default state, and is only available when the reference level is set at -20dBm and below.

9.3.3 Measurement menu

Measure	<ul style="list-style-type: none"> · [Constellation]: Press 【Measure】 →[Constellation] to select the constellation diagram to display the demodulation result.
Constellation	<ul style="list-style-type: none"> · [I/Q View Vector <u>Const</u>]: Press 【Measure】 →[I/Q View Vector <u>Const</u>] to set the I/Q display as vector or scalar, which is scalar by default.
I/Q View Vector <u>Const</u>	<ul style="list-style-type: none"> · [Summary]: Press 【Measure】 →[Summary] to display the demodulation results in a table format.
Summary	<ul style="list-style-type: none"> · [Pass/Fail Mode]: Press 【Measure】 →[Pass/Fail Mode] to open the Pass Test function submenu. Refer to the [Pass/Fail Mode] menu for details.
Pass/Fail Mode >	

9.3 GSM/EDGE mode menu description

9.3.4 Test pass menu

<p>Pass/Fail Mode</p> <p>Pass/Fail Config ></p> <p>Pass/Fail Reset</p> <p>Pass/Fail Save</p> <p>Pass/Fail Load ></p> <p>< Back</p>	<ul style="list-style-type: none"> · [Pass/Fail Config]: Press 【Measure】 → [Pass/Fail Mode] → [Pass/Fail Config] to pop up the test item configuration interface, to turn on or off the unwanted test items and change the maximum and minimum values of the test items allowed to pass. · [Pass/Fail Reset]: Press 【Measure】 → [Pass/Fail Mode] → [Pass/Fail Reset] to restore the test item to its default state. · [Pass/Fail Save]: Press 【Measure】 → [Pass/Fail Mode] → [Pass/Fail Save] to store the current test item parameters to the instrument. · [Pass/Fail Load]: Press 【Measure】 → [Pass/Fail Mode] → [-Pass/Fail Load] to recall the saved test item parameters.
---	---

9.3.5 Sweep menu

<p>Sweep</p> <p>Sweep <u>Cont</u> Single</p> <p>Sweep Restart</p>	<ul style="list-style-type: none"> · [Sweep <u>Cont</u> Single]: Press 【Sweep】 → [Sweep <u>Cont</u> Single] to set continuous sweep mode or single sweep mode. · [Sweep Restart]: Press 【Sweep】 → [Sweep Restart] to re-sweep.
---	--

9.3.6 File menu

Please refer to the file menu description in spectrum analysis mode.

9.3.7 System menu

Please refer to the system menu description in spectrum analysis mode.

10 LTE Analyzer Mode (Option)

LTE Analyzer measurement mode is an extension of the spectrum measurement mode. The 4024CA spectrum analyzer LTE Analyzer measurement mode is mainly for demodulation and analysis of LTE signals, and used to measure, analyze and display the signals emitted by 4G base stations.

This manual is designed to make the measurement setting as simple as possible. Simply refer to the specifications of your ongoing measurement and base station setting, then enter the parameters of base station measurement setting to get the desired measurement data for 4G signals.

LTE Analyzer measurement mode includes measurement functions: constellation diagram measurement, data channel measurement, control channel measurement, time alignment error measurement, carrier aggregation measurement, ID scanner measurement, power vs time measurement, data allocation Map location, etc.

Notice

All operations in this section are based on the premise that the LTE Analyzer measurement mode has been selected, and will not be described separately later.

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10.1 Introduction to typical measurements

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10.1 Introduction to typical measurements

10.1.1 Constellation diagram measurement

The operation steps for LTE signal constellation diagram measurement are as follows:

a) Set the signal generator to output single carrier LTE signals:

Use the signal generator to generate an LTE, set the frequency to 1GHz, power to -30dBm, mode to LTE-FDD, channel bandwidth 10MHz, cell ID to 1, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Set center frequency:

Press **【Freq】** → [Center Freq] to set the frequency to be measured with the numeric keys or [↑] & [↓] keys or rotary knob.

Notice

In LTE Analyzer measurement mode, click **【Freq】** and select [Center Freq] by default. You can directly enter the frequency without clicking [Center Freq] repeatedly.

d) Band settings:

Press **【Freq】** → [Band Set] to call up the band list, select the band to be measured LTE signal in the band list, and then press [Done]. The instrument has been configured with LTE signal band; or click [Center Freq] to call as needed, or input the configuration of band under test and set the center frequency to 1GHz.

Notice

Each operator or LTE signal band has a fixed standard or configuration. When selecting a band, it is important to pay attention to the correctness of the selected band, otherwise the required data will not be measured.

e) Set the channel bandwidth:

Press **【Setup】** → [Channel BW] to set the channel bandwidth to be measured by the numeric keys or [↑] & [↓] keys or the rotary knob, which is set to 10MHz.

10.1 Introduction to typical measurements

f) Switch measurement mode:

Press **【Setup】** → [Mode FDD TDD] to switch FDD and TDD measurement mode. It is set to FDD mode in this example.

g) Set subframe number:

Press **【Setup】** → [Subframe No 0] to set the subframe number with the numeric keys or [**↑**] & [**↓**] keys or the rotary knob.

h) Set cell ID:

Press **【Setup】** → [Cell ID Auto Man] to set the cell ID automatically or manually. Use the numeric keys or [**↑**] & [**↓**] keys or the rotary knob to set the cell ID manually. It is set to Auto in this example.

i) Open constellation diagram:

Press **【Measure】** → [Constellation] to open the constellation diagram and view the constellation diagram of the current measurement signal, as shown in the figure below:

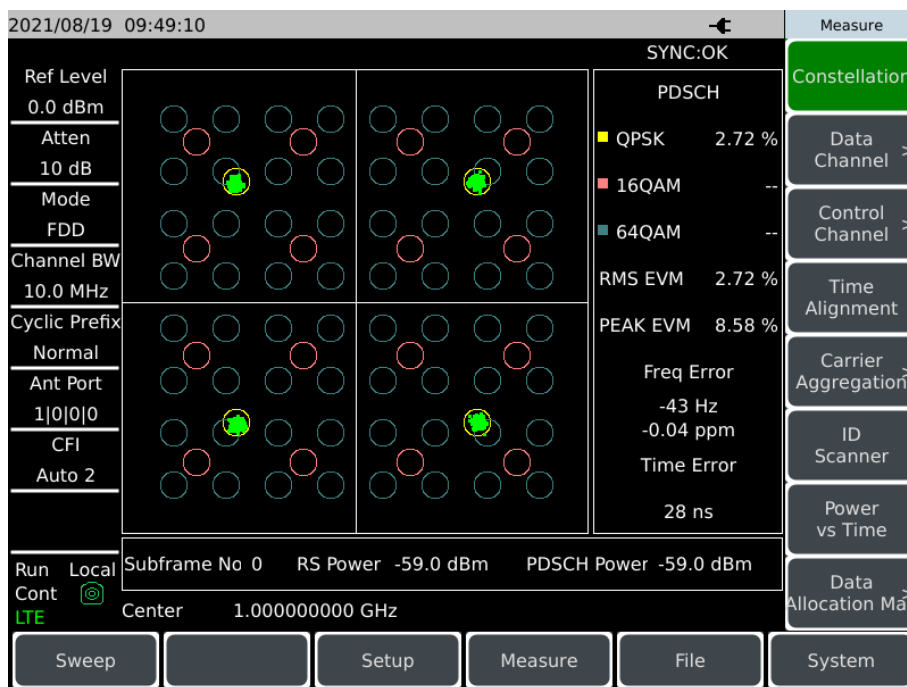


Figure 10-1 Constellation diagram

10.1.2 Data channel measurement

a) Set the signal generator to output single carrier LTE signals:

Use the signal generator to generate an LTE, set the frequency to 1GHz, power to -30dBm, mode to LTE-FDD, channel bandwidth 10MHz, cell ID to 1, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

10.1 Introduction to typical measurements

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Set center frequency:

Press **【Freq】** → [Center Freq] to set the frequency to be measured with the numeric keys or [↑] & [↓] keys or rotary knob. Set the center frequency to 1GHz.

d) Set channel bandwidth:

Press **【Freq】** → [Channel BW] to set the channel bandwidth to 10MHz.

e) Data channel:

Press **【Measure】** → [Data Channel] to view the current data channel measurement results.

f) Open RB mark:

Press **【Measure】** → [Data Channel] → [Marker Off On] to turn on or off the RB number mark.

g) Switch RB number:

Press **【Measure】** → [Data Channel] → [RB No. 0], and move in the horizontal direction of the data channel measurement map by the numeric keys or [↑] [↓] or the rotary knob, the demodulation information of the corresponding position of RB number will be displayed in the information bar, as shown in the following figure:

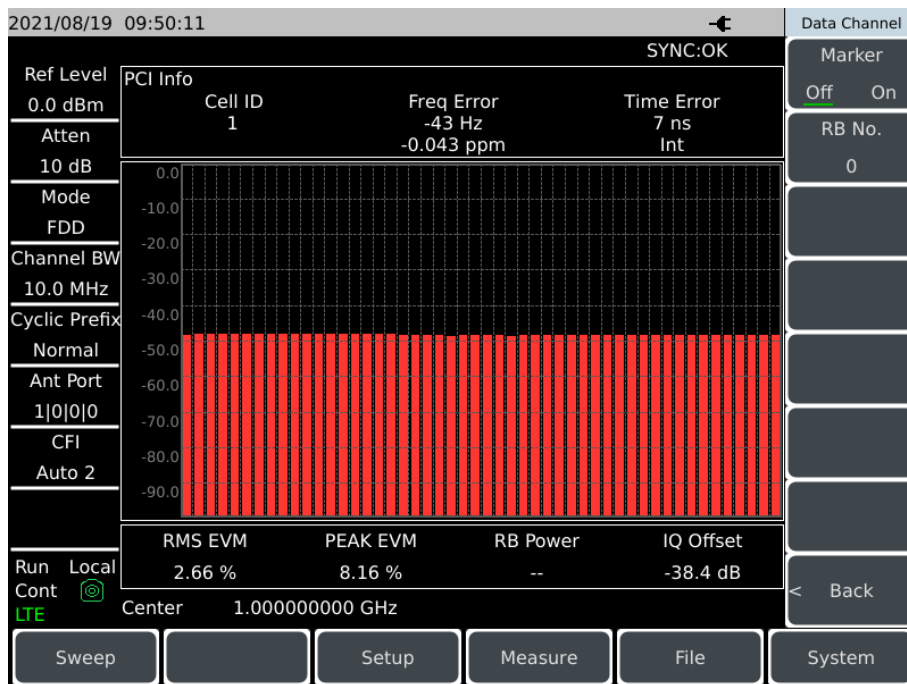


Figure 10-2 Data channel test results

Notice

The RB number can be set from 0 to 99.

10.1.3 Control channel measurement

a) Set the signal generator to output single carrier LTE signals:

Use the signal generator to generate an LTE, set the frequency to 1GHz, power to -10dBm, mode to LTE-FDD, channel bandwidth 10MHz, cell ID to 1, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Set center frequency:

Press **【Freq】** → [Center Freq] to set the frequency to be measured with the numeric keys or [↑] & [↓] keys or rotary knob. Set the center frequency to 1GHz.

d) Set channel bandwidth:

Press **【Freq】** → [Channel BW] to set the channel bandwidth to 10MHz.

e) Open control channel:

Press **【Measure】** → [Control Channel] to view the current control channel measurement results, as shown in the following figure:

10 LTE Analyzer Mode (Option)

10.1 Introduction to typical measurements

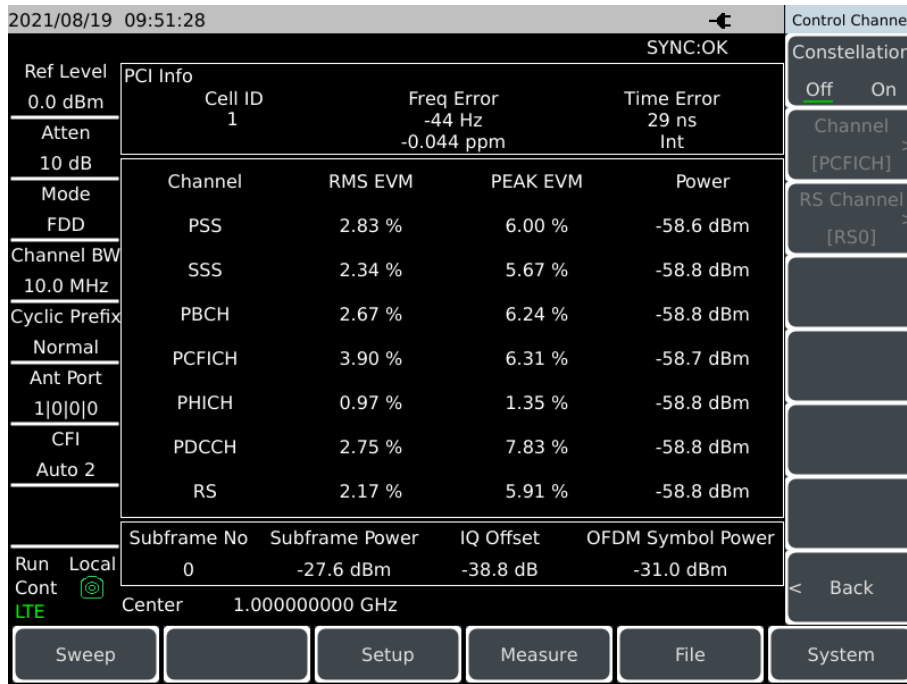


Figure 10-3 Data channel measurement interface

f) Open constellation diagram:

Press **[Measure]** → **[Control Channel]** → **[Constellation Off On]** to open the constellation diagram and view the constellation diagram of the current measurement signal, as shown in the figure below:

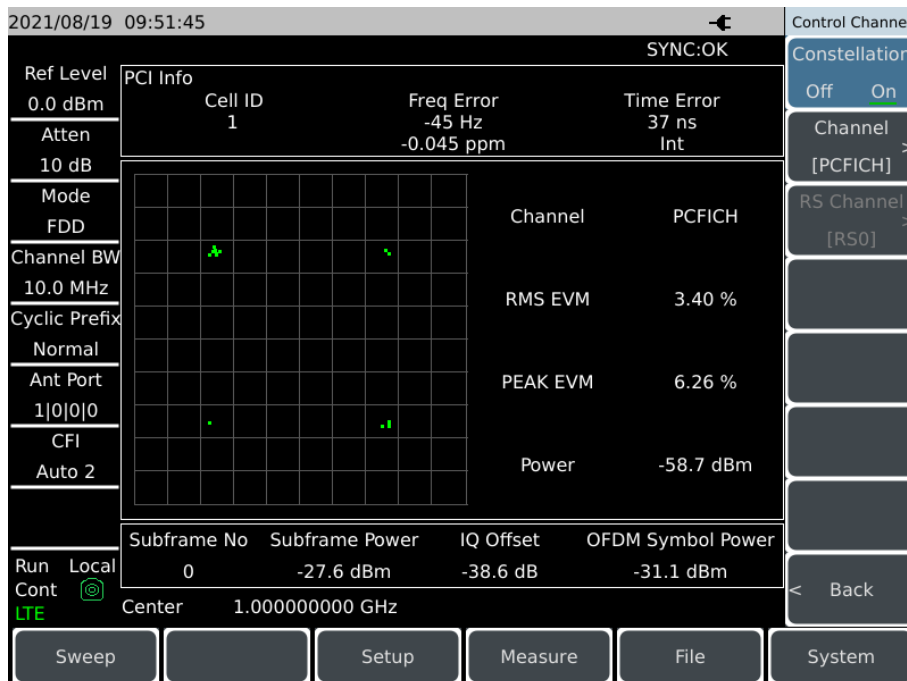


Figure 10-4 Data channel constellation measurement interface

g) Select channel:

10.1 Introduction to typical measurements

Press **【Measure】** →[Control Channel]→[Channel [PCFICH]] to pop up the selector channel menu and select the channel to be measured.

Notice

The [Channel [PCFICH]] menu can only be activated when the constellation diagram is open.

h) Switch RS channel:

Press **【Measure】** →[Control Channel]→[RS Channel [RS0]] to pop up the RS channel menu and select the RS ALL channel to be measured, as shown in the figure below:

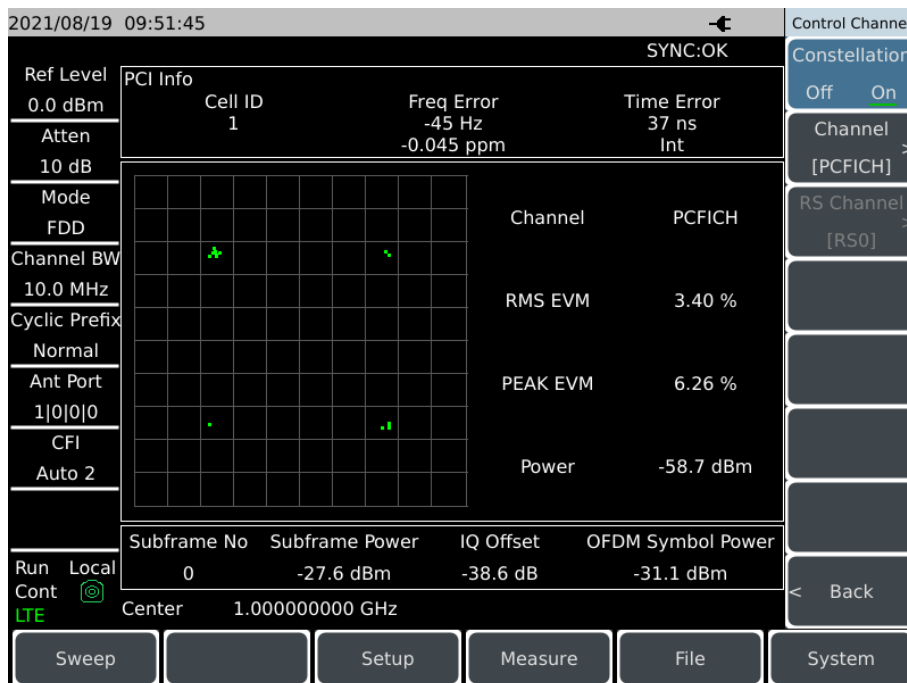


Figure 10-5 RS channel measurement interface

Notice

The [RS Channel [RS0]] menu is only activated when it is opened when the RS channel is selected in the Select Channel menu.

10.1.4 Time alignment error measurement

a) Set the signal generator to output single carrier LTE signals:

10.1 Introduction to typical measurements

Use the signal generator to generate an LTE, set the frequency to 1.2GHz, power to -21dBm, mode to LTE-FDD, channel bandwidth 10MHz, cell ID to 1, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Set center frequency:

Press **【Freq】** →[Center Freq] to set the frequency to be measured with the numeric keys or [↑] & [↓] keys or rotary knob. Set the center frequency to 1GHz.

d) Set channel bandwidth:

Press **【Freq】** →[Channel BW] to set the channel bandwidth to 10MHz.

e) Set port number:

Press **【Setup】** →[More 1 of 2]→[Port Num] to set it to Auto.

f) Time alignment error measurement:

Press **【Measure】** →[Time Alignment] to view the current time alignment error measurement results, as shown in the following figure:



Figure 10-6 Time Alignment measurement interface

10.1.5 Carrier aggregation measurement

a) Set the signal generator to output multi-carrier LTE signals:

Use the signal generator to generate an LTE, set the frequency to 1GHz, power to -30dBm, mode to LTE-FDD, channel bandwidth 10MHz, set carrier 1 frequency offset to -100MHz, cell ID to 1, carrier 2 frequency offset to 0MHz, cell ID to 2, carrier 3 frequency offset to 200MHz, cell ID to 3, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Carrier aggregation measurement:

Press **【Measure】** →[Carrier Aggregation] to open the carrier aggregation measurement interface.

d) Switch configuration:

Press **【Measure】** →[Carrier Aggregation]→[CA Configure 1 2 3 4 5] to switch between different carrier aggregation.

e) Turn on and off configuration:

Press **【Measure】**→[Carrier Aggregation]→[Measure Off On] to turn on or off the carrier aggregation configuration selected in the [CA Configure 1 2 3 4 5] menu by key switching. At least two configurations need to be reserved, and carriers 1, 2 and 3 are turned on.

Notice

At least two carrier configurations need to be reserved.

f) Switch center frequency:

Press **【Measure】** →[Carrier Aggregation]→[Center Freq] to set the center frequency of the channel to be measured by the numeric keys or [↑] & [↓] keys or the rotary knob. Set Carrier 1 to 900MHz, Carrier 2 to 1GHz, and Carrier 3 to 1.2GHz.

g)Set the channel bandwidth:

Press **【Measure】** →[Carrier Aggregation]→[Channel BW] to set the bandwidth of the starting

10.1 Introduction to typical measurements

channel to be measured, with all three carriers set to 10MHz.

h) Set cell ID:

Press **【Measure】** →[Carrier Aggregation]→[Cell ID Auto Man] to set the cell ID to Automatic.

i) Set CIF:

Press **【Measure】** →[Carrier Aggregation]→[CFI [Auto]] to open CFI configuration submenu and select CFI configuration.

j) Set PHICH type:

Press **【Measure】** →[Carrier Aggregation]→[More 1 of 2]→[PHICH Ng [1/6]] to select the PHICH Ng type.

k) Change cyclic prefix mode:

Press **【Measure】**→[Carrier Aggregation]→[More 1 of 2]→[Cyclic Prefix Norm Ext] to select the cyclic prefix mode.

The measurement results are shown in the figure below:

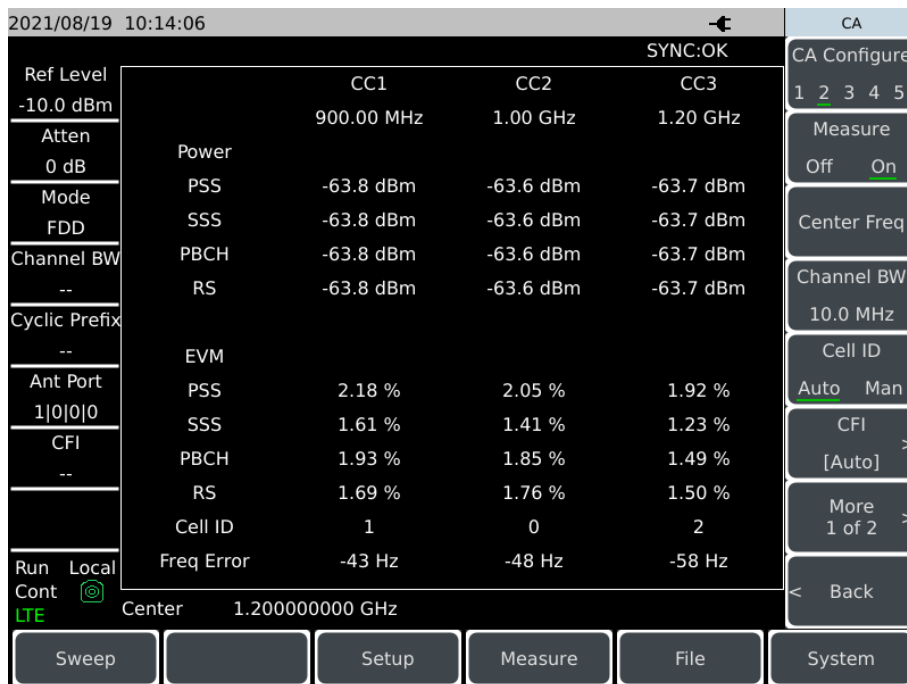


Figure 10-7 Carrier aggregation measurement interface

10.1.6 ID scanner measurement

a) Set the signal generator to output multi-carrier LTE signals:

Use the signal generator to generate an LTE, set the frequency to 1GHz, power to -30dBm, mode to

10.1 Introduction to typical measurements

LTE-FDD, channel bandwidth 10MHz, set carrier 1 frequency offset to 0MHz, cell ID to 1, carrier 2 frequency offset to 0MHz, cell ID to 2, carrier 3 frequency offset to 0MHz, cell ID to 3, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Set center frequency:

Press **【Freq】** → [Center Freq] to set the frequency to be measured with the numeric keys or [↑] & [↓] keys or rotary knob. Set the center frequency to 1GHz.

d) Set channel bandwidth:

Press **【Freq】** → [Channel BW] to set the channel bandwidth to 10MHz.

e) ID scanner measurement:

Press **【Measure】** → [ID Scanner] to view the cell ID sweep measurement results, as shown in the following figure:

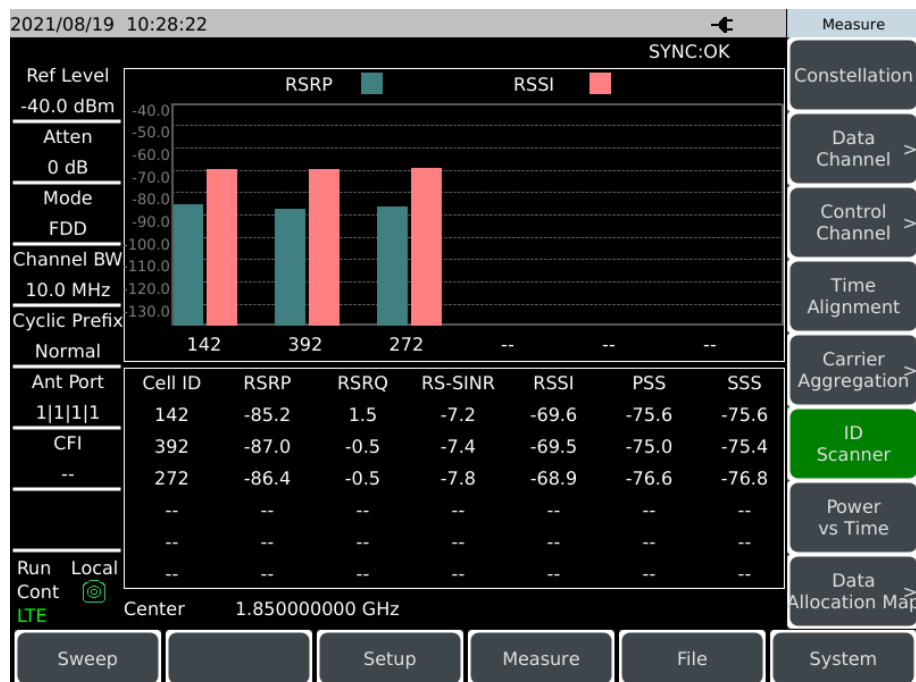


Figure 10-8 ID scanner measurement interface

10.1.7 Power vs time measurement

a) Set the signal generator to output single carrier LTE signals:

10.1 Introduction to typical measurements

Use the signal generator to generate an LTE, set the frequency to 1GHz, power to -30dBm, mode to LTE-FDD, channel bandwidth 10MHz, cell ID to 1, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **[Preset]** .

c) Set center frequency:

Press **[Freq]** →[Center Freq] to set the frequency to be measured with the numeric keys or [**↑**] & [**↓**] keys or rotary knob. Set the center frequency to 1GHz.

d) Set channel bandwidth:

Press **[Freq]** →[Channel BW] to set the channel bandwidth to 10MHz.

e) Power vs time measurement:

Press **[Measure]** →[Power vs Time] to view the current power vs time measurement results, as shown in the following figure:

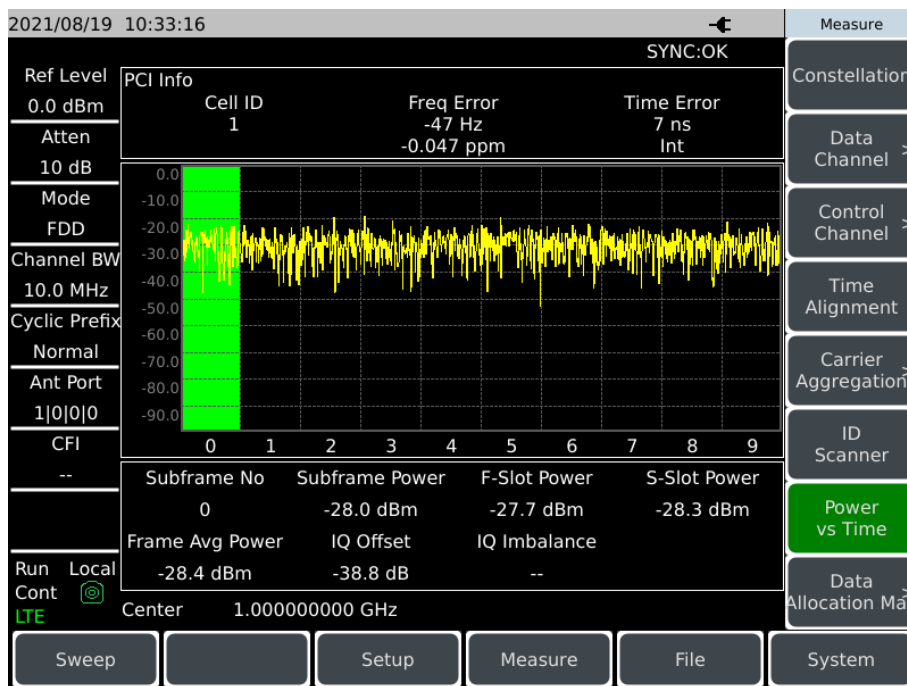


Figure 10-9 Power vs Time measurement interface

10.1.8 Data allocation Map location

a) Set the signal generator to output single carrier LTE signals:

Use the signal generator to generate an LTE, set the frequency to 1GHz, power to -30dBm, mode to

10.1 Introduction to typical measurements

LTE-FDD, channel bandwidth 10MHz, cell ID to 1, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Set center frequency:

Press **【Freq】** → [Center Freq] to set the frequency to be measured with the numeric keys or [↑] & [↓] keys or rotary knob. Set the center frequency to 1GHz.

d) Set channel bandwidth:

Press **【Freq】** → [Channel BW] to set the channel bandwidth to 20MHz.

e) Data allocation Map location:

Press **【Measure】** → [Data Allocation Map] to view the current data allocation Map location results, as shown in the following figure:

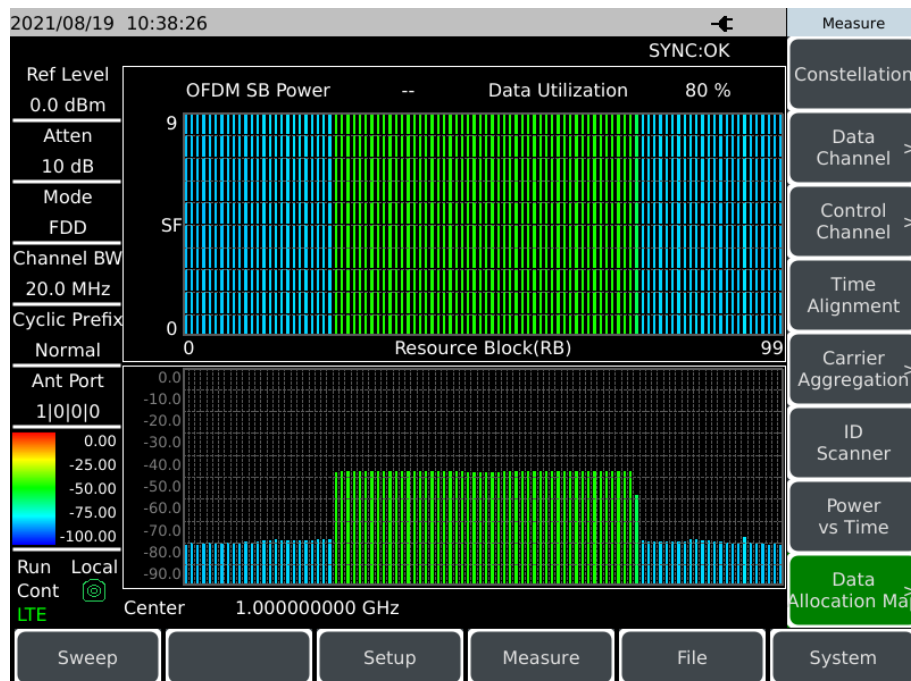


Figure 10-10 Data allocation Map location interface

10.2 LTE Analyzer mode menu structure

10.2 LTE Analyzer mode menu structure

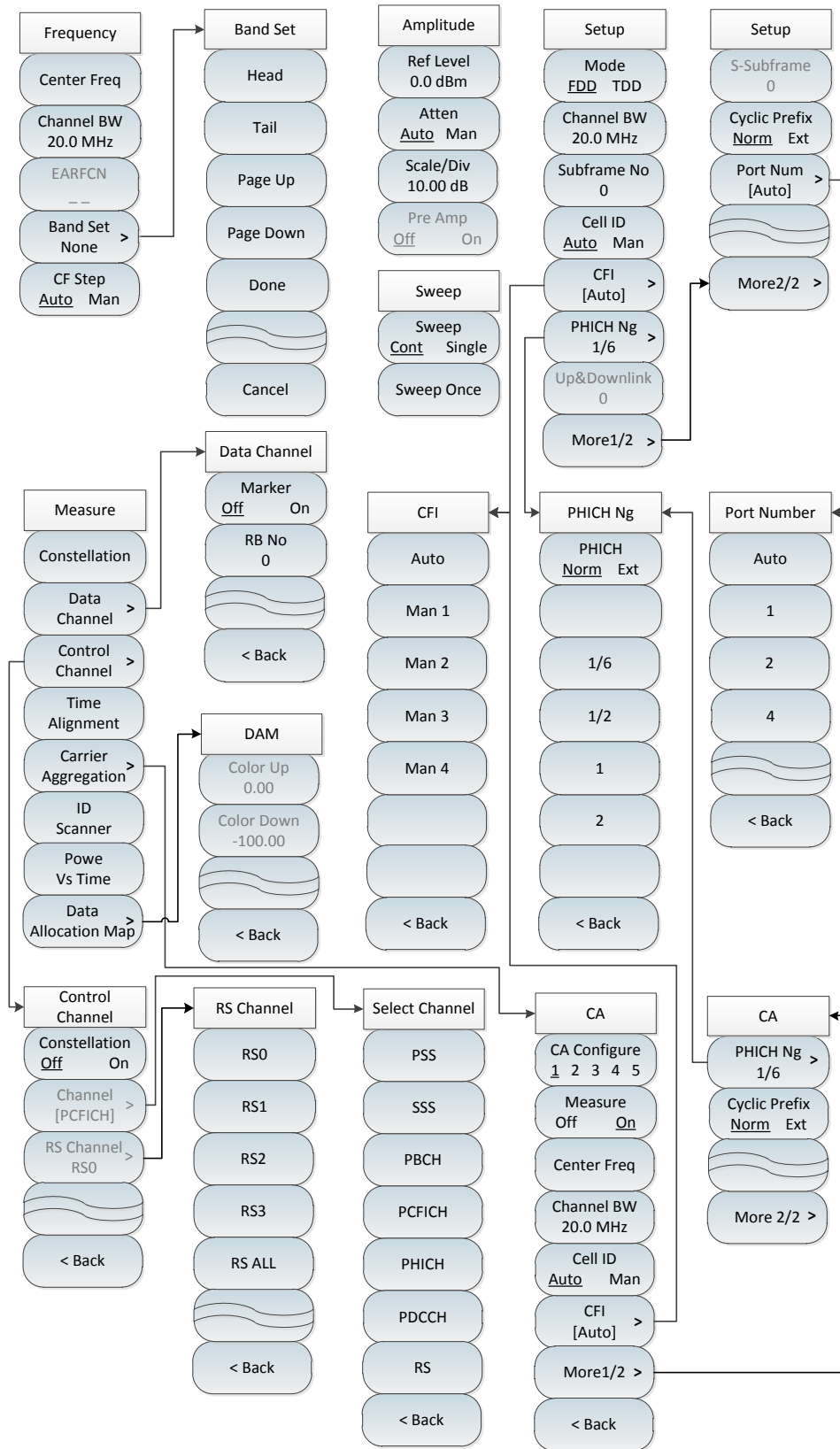


Figure 10-11 Block diagram of LTE Analyzer mode menu

10.3 LTE Analyzer mode menu description

- Frequency menu 201
- Amplitude menu 202
- Sweep menu 202
- Measurement setup menu. 203
- Measurement menu 204
- Control channel menu 205
- Data channel menu 205
- Carrier aggregation menu 206
- File menu 206
- System menu 206

10.3.1 Frequency menu

<div style="border: 1px solid gray; border-radius: 5px; padding: 5px; margin-bottom: 5px; text-align: center;">Frequency</div> <div style="border: 1px solid gray; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Center Freq</div> <div style="border: 1px solid gray; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Channel BW 20.0 MHz</div> <div style="border: 1px solid gray; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">EARFCN --</div> <div style="border: 1px solid gray; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Band Set None ></div> <div style="border: 1px solid gray; border-radius: 15px; padding: 5px; text-align: center;">CF Step <u>Auto</u> Man</div>	<ul style="list-style-type: none"> · [Center Freq]: Press [Freq] →[Center Freq] to set it by pressing the numeric keys on the front panel and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or the [↑] & [↓] keys and the rotary knob. · [Special Note]: When using the [↑] or [↓] key and the rotary knob, the size of the frequency step is the same as that set by [CF Step], and you can use the numeric keys or the [↑] or [↓] key and the rotary knob to set the step frequency value after pressing [CF Step <u>Auto</u> Man] to switch to [CF Step <u>Auto</u> Man]. · [Channel BW]: Press [Freq] →[Channel BW] to set it by pressing the numeric keys on the keypad and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or the [↑] & [↓] keys and the rotary knob. · [EARFCN]: Press [Freq] →[EARFCN] to pop up the EARFCN setting dialog, and set the EARFCN value according to the prompted range. · [Special Note]: The [EARFCN] function can be activated only when the band setting has been set. · [Band Set None]: Press [Freq] →[Band Set None] to pop up the corresponding band list. Select the desired band standard via [Head]→[Tail]→[Page Up]→ [Page Down], and then click [Done]. · [Freq Step <u>Auto</u> Man]: Press [Freq] →[Freq Step <u>Auto</u> Man] to change the step
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10.3 LTE Analyzer mode menu description

	size of the frequency by entering the number via the numeric keys on the front panel, and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu to complete the input, or by pressing the [↑] & [↓] keys and the rotary knob.
--	---

10.3.2 Amplitude menu

<div style="border: 1px solid gray; padding: 5px; margin-bottom: 5px; text-align: center;">Amplitude</div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Ref Level 0.0 dBm</div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Atten <u>Auto</u> Man</div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Scale/Div 10.00 dB</div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Pre Amp <u>Off</u> On</div>	<ul style="list-style-type: none"> · [Ref Level]: Press 【Ampt】 →[Ref Level] to set it by pressing the numeric keys on the front panel, then selecting [dBm]→[-dBm], or pressing the [↑] & [↓] keys and the rotary knob. · [Special Note]: The step is 5dB when using the [↑] [↓] keys, and 1dB when using the rotary knob. · [Atten <u>Auto</u> Man]: Press 【Ampt】 →[Atten <u>Auto</u> Man] to adjust the input attenuation of the spectrum analyzer. In automatic mode, the input attenuator is associated with the reference level. In manual mode, the attenuation of the attenuator can be adjusted with a numeric keypad, a step key, or a rotary knob, and the attenuation ranges from 0dB to 30dB. · [Scale/Div]: Press 【Ampt】 →[Scale/Div] to set it with the numeric keys, or [↑] & [↓] keys and rotary knob. The setting range of scale/div is 0.01dB-100dB. It is 10.00dB/div by default. · [Pre Amp <u>Off</u> On]: Press 【Ampt】 →[Pre Amp <u>Off</u> On] to turn on or off the preamplifier. The preamplifier ON/OFF is grayed out and not selectable in the default state, and is only available when the reference level is set at -20dBm and below. · [Special Note]: When the preamplifier is turned on, care should be taken not to input a signal greater than +13dBm, otherwise the instrument will be damaged.
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10.3.3 Sweep menu

<div style="border: 1px solid gray; padding: 5px; margin-bottom: 5px; text-align: center;">Sweep</div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Sweep <u>Cont</u> Single</div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; margin-bottom: 5px; text-align: center;">Sweep Once</div>	<ul style="list-style-type: none"> · [Sweep <u>Cont</u> Single]: Press 【Sweep】 →[Sweep <u>Cont</u> Single] to set continuous sweep mode or single sweep mode. · [Sweep once]: Press 【Sweep】 →[Sweep once] to re-sweep.
--	--

10.3.4 Measurement setup menu

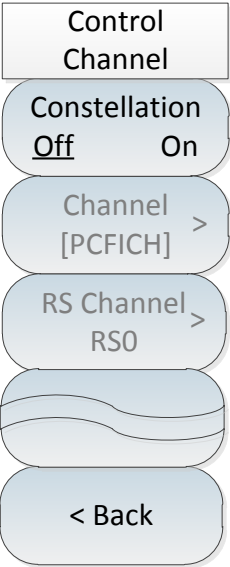
<div style="border: 1px solid black; padding: 5px; text-align: center;">Setup</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">Mode <u>FDD</u> TDD</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">Channel BW 20.0 MHz</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">Subframe No 0</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">Cell ID <u>Auto</u> Man</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">CFI [Auto] ></div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">PHICH Ng 1/6 ></div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">Up&Downlink 0</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">More1/2 ></div>	<ul style="list-style-type: none"> • [Mode <u>FDD</u> TDD]: Press [Setup] → [Mode <u>FDD</u> TDD] to select the measurement mode. • [Channel BW 20.0MHz]: Press [Measure] → [Channel BW 20.0MHz] to set it by pressing the numeric keys on the keypad and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or the [↑] & [↓] keys and the rotary knob. • [Subframe No 0]: Press [Measure] → [Subframe No 0] to set it with the numeric keys, or with the [↑] & [↓] keys and the rotary knob. The measurement information under the current subframe number will be displayed after the setting is completed. • [Cell ID <u>Auto</u> Man]: Press [Setup] → [Cell ID <u>Auto</u> Man] to set whether the cell ID is automatic or manual. If you choose manual, set it with the numeric keys on the front panel, or with the [↑] & [↓] keys and the rotary knob. • [CFI [Auto]]: Press [Setup] → [CFI [Auto]] to open CFI configuration submenu and select the desired CFI configurations via [AUTO]→[MAN 1]→[MAN 2], [MAN 3] or [MAN 4]. • [PHICH Ng [1/6]]: Press [Setup] → [PHICH Ng [1/6]] to configure PHICH. • [Up&Downlink 0]: Press [Setup] → [Up&Downlink 0] to set it with the numeric keys on the front panel, or with the [↑] & [↓] keys and the rotary knob. The measurement information under the current subframe number will be displayed after the setting is completed. • [Special Note]: [Up&Downlink 0], which can only be set when the measurement mode is TDD, supports 7 up/down link configurations from 0-6.
<div style="border: 1px solid black; padding: 5px; text-align: center;">Setup</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">S-Subframe 0</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">Cyclic Prefix <u>Norm</u> Ext</div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">Port Num [Auto] ></div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; text-align: center; margin-bottom: 5px;">More2/2 ></div>	<ul style="list-style-type: none"> • [S-Subframe 0]: Press [Setup] → [S-Subframe 0] to set the special subframe with the numeric keys on the front panel, or with the [↑] & [↓] keys and the rotary knob. • [Special Note]: [S-Subframe 0], which cannot be edited in FDD measurement mode. It can be set only in TDD measurement mode and supports 10 special sub-frames from 0-9. • [Cyclic Prefix <u>Norm</u> Ext]: Press [Setup] → [Cyclic Prefix <u>Norm</u> Ext] to select the cyclic prefix mode by key switching. • [Port Num [Auto]]: Press [Setup] → [Port Num [Auto]] to pop up the Select Port Number menu, and select the desired port number by [Auto]→[1]→[2]→[4].

10.3 LTE Analyzer mode menu description

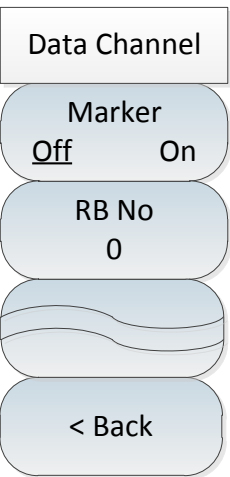
10.3.5 Measurement menu

<p>Measure</p>	<p>• [Constellation]: Press 【Measure】 →[Constellation] to enable the constellation diagram measurement mode.</p>
<p>Constellation</p>	<p>• [Data Channel]: Press 【Measure】 →[Data Channel] to pop up the Data Channel submenu. Refer to [Data Ch] menu for details.</p>
<p>Data Channel ></p>	<p>• [Control Channel]: Press 【Measure】 →[Control Channel] to pop up the Control Channel submenu. Refer to [Data Ch] menu for details.</p>
<p>Control Channel ></p>	<p>• [Time Alignment]: Press 【Measure】 →[Time Alignment] to enable the time alignment error measurement mode.</p>
<p>Time Alignment</p>	<p>• [Carrier Aggregation]: Press 【Measure】 →[Carrier Aggregation] to pop up the Carrier Aggregation submenu. Refer to [Carrier Aggregation] menu for details.</p>
<p>Carrier Aggregation ></p>	<p>• [ID Scanner]: Press 【Measure】 →[ID Scanner] to enable the ID sweep measurement mode.</p>
<p>ID Scanner</p>	<p>• [Power vs Time]: Press 【Measure】 →[Power vs Time] to enable the power VS time measurement mode.</p>
<p>Power Vs Time</p>	<p>• [Data Allocation Map]: Press 【Measure】 →[Data Allocation Map] to enable the data allocation Map location mode, and change the color upper bound and color lower bound under the submenu.</p>
<p>Data Allocation Map ></p>	

10.3.6 Control channel menu

 <p>The flowchart for the Control Channel menu shows a sequence of buttons: 'Control Channel' (top), 'Constellation Off On' (with 'Off' underlined), 'Channel [PCFICH]' (with a right arrow), 'RS Channel RSO' (with a right arrow), a separator line, and '< Back' (bottom).</p>	<ul style="list-style-type: none"> · [Constellation <u>Off</u> On]: Press [Measure] → [Control Channel] → [Constellation <u>Off</u> On]. · [Channel [PCFICH]]: Press [Measure] → [Control Channel] → [Channel [PCFICH]] to pop up the selector channel menu and select the desired channel via [PSS], [SSS], [PBCH], [PCFICH], [PHICH], [PDCCH] and [RS]. · [Special Note]: [CH PSS] is gray by default and cannot be selected. The channel can be selected only when the constellation diagram is opened. · [RS Channel RS0]: Press [Measure] → [Control Channel] → [RS Channel RS0] to pop up the RS channel menu and select the desired channel via [RS0], [RS1], [RS2], [RS3] and [RS ALL]. · [Special Note]: [RS Channel RS0] is grayed out in the default state and cannot be checked, and it can only be activated when the selected channel is RS state.
---	---

10.3.7 Data channel menu

 <p>The flowchart for the Data Channel menu shows a sequence of buttons: 'Data Channel' (top), 'Marker Off On' (with 'Off' underlined), 'RB No 0', a separator line, and '< Back' (bottom).</p>	<ul style="list-style-type: none"> · [Marker <u>Off</u> On]: Press [Measure] → [Data Channel] → [Marker <u>Off</u> On] to turn on or off the mark by pressing the key. · [RB No 0]: Press [Measure] → [Data Channel] → [RB No 0] to set RB number with the numeric keys on the front panel, or with the [<u>↑</u>] & [<u>↓</u>] keys and the rotary knob.
---	---

10.3 LTE Analyzer mode menu description

10.3.8 Carrier aggregation menu

	<ul style="list-style-type: none"> ·[CA Configure 1 2 3 4 5]: Press [Measure] →[Carrier Aggregation]→[CA Configure 1 2 3 4 5] to switch between different carrier aggregation configurations, and the selected configuration will be underlined. ·[Measure Off On]: Press [Measure] →[Carrier Aggregation]→[Measure Off <u>On</u>] to turn on the carrier aggregation on or off by pressing the key. ·[Center Freq]: Press [Measure] →[Carrier Aggregation]→[Center Freq] to set it by pressing the numeric keys on the front panel and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or by pressing [↑] & [↓] keys and the rotary knob. ·[Channel BW 20.0 MHz]: Press [Measure] →[Carrier Aggregation]→[Channel BW 20.0 MHz]. ·[Cell ID Auto Man]: Press [Measure] →[Carrier Aggregation]→[Cell ID <u>Auto</u> Man] to set whether the cell ID is automatic or manual. If you choose manual, set it with the numeric keys on the front panel, or with the [↑] & [↓] keys and the rotary knob. . ·[CFI [Auto]]: Press [Measure] →[Carrier Aggregation]→[CFI [Auto]] to open CFI configuration submenu and select the desired CFI configurations via [Auto]→[Man 1]→[Man 2], [Man 3] or [Man 4].
	<ul style="list-style-type: none"> ·[PHICH Ng [1/6]]: Press [Measure] →[Carrier Aggregation]→[More 1 of 2]→[PHICH Ng [1/6]] to configure PHICH. ·[Cyclic Prefix Norm Ext]: Press [Measure] →[Carrier Aggregation]→[More 1 of 2]→[Cyclic Prefix <u>Norm</u> Ext] to select the cyclic prefix mode by key switching.

10.3.9 File menu

Please refer to the file menu description in spectrum analysis mode.

10.3.10 System menu

Please refer to the system menu description in spectrum analysis mode.

11 5GNR Mode (Option)

5GNR measurement mode is an extension of the spectrum measurement mode. The 4024CA spectrum analyzer 5GNR measurement mode is mainly for demodulation and analysis of 5GNR signals and is mainly applied to measure, analyze and display the signals emitted from 5G base stations.

This manual is designed to make the measurement setting as simple as possible. Simply refer to the specifications of your ongoing measurement and base station setting, then enter the parameters of base station measurement setting to get the desired measurement data for 5GNR signals.

5G measurements are usually compliant with 3GPP and equipment manufacturer standards, and they can be configured manually or based on band selection, so there are two ways to measure 5GNR signals: manual and automatic measurement methods; in addition to the basic measurement functions, there are other additional measurement functions: beam measurement, multi-PCI measurement, power vs. time, and indoor and outdoor route maps.

Notice

All operations in this section are based on the premise that the 5GNR measurement mode has been selected, and will not be described separately later.

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- [5GNR mode menu description](#) 222

11.1 Introduction to typical measurements

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- [Multi-PCI measurement](#) 214
- [Power vs Time](#) 215
- [Outdoor route Map location](#) 217
- [Indoor route Map location](#) 218

11.1 Introduction to typical measurements

11.1.1 5GNR signal manual measurement

The operation steps for 5GNR signal manual measurement are as follows:

a) Set the signal generator to output 5GNR signals:

Use the signal generator to generate a 5GNR signal, set the frequency to 2.60045GHz, power to -10dBm, cell ID to 1, eight beams, beams 1, 3, 5 and 7 on, beams 0, 2, 4 and 6 off, carrier spacing 30kHz, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Set center frequency:

Press **【Freq】** → [Center Freq] to set the frequency to be measured with the numeric keys or [↑] & [↓] keys or rotary knob to 1GHz.

Notice

In 5GNR measurement mode, click **【Freq】** and select [Center Freq] by default. You can directly enter the frequency without clicking [Center Freq] repeatedly.

d) Set SSB offset:

Press **【Freq】** → [SSB Offset] to set the offset to be measured with the numeric keys or [↑] & [↓] keys or rotary knob to 0Hz.

Notice

SSB stands for Synchronous Signal Block or SS Block, which actually refers to the Synchronous PBCH (Physical Broadcast Channel) block because the synchronous signal and the PBCH channel are packed into a block that always moves together and should be detected first in the 5GNR frame.

e) Set carrier spacing:

Press **【Freq】** → [SSB SCS] to select the carrier spacing of the signals to be measured. There are three

11.1 Introduction to typical measurements

cases A, B and C available. Select case B 30kHz.

f) After the above settings are correctly completed, the instrument recognizes the 5GNR signal and displays the individual measurement results on the screen.

As shown in Figure 11-1.

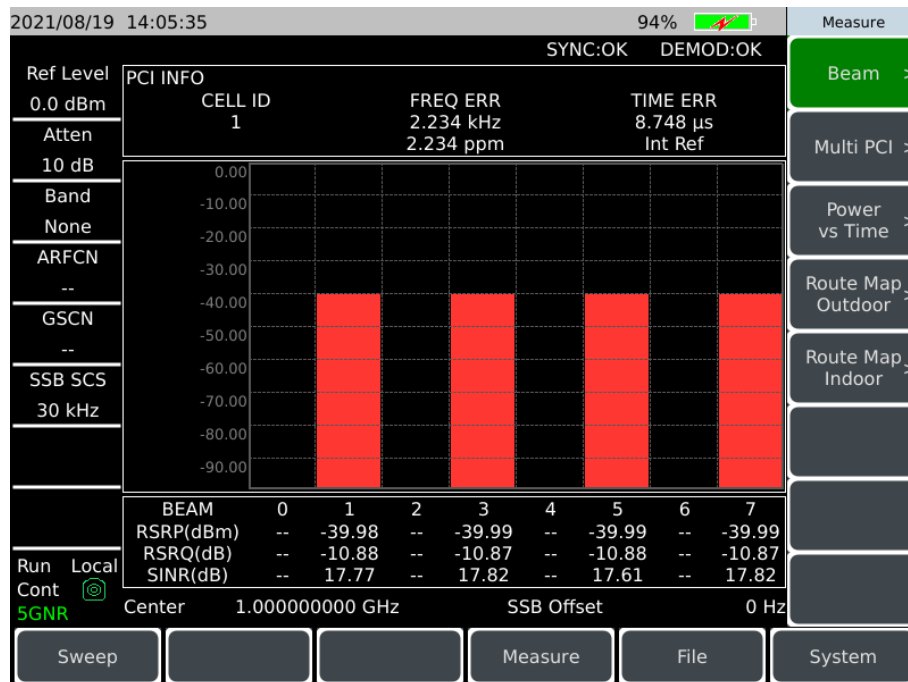


Figure 11-1 5GNR manual measurement interface

Notice

The center frequency, SSB offset and carrier spacing must be set to correctly match the 5GNR signal being measured, otherwise the measured signal cannot be measured.

11.1.2 5GNR signal automatic measurement

a) Set the signal generator to output 5GNR signals:

Use the signal generator to generate a 5GNR signal, set the frequency to 2.60045GHz, power to -10dBm, cell ID to 1, eight beams, beams 1, 3, 5 and 7 on, beams 0, 2, 4 and 6 off, carrier spacing 30kHz, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

11.1 Introduction to typical measurements

Press **【Preset】** .

c) Import band configuration:

Press **【Freq】** →[Band Set]→[Band None] to call up the band list, select the band n1 UL of the 5GNR signal to be measured in the band list, and then press [Done]. The instrument has been configured with 5GNR signal band.

Notice

Each operator or 5G band has a fixed standard or configuration. When selecting a band, it is important to pay attention to the correctness of the selected band, otherwise the required data will not be measured.

d) Automatic SSB detection:

Press **【Freq】** →[Band Set]→[Auto SSB], then the instrument will search under the current band and display the search prompt; After the search is completed, if the search fails, the instrument will display the failure prompt; if the search is successful, the test result will be displayed directly.

Notice

The ARFCN and GSCN can only be used during band selection, where the ARFCN can adjust the center frequency and the GSCN can adjust the SSB offset, but they will be adjusted automatically during automatic SSB detection, so there is no need to modify them manually.

The structure of 5GNR signal measurement is shown in Figure 11-2 (the display results are different under different parameter settings, and Figure 11-2 is only an example):

11.1 Introduction to typical measurements

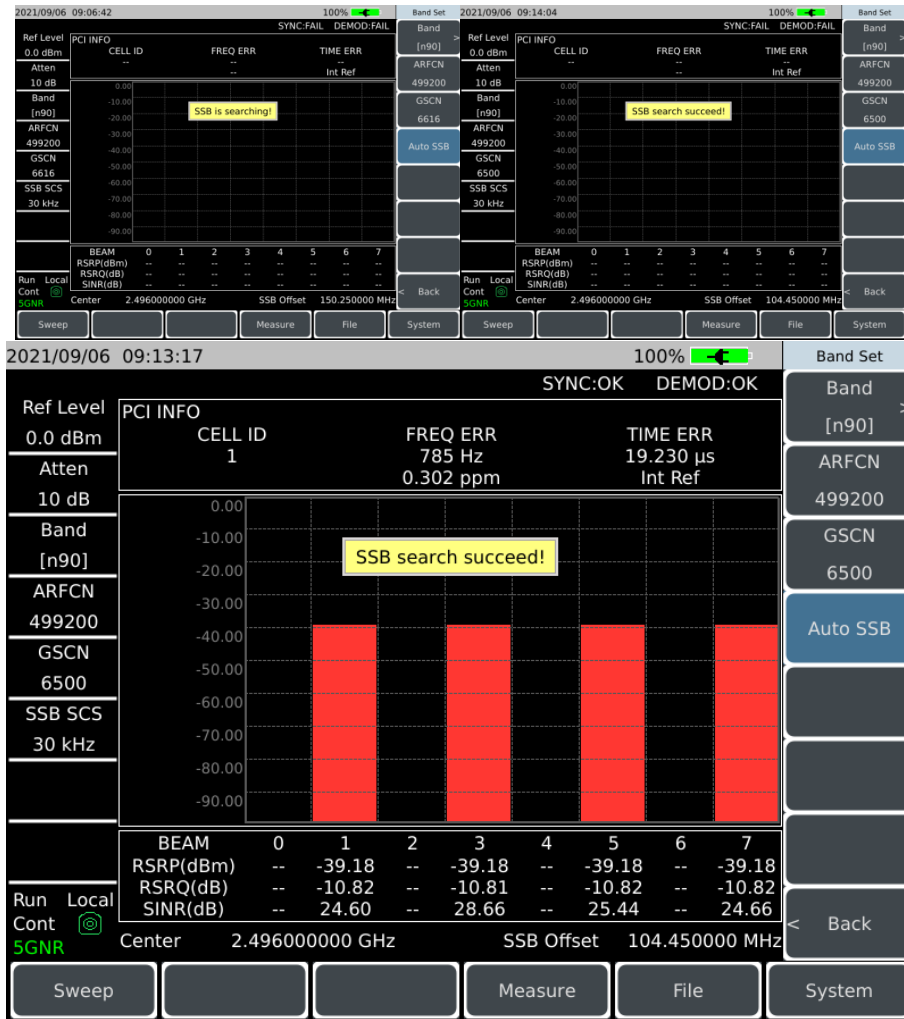


Figure 11-2 5GNR automatic measurement interface

11.1.3 Beam measurement

a) Set the signal generator to output 5GNR signals:

Use the signal generator to generate a 5GNR signal, set the frequency to 2.60045GHz, power to -10dBm, cell ID to 1, eight beams, beams 1, 3, 5 and 7 on, beams 0, 2, 4 and 6 off, carrier spacing 30kHz, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **[Preset]** .

c) Import band configuration:

Press **[Freq]** → **[Band Set]** → **[Band None]** to call up the band list, select the band n1 UL of the 5GNR signal to be measured in the band list, and then press **[Done]**. The instrument has been configured with 5GNR signal band.

11.1 Introduction to typical measurements

d) Beam measurement:

Press **【Measure】** →[Beam] to enter the [Beam] submenu.

Press **【Measure】** →[Beam]→[View Single Multi] to select the single beam or multi beam, which is the multi beam the default, as shown in Figure 11-3 and 11-4.

Press **【Measure】** →[Beam]→[Cell ID Auto Man] to set the cell ID automatically or manually.

Press **【Measure】** →[Beam]→[Beam 0] to set the beam to be viewed to be displayed in the display area.

Press **【Measure】** →[Beam]→[Constellation Off On] to open the constellation diagram and view the constellation diagram of the current beam, as shown in Figure 11-5.

Press **【Measure】** →[Beam]→[MIB Off On] to display the details of PBCH MIB information.

Notice

[Beam 0] and [Constellation Off On] are only activated when single beam is selected as the view type. [MIB Off On] are only activated when View is Single, Constellation is On, and channel is PBCH.

e) Press **【Measure】** →[Beam]→[Channel] to select a different channel and then view the measurement results.

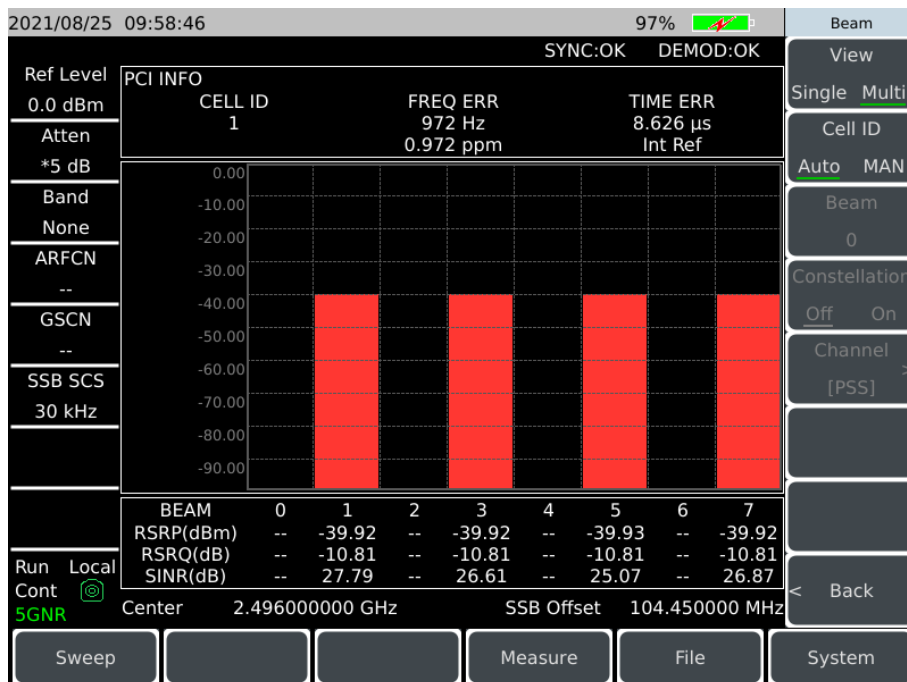


Figure 11-3 5GNR multi-beam measurement interface

11.1 Introduction to typical measurements

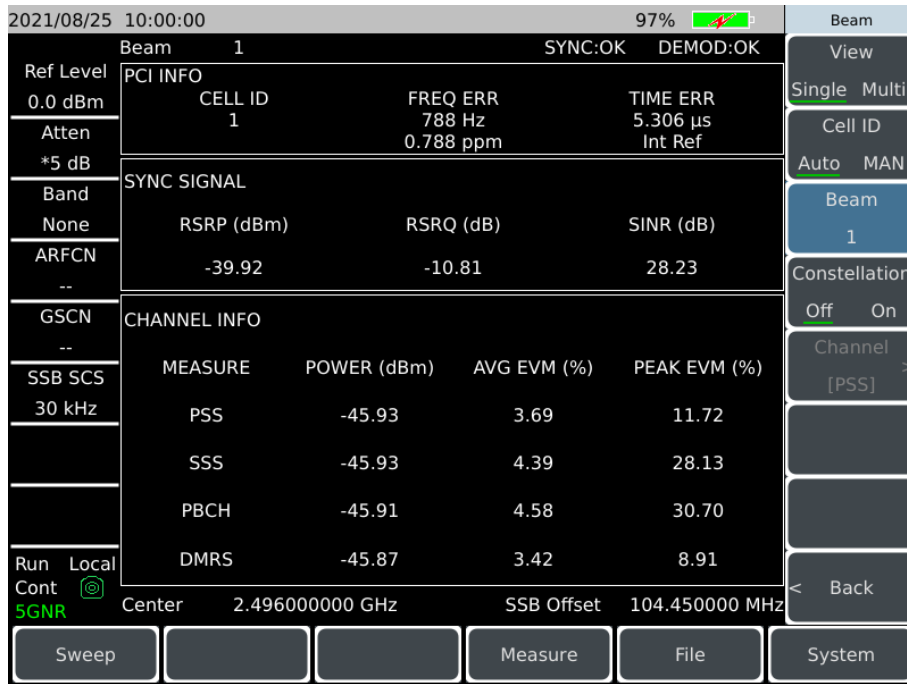


Figure 11-4 Single-beam measurement interface

Notice

The [Channel [PSS]] menu can only be activated when the constellation diagram is open.



Figure 11-5 Single-beam measurement constellation diagram interface

11.1 Introduction to typical measurements

11.1.4 Multi-PCI measurement

a) Set the signal generator to output 5GNR signals:

Use the signal generator to generate a 5GNR signal, set the frequency to 2.60045GHz, power to -10dBm, cell ID to 1, eight beams, beams 1, 3, 5 and 7 on, beams 0, 2, 4 and 6 off, carrier spacing 30kHz, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Import band configuration:

Press **【Freq】** →[Band Set]→[Band None] to call up the band list, select the band n1 UL of the 5GNR signal to be measured in the band list, and then press [Done]. The instrument has been configured with 5GNR signal band.

d) Multi-PCI measurement:

Press **【Measure】** →[Multi PCI] to enter the [Multi PCI] submenu.

Press **【Measure】** →[Multi PCI]→[View Chart Table] to select the display type as a bar chart or table.

Press **【Measure】** →[Multi PCI]→[Page 1] to set the page number to be viewed through the numeric keys, the [↑] & [↓] keys or the rotary knob.

Press **【Measure】** →[Multi PCI]→[Beam Num 3] to set the number of beams currently displayed by the numeric keys or [↑] & [↓] keys or the rotary knob.

Once the above setup is complete, the measurement results can be seen in the display area, as shown in the figure:

11.1 Introduction to typical measurements

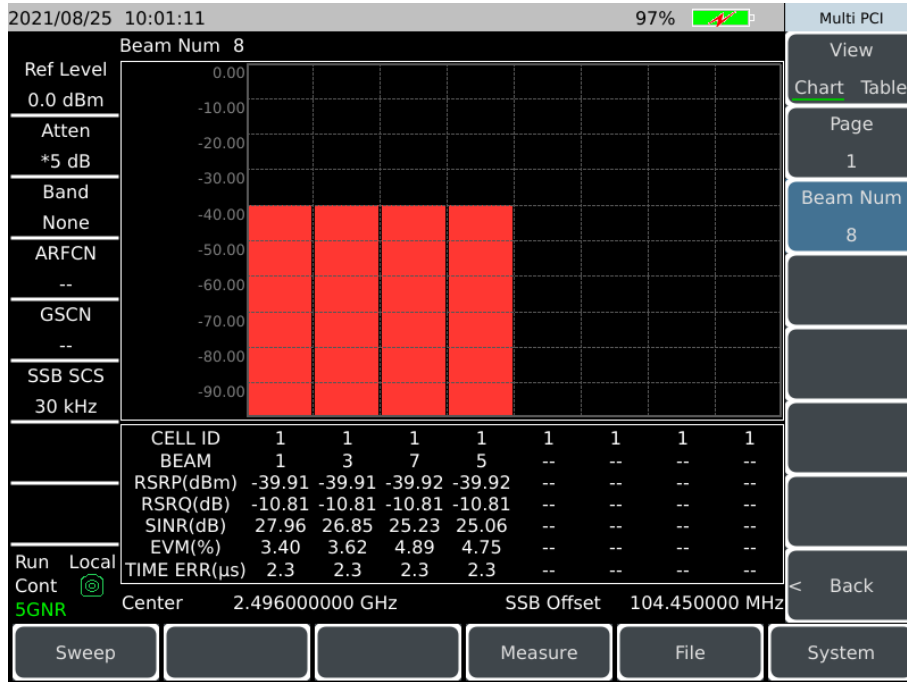


Figure 11-6 Multi-PCI measurement bar chart display interface

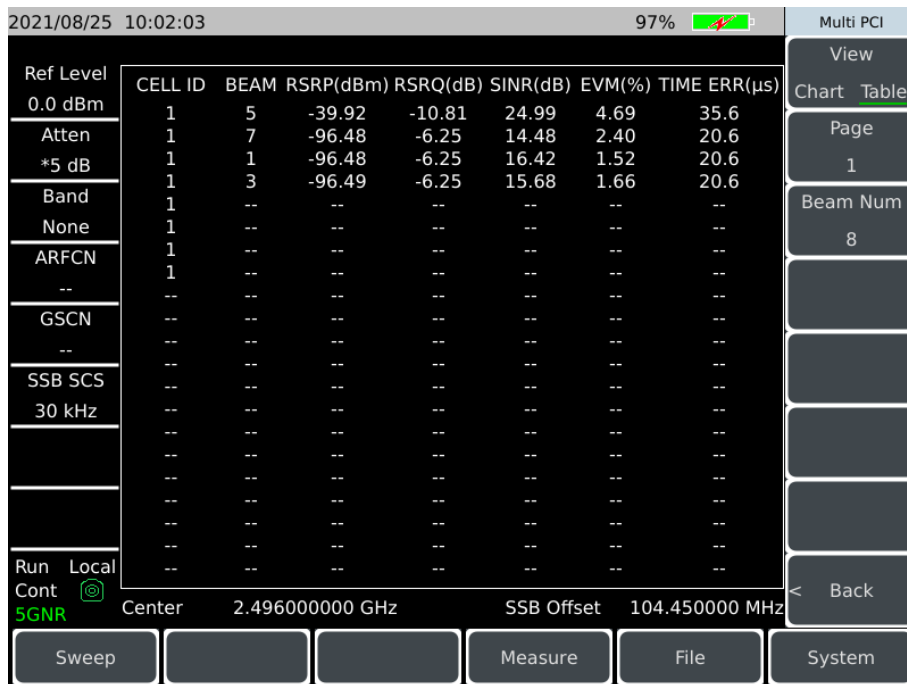


Figure 11-7 Multi-PCI measurement table display interface

11.1.5 Power vs Time

a) Set the signal generator to output 5GNR signals:

Use the signal generator to generate a 5GNR signal, set the frequency to 2.60045GHz and the power to -10dBm, as shown in Figure 5-1. Connect the RF output of the signal generator to the spectrum

11.1 Introduction to typical measurements

analyzer RF input through the cable and connect the trigger output of the signal source to the trigger input of the spectrum analyzer.

b) Reset the spectrum analyzer to its default state:

Press **[Preset]** .

c) Frequency offset setting:

Press **[Freq]** and use the numeric keys to enter the center frequency as 2600.45MHz and the SSB frequency bias as 0Hz.

e) or by importing the band configuration:

Press **[Freq]** →[Band Set]→[Band None] to call up the band list, select the band of the 5GNR signal to be measured in the band list, and then press [Done].

d) Power vs time measurement:

Press **[Measure]** →[Power vs Time] to enter [Power vs Time] submenu.

e) Press **[Measure]** →[Power vs Time]→[Subframe No. 0] to select the subframe ID, which is 0 by default, or select subframe 1 as shown in Figure 11-8.

f) Press **[Measure]** →[Power vs Time]→[Trigger [External]]→[External] to select the trigger mode as external or GPS, and the default is external trigger mode.

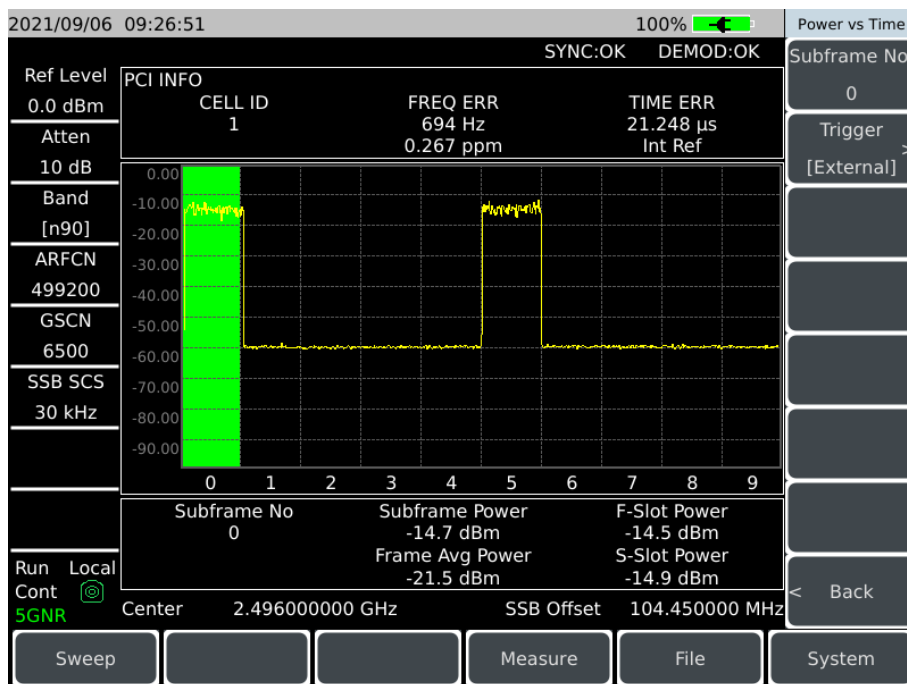


Figure 11-8 Power vs time display interface

11.1.6 Outdoor route Map location

a) Set the signal source to generate 5GNR signals:

Use the signal generator to generate a 5GNR signal, set the frequency to 2.60045GHz, power to -25dBm, cell ID to 1, eight beams, beams 1, 3, 5 and 7 on, beams 0, 2, 4 and 6 off, carrier spacing 30kHz, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Import band configuration:

Press **【Freq】** →[Band Set] →[Band None] to call up the band list, select the band n1 UL of the 5GNR signal to be measured in the band list, and then press [Done]. The instrument has been configured with 5GNR signal band.

d) Outdoor route Map location:

Press **【Measure】** →[Route Map Outdoor] to enter [Route Map Outdoor] submenu.

Press **【Measure】** →[Route Map Outdoor]→[Save Recall] to save the collected data via [Save Recall] submenu, or to save it as a CSV or BMP file. The saved data can be called out again via [Recall Data].

Press **【Measure】** →[Route Map Outdoor]→[Meas Setup] to select PCI or beam in [Meas Type PCI Beam]. If a beam is selected, the beam index and cell ID can be set as required. The upper and lower limits of power can be set via [Upper] and [Lower].

Press **【Measure】** →[Route Map Outdoor] to enter [Distance Time] submenu.

Press **【Measure】** →[Route Map Outdoor]→[Distance Time]→[Repeat Type Time Dist] to set the repeat type as time or distance. When set to time, you can set the repeat time by [Repeat Time]; when set to distance, you can set the repeat distance by [Repeat Distance].

Press **【Measure】** →[Route Map Outdoor]→[Start Collection] and the instrument starts collecting data.

Press **【Measure】** →[Route Map Outdoor]→[Zoom In] to zoom in on the map.

Press **【Measure】** →[Route Map Outdoor]→[Zoom Out] to zoom out on the map.

Once the setup is complete, the measurement results can be viewed in the display area, as shown in the figure:

11 5GNR Mode (Option)

11.1 Introduction to typical measurements



Figure 11-9 Signal generator for outdoor route Map location



Figure 11-10 Outdoor route map area measurement interface

11.1.7 Indoor route Map location

a) Set the signal generator to output 5GNR signals:

Use the signal generator to generate a 5GNR signal, set the frequency to 2.60045GHz, power to -10dBm, cell ID to 1, eight beams, beams 1, 3, 5 and 7 on, beams 0, 2, 4 and 6 off, carrier spacing

11.1 Introduction to typical measurements

30kHz, and connect the output of the signal generator to the spectrum analyzer RF input through the cable, as shown in Figure 5-1.

b) Reset the spectrum analyzer to its default state:

Press **【Preset】** .

c) Import band configuration:

Press **【Freq】** →[Band Set] to call up the band list, select the band n1 UL of the 5GNR signal to be measured in the band list, and then press [Done]. The instrument has been configured with 5GNR signal band.

d) Indoor route Map location:

Press **【Measure】** →[Route Map Indoor] to enter [Route Map Indoor] submenu.

Press **【Measure】** →[Route Map Indoor]→[Up] to move the marker up.

Press **【Measure】** →[Route Map Indoor]→[Down] to move the marker down.

Press **【Measure】** →[Route Map Indoor]→[Left] to move the marker to the left.

Press **【Measure】** →[Route Map Indoor]→[Right] to move the marker to the right.

Press **【Measure】** →[Route Map Indoor]→[Mark] to mark at the marker.

Press **【Measure】** →[Route Map Indoor]→[More 1 of 2]→[Delete] to delete the current mark.

Press **【Measure】** →[Route Map Indoor]→[More 1 of 2]→[Clear] to clear all marks.

Press **【Measure】** →[Route Map Indoor]→[More 1 of 2]→[Recall Data] to save the collected data via [Recall Data] submenu, or to save it as a CSV or BMP file. The saved data can be called out again via [Recall Data].

Press **【Measure】** →[Route Map Indoor]→[More 1 of 2]→[Meas Setup] to select PCI or beam in [Meas Type PCI Beam]. If a beam is selected, the beam index and cell ID can be set as required. The upper and lower limits of power can be set via [Upper] and [Lower]. The output power of the signal generator can be changed to obtain different measurement results.

Once the setup is complete, the measurement results can be viewed in the display area, as shown in the figure:

11.1 Introduction to typical measurements

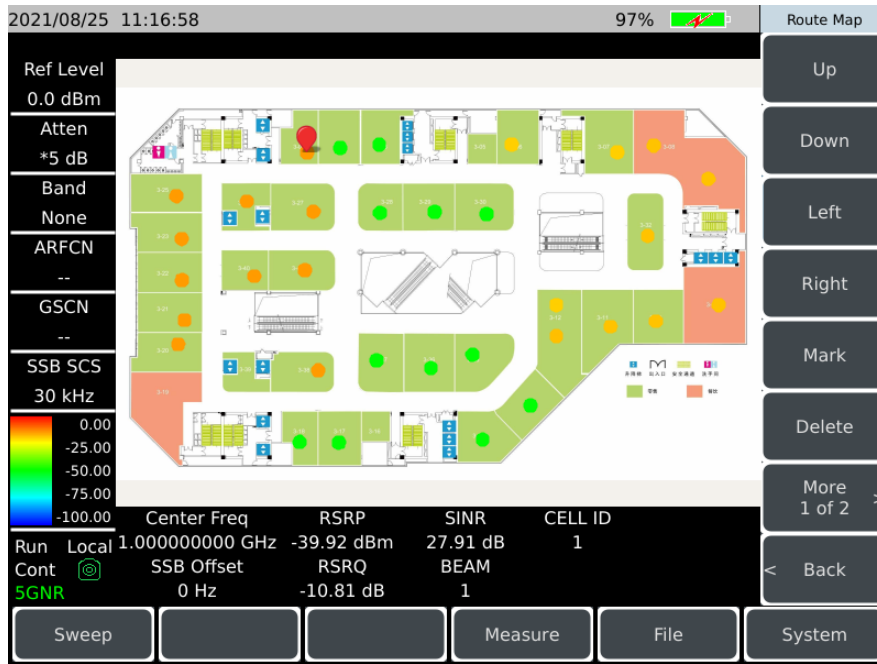


Figure 11-11 Indoor route Map location interface

11.2 5GNR mode menu structure

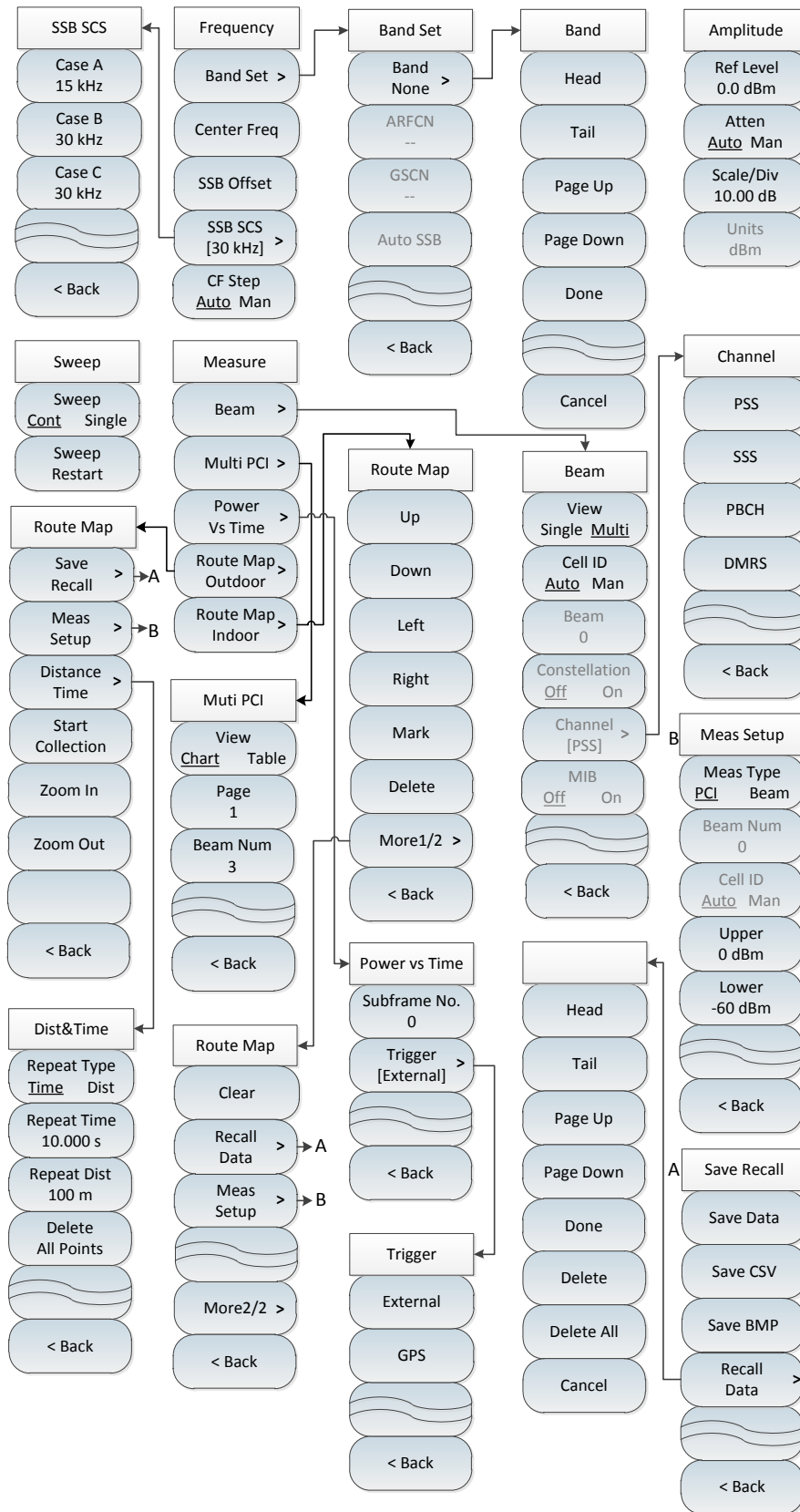


Figure 11-12 5GNR menu block diagram

11.3 5GNR mode menu description

11.3 5GNR mode menu description

- Frequency menu 222
- Band configuration menu 223
- Amplitude menu 224
- Sweep menu 224
- Measurement menu 225
- Beam measurement menu 225
- Multi-PCI measurement menu 226
- Power vs time menu 226
- Outdoor route map menu 227
- Indoor route map menu 229
- File menu 230
- System menu 230

11.3.1 Frequency menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Frequency</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Band Set ></div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Center Freq</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">SSB Offset</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">SSB SCS [30 kHz] ></div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center;">CF Step <u>Auto</u> Man</div>	<ul style="list-style-type: none"> • [Band Set]: Press 【Freq】 →[Band Set] to activate the [Band Set] submenu to set the required configuration from [Band Set] submenu. Refer to [Band Set] submenu for details. • [Center Freq]: Press 【Freq】 →[Center Freq] to set it by pressing the numeric keys on the front panel and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or the [↑] & [↓] keys and the rotary knob. • [Special Note]: When using the [↑] or [↓] key and the rotary knob, the size of the frequency step is the same as that set by [CF Step], and you can use the numeric keys or the [↑] or [↓] key and the rotary knob to set the step frequency value after pressing [CF Step <u>Auto</u> Man] to switch to [CF Step <u>Auto</u> Man]. • [SSB Offset]: Press 【Freq】 →[SSB Offset] to set it by pressing the numeric keys on the front panel and then selecting [GHz], [MHz], [kHz] or [Hz] in the frequency unit menu, or the [↑] & [↓] keys and the rotary knob. • [SSB SCS [30 kHz]]: Press 【Freq】 →[SSB SCS [30 kHz]] to activate the Carrier Spacing submenu, and then select the corresponding setting.
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11.3 5GNR mode menu description

·**[CF Step Auto Man]:** Press **[Freq]** →[CF Step Auto Man] to change the step value of frequency with the numeric keys on the front panel, or the [↑] & [↓] keys and the rotary knob. The frequency step is set to 1MHz in the auto state.

11.3.2 Band configuration menu

·**[Band None]:** Press **[Freq]** →[Band Set]→[Band None] to pop up the corresponding band list. Select the desired band standard via [Head]→[Tail]→[Page Up]→[Page Down] and then click [Done].

·**[ARFCN]:** Press **[Freq]** →[Band Set]→[ARFCN] to change it with the numeric keys, or the [↑] & [↓] keys and the rotary knob.

·**[GSCN]:** Press **[Freq]** →[Band Set]→[GSCN] to change it with the numeric keys, or the [↑] & [↓] keys and the rotary knob.

·**[Special Note]:** The ARFCN and GSCN can only be set after the band is selected and have a limited range. The ARFCN can change the center frequency of the current band, and the GSCN can change the SSB offset of the current band. The ARFCN and GSCN usually do not need to be set, but only if they are needed.

·**[Auto SSB]:** Press **[Freq]** →[Band Set]→[Auto SSB] and click [Auto SSB], the instrument will automatically measure and display the measurement results. If the measurement fails, there will be a failure prompt.

·**[Special Note]:** Before clicking [Auto SSB], please make sure the current band is selected correctly.

11.3 5GNR mode menu description

11.3.3 Amplitude menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Amplitude</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Ref Level 0.0 dBm</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Atten <u>Auto</u> Man</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Scale/Div 10.00 dB</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px;">Units dBm</div>	<ul style="list-style-type: none"> · [Ref Level]: Press 【Ampt】 → [Ref Level] to set it by pressing the numeric keys on the front panel, then selecting [dBm] → [-dBm], or pressing the [↑] & [↓] keys and the rotary knob. · [Special Note]: The step is 5dB when using the [↑] [↓] keys, and 1dB when using the rotary knob. · [Atten <u>Auto</u> Man]: Press 【Ampt】 → [Atten <u>Auto</u> Man] to adjust the input attenuation of the spectrum analyzer. In automatic mode, the input attenuator is associated with the reference level. In manual mode, the attenuation of the attenuator can be adjusted with a numeric keypad, a step key, or a rotary knob, and the attenuation ranges from 0dB to 30dB. · [Scale/Div]: Press 【Ampt】 → [Scale/Div] to set it with the numeric keys, or [↑] & [↓] keys and rotary knob. The setting range of scale/div is 0.01dB-100dB. It is 10dB/div by default. · [Units]: Press 【Ampt】 → [Units]. The amplitude in 5GNR measurement mode is displayed in dBm.
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11.3.4 Sweep menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Sweep</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px;">Sweep <u>Cont</u> Single</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px;">Sweep Restart</div>	<ul style="list-style-type: none"> · [Sweep <u>Cont</u> Single]: Press 【Sweep】 → [Sweep <u>Cont</u> Single] to set continuous sweep mode or single sweep mode. · [Sweep Restart]: Press 【Sweep】 → [Sweep Restart] to re-sweep.
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11.3.5 Measurement menu

	<ul style="list-style-type: none"> · [Beam]: Press [Measure] →[Beam] to activate the [Beam] submenu to set the required configuration from [Beam] submenu. Refer to [Beam] submenu for details. · [Multi PCI]: Press [Measure] →[Multi PCI] to activate the [Multi PCI] submenu to set the required configuration from [Multi PCI] submenu. Refer to [Multi PCI] submenu for details. · [Power vs Time]: Press [Measure] →[Power vs Time] to activate the [Power vs Time] submenu to set the required configuration from [Power vs Time] submenu. Refer to [Power vs Time] submenu for details. · [Route Map Outdoor]: Press [Measure] →[Route Map Outdoor] to activate the [Route Map Outdoor] submenu to set the required configuration from [Route Map Outdoor] submenu. Refer to [Route Map Outdoor] submenu for details. · [Route Map Indoor]: Press [Measure] →[Route Map Indoor] to activate the [Route Map Indoor] submenu to set the required configuration from [Route Map Indoor] submenu. Refer to [Route Map Indoor] submenu for details.
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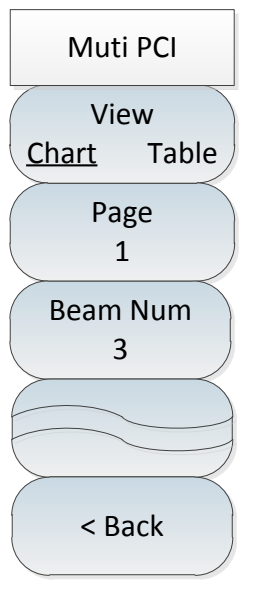
11.3.6 Beam measurement menu

	<ul style="list-style-type: none"> · [View Single Multi]: Press [Measure] →[Beam]→[View Single Multi] to select whether the display type is single beam or multi beam. · [Cell ID Auto Man]: Press [Measure] →[Beam]→[Cell ID Auto Man] to set whether the cell ID is automatic or manual. If you choose manual, set it with the numeric keys on the front panel, or with the [↑] & [↓] keys and the rotary knob. · [Beam 0]: Press [Measure] →[Beam]→[Beam 0] to set with the numeric keys on the front panel, or with the [↑] & [↓] keys and the rotary knob. The measurement information of the current set beam will be displayed after the setting is completed. · [Constellation Off On]: Press [Measure] →[Beam]→[Constellation Off On] to turn on or off the constellation diagram. · [Special Note]: [Beam 0] and [Constellation Off On] are only activated when single beam is selected as the display type. · [Channel [PSS]]: Press [Measure] →[Beam MEAS]→[CH PSS] to pop up the channel menu, and select the desired channel by [PSS]→[SSS]→[PBCH]→[MDRS]. · [MIB Off On]: Press [Measure] →[Beam]→[MIB Off On] to display the details of PBCH MIB information.
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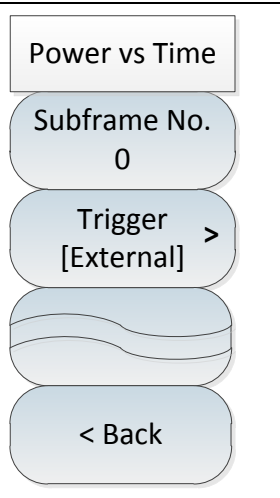
11.3 5GNR mode menu description

·**[Special Note]: [Channel PSS] is gray by default and cannot be selected. The channel can be selected only when the constellation diagram is opened.**

11.3.7 Multi-PCI measurement menu

 <p>Muti PCI</p> <p>View Chart Table</p> <p>Page 1</p> <p>Beam Num 3</p> <p>< Back</p>	<ul style="list-style-type: none"> ·[View Chart Table]: Press [Measure] →[Multi PCI]→[View <u>Chart</u> Table] to select the display type as a bar chart or a table. ·[Page 1]: Press [Measure] →[Multi PCI]→[Page 1] to set by the numeric keys, or with the [↑] & [↓] keys and the rotary knob. The measurement information under the current set page will be displayed after the setting is completed. ·[Beam Num 3]: Press [Measure] →[Multi PCI]→[Beam Num 3] to set with the numeric keys on the front panel, or with the [↑] & [↓] keys and the rotary knob. The measurement information for setting the number of beams will be shown in the display after the setting is completed. ·[Special Note]: The number of beams is set to a maximum of 8.
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11.3.8 Power vs time menu

 <p>Power vs Time</p> <p>Subframe No. 0</p> <p>Trigger [External] ></p> <p>< Back</p>	<ul style="list-style-type: none"> ·[Subframe No. 0]: Press [Measure] →[Power vs Time]→[Subframe No. 0] to set it with the numeric keys, or with the [↑] & [↓] keys and the rotary knob. The measurement information under the current subframe number will be displayed after the setting is completed. ·[Trigger [External]]: Press [Measure] →[Power vs Time]→[Trigger [External]] to activate the submenu for trigger selection.
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11.3 5GNR mode menu description

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Trigger</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">External</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">GPS</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">< Back</div>	<ul style="list-style-type: none"> · [External]: Press [Measure] → [Power vs Time] → [Trigger [External]] → [External] to select external trigger mode. · [GPS]: Press [Measure] → [Power vs Time] → [Trigger [External]] → [GPS] to select GPS trigger mode.
---	---

11.3.9 Outdoor route map menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Route Map</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Save Recall ></div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Meas Setup ></div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Distance Time ></div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Start Collection</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Zoom In</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Zoom Out</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">< Back</div>	<ul style="list-style-type: none"> · [Save Recall]: Press [Measure] → [Route Map Outdoor] → [Save Recall] to activate the [Save Recall] submenu. · [Meas Setup]: Press [Measure] → [Route Map Outdoor] → [Meas Setup] to activate the [Meas Setup] submenu. · [Distance Time]: Press [Measure] → [Route Map Outdoor] → [Distance Time] to activate the [Distance Time] submenu. · [Start Collection]: Press [Measure] → [Route Map Outdoor] → [Start Collection]. After clicking [Start Collection], the instrument starts to measure the data and mark the location and measurement results on the map. The interval between each two annotations can be set via the [Distance Time] menu. · [Zoom In]: Press [Measure] → [Route Map Outdoor] → [Zoom In] to set the zoom-in display of the map. · [Zoom Out]: Press [Measure] → [Route Map Outdoor] → [Zoom Out] to set the zoom-out display of the map.
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11.3 5GNR mode menu description

<p>Save Recall</p> <p>Save Data</p> <p>Save CSV</p> <p>Save BMP</p> <p>Recall Data ></p> <p>< Back</p>	<ul style="list-style-type: none"> • [Save Data]: Press 【Measure】 → [Route Map Outdoor] → [Save Recall] → [Save Data] to store the collection data to the instrument. • [Save CSV]: Press 【Measure】 → [Route Map Outdoor] → [Save Recall] → [Save CSV] to store the collection data as a file in CSV format. • [Save BMP]: Press 【Measure】 → [Route Map Outdoor] → [Save Recall] → [Save BMP File] to store the collection data as images. • [Recall Data]: Press 【Measure】 → [Route Map Outdoor] → [Save Recall] → [Recall Data] to recall the stored historical collection data for viewing.
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<p>Meas Setup</p> <p>Meas Type PCI Beam</p> <p>Beam Num 0</p> <p>Cell ID Auto Man</p> <p>Upper 0 dBm</p> <p>Lower -60 dBm</p> <p>< Back</p>	<ul style="list-style-type: none"> • [Meas Type PCI Beam]: Press 【Measure】 → [Route Map Outdoor] → [Meas Setup] → [Meas Type PCI Beam] to set the meas type to PCI or Beam. • [Beam Num 0]: Press 【Measure】 → [Route Map Outdoor] → [Meas Setup] → [Beam Num 0] to set it with the numeric keys, or with the [↑] & [↓] keys and the rotary knob. The measurement information under the current beam number will be displayed after the setting is completed. • [Cell ID Auto Man]: Press 【Measure】 → [Route Map Outdoor] → [Meas Setup] → [Cell ID Auto Man] to set whether the cell ID is automatic or manual. If you choose manual, set it with the numeric keys on the front panel, or with the [↑] & [↓] keys and the rotary knob. • [Upper 0 dBm]: Press 【Measure】 → [Route Map Outdoor] → [Meas Setup] → [Upper 0 dBm] to set the value of the upper with the numeric keys on the front panel, or with the [↑] & [↓] keys and the rotary knob. • [Lower -60 dBm]: Press 【Measure】 → [Route Map Outdoor] → [Meas Setup] → [Lower -60 dBm] to set the value of the lower with the numeric keys on the front panel, or with the [↑] & [↓] keys and the rotary knob.
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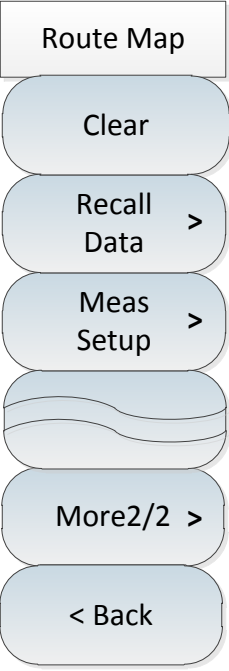
11.3 5GNR mode menu description

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Dist&Time</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Repeat Type Time Dist</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Repeat Time 10.000 s</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Repeat Dist 100 m</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Delete All Points</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">< Back</div>	<ul style="list-style-type: none"> • [Repeat Type Time Dist]: Press 【Measure】 →[Route Map Outdoor]→[Distance Time]→[Repeat Type <u>Time</u> Dist] to set the repeat type to time or distance. • [Repeat Time 10.000s]: Press 【Measure】 →[Route Map Outdoor]→[Distance Time]→[Repeat Time 10.000s] to set the time between two acquisitions, which is valid when and only when the repeat type is set to time. • [Repeat Dist 100m]: Press 【Measure】 →[Route Map Outdoor]→[Distance Time]→[Repeat Dist 100m] to set the distance between two acquisitions, which is valid when and only when the repeat type is set to distance. • [Delete All Points]: Press 【Measure】 →[Route Map Outdoor]→[Distance Time]→[Delete All Points] to delete all the collection data on the map.
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11.3.10 Indoor route map menu

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">Route Map</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Up</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Down</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Left</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Right</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Mark</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">Delete</div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">More1/2 ></div> <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin-bottom: 5px; text-align: center;">< Back</div>	<ul style="list-style-type: none"> • [Up]: Press 【Measure】 →[Route Map Indoor]→[Up] to move the marker up on the map. • [Down]: Press 【Measure】 →[Route Map Indoor]→[Down] to move the marker down on the map. • [Left]: Press 【Measure】 →[Route Map Indoor]→[Left] to move the marker to the left on the map. • [Right]: Press 【Measure】 →[Route Map Indoor]→[Right] to move the marker to the right on the map. • [Mark]: Press 【Measure】 →[Route Map Indoor]→[Mark] to mark the test result of the current mark point on the map. • [Delete]: Press 【Measure】 →[Route Map Indoor]→[Delete] to delete this mark.
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11.3 5GNR mode menu description

 <p>The screenshot shows a vertical menu with the following items from top to bottom: 'Route Map' (highlighted), 'Clear', 'Recall Data >', 'Meas Setup >', a decorative wavy line, 'More2/2 >', and '< Back'.</p>	<ul style="list-style-type: none">• [Clear]: Press [Measure] → [Route Map Indoor] → [More 1 of 2] → [Clear] to clear all marks.• [Recall Data]: Press [Measure] → [Route Map Indoor] → [More 1 of 2] → [Recall Data]. Refer to “Outdoor route map menu” for details.• [Meas Setup]: Press [Measure] → [Route Map Indoor] → [More 1 of 2] → [Meas Setup]. Refer to “Outdoor route map menu” for details.
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11.3.11 File menu

Please refer to the file menu description in spectrum analysis mode.

11.3.12 System menu

Please refer to the system menu description in spectrum analysis mode.

12 Technical Specifications

The functional characteristics of each complete part and module of 4024CA spectrum analyzer are introduced in conjunction with the functional block diagram of the instrument. A list of recommended instrumentation for 4024CA spectrum analyzer is given, and several performance characteristic measurement methods and procedures for 4024CA spectrum analyzer, such as third-order intercept (TOI), are introduced.

- [Working Principle](#) 231
- [Performance characteristic test](#) 232

12.1 Working Principle

Covering the 9kHz-9GHz band, the 4024CA spectrum analyzer integrates a variety of measurement functions such as spectrum measurement and analysis, field strength measurement, occupied bandwidth, channel power, adjacent channel power, audio demodulation and IQ data capture, and provides a variety of options such as Interference Analyzer, demodulation analysis of analog modulated signals, Real-Time Spectrum, GSM/EDGE measurement, LTE Analyzer and 5G NR measurement, which enables the measurement of RF signal frequency, amplitude and other parameters. The functional block diagram of 4024CA spectrum analyzer is shown in Figure 12-1.

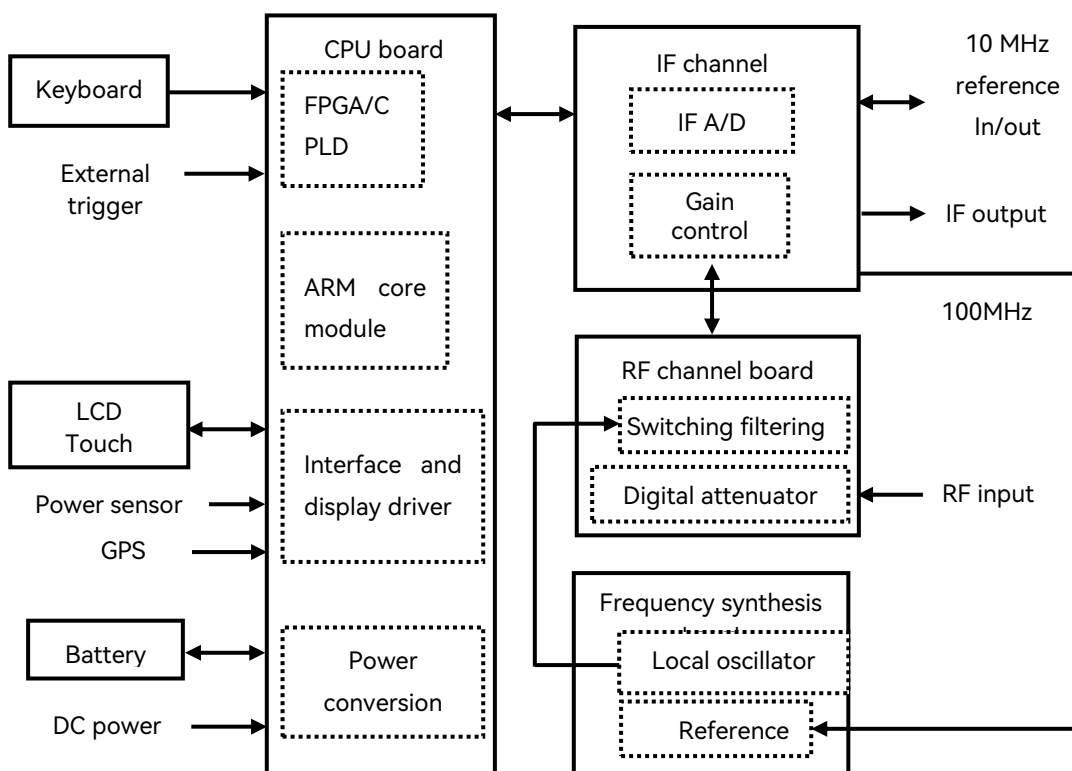


Figure 12-1 Instrument function block diagram

12.2 Performance characteristics test

The system hardware consists of RF channel board, frequency synthesis board, IF channel board, CPU board, display, keyboard, battery, etc.

Among them, the RF channel board includes 30dB digital attenuator and switching filtering and frequency conversion. The instrument automatically correlates the attenuation value of the attenuator according to the reference level, or the user manually sets the attenuation value to provide the appropriate mixer level. The switching filtering and frequency conversion completes the sub-band filtering and frequency conversion processing of the RF input signal, and outputs the IF signal to the IF channel board.

The IF channel board filters the IF signal input by the frequency conversion module, implements gain control for different bands to adjust the amplitude of AD sampling signal, and finally outputs the differential digital signal to FPGA after AD conversion to complete digital down conversion, IF filtering and video filtering, and can provide 10MHz reference input and output function.

The CPU board includes power conversion and management circuit, interface and display circuit, FPGA/CPLD control and digital signal processing circuit, and ARM core module to realize the DC/DC conversion, power management, digital signal processing, logic circuit control and other functions of the instrument power supply, and finally output the digital signal to the LCD by means of sweep curve, Spectrogram and so on.

The frequency synthesis board is provided by the IF channel board with 100MHz output signal as the frequency reference of the local oscillator. The local oscillator generation circuit provides the local oscillator signal for the mixer in the RF channel board, which is related to the hardware scan speed, phase noise, sideband spurious and other indicators of the instrument.

12.2 Performance characteristics test

The test equipment and inspection facilities shall comply with GB/T 6592-1996, and shall have and maintain sufficient accuracy, quality and quantity of equipment and facilities, which shall be verified by the measurement department and within the validity period of measurement. Other instruments and equipment applicable to the inspection requirements of this standard may also be used. See the following table for the test instruments and equipment.

12.2 Performance characteristics test

Figure 12-1 Recommended instruments and equipment for 4024CA spectrum analyzer

No.	Instrument	Main technical indicators	Recommended model
1	Synthesized signal generator	Frequency range 250kHz to 20GHz, power output -100dBm to +10dBm With internal and external AM mode and low frequency output function	1464A
2	Synthesized signal generator	Frequency range 250kHz to 20GHz, power output -100dBm to +10dBm	1464A
3	Vector signal generator	Spectrum range 100kHz-9GHz, RF bandwidth 500MHz, with 2G/4G/5G option	SMW200A
4	Spectrum analyzer	Frequency range: 3Hz ~ 26.5GHz	4051 or E4440A
5	Function generator	Waveform: sine wave, triangle wave, square wave, etc, Frequency range: 1μHz to 80MHz, amplitude range: 1mV to 10V	Agilent 33250A
6	Power meter	Frequency range: 10MHz to 20GHz, power Range: -70dBm to +20dBm	Anritsu ML2437A
7	Power sensor	Frequency range: 10MHz to 20GHz, power Range: -70dBm to +20dBm	Anritsu MA2445D
8	Vector network analyzer	Frequency range: 10Hz ~ 12.5GHz	N5245A
9	Microwave power amplifier	Frequency range: 2GHz-10GHz, gain: ≥20dB Output 1dB compression point: ≥ +40dBm	GT-1000A
10	RF power splitter	Frequency range: DC~10GHz	81311
11	RF directional coupler	Frequency range 300kHz-9GHz, directionality 30dB, VSWR<1.45	70607
12	Low-pass filter	Cutoff frequency 1.0GHz, insertion loss <0.9dB, out-of-band rejection >65dB	SLP-1200
13	Low-pass filter	Cutoff frequency 2.25GHz, insertion loss <2dB, out-of-band rejection >40dB	VLF-2250
14	Low-pass filter	Cutoff frequency 3GHz, insertion loss <2dB, out-of-band rejection >40dB	VLF-3000
15	50Ω load	Impedance: 50 Ω, interface type: N male	
16	Coaxial attenuator	Impedance: 50 Ω, power handling ≥ 2W, attenuation 30dB Frequency range DC~ 18GHz	71513B
17	Adapter	RF coaxial adapters, including 3.5mm(m)-3.5mm(m), 3.5mm(f)-3.5mm(f), BNC(m)-3.5mm(f), 3.5mm(f)-N(m), 3.5mm(m)-N(m), BNC(m)-BNC(f)-BNC(m) etc.	Homemade or outsourced
18	Cable	BNC(m)-BNC(m), two required	Homemade
19	RF cable	3.5mm cable (m-m)	Homemade
20	Computer	Win XP or Win7 platform	
21	Leakage current puncture tester	Leakage current 0.5 mA~ 20mA, voltage 242V, 3kV and 5kV	CJ2673

12.2 Performance characteristics test

Table 12-1 (Continued)

22	Variable-frequency power source	Frequency 47Hz~ 400Hz, voltage 0~ 3000V	AFC-1kW
23	Temperature & humidity chamber	Temperature -70°C to +150°C, humidity 25 - 98%RH	ESL-10P
24	Impact testbed	Maximum load 100kg, acceleration (50-400)m/s ²	P-100
25	Electrodynamic vibration generator	Maximum load 500kg, maximum displacement 51mm (p-p) Rated thrust 31.36kN, frequency range 5-2500Hz	DC-3200-36
26	Digital megohmmeter	Insulation resistance 0.01MΩ-1GΩ, test voltage 50V-1000V	FLUKE 1508

This section provides the recommended test methods for the main technical indicators of the 4024CA spectrum analyzer, which can fully reflect the performance and condition of the spectrum analyzer. The spectrum analyzer to be tested should be stored at the operating temperature for at least 2 hours, and then started and warmed up for 30 minutes before testing the following indicators without error.

Notice

The specific operation steps for testing the following indicators are provided according to the testing instrument shown in the figure. When other testing instruments same performance characteristics are used for testing, please refer to the operation Instructions of such instruments for the specific operation. The reset instruments mentioned in the test steps refer to the manufacturer reset mode. If the device is in the user-defined reset state, it should be changed to the manufacturer reset state and reset again to ensure that the initial state of the device is in a known state.

- [Frequency reference](#) 235
- [Frequency range](#) 236
- [Frequency readout accuracy](#) 238
- [Span](#) 239
- [Sweep time](#) 241
- [Resolution bandwidth](#) 243
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12.2 Performance characteristics test

● Second harmonic distortion	251
● Third-order intermodulation distortion	253
● 1dB gain compression	255
● Image, multiple and out-of-band responses	258
● Residual responses	259
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● Scale fidelity	263
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● Input voltage standing wave ratio (VSWR)	269
● Maximum safe input level	270
● Scale display	270
● Video bandwidth	271

12.2.1 Frequency reference

Description: Frequency reference is the basis for frequency measurement of the spectrum analyzer. The frequency reference requires high frequency accuracy and stability. The equipment for the aging rate and temperature stability is complex; the test requires a long time. Field test is not applicable. These two indexes are guaranteed by the design of the constant temperature or temperature compensated crystal oscillator manufacturer used in the instrument. In the process of acceptance, appraisal and production inspection of spectrum analyzer, the accuracy test on the reference frequency is the main inspection target. The available initial accuracy is the component design rating.

a) Test equipment

Synthesized signal generator 1464A

Frequency standards

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One 3.5mm (f)-N(m) adapter

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c) Cable

3.5mm cable (m-m) 1

d) Test steps

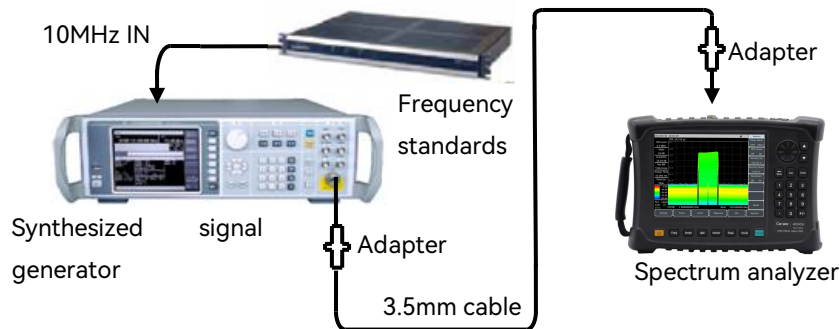


Figure 12-2 Frequency reference accuracy test

- 1) As shown in Figure 12-2, connect the test equipment and the frequency standard output port to the 10 MHz input port of the signal generator to enable external frequency standard ports to provide reference frequencies for the synthesized signal generator. Connect the RF output port of the synthesized signal generator to the RF input port of the spectrum analyzer (**if a frequency standard is not available, a signal generator with a high stability frequency reference option can be used instead**);
- 2) Set the output frequency f_0 of the synthesized signal generator to 9GHz and the output power to -10dBm;
- 3) Set the center frequency of the spectrum analyzer to 9GHz, the span to 2MHz, enable the frequency counting marker function and record the frequency counting measurement results f_s ;
- 4) Calculate the frequency reference accuracy according to Equation 1

$$S = (f_s - f_0) / f_0 \quad (1)$$

Record the frequency reference accuracy calculation results in the corresponding test items in the 4024CA Spectrum Analyzer Record Sheet. The aging rate, temperature stability and calibration accuracy are provided by the measurement certificates that are issued after batch sampling inspection.

12.2.2 Frequency range

Description: Test the frequency measurement range of the spectrum analyzer by using a 9kHz signal and a signal with the frequency of 9GHz. Use the high-frequency stable signal generator to send signals within the nominal upper and lower limits of the 4024CA spectrum analyzer to check whether

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the frequency measurement capability of the 4024CA is adequate.

a) Test equipment

Synthesized signal generator 1464A

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One BNC(m)-3.5mm(f) adapter

One 3.5mm (f)-N(m) adapter

c) Cable

One BNC (m-m) cable

One 3.5mm (m-m) cable

d) Test steps

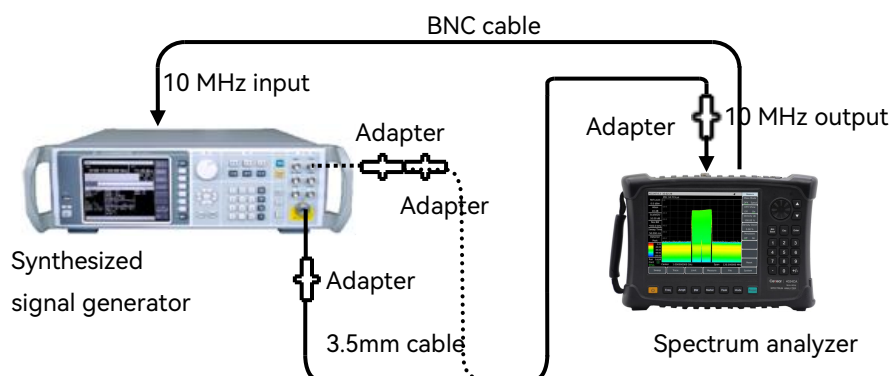


Fig. 12- 3 Frequency span test

1) Connect the test equipment by following the dotted line in Figure 12-3. The 1464A Synthesized signal generator provides reference frequencies for the spectrum analyzer. The low-frequency output port of the synthesized signal generator is connected to the RF input of the spectrum analyzer;

2) Set The synthesized signal generator as follows: Press **【Freq】** → **[LFOut]** → **【Freq】** (to 9kHz) → **[Ampt]** -10 dBm → **[Back]** → **[LFOut On Off]**.

3) Set the center frequency of the spectrum analyzer to 9 kHz, span to 1 kHz, reference level to 0 dBm, and resolution bandwidth to 10 Hz. For the other items, remain the default values. On the spectrum analyzer, press **【Peak】** . At this time, the cursor points to the maximum signal response; the marker amplitude value has no obvious jitter; the signal can be clearly distinguished. Then, record

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the center frequency as the lower-limit measured value of the frequency span; otherwise, record **Fail to meet the requirements**;

4) Connect the RF output of the 1464A Synthesized signal generator to the RF input of the spectrum analyzer with adapters and cables by following the solid lines of Figure 12- 3. Set the output frequency of the signal generator to 9GHz, the modulation function to off, and the output power to -10dBm;

5)Set the center frequency of the spectrum analyzer to 9 GHz, span to 1 kHz, reference level to 0 dBm, and resolution bandwidth to 10 Hz. For the other items, remain the default values. On the spectrum analyzer, press **【Peak】** . At this time, the cursor points to the maximum signal response; the marker amplitude value has no obvious jitter; the signal can be clearly distinguished. Then, record the center frequency as the upper-limit measured value of the frequency span; otherwise, record **Fail to meet the requirements**;

6) The test results in the corresponding test items in the 4024CA Spectrum Analyzer Record Sheet.

12.2.3 Frequency readout accuracy

Description: Frequency accuracy is used to represent the proximity of the frequency measurement indicator value of the spectrum analyzer to the corresponding true value. The frequency measurement indicator value of the spectrum analyzer during frequency scanning is subject to the influence of some factors such as frequency reference, span and RBW. Use an input signal with known frequency to test the accuracy of the frequency read out from the spectrum analyzer, which represents the degree of difference between the test indicator value and the true value. The smaller the difference, the higher the accuracy.

a) Test equipment

Synthesized signal generator 1464A

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One 3.5mm (f)-N(m) adapter

c) Cable

One 3.5mm (m-m) cable

d) Test steps

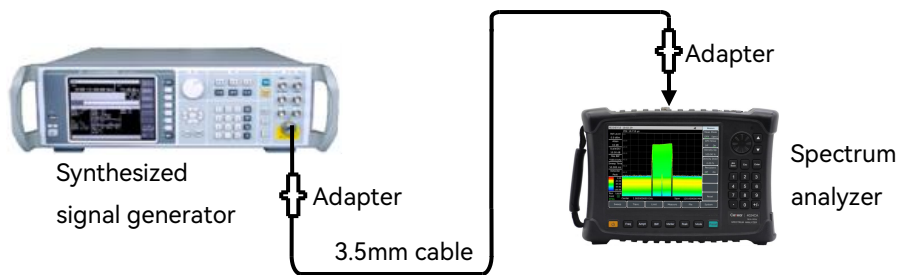


Figure 12-4 Block diagram of testing the accuracy of readout frequency

- 1) Connect the test equipment according to Figure 12- 4, in which the RF output of the signal generator is connected to the RF input of the spectrum analyzer;
- 2) Press the Reset key on the signal generator; set output frequency f_0 of the signal generator according to the “Frequency readout accuracy” item column of the “4024CA Spectrum Analyzer Recording Table”; set the power level to -10dBm , and turn on the RF output switch.
- 3) Set the center frequency of the spectrum analyzer to f_0 , span to 500 kHz, and reference level to 0dBm . For other items including resolution bandwidth and scan time, remain the default values.
- 4) Press **【Peak】** on the spectrum analyzer, and read out the peak signal frequency f_s through the cursor.
- 5) Calculate the error of frequency readout (Δf) by formula (2):

$$\Delta f = f_s - f_0 \quad (2)$$

- 6) Record Δf as the test result in the corresponding test item of the “4024CA Spectrum Analyzer Recording Table”.
- 7) Repeat steps 2 through 6 to test all combinations of frequencies and spans listed in the corresponding test items of the “4024CA Spectrum Analyzer Recording Table”.

12.2.4 Span

Description: Use two synthesized signal generators to send two signals of known frequency as the input of the spectrum analyzer. Set the center frequency of the spectrum analyzer to the middle value of the two frequencies. Measure the frequency difference between the two signals by using the cursor. Calculate and record the percentage of the error between the measured delta marker and the span. Enable the two signal generators to share a reference frequency with the spectrum analyzer.

Note: It can also be tested with a signal generator. Firstly set the center frequency and span of the spectrum analyzer, enable the frequency value of the first signal generator on the spectrum analyzer,

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and set the difference marker on the spectrum analyzer; then enable the frequency value of the second signal generator on the spectrum analyzer. Read the difference marker of the two signals on the spectrum analyzer and record it as the measured value. Enable the signal generator to share a reference frequency with the spectrum analyzer.

a) Test equipment

Synthesized signal generator 1464A

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One 3.5mm (f)-N(m) adapter

c) Cable

One BNC (m-m) cable

One 3.5mm (m-m) cable

d) Test steps

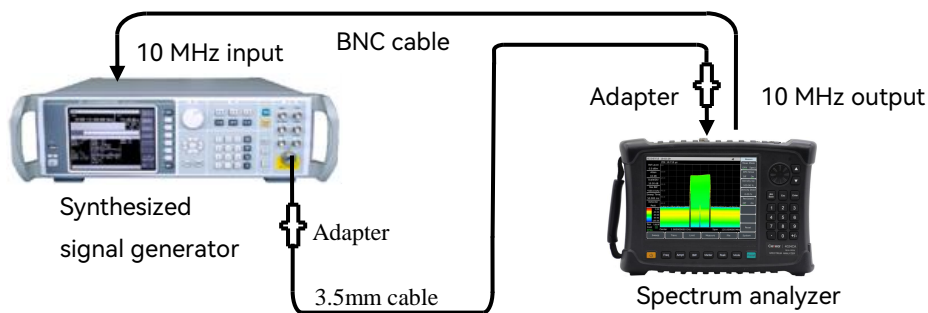


Figure 12- 5 Settings for testing span accuracy

- 1) Set the span directly on the operation display interface of the spectrum analyzer. If it meets the requirements of "the minimum span under non-zero span is 10Hz, the maximum span is full span, and the span can be set to 0Hz", record it as "√" in the span test items in *4024CA Spectrum Analyzer Record Sheet*, otherwise record it as "x";
- 2) Set the span of the spectrum analyzer to 99Hz, 100Hz and 101Hz respectively. If the set span can be correctly displayed on the measurement interface of the spectrum analyzer, the span meets the resolution requirements of 1Hz. Record the test results in the corresponding test column of span resolution in *4024CA Spectrum Analyzer Record Sheet*,
- 3) Connect the test instrument according to Figure 12-5. The synthesized signal generator provides frequency reference for the spectrum analyzer;

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- 4) Set the center frequency f_0 of the spectrum analyzer to 4.5GHz and reference level to 0dBm; set the span according to the “span accuracy” item column in the 4024CA Spectrum Analyzer Record Sheet.
- 5) Firstly set the output frequency of the signal generator to f_1 ($f_1 = f_0 - 0.4 \times \text{span}$ (set through the spectrum analyzer)), the power to -10 dBm, and the state of RF output to on.
- 6) Press **【Peak】** → **【Marker】** → [Delta] on the spectrum analyzer.
- 7) Set the output frequency of the signal generator to f_2 ($f_2 = f_0 + 0.4 \times \text{span}$), and the output power to -10 dBm.
- 8) Press the **【Peak】** key on the spectrum analyzer and move the delta marker to f_2 . After scanning is completed, read the frequency difference Δf of the two signals through the spectrum analyzer;
- 9) Record the frequency difference Δf and calculate the span accuracy by the following formula:

$$\text{Span accuracy} = 100 \times [\Delta f - (0.8 \times \text{span})] / (0.8 \times \text{span})\% \quad (3)$$

Record the results in the corresponding test items of the “4024CA Spectrum Analyzer Recording Table”.

- 10) Turn off all frequency markers and set the span of the spectrum analyzer and the frequency of the signal generator according to the spans of the spectrum analyzer in the Recording Table. Repeat steps 5 to 10 until all span tests are completed.

12.2.5 Sweep time

Description: The amplitude modulation signal is displayed on the spectrum analyzer at zero span, and the frequency of the modulation signal is adjusted so that the peaks are evenly spaced on the screen. The modulated signal frequency is counted and the actual sweep time is calculated, and then compared with the specified time, which is the sweep time accuracy. Sweep time accuracy is guaranteed by design, and a typical sweep time test is selected for verification in order to reduce test time.

a) Test equipment

Synthesized signal generator 1464A

Function generator Agilent 33250A

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One 3.5mm (f)-N(m) adapter

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c) Cable

Two BNC (m-m) cables

3.5mm cable (m-m) 1

d) Test steps

1) Connect the test equipment according to Figure 12-6. The output of the function generator is connected to the amplitude modulation input of the signal generator, the RF output of the signal generator is connected to the RF input of the spectrum analyzer to be tested, and The synthesized signal generator provides frequency reference for the spectrum analyzer;

2) If the center frequency of the spectrum analyzer is set to 3GHz, the span is set to 0Hz, the resolution bandwidth and video bandwidth are set to 10MHz respectively, and the number of sweep points is 201, the minimum settable sweep time is not greater than 10 μ s, and the maximum settable sweep time is 600s. If the above settings meet the requirements of "sweep time range (zero span)" in the 4024CA Spectrum Analyzer Record Sheet, it is recorded as "√", otherwise it is recorded as "×".

3) Reset the 1464A spectrum analyzer and set the frequency to 3 GHz, and power to -5 dBm. Press [MOD] [AM Menu] [AM Input], [Ext], [Return] to turn on the amplitude modulation switch and the RF output switch.

4) Use the soft keys on the Agilent 33250A to set the following: **[Ampt]** , 1 [Vrms], [Offset] 0 [v], [Output], and set the output waveform to [RAMP];

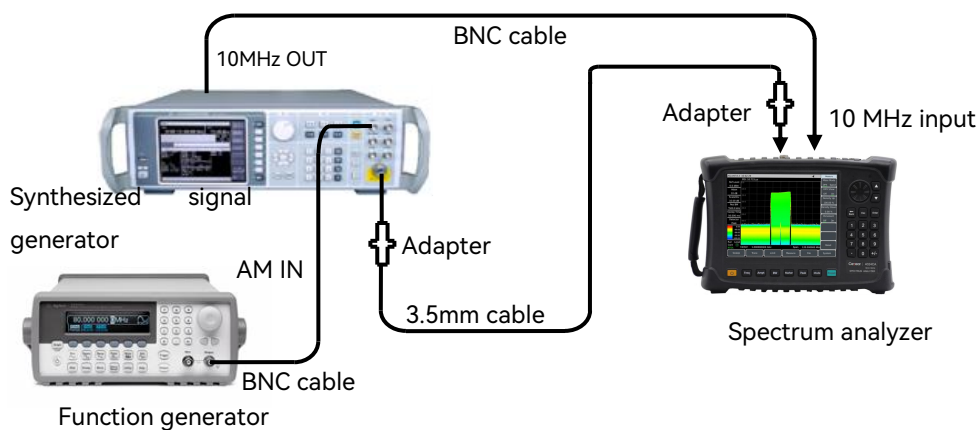


Figure 12-6 Sweep time accuracy test settings

5) Set the calibration type of the spectrum analyzer as linear, the peak detection mode, the sweep points to the default 1001 points, the resolution bandwidth to 3MHz, and the video bandwidth to 3MHz;

6) Set **[Freq]** → 10 → [kHz] on the Agilent 33250A. Set spectrum analyzer: [Sweep Time Auto Man]

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1 [ms], [Sweep Type Cont Single];

7) Set the spectrum analyzer: Press **【Peak】** , and place the marker on the first peak from the left through [Next pk Left] or [Next pk Right]. Press **【Marker】**, [Delta] and **【Peak】** to place the marker on the ninth peak from the left through [Next pk Left] or [Next pk Right]. Read the delta marker and calculate as follows:

$$\text{Sweep time error} = 100 \times ((\text{marker difference reading} \times 1.25 - \text{set sweep time}) / \text{set sweep time}) \% \quad (4)$$

And record the calculated data at the 1ms sweep time of the corresponding test item in the 4024CA Spectrum Analyzer Record Sheet.

8) Close the marker and repeat steps 6 to 7 for the other sweep times listed in the table. Set the modulation rate (Frequency) in step 6 according to the following equation:

$$\text{Modulation rate} = 10/\text{sweep time setting} \quad (5)$$

12.2.6 Resolution bandwidth

Description: Resolution bandwidth is used to represent the capability of the spectrum analyzer to clearly separate two input signals. It is subject to the influence of some factors such as IF filter bandwidth, phase noise, and sweep time. Most spectrum analyzers can be used to test different resolution bandwidths by using the LC filter, crystal filter, SAW, digital filter, etc.

Connect the output of the signal generator to the RF input of the spectrum analyzer. Set the span of the spectrum analyzer to approximately 2~3 times higher than the current resolution bandwidth (to ease the measurement of -3 dB bandwidth). Reduce the signal source output amplitude by 3 dB to determine the actual -3 dB point. After the marker reference is set, the output value of the signal source is increased by 3 dB and is returned back to the previous level. Then sweep is started. The delta marker is taken as the measured value of 3 dB bandwidth.

The readings in the spectrum analyzer usable for 3dB bandwidth test can be used as test values. The span error of spectrum analyzer may cause an error to the resolution bandwidth accuracy. Compared with the error of resolution bandwidth, the span error can be neglected.

a) Test equipment

Synthesized signal generator 1464A

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

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One 3.5mm (f)-N(m) adapter

c) Cable

One BNC (m-m) cable

One 3.5mm cable (m-m)

d) Test steps

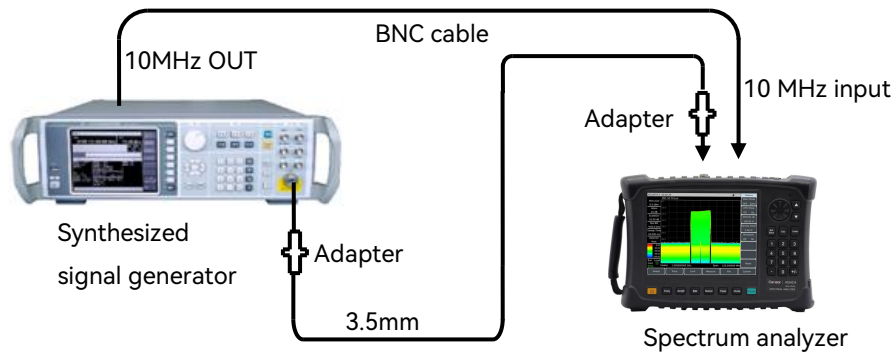


Figure 12-7 RBW test settings

- 1) Connect the test equipment according to Figure 12-7. The signal generator provides frequency reference for the spectrum analyzer;
- 2) Set the synthesized signal generator as follows: frequency is 100 MHz; power is -2 dBm; power step is 1 dB.
- 3) Set the minimum resolution bandwidth on the spectrum to 1Hz, and adjust the resolution bandwidth through the arrow keys. If the relationship of "range 1Hz-10MHz, step 1-3 times, 20MHz" is satisfied, then mark "√" on the corresponding test item in the 4024CA Spectrum Analyzer Record Sheet, otherwise mark "×" in the test result column;
- 4) Reset the spectrum analyzer; press **【Measure】** → [OBW] to open the function of measuring occupied bandwidths; select measurement method dBc and change dBc to -3.01 dB;
- 5) Set the center frequency of the spectrum analyzer to 100 MHz, span to 30 MHz, amplitude scale to 1dB/div, and resolution bandwidth to 10 MHz. For the other items, remain the default values.
- 6) Adjust the output power of The synthesized signal generator to make the signal be 2 to 3 divisions below the reference level;
- 7) Use 4024 spectrum analyzer to search the peak value; record the 3dB bandwidth marker difference $\Delta f_{-3\text{dB}}$ that is read out at this time; calculate the resolution bandwidth accuracy δ by the following formula and fill the result in the corresponding test item of the "4024CA Spectrum Analyzer Recording Table".

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$$\delta = \frac{\Delta f_{-3dB} - RBW}{RBW} \times 100\% \quad (6)$$

8) Set the spectrum analyzer according to the “Resolution bandwidth accuracy” item column of the “4024CA Spectrum Analyzer Recording Table”, with the span close to three times of the resolution bandwidth. Repeat steps 7 and 8 until all resolution bandwidth tests are completed.

12.2.7 RBW conversion uncertainty

Description: Connect the RF output of the synthesized signal generator to the input port of the spectrum analyzer; adjust the amplitude of output signals to make the signals be two or three divisions below the reference level of the spectrum analyzer. As The synthesized signal generator has a fixed amplitude, so you can change the resolution bandwidth of the spectrum analyzer and the difference between them equal to the resolution bandwidth conversion uncertainty. The spectrum analyzer has a resolution bandwidth with 1 to 3 steps.

a) Test equipment

Signal generator 1464A

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One 3.5mm (f)-N(m) adapter

c) Cable

One BNC (m-m) cable

3.5mm cable (m-m) 1

d) Test steps

1) Connect the equipment as shown in Figure 12-8. The synthesized signal generator 1464A provides frequency reference for the spectrum analyzer;

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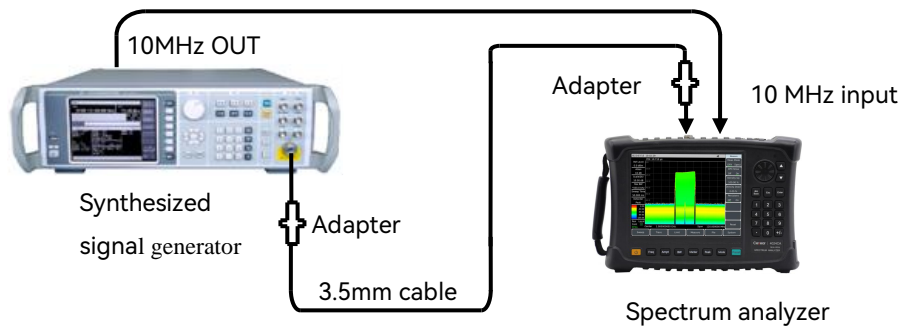


Figure 12-8 RBW conversion uncertainty test settings

2) Set the spectrum analyzer as follows:

Center frequency	2,000 MHz
Span.....	10 MHz
Logarithmic scale dB/div.....	1dB
Resolution bandwidth	auto
RBW/VBW	10
SPAN/RBW	100

3)At this time, the resolution bandwidth that the spectrum analyzer automatically associates with is 100 kHz. Press **【Peak】** on the spectrum analyzer to set the peak value of the cursor, and set the cursor to the delta mode;

4)Set the span of the spectrum analyzer according to the resolution of the corresponding test item in the “4024CA Spectrum Analyzer Recording Table”. Set the ratio of the span to the resolution bandwidth to 100 (the 10 MHz resolution bandwidth needs to be set manually, and the other resolution bandwidths are automatically adjusted according to the changes of span).

5)Search the peak value and read the amplitude difference value of the delta marker, which should be recorded as the uncertainty of current resolution bandwidth conversion in the “4024CA Spectrum Analyzer Recording Table”.

6)Repeat steps 4 and 5 until all resolution bandwidths are tested.

12.2.8 Sideband noise

Description: Sideband noise is an indicator to represent the short-term stability of the local oscillator signal frequency of the spectrum analyzer.

Measure the sideband noises of the 1.0GHz and 0 dBm reference signals at the deviation points of

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10kHz, 100kHz, 1MHz and 10MHz from the carrier wave. Average the sideband noise at each frequency deviation point by using the noise marker and video averaging function. If there is a spurious response at the set frequency deviation point, deviate the marker from the spurious response to ensure the measurement accuracy.

a) Test equipment

Synthesized signal generator 1464A

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One 3.5mm (f)-N(m) adapter

c) Cable

One BNC (m-m) cable

3.5mm cable (m-m) 1

d) Test steps

1) Connect the test instrument according to Figure 12-9. The synthesized signal generator provides frequency reference for the spectrum analyzer;

2) Set the output frequency of the signal generator to 1GHz and the output power to 0dBm;

3) On the spectrum analyzer, set the frequency to 1 GHz, span to 30 kHz, and the amplitude (reference level) to 0 dBm.

4) Press **【Peak】** → **【Marker】** → **[Delta]** on the spectrum analyzer to set the delta marker to 10 kHz, and turn on the noise marker;

5) Set the resolution bandwidth and video bandwidth according to Table 12- 2; enable the average function; and perform 10 times of average.

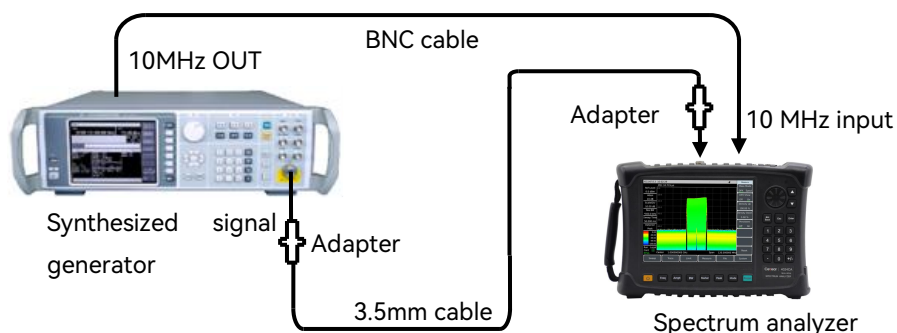


Figure 12- 9 Schematic diagram of sideband noise test

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6) Record the delta marker amplitude value as the sideband noise of +10 kHz offset in the corresponding measuring item of the “4024CA Spectrum Analyzer Recording Table”.

7) Press “ **【Marker】** → 10 [kHz]” on the spectrum analyzer and record the delta marker amplitude value as the sideband noise at the -10 kHz offset point;

8) Set the spectrum analyzer according to table 12- 2; test the SSB noise at the deviation points of ± 100 kHz, ± 1 MHz and ± 10 MHz successively; record the delta marker amplitude value in the corresponding test item of the “4024CA Spectrum Analyzer Recording Table”. If there is a spurious response at the frequency deviation point under test, keep away from the spurious response when reading the marker value in the test.

Table 12-2 Sideband noise measurement settings

Offset frequency Δf	Span	RBW	Video bandwidth and average
± 10 kHz	30kHz	300Hz	Video bandwidth 30Hz; average <u>ON</u>
± 100 kHz	300kHz	3kHz	Video bandwidth is 300Hz; average <u>ON</u>
± 1 MHz	2.2MHz	10kHz	Video bandwidth 1kHz; average <u>ON</u>
± 10 MHz	25MHz	100kHz	Video bandwidth 10kHz; average <u>ON</u>

12.2.9 Displayed average noise level (DANL)

Description: The displayed average noise level refers to the background noise observed by the spectrum analyzer when there is no additional noise or signal.

The input port of the spectrum analyzer is connected to a 50 Ω load. The normalized noise value observed when the input attenuation value is set to 0dB is the measured value of the displayed average noise level. During the test, if the zero frequency amplitude is found to be high, the test of this indicator should be started after the zero frequency calibration; if there is a Residual responses point in the test process, the Residual responses should be avoided for the test of this indicator.

a) Test equipment

50 Ω load

b) Test steps

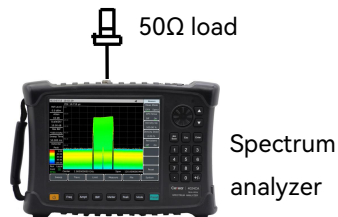


Figure 12- 10 Settings for the test of displayed average noise level

1) Connect the 50Ω load to the RF input port of the spectrum analyzer according to Figure 12- 10;

Displayed average noise; the preamplifier is on (2 MHz-3 GHz)

2) Set the spectrum analyzer as follows:

Start frequency.....	2MHz
Stop frequency.....	3MHz
Reference level.....	-50dBm
Marker.....	All Off
Resolution bandwidth.....	100kHz
Video bandwidth.....	30kHz
Video type.....	Logarithm
Pre-amplifier.....	On
Detector type.....	Mean

3) Press **【Marker】** → [Marker Noise Off On] → **【Peak】** → [Peak Search] .

4) Press **【BW】** → [Average Off On] → “5” → [Enter]; wait until “average 5/5” is shown on the left side of the screen.

5) Read the peak value of the marker as the displayed average noise level of the 2 MHz-3 GHz frequency band in the case that the preamplifier is on, and record it in the corresponding test item of the “4024CA Spectrum Analyzer Recording Table”. Turn off the noise cursor and the average function.

Displayed average noise; the preamplifier is on (3GHz-9GHz)

6) Set the start frequency of the spectrum analyzer to 3GHz, the stop frequency to 9GHz; and make the others unchanged;

7) Repeat steps 3 to 4;

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8) Read the peak value of the cursor as the displayed average noise level of the 3 GHz–9 GHz frequency band in the case that the preamplifier is on, and record it in the corresponding test item of the “4024CA Spectrum Analyzer Recording Table”. Turn off the noise cursor and the average function.

Displayed average noise; the preamplifier is off (2 MHz–3 GHz)

9) Set the start frequency of the spectrum analyzer to 2 MHz, the stop frequency to 3 GHz, the reference level to -20dBm, the preamplifier to be off; and make the others unchanged;

10) Repeat steps 3 to 4;

11) Read the peak value of the cursor as the displayed average noise level of the 2 MHz–3 GHz frequency band in the case that the preamplifier is Off, and record it in the corresponding test item of the “4024CA Spectrum Analyzer Recording Table”. Turn off the noise cursor and the average function.

Displayed average noise; the preamplifier is off (3GHz–9 GHz)

12) Set the start frequency of the spectrum analyzer to 3 GHz, the termination frequency to 9 GHz, the reference level to -20dBm, the preamplifier to be off; and make the others unchanged;

13) Repeat steps 3 to 4;

14) Read the peak value of the cursor as the displayed average noise level of the 3 GHz–9 GHz frequency band in the case that the preamplifier is Off, and record it in the corresponding test item of the “4024CA Spectrum Analyzer Recording Table”. Turn off the noise cursor and the average function.

Displayed average noise; the preamplifier is on(9kHz–2 MHz)

15) Set the start frequency of the spectrum analyzer to 9 kHz, the stop frequency to 100 kHz, the reference level to -50dBm, the resolution bandwidth to 100Hz, the video bandwidth to 30Hz, the preamplifier on, and the detector type to average;

16) Repeat steps 3 to 4;

17) Read the peak value of the cursor as the displayed average noise level of the 9 kHz–100 kHz frequency band in the case that the preamplifier is on, and record it in the corresponding test item of the “4024CA Spectrum Analyzer Recording Table”. Turn off the noise cursor and the average function;

18) Set the start frequency and stop frequency of the 4024CA spectrum analyzer to 100kHz and 2MHz respectively, measure the average noise level indicator displayed when the 100kHz–2MHz band preamplifier is turned on and record the measurement results according to steps 15–17.

Displayed average noise; the preamplifier is off (9kHz-2 MHz)

19) Set the start frequency of the 4024CA spectrum analyzer to 9 kHz, the stop frequency to 10 kHz, the reference level to -20dBm, the resolution bandwidth to 100Hz, the video bandwidth to 30Hz, the preamplifier off, and the detector type to average;

20) Repeat steps 3 to 4;

21) Read the peak value of the cursor as the displayed average noise level of the 9 kHz-100 kHz frequency band in the case that the preamplifier is off, and record it in the corresponding test item of the “4024CA Spectrum Analyzer Recording Table”. Turn off the noise cursor and the average function;

22) Set the start frequency and stop frequency of the 4024CA spectrum analyzer to 100kHz and 2MHz respectively, measure the average noise level indicator displayed when the 100kHz-2MHz band preamplifier is turned off and record the measurement results according to steps 19-21.

12.2.10 Second harmonic distortion

Description: When a signal is input to a nonlinear device (such as a mixer and amplifier, etc.), the nonlinear device will generate the harmonics of the input signal, and the unwanted second harmonic component attached to the signal is called for second harmonic distortion.

The synthesized signal generator provides a signal to the spectrum analyzer to measure the second harmonic distortion via a low pass filter. The low pass filter removes any harmonic distortion from the signal source. The synthesized signal generator is locked to the 10 MHz reference of the spectrum analyzer.

a) Test equipment

Synthesized signal generator 1464A

One 1.0 GHz low-pass filter

One 2.0 GHz low-pass filter

One 3.0 GHz low-pass filter

b) Adapter

One 3.5mm(f)-3.5mm(f) adapter

One 3.5mm (f)-N(m) adapter

c) Cable

One BNC (m-m) cable

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3.5mm cable (m-m) 1

d) Test steps

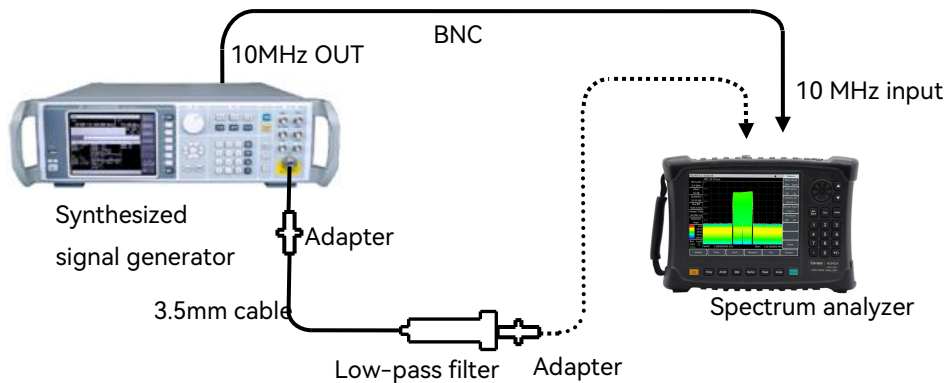


Figure 12-11 Second harmonic distortion test settings

1) Connect the test instrument as shown in Figure 12-11. The synthesized signal generator provides 10MHz frequency reference for the spectrum analyzer and selects a 1GHz low-pass filter;

2) Set the 1464B frequency to 900MHz, the amplitude to -30dBm, and the RF output is on;

3) Set the spectrum analyzer as follows (other items remain the default settings of the system):

Center frequency 900 MHz

Span 10 kHz

Reference level -30dBm

4) Press **【Peak】** on the spectrum analyzer. Adjust the 1464A power level so that the spectrum analyzer reads -30dBm ±0.1dB;

5) Press **【Marker】** → [Delta] and set the center frequency to 1.8GHz;

6) Press **【Peak】** after the spectrum analyzer has completed a new sweep. Record the delta marker reading in the corresponding test item of 4024CA Spectrum Analyzer Record Sheet as the second harmonic distortion value;

7) Select the filter and adapter of appropriate frequency band to suppress the harmonic generated by the signal generator itself. Refer to steps 1-6 to test 1.9GHz, 2.5GHz and 4.2GHz as the test points of 1.2GHz-2GHz, 2GHz-2.6GHz and 2.6GHz-4.5GHz respectively. Test the second harmonic distortion index and record it in the test result column of the corresponding test item in the 4024CA Spectrum Analyzer Record Sheet.

12.2.11 Third-order intermodulation distortion

Description: Third-order intermodulation distortion is a useless frequency component formed by the interaction of the spectral components of two or more input signals due to the nonlinearity of the device.

Two Synthesized signal generators generate two sine wave signals with a frequency interval of 100kHz and the same power and input them to the spectrum analyzer at the same time. The marker function of the spectrum analyzer is used to indirectly measure the third-order intermodulation distortion products.

a) Test equipment

Power meter	ML2437A
Power sensor	MA2445D
Synthesized signal generator 1	1464A
Synthesized signal generator 2	1464A
RF directional coupler	70607

Two 1.0 GHz low-pass filters

Two 2.0 GHz low-pass filters

Two 6.8 GHz low-pass filters

b) Adapter

Three 3.5mm(f)-3.5mm(f) adapters

One BNC T(m) (f)(f) adapter

One 3.5mm (m)-N(m) adapter

c) Cable

Two BNC (m-m) cables

Two 3.5mm (m-m) cables

d) Test steps

12.2 Performance characteristics test

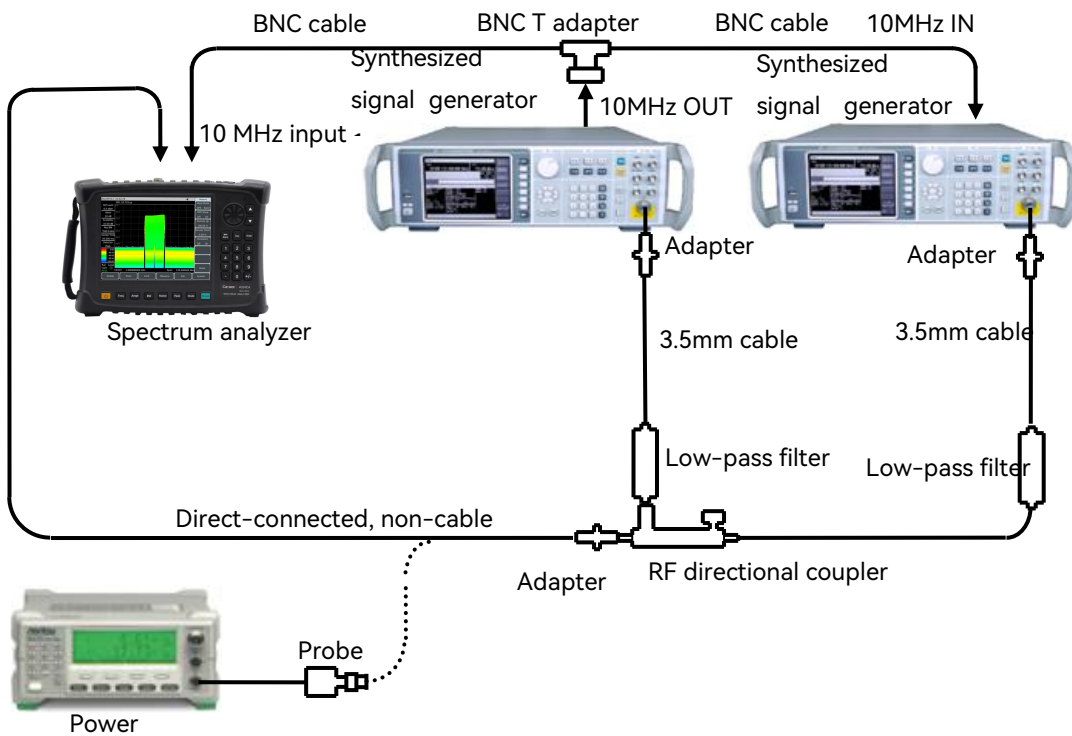


Figure 12-12 Third-order intermodulation distortion test settings (50MHz-4GHz)

1) Connect the instrument as shown in Figure 12-12, select the appropriate low-pass filter and adapter according to the test frequency point, and do not connect the directional coupler to the spectrum analyzer;

2) Set the frequency of synthesized signal generator 1 to 900MHz, the amplitude to 0dBm and the RF output ON;

3) Reset the synthesized signal generator 2 and set the frequency to 900.1 MHz, the amplitude to -110 dBm and the RF output OFF;

4) Connect the power meter ML2437A to the Power sensor MA2445D and zero it. Set the calibration factor frequency of the power meter to 900mh;

5)Set the spectrum analyzer as follows (other items remain the default settings of the system):

- Center frequency 900 MHz
- Frequency step 100MHz
- Span 1kHz
- Reference Level -10 dBm

6) Connect the power sensor to the output of the RF directional coupler with an adapter instead of a cable;

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- 7) Adjust the output amplitude of the synthetic signal generator 1 so that the display reading of the power meter is close to -15dbm;
- 8) Remove the power sensor from the RF directional coupler. The directional coupler is directly connected to the RF input of the spectrum analyzer with an adapter;
- 9) Press **【Peak】** on the spectrum analyzer and wait for the new sweep to complete. Press **【Marker】** → [Delta] → **【Freq】** → [↑];
- 10) Turn on the RF output on the synthesized signal generator 2, and set the power to - 15dBm;
- 11) Press **【Peak】** on the spectrum analyzer;
- 12) Adjust the power level of synthesized signal generator 2 so that the delta marker reading of the spectrum analyzer is close to 0dB;
- 13) Press **【Marker】** → [Delta] → **【Freq】** [↓] [↓] on the spectrum analyzer and wait for the new sweep to complete. Press **【BW】** → [Average Off On] → 5 → [Enter]. Wait for the video to average 5 times and then press **【Peak】** .
- 14) The peak marker reading of the spectrum analyzer is the low-end third-order intermodulation distortion product ΔA . The third-order intercept point (where L_0 is the mixer level) is calculated according to the following equation based on the third-order intermodulation product.

$$TOI = L_0 - \frac{\Delta A}{2} \quad (7)$$

- 15) Press **【Freq】** → [↑][↑][↑] on the spectrum analyzer, wait for a new sweep to complete, and press **【Peak】** ;
- 16) The marker delta at this point is the product of high-end intermodulation distortion. Calculate the third-order intercept point at this point according to Equation 7, compare the high-end intermodulation distortion product with the low-end intermodulation distortion product, and record the smaller value as the final test result in the corresponding test item of the 4024CA Spectrum Analyzer Record Sheet;
- 17) Connect the test equipment as shown in Figure 12-12, select the appropriate filter, adapter and directional coupler, and refer to steps 1-16 to select 3GHz, 4.5GHz and 6GHz as the test points for the three frequency bands of 2.4GHz-4GHz, 4GHz-5.2GHz and 5.2GHz-9GHz, test the third-order intercept point indicators and record them in the test table.

12.2.12 1dB gain compression

Description: When the input signal level increases, the frequency spectrum analyzer mixer, amplifier and other unit circuits can work close to the saturation point. At this time, the output signal

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component no longer changes linearly with the input signal. Usually, the 1dB compression point is represented by the input level corresponding to the 1dB lower output deviation from the linear value.

This test measures the gain compression of the spectrum analyzer with two signals spaced 10MHz apart. Firstly, input the small signal on the spectrum analyzer (lower than -10dBm). Then input the specified large amplitude signal on the spectrum analyzer. The decrease in the amplitude of the first signal caused by the second signal is the measured gain compression.

a) Test equipment

Power meter	ML2437A
Power sensor	MA2445D
Synthesized signal generator 1	1464A
Synthesized signal generator 2	1464A
RF directional coupler	70607

b) Adapter

Two 3.5mm (f)-3.5mm (f) adapters

One BNC T(m) (f)(f) adapter

One 3.5mm (m)-N(m) adapter

c) Cable

Two BNC (m-m) cables

3.5mm cable (m-m) 2

d) Test steps

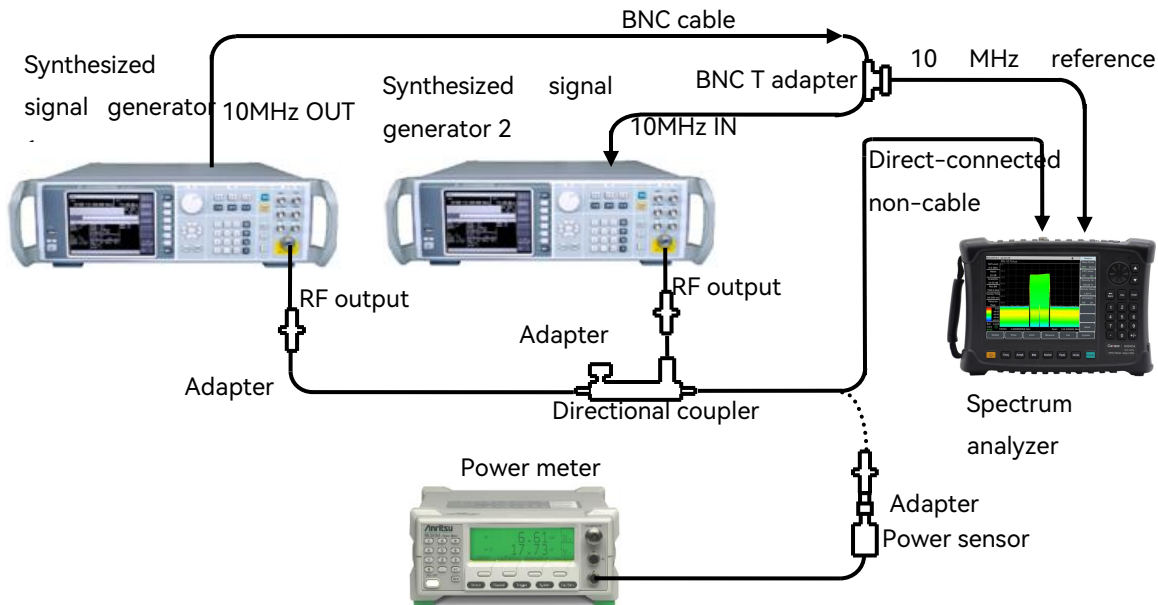
12.2 Performance characteristics test

Figure 12-13 1dB gain compression test block diagram

- 1) Connect the power meter ML2437A to the Power sensor MA2445D and zero it;
- 2) Connect the test instrument as shown in the solid line in Figure 12-13. The synthesized signal generator 1 provides 10MHz frequency reference for the spectrum analyzer and the synthesized signal generator 2;
- 3) Reset the synthesized signal generator 2 and set the frequency to 1.5GHz, the power to 0dBm, external reference, and the RF output ON;
- 4) Reset the synthesized signal generator 1 and set the frequency to 1.53GHz, the power to 0 dBm, external reference, and the RF output OFF;
- 5) Set the spectrum analyzer as follows (other items remain the default settings of the system):

Center frequency	1.5GHz
Span	1kHz
Reference Level	-10 dBm
Logarithm scale	1dB/div
- 6) Adjust the output power level of synthesized signal generator 2 so that the signal peak value is 2-3 divisions below the reference level of the spectrum analyzer;
- 7) Press **【Peak】** → **【Marker】** → **[Delta]** on the spectrum analyzer to turn on the delta marker function. Turn on the RF output of synthesized signal generator 1. Adjust the output power level of

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synthesized signal generator 1 so that the delta marker reading of the spectrum analyzer is close to -1dB. Turn off the output of synthesized signal generator 2;

9) Disconnect the RF directional coupler output from the spectrum analyzer. Connect to the Power sensor following the dashed line in Figure 12-13, and set the power meter frequency to 2GHz. At this point, the power meter reads 1dB compression point in the 50MHz-4GHz band. Record the test result in the 4024CA Spectrum Analyzer Record Sheet;

10) Select the adapter and directional coupler of appropriate frequency band. Refer to steps 1-9, select 3.5GHz, 4.5GHz and 8GHz as the test points of 2.4GHz-4GHz, 4GHz-5.2GHz and 5.2GHz-9GHz respectively, test the 1dB gain compression index and record the test results in the 4024CA Spectrum Analyzer Record Sheet.

12.2.13 Image, multiple and out-of-band responses

Description: During frequency mixing, two input signals can generate the same IF signal with that of the LO signal with the same frequency, with one signal frequency one IF lower than the LO and another signal frequency one IF higher than the LO. In this case, one of the signals is called the mirror frequency of the other. Each frequency of the LO has a mirror frequency of corresponding input signal, with the difference of two IFs between the signal and frequency of the mirror frequency.

Test the image, multiple and out-of-band responses on all frequency bands. The signal is applied to the input port of the spectrum analyzer for reference amplitude measurement. The synthesized signal generator is then tuned to a frequency that causes a mirror, multiple or out-of-band response, and the amplitude displayed on the spectrum analyzer is measured and recorded.

a) Test equipment

Synthesized signal generator 1464A

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One 3.5mm (f)-N(m) adapter

c) Cable

One BNC (m-m) cable

3.5mm cable (m-m) 1

d) Test steps

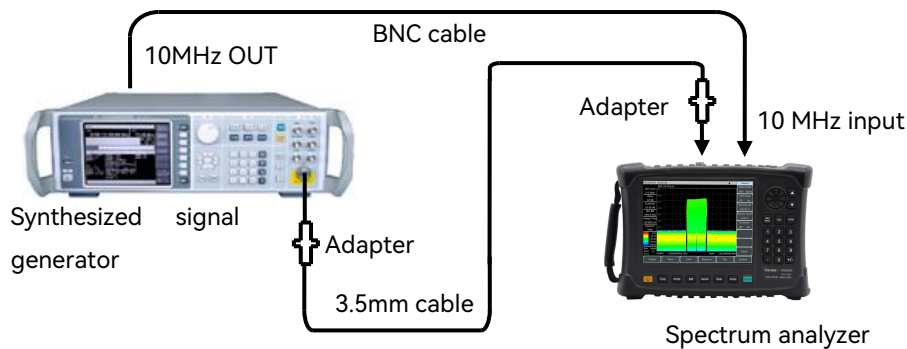


Figure 12-14 Mirror, multiple and out-of-band response test settings

1) Connect the test instrument according to Figure 12-14. The synthesized signal generator 1464A provides frequency reference for the spectrum analyzer;

2) Set the frequency of synthesized signal generator 1464A to 2GHz and power to -10dBm;

3) Set the spectrum analyzer as follows:

Center frequency 2GHz

Span 10kHz

Reference Level -10 dBm

Resolution bandwidth 100kHz

Video bandwidth 10kHz

4) Adjust the output power level of synthesized signal generator so that the signal peak is close to the reference level of the spectrum analyzer.

5) On the spectrum analyzer, choose **【Peak】** → **【Marker】** → [Delta].

6) Set 1464B to each frequency point listed in the corresponding test item of the 4024CA Spectrum Analyzer Record Sheet corresponding to 2 GHz where Image, multiple and out-of-band responses may occur, set the reference level of the spectrum analyzer to -40 dBm, press **【Peak】**, and record the delta marker amplitude value as the response amplitude in the corresponding test item of the 4024CA Spectrum Analyzer Record Sheet;

7) For the Image, multiple and out-of-band responses of the residual frequency points listed in the 4024CA Spectrum Analyzer Record Sheet, refer to the settings in steps 2-6 until the test of all frequencies is completed.

12.2.14 Residual responses

Description: it refers to the discrete response displayed on the display when the spectrum analyzer

12.2 Performance characteristics test

has not connected with any input signal.

a) Test equipment

50Ω load

b) 5 Test steps

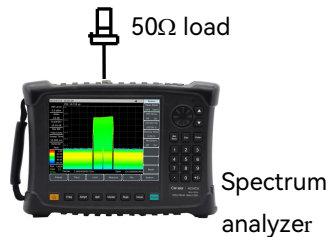


Figure 12-15 Residual responses test settings

Residual responses, 10MHz-9GHz (Preamplifier ON)

1) Connect test instruments according to Figure 12-15. Connect a 50Ω load on the spectrum analyzer signal input port and set up the spectrum analyzer as follows:

- Center frequency65 MHz
- Frequency step 100MHz
- Span 110MHz
- Reference level-50dBm
- Pre-amplifier ON
- Resolution bandwidth 10kHz
- Video bandwidth3kHz

2) Turn on the limit line function, set the upper limit line to -95dbm, and the noise level should be at least 5dB below the limit line. If not, it is necessary to reduce the noise level by reducing the resolution bandwidth and video bandwidth;

3) Observe whether there is Residual responses on the noise analyzer baseline of the spectrum analyzer. If yes, use the marker to read the Residual responses amplitude and record the measurement result. The test should be such that the amplitude of the Residual responses signal is greater than the display average noise level by more than 10 dB. If the Residual responses signal amplitude is small, the resolution bandwidth should be further reduced to minimize the display average noise level;

4) Press **【Freq】** → [Center Freq] → [↑] to change the center frequency. Repeat step 3 to check

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the Residual responses at frequencies up to 9 GHz and record the maximum value of the measured response in the measurement results of the corresponding test items in the 4024CA Spectrum Analyzer Record Sheet;

Residual responses, 10MHz-9GHz (Preamplifier OFF)

5) Set the spectrum analyzer as follows:

Center frequency65 MHz
 Frequency step 100MHz
 Span 110MHz
 Reference level-20dBm
 Pre-amplifierOFF
 Resolution bandwidth 10kHz
 Video bandwidth3kHz

6) Turn on the limit line function, set it to -82dBm, and the noise level should be at least 5dB below the limit line. If not, it is necessary to reduce the noise level by reducing the resolution bandwidth and video bandwidth;

7) Observe whether there is Residual responses on the noise analyzer baseline of the spectrum analyzer. If yes, use the marker to read the Residual responses amplitude and record the measurement result. The test should be such that the amplitude of the Residual responses signal is greater than the display average noise level by more than 10 dB. If the Residual responses signal amplitude is small, the resolution bandwidth should be further reduced to minimize the display average noise level;

8) Press **【Freq】** → [Center Freq] → [↑] to change the center frequency. Repeat step 7 to check the Residual responses when the frequency reaches 9GHz and the preamplifier is turned off, and record the maximum value of the measured response in the measurement results of the corresponding test items in the 4024CA Spectrum Analyzer Record Sheet.

12.2.15 Reference level

Description: The vertical scale position that has been calibrated on the spectrum analyzer screen is used as the reference of amplitude measurement. The reference level usually refers to the top scale line. Reference level switching may cause a linkage of gain/attenuation. The error of reference level conversion is used to check the switching gain error of the spectrum analyzer.

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Note: If the error is large when the power meter performs a measurement at -60 dBm, the test result of -50dbm can be directly reduced by 10dB, or a calibrated 10dB attenuator can be connected to the input port of the spectrum analyzer for testing.

a) Test equipment

Signal generator.....	1464A
Power meter	ML2437A
Power sensor	MA2445D
Power splitter	81313

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One 3.5mm (m)-N(m) adapter

c) Cable

One BNC (m-m) cable

3.5mm cable (m-m) 1

d) Test steps

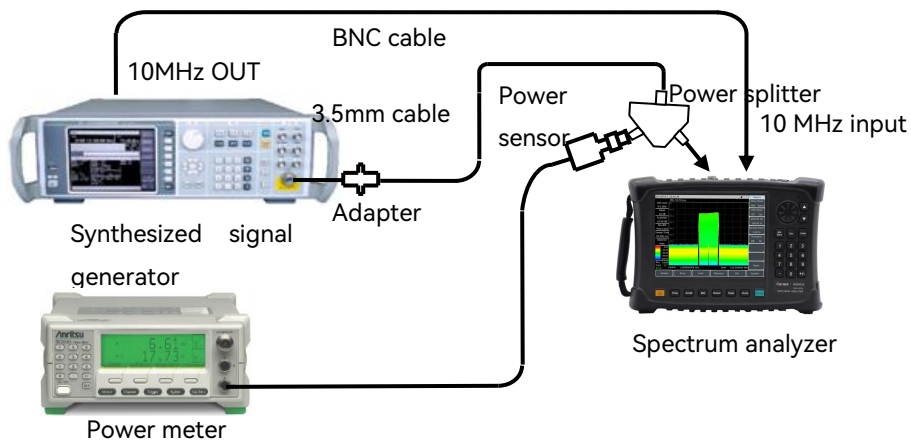


Figure 12- 16 Settings for the test of reference level uncertainty and scale fidelity

1) Connect the power meter ML2437A to the Power sensor MA2445D, conduct zero calibration on them, and set the calibration factor frequency to 50 MHz;

2) Connect the test equipment according to Figure 12-16. The synthesized signal generator 1464A provides reference frequencies for the spectrum analyzer. The output ends of the signal generator are respectively connected to the spectrum analyzer and the Power sensor via a power splitter;

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3) Set **【Ampt】** → [Ref Level] on the 4024 spectrum analyzer, and use the rotary knob or step key [↑] [↓]. If the maximum and minimum reference levels can be set to +30dBm and -120dBm respectively, the indicator of reference level range is up to the requirement and the corresponding test item of the “4024 Spectrum Analysis Recording Table” should be marked as “√”; otherwise, it should be marked as “x”;

4) Set the output frequency of the 1464A to 50 MHz and adjust the output power to make the power meter reads -3 dBm ±0.05dB;

5) Set the spectrum analyzer as follows:

Center frequency50 MHz
 Reference level 0 dBm
 Span 1 kHz
 Logarithmic scale dB/div 1 dB
 Resolution bandwidth 100kHz

6) Press **【Peak】** → **【Marker】** → [Delta] on the spectrum analyzer.

7) Adjust the output power of the signal generator to reduce the power meter reading by 10dB ±0.02dB;

8) Set the reference level of the spectrum analyzer listed in the “4024CA Spectrum Analyzer Recording Table”; wait until the scanning is completed; and then press **【Peak】** ;

9) Record the delta marker amplitude read out through the spectrum analyzer; make calculation by the formula: delta marker amplitude read out through the spectrum analyzer - current reference level; record the calculating data as the uncertainty of current reference level in the corresponding test item of the “4024CA Spectrum Analyzer Recording Table”.

10) Repeat steps 7 through 9 to set the residual reference levels listed in the corresponding test items of the “4024CA Spectrum Analyzer Recording Table”.

12.2.16 Scale fidelity

Description: Scale fidelity is the error between the vertical scale and theoretical value of the spectrum analyzer screen, which is used to check the linearity of the analog-to-digital converter of spectrum analyzer.

Test the fidelity at 10 dB/div, and the resolution bandwidth is set to 10 Hz, and the initial amplitude of the input signal is set at the 0 dBm reference level. When the signal amplitude is reduced, compare the displayed signal amplitude with the reference level. The signal generator provides a 10

12.2 Performance characteristics test

MHz reference frequency for the spectrum analyzer.

Note: If the error is large when the power meter performs a measurement at -60dBm, the test result of -50dbm can be directly reduced by 10dB, or a calibrated 10dB attenuator can be connected to the input port of the spectrum analyzer for testing.

a) Test equipment

Signal generator.....	1464A
Power meter	ML2437A
Power sensor	MA2445D
Power splitter	81311

b) Adapter

- One 3.5mm (f)-3.5mm (f) adapter
- One 3.5mm (m)-N(m) adapter

c) Cable

- One BNC (m-m) cable
- 3.5mm cable (m-m) 1

d) Test steps

1) Connect the power meter to the Power sensor and perform zero calibration; set the calibration factor frequency to 50 MHz;

2) Connect the test equipment according to Figure 12-16. The synthesized signal generator 1464A provides frequency reference for the spectrum analyzer. The output ends of the signal generator are respectively connected to RF input port of the spectrum analyzer and the power sensor via a power splitter;

3) Set the spectrum analyzer as follows (other items remain the default settings of the system):

Center frequency	50 MHz
Reference level	0 dBm
Marker	Off
Span	1 kHz
Resolution bandwidth	10Hz

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- 4) Set the frequency of the 1464A to 50 MHz, the amplitude to 6dB, and the amplitude step to 0.05dB;
- 5) Press **【Peak】** on the spectrum analyzer;
- 6) Adjust the output amplitude of the 1464A until the power meter reads $0\text{dBm} \pm 0.05\text{dB}$;
- 7) Press **【Peak】** → **【Marker】** → [Delta] on the spectrum analyzer.
- 8) Adjust the output signal amplitude of the 1464A to reduce the power meter reading by $10\text{dB} \pm 0.05\text{dB}$;
- 9) Make calculation by the formula: delta marker amplitude read out through the spectrum analyzer - power variation value of the signal source, and record the calculating data in the corresponding test item of the “4024CA Spectrum Analyzer Recording Table”; then repeat steps 8 and 9.

12.2.17 Absolute amplitude accuracy

Description: The Absolute amplitude accuracy means the difference between the power reading of the synthesized signal generator tested on the power meter and the reading of the signal generator tested on the spectrum analyzer. The Absolute amplitude accuracy is affected by the front-end program-controlled step attenuator and the frequency response of the microwave and millimeter-wave frequency conversion channel. The amplitude accuracy of each frequency is tested respectively when the attenuation is 0 dB and when the attenuation is set to different values, to ensure the test comprehensiveness.

a) Test equipment

Synthesized signal generator	1464A
Power meter	ML2437A
Power sensor	MA2445D
Power splitter	81311

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One 3.5mm (m)-N(m) adapter

c) Cable

One BNC (m-m) cable

3.5mm cable (m-m) 1

12.2 Performance characteristics test

d) Test steps

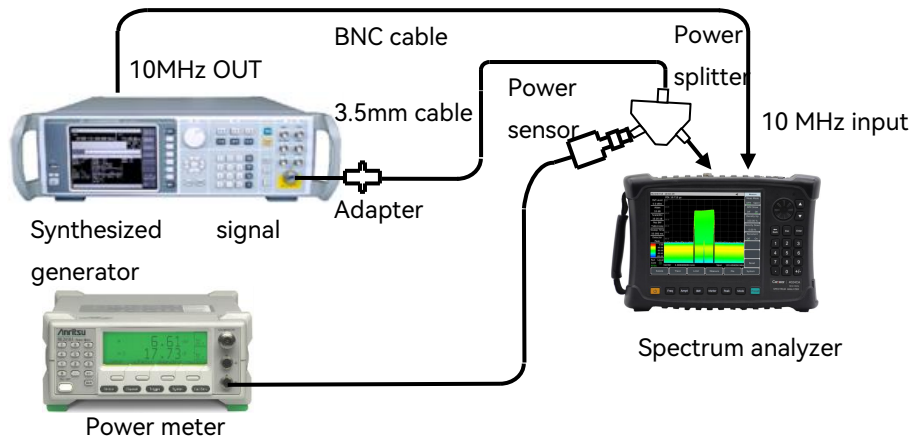


Figure 12- 17 Test settings for Absolute amplitude accuracy

- 1) Connect the power meter to the Power sensor, and conduct zero calibration on them.
- 2) Connect the test equipment as shown in Figure 12-17. To be specific, connect the output port of the signal generator to the SUM port of the power splitter, and ports 1 and 2 to the RF input port of the spectrum analyzer and the Power sensor respectively.

Absolute amplitude accuracy (Preamplifier OFF)

- 3) Set the frequency of signal generator 1464A to 10MHz and the output power to -15dbm;
- 4) Set the spectrum analyzer as follows:

Center frequency	10 MHz
Span.....	100kHz
Reference Level.....	-10 dBm
Pre-amplifier.....	0dB
Resolution bandwidth	1kHz
Video bandwidth.....	100Hz
- 5) Set the calibration factor frequency of the power meter to be the same as that of the signal generator, and adjust the output power level of 1464A to make the power meter reading close to -25dBm;
- 6) Set the spectrum analyzer marker to the peak value, read the level value L indicated by the marker of the spectrum analyzer and the test reading L_{power_meter} on the power meter, and calculate the

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Absolute amplitude accuracy ΔL as follows:

$$\Delta L = L - L_{power_meter} \quad (8)$$

7) Record the calculated ΔL in the 4024CA Spectrum Analyzer Records as the test results of the Absolute amplitude accuracy.

8) Change the frequency settings of the signal generator 1464A, power meter, and spectrum analyzer according to the 4024CA Spectrum Analyzer Record Sheet, and repeat steps 3-7 until all frequency points are tested when the preamplifier is turned off.

Absolute amplitude accuracy (Preamplifier ON)

Set the frequency of signal generator 1464A to 100 MHz and the amplitude to -35 dBm after reset;

10) Set the spectrum analyzer as follows:

Center frequency 100MHz
 Span 100kHz
 Reference level -40dBm
 Preamplifier on
 Resolution bandwidth 1kHz
 Video bandwidth 100Hz

11) Adjust the output amplitude of the signal generator to make the power meter reading -40dBm;

12) Set the spectrum analyzer marker to the peak, read the level value L indicated by the marker and the test reading $L_{power\ meter}$ on the power meter, and calculate the Absolute amplitude accuracy ΔL according to Equation 8, and record the calculated ΔL as the test result of the Absolute amplitude accuracy into the *4024CA Spectrum Analyzer Record Sheet*,

13) Change the frequency settings of the signal generator 1464C, power meter, and spectrum analyzer according to the 4024CA Spectrum Analyzer Record Sheet until all frequency points are tested when the preamplifier is turned on.

12.2.18 Input attenuator

Description: This test measures the attenuation switching uncertainty over the entire frequency band for the input attenuator range. The reference output of the synthesized signal generator is connected to the 10MHz input of the spectrum analyzer. Switch the uncertainty by referring to the settings of the 0 dB attenuator.

12.2 Performance characteristics test

a) Test equipment

Synthesized signal generator 1464A

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One 3.5mm (f)-N(m) adapter

c) Cable

One BNC (m-m) cable

3.5mm cable (m-m) 1

d) Test steps

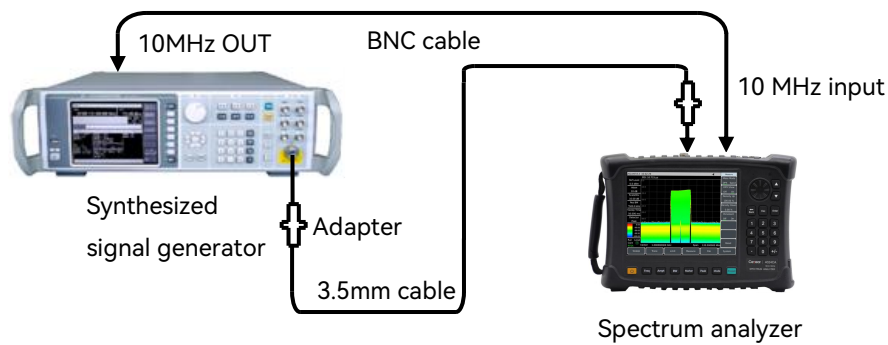


Figure 12-18 Input attenuator conversion uncertainty test settings

- 1) Connect the test equipment according to Figure 12-18. The synthesized signal generator 1464A provides reference frequencies for the spectrum analyzer;
- 2) Set the output power level of the signal generator to -13dBm and the output frequency to 50MHz;
- 3) Press **【Preset】** on the spectrum analyzer, and then set as follows:

Center frequency50 MHz
 Span..... 1kHz
 Reference Level..... -10 dBm
 Attenuation 0dB
 Resolution bandwidth10Hz

12.2 Performance characteristics test

- 4) Wait for a new scan to complete and press **【Peak】** → **【Marker】** → [Delta], using the attenuation of 0 dB as a reference;
- 5) Set the spectrum analyzer, and press **【Ampt】** → [Atten Auto Man] to set the attenuation value of the attenuator against the test table;
- 6) Wait for the sweep to complete and then press **【Peak】** . The current amplitude value of the delta marker is the error of the attenuator switching.
- 7) Repeat steps 5-6 until all attenuator attenuation values in the table are tested, and record the test results in the 4024CA Spectrum Analyzer Record Sheet.
- 8) Set the center frequency of the signal generator and spectrum analyzer to 6GHz, measure the attenuator switching uncertainty indicator at this frequency point with reference to steps 2-7 and record it in the 4024CA Spectrum Analyzer Record Sheet.

12.2.19 Input voltage standing wave ratio (VSWR)

Description: The RF input VSWR reflects the impedance matching degree of the RF receiving front end of the spectrum analyzer. This index is mainly affected by the adapter, cable and attenuator. During the test, the attenuation of the attenuator is required to be greater than or equal to 10dB. The 4024CA spectrum analyzer is designed with a split-band switch combined with an electronic attenuator. Different electronic attenuators are used in 9kHz-5.2GHz and 5.2GHz-9GHz bands. To avoid mutual influence between the two, the spectrum analyzer should be set to work in a suitable frequency range when testing voltage VSWR indicators, so that only one attenuator works in the test band.

a) Test equipment

Network analyzer.....N5245A

3.5mm calibration kit (including open circuit, short circuit and load)

One 3.5mm (m-m) cable

b) Adapter

One 3.5mm (f)-3.5mm (f) adapter

One 3.5mm (f)-N(m) adapter

c) Test steps

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Figure 12- 19 Input port voltage standing wave test

- 1) Set the frequency range and source output power of vector network analyzer as appropriate parameters, and select VSWR display mode;
- 2) Conduct single port measurement calibration for vector network analyzer at the end of calibration cable (including open circuit, short circuit and load calibration);
- 3) After the calibration, remove the calibration kit from the end of the calibration cable and connect it to the RF input port of the spectrum analyzer, as shown in Figure 12-19;
- 4) Press **【Preset】** on the spectrum analyzer and wait to restart and enter the spectrum analysis measurement interface. (Since the 4024CA spectrum analyzer is controlled by two electronic attenuator section switches inside the instrument, the frequency range of the instrument shall be set to 0-5.2GHz and 5.2GHz-9GHz respectively during the input voltage VSWR test to make the measurement results not affected by the attenuators outside the frequency band);
- 5) Read the maximum voltage standing wave ratio (VSWR) on the vector network analyzer with the marker function;
- 6) Record the test results in the corresponding test items in the 4024CA Spectrum Analyzer Record Sheet.

12.2.20 Maximum safe input level

The maximum safe input level of the 4024CA spectrum analyzer is +27dBm (typical). This technical indicator is guaranteed by the design of the RF front-end receive module of the spectrum analyzer. The careful explanation of the maximum safe input level is given in chapter 2.3 main technical indicators.

12.2.21 Scale display

After the 4024CA spectrum analyzer is powered on and started normally, choose **【Ampt】** → [Scale Type Log Lin] to manually set the scale ranging from 0.1 to 10 dB/div with an 0.1 dB steps. **【Ampt】** → [Scale Type Log Lin] a total of 10 divisions are displayed; **【Ampt】** → [Units] a total of 11

12.2 Performance characteristics test

amplitude units are provided: dBm, dBW, dBV, dBmV, dB μ V, dBA, dBmA, dB μ A, Volts, and Watts, which indicates that the spectrum analyzer can properly display scales.

12.2.22 Video bandwidth

After the 4024CA spectrum analyzer is powered on and started normally, set the resolution bandwidth to 10MHz, and then the video bandwidth is 10MHz. Press "↓" to change other resolution bandwidth, and the corresponding video bandwidth will automatically change. Moreover, the video bandwidth will be automatically coupled with the resolution bandwidth, at least to 1Hz, with steps 1 to 3.

13 Fault Message Description and Repair Method

This chapter will show you how to find problems and accept after-sales service. This also includes the interpretation of internal spectrum analyzer error messages.

If you encounter any problem when operating the 4024CA spectrum analyzer or want to buy relevant components, options or accessories, we can provide you with complete after-sales services.

Generally, causes of problems are due to hardware, software or user maloperation. In case of any problem, please contact us in time. If the spectrum analyzer you purchased is still under warranty, we will repair your spectrum analyzer free of charge as promised in the warranty. Otherwise, we will only charge the cost.

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13.1 Fault message description

Tips

Remarks

This section introduces the way on how to judge and handle failures (if any) of 4024CA spectrum analyzer, feed back the problem to the manufacturer as accurately possible if necessary for quick solution.

In case of any problem with the 4024CA spectrum analyzer you are using, you can check it by yourself according to the following tips. If the problem cannot be solved, please contact us.

If the 4024CA spectrum analyzer cannot be started after pressing the start button, please check whether the power supply is normal and whether the adapter indicator is on or whether the battery level is normal. If there is nothing abnormal, instrument may be faulty, please contact us for repair.

If the 4024CA spectrum analyzer cannot enter the system or application program after startup, please press the **【Preset】** key to make 4024CA spectrum analyzer return to a known state. If it still cannot work normally, it may be faulty, please contact us for repair.

If the performance indicators of 4024CA spectrum analyzer are abnormal, please check the test tools and test environment for compliance with the requirements, the test port connectors for any damages and the calibration kit for normal performance indicators. If everything above is normal, the

13.2 Method to obtain after-sales services

instrument may be faulty, please contact us for repair.

If the 4024CA spectrum analyzer cannot realize communication via LAN, check the IP address settings of the analyzer first, and check whether the yellow Indicator beside the LAN port on the top LAN panel flashes. If no, check the LAN cable and connection. In case of no above problems, the instrument may be faulty, please contact us for repair.

13.2 Method to obtain after-sales services

In case of any failure to the 4024CA spectrum analyzer that is difficult to be eliminated, contact us by phone or fax. If it is confirmed that the instrument needs to be repaired, please package the instrument according to the following steps:

- 1) Write a paper document describing the instrument failure and put it in the package together with the analyzer.
- 2) Pack it with the original packing materials, so as to minimize possible damage;
- 3) Place cushions at the four corners of the outer packing carton, and place the instrument in the outer packing carton;
- 4) Seal the opening of the packing carton with adhesive tape and reinforce the packing carton with nylon tape;
- 5) Specify text like “Fragile”! Do not touch! Handel with care!” and so on;
- 6) Please check it as precision instrument, and keep a copy of all shipping documents.

Appendix A 4024CA Spectrum Analyzer Record Sheet

This chapter contains the "Table A 4024CA Spectrum Analyzer Qualification Records".

- [Table A 4024CA_Spectrum Analyzer Qualification Records..... 276](#)

Table A 4024CA Spectrum Analyzer Qualification Records

Table A 4024CA Spectrum Analyzer Qualification Records

Instrument No.: _____

Test Personnel: _____

Test Date: _____

Test Condition: _____

No.	Test Item	Unit	Standard Requirement	Results
1	Design and Structure	/	Structure: Handheld Appearance color: Black This instrument features neat and beautiful appearance, clear text display on the panel, flexible key operation, and convenient and reliable connection and removal of all structure, and free of obvious mechanical damage and stains	
2	Function	/	Spectrum measurement	
		/	Power kit measurement	
		/	Audio demodulation	
		/	IQ capture	
3	Options	/	GPS and Beidou positioning	
		/	Interference Analyzer	
		/	List Sweep	
		/	Zero span IF output	
		/	Location Analyzer	
		/	Real-Time Spectrum analyzer	
		/	5G NR measurement	
		/	gate sweep measurement	
		/	LTE Analyzer	
		/	GSM/EDGE measurement	
		/	120MHz analysis bandwidth	
		/	Indoor and outdoor map	
4	Frequency range	kHz	Lower frequency limit	9kHz±21Hz
		GHz	Upper frequency limit	9GHz±21Hz
5	Frequency reading accuracy	kHz	1.0GHz (bandwidth 500kHz):	±11.10
		MHz	1.0GHz (bandwidth 50MHz):	±1.03
		MHz	1.0GHz (bandwidth 500MHz):	±10.30
		kHz	3.0GHz (bandwidth 500kHz):	±12.70
		MHz	3.0GHz (bandwidth 50MHz):	±1.03
		MHz	3.0GHz (bandwidth 500MHz):	±10.30
		kHz	3.5GHz (bandwidth 500kHz):	±13.10
		MHz	3.5GHz (bandwidth 50MHz):	±1.03
		MHz	3.5GHz (bandwidth 500MHz):	±10.30
		kHz	4.5GHz (bandwidth 500kHz):	±13.90
		MHz	4.5GHz (bandwidth 50MHz):	±1.03

Note: The contents in the table need to be tailored as per the options configuration to meet the actual test and inspection requirements.

Table A 4024CA Spectrum Analyzer Qualification Records

Table A (cont. 1)

No.	Test Item		Unit	Standard Requirement	Results	
5	Frequency reading accuracy	MHz	4.5GHz(bandwidth 500MHz):	±10.30		
		kHz	6.0GHz(bandwidth 500kHz):	±15.10		
		MHz	6.0GHz(bandwidth 50MHz):	±1.03		
		MHz	6.0GHz(bandwidth 500MHz):	±10.30		
		kHz	7.0GHz(bandwidth 500kHz):	±15.90		
		MHz	7.0GHz(bandwidth 50MHz):	±1.03		
		MHz	7.0GHz(bandwidth 500MHz):	±10.30		
		kHz	8.0GHz(bandwidth 500kHz):	±16.70		
		MHz	8.0GHz(bandwidth 50MHz):	±1.03		
		MHz	8.0GHz(bandwidth 500MHz):	±10.30		
6	Span	Range	/	Range: 0Hz, 10Hz~ 9GHz		
		Resolution	Hz	Span resolution: 1Hz		
		Accuracy	/	1kHz	±2.0%	
			/	10kHz	±2.0%	
			/	100kHz	±2.0%	
			/	1MHz	±2.0%	
			/	10MHz	±2.0%	
			/	100MHz	±2.0%	
			/	1GHz	±2.0%	
7	Sweep Time	Range	/	1µs-6000s (zero span)		
		Accuracy	/	1ms	±2.0%	
			/	10ms	±2.0%	
			/	100ms	±2.0%	
			/	1s	±2.0%	
			/	10s	±2.0%	
8	RBW	Range	/	Range: 1Hz-10MHz (in 1-3-10 steps), 20MHz		
		Accuracy	/	20MHz	±20.0%	
			/	10MHz	±10.0%	
			/	3MHz	±10.0%	
			/	1MHz	±10.0%	
			/	300kHz	±10.0%	
			/	100kHz	±10.0%	
			/	30kHz	±10.0%	
			/	10kHz	±10.0%	
			/	3kHz	±10.0%	
/	1kHz	±10.0%				

Table A 4024CA Spectrum Analyzer Qualification Records

Table A (cont. 2)

No.	Test Item	Unit	Standard Requirement	Results	
9	RBW conversion uncertainty	dB	20MHz	±0.7	
		dB	10MHz	±0.7	
		dB	3MHz	±0.7	
		dB	1MHz	±0.7	
		dB	300kHz	±0.7	
		/	100kHz	Reference	
		dB	30kHz	±0.7	
		dB	10kHz	±0.7	
		dB	3kHz	±0.7	
		dB	1kHz	±0.7	
		dB	300Hz	±0.7	
		dB	100Hz	±0.7	
		dB	30Hz	±0.7	
		dB	10Hz	±0.7	
		dB	3Hz	±0.7	
dB	1Hz	±0.7			
10	Sideband noise (carrier 1GHz)	dBc/Hz	+10kHz	≤-108	
		dBc/Hz	-10kHz	≤-108	
		dBc/Hz	+100kHz	≤-110	
		dBc/Hz	-100kHz	≤-110	
		dBc/Hz	+1MHz	≤-118	
		dBc/Hz	-1MHz	≤-118	
		dBc/Hz	+10MHz	≤-129	
		dBc/Hz	-10MHz	≤-129	
11	Displayed average noise	dBm	2MHz-3GHz (Pre-amplifier ON)	≤ -160	
		dBm	3GHz-9GHz (Pre-amplifier ON)	≤ -157	
		dBm	2MHz-3GHz (Pre-amplifier OFF)	≤ -140	
		dBm	3GHz-9GHz (Pre-amplifier OFF)	≤ -138	
12	Second harmonic distortion	dBc	<1.2GHz	≤ -65	
		dBc	1.2GHz~2GHz	≤-65	
		dBc	2GHz~2.6GHz	≤-70	
		dBc	2.6GHz~4.5GHz	≤-70	
13	Third-order intermodulation distortion	dBm	50MHz~2.4GHz	≥+10	
		dBm	2.4GHz~4GHz	≥+10	
		dBm	4GHz~5.2GHz	≥+10	
		dBm	5.2GHz~9GHz	≥+12	

Table A 4024CA Spectrum Analyzer Qualification Records

Table A (cont. 3)

No.	Test Item		Unit	Standard Requirement	Results
14	1 dB gain compression		dBm	50MHz~2.4GHz	≥0
			dBm	2.4GHz~4GHz	≥0
			dBm	4GHz~5.2GHz	≥0
			dBm	5.2GHz~9.0GHz	≥0
15	Image, multiple and out-of-band response	2GHz	dBc	Image frequency 8847.2MHz	≤-65
			dBc	Image frequency 2547.2MHz	≤-65
		3.5GHz	dBc	Image frequency 7197.2MHz	≤-65
			dBc	Image frequency 4047.2MHz	≤-65
		5GHz	dBc	Image frequency 5547.2MHz	≤-65
		7GHz	dBc	Image frequency 7547.2MHz	≤-65
16	Residual spurious response		dBm	10MHz-9GHz (Preamplifier ON)	≤ -95
			dBm	10MHz-9GHz (Preamplifier OFF)	≤ -82
17	Ref Level	Range	/	Logarithmic scale: - 150dbm to + 30dBm, 1dB step	
		Conversion error	/	0dBm	Reference
	dB		-10dBm	±1.20	
	dB		-20dBm	±1.20	
	dB		-30dBm	±1.20	
	dB		-40dBm	±1.20	
	dB		-50dBm	±1.20	
	dB		-60dBm	±1.20	
	18	Scale fidelity		dB	-10dBm
dB				-20dBm	±1.00
dB				-30dBm	±1.00
dB				-40dBm	±1.00
dB				-50dBm	±1.00
dB				-60dBm	±1.00
19	Absolute amplitude accuracy	Pre-amplifier OFF	dB	10MHz (attenuation 0dB, input - 25dBm):	±1.30
			dB	350MHz (attenuation 0dB, input - 25dBm):	±1.30
			dB	650MHz (attenuation 0dB, input - 25dBm):	±1.30
			dB	950MHz (attenuation 0dB, input - 25dBm):	±1.30
			dB	1250MHz (attenuation 0dB, input - 25dBm):	±1.30
			dB	1550MHz (attenuation 0dB, input - 25dBm):	±1.30
			dB	1850MHz (attenuation 0dB, input - 25dBm):	±1.30
			dB	2150MHz (attenuation 0dB, input - 25dBm):	±1.30
			dB	2450MHz (attenuation 0dB, input - 25dBm):	±1.30
			dB	2750MHz (attenuation 0dB, input - 25dBm):	±1.30

Table A 4024CA Spectrum Analyzer Qualification Records

Table A (cont. 4)

No.	Test Item	Unit	Standard Requirement	Results				
19	Absolute amplitude accuracy	Pre-amplifier OFF	dB	3050MHz (attenuation 0dB, input - 25dBm): ±1.30				
			dB	3350MHz (attenuation 0dB, input - 25dBm): ±1.30				
			dB	3650MHz (attenuation 0dB, input - 25dBm): ±1.30				
			dB	3850MHz (attenuation 0dB, input - 25dBm): ±1.30				
			dB	4150MHz (attenuation 0dB, input - 25dBm): ±1.30				
			dB	4450MHz (attenuation 0dB, input - 25dBm): ±1.30				
			dB	4750MHz (attenuation 0dB, input - 25dBm): ±1.30				
			dB	5050MHz (attenuation 0dB, input - 25dBm): ±1.30				
			dB	5350MHz (attenuation 0dB, input - 25dBm): ±1.30				
			dB	5650MHz (attenuation 0dB, input - 25dBm): ±1.30				
			dB	5850MHz (attenuation 0dB, input - 25dBm): ±1.30				
			dB	6150MHz (attenuation 0dB, input - 25dBm): ±1.30				
		Pre-amplifier ON	dB	100MHz (attenuation 0dB, input - 40dBm): ±1.30				
			dB	1000MHz (attenuation 0dB, input - 40dBm): ±1.30				
			dB	2000MHz (attenuation 0dB, input - 40dBm): ±1.30				
			dB	3000MHz (attenuation 0dB, input - 40dBm): ±1.30				
			dB	4000MHz (attenuation 0dB, input - 40dBm): ±1.30				
			dB	5000MHz (attenuation 0dB, input - 40dBm): ±1.30				
			dB	6000MHz (attenuation 0dB, input - 40dBm): ±1.30				
			dB	7000MHz (attenuation 0dB, input - 40dBm): ±1.30				
			dB	8000MHz (attenuation 0dB, input - 40dBm): ±1.30				
			dB	9000MHz (attenuation 0dB, input - 40dBm): ±1.30				
			20	Input attenuator	Range	/	0-30dB, 5dB step	
					Switch	/	Attenuation 0dB	Reference
uncertainty	dB	Attenuation 5dB			±1.20			
(50MHz)	dB	Attenuation 10dB			±1.20			
(50MHz)	dB	Attenuation 15dB			±1.20			

Table A 4024CA Spectrum Analyzer Qualification Records

Table A (cont. 5)

No.	Test Item		Unit	Standard Requirement	Results
20	Input attenuator or	Switch uncertainty (50MHz)	dB	Attenuation 20dB ±1.20	
			dB	Attenuation 25dB ±1.20	
			dB	Attenuation 30dB ±1.20	
		Switch uncertainty (6GHz)	/	Attenuation 0dB Reference	
			dB	Attenuation 5dB ±1.20	
			dB	Attenuation 10dB ±1.20	
			dB	Attenuation 15dB ±1.20	
			dB	Attenuation 20dB ±1.20	
			dB	Attenuation 25dB ±1.20	
21	Input voltage standing wave ratio		/	10MHz~5.2GHz ≤2.00:1	
			/	5.2GHz~9GHz ≤2.00:1	
22	Maximum safe input level		/	+27dBm (continuous wave, input attenuator is automatically coupled)	
23	Scale display		/	Logarithmic scale: 0.1-10dB per division, minimum 0.1dB steps (10 divisions display) Linear scale: 10 divisions display, scale units: V, A, W, dBm, dBV, dBmV, dBμV, dBA, dBmA, dBμA etc.	
24	VBW		/	Bandwidth range: 1Hz~-10MHz (in 1-3-10 steps), 20MHz	
25	Interface	RF interface	/	Type N female adapter	
		Communication interface	/	USB interface: type A, two	
			/	USB interface: mini type, one	
			/	LAN interface: Standard RJ45	
		Frequency reference	/	Reference input/output, BNC female	
		Other interface	/	GPS antenna interface: BNC female	
			/	External trigger input interface: BNC female	
/	Zero span IF output interface: BNC female				
26	Safety		/	Dielectric Strength requires AC 1500V, 10mA/min; no breakdown, no arcing.	
			mA	Voltage 242 V, leakage current ≤3.5 mA, 1min.	
			MΩ	The insulation resistance between the power input end and the casing should not be less than 100 MΩ under standard atmospheric conditions for testing.	
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 the unit does not have this test item.				
Comprehensive judgment: Pass <input type="checkbox"/> Fail <input type="checkbox"/>					