S3302 Series Handheld Spectrum Analyzer

Quick Start Guide

Saluki Technology Inc.

The document applies to the handheld spectrum analyzers of the following models:

- S3302SA handheld spectrum analyzer (9kHz-4GHz).
- S3302SB handheld spectrum analyzer (9kHz-6.5GHz).
- S3302SC handheld spectrum analyzer (9kHz-9GHz).
- S3302A handheld spectrum analyzer (9kHz-20GHz).
- S3302B handheld spectrum analyzer (9kHz-26.5GHz).
- S3302C handheld spectrum analyzer (9kHz-32GHz).
- S3302D handheld spectrum analyzer (9kHz-44GHz).
- S3302E handheld spectrum analyzer (9kHz-50GHz).
- S3302F handheld spectrum analyzer (9kHz-67GHz).

Standard pack and accessories:

No.	Item
1	Main Machine
2	Power cord
3	Power adapter
4	U disk (manual)
5	USB cable
6	Battery

Options of the S3302 series in addition to standard accessories:

Model No.	Description	Note
S3302-05	Programming manual	/
S3302-06	Power adapter	/
S3302-07	Rechargeable lithium-ion battery	/
S3302-08	CAT5 LAN cable	Point to point, 2m
S3302-09	Micro SD card	Capacity: 8GB
S3302-10	GPS option	GPS Exposed Antenna(BNC), Built-In GPS Module and Software
S3302-11	USB power meter option	Provide USB Power Measurement function (Option 12-15 needed)
S3302-12	S87230 USB power continuous wave power sensor (9kHz - 6GHz)	Need option 11
S3302-13	S87231 USB power continuous wave power sensor (10MHz - 18GHz)	Need option 11
S3302-14	S87232 USB power continuous wave power sensor (50MHz - 26.5GHz)	Need option 11
S3302-15	S87233 USB power continuous wave power sensor (50MHz - 40GHz)	Need option 11
S3302-16	Interference analyzer option	Waterfall, RSSI

Model No.	Description	Note
S3302-17	AM/FM/PM analyzer option	To Realize Modulation Characteristics Analysis of AM/FM/PM Signals.
S3302-18	Channel scanner option	To Realize Signal Power Measurement of Multiple Channels and Frequency.
S3302-19	List sweep option	To Realize Continuous Sweep Measurement of Various Frequency Bands .
S3302-20	Zero span IF output	Output the third(3rd.) IF(140.25MHz) or fourth(4th.) IF(31.25MHz) signal
S3302-21	S89101A antenna (10kHz - 20MHz)	Need option 25
S3302-22	S89101B antenna (20MHz - 200MHz)	Need option 25
S3302-23	S89101C antenna (200MHz - 500MHz)	Need option 25
S3302-24	S89101D antenna (500MHz - 4GHz)	Need option 25
S3302-25	S89401 antenna amplifier (10kHz - 4GHz, N(f))	For option 21-24
S3302-26	S89901 antenna (1GHz - 18GHz, N(f))	Do not need amplifier
S3302-27	S89902 antenna (18GHz - 40GHz, 2.92mm(f))	Do not need amplifier
S3302-28	Functional bag	/
S3302-29	Backpack	/
S3302-30	Carrying case	For safety carrying
S3302-31	S89901 antenna handle	Need option 26
S3302-32	S89902 antenna handle	Need option 27
S3302-33	Signal analyzer	To realize the rapid analysis of interference signal, and provide the audio output and IQ Capture.
S3302-34	Field strength option	Provide Pscan, Fscan, MScan etc. Functions
S3302-35	Tracking generator (100kHz - 4GHz)	For S3302SA only
S3302-36	Tracking generator (100kHz - 6.5GHz)	For S3302SB only
S3302-37	Tracking generator (100kHz - 9GHz)	For S3302SC only
S3302-38	Orientation analysis option	Built-In software(need option10, 50 and directional Antenna)
S3302-39	Coverage map option	Built-In software(need option10)
S3302-40	Charger of power supply by vehicle	/
S3302-41	Portable omnidirectional antenna	Frequency range :700MHz - 2.7GHz (for communication bands)
S3302-42	700MHz - 4GHz directional antenna	Active log-periodic antenna
S3302-43	700MHz - 6GHz directional antenna	Active log-periodic antenna
S3302-44	680MHz - 10GHz directional antenna	Active log-periodic antenna
S3302-45	680MHz - 20GHz directional antenna	Active log-periodic antenna
S3302-46	400MHz - 4GHz directional antenna	Active log-periodic antenna
S3302-47	400MHz - 6GHz directional antenna	Active log-periodic antenna
S3302-48	380MHz - 10GHz directional antenna	Active log-periodic antenna

Model No.	Description	Note
S3302-49	380MHz - 20GHz directional antenna	Active log-periodic antenna
S3302-50	External electric compass	External USB electric compass (need option38)
S3302-51	6GHz omnidirectional antenna (680MHz - 6GHz)	Portable omnidirectional antenna
S3302-52	8GHz omnidirectional antenna (300MHz - 8GHz)	Portable omnidirectional antenna
S3302-53	VHF/UHF portable antenna	Frequency range :140MHz/430MHz
S3302-54	Passive directional antenna (700MHz - 4GHz)	Passive log-periodic antenna
S3302-55	Passive directional antenna (700MHz - 6GHz)	Passive log-periodic antenna
S3302-56	Passive directional antenna (680MHz - 10GHz)	Passive log-periodic antenna
S3302-57	Passive directional antenna (680MHz - 18GHz)	Passive log-periodic antenna
S3302-58	Passive directional antenna (680MHz - 25GHz)	Passive log-periodic antenna
S3302-59	Passive directional antenna (680MHz - 35GHz)	Passive log-periodic antenna
S3302-60	N/SMA-JJ RF cable (2m)	N male to SMA male RF coaxial cable, DC-18GHz, Length 2m
S3302-61	N/SMA-JJ RF cable (1m)	N male to SMA male RF coaxial cable, DC-18GHz, Length 1m
S3302-62	Differential antenna orientation analysis function option	Built-in high-precision direction finding software (need option 63, 64 or 65)
S3302-63	8GHz differential antenna assembly	Frequency range: 1GHz-8GHz, including differential antenna components, transport box, high-precision electronic compass, tripod, etc. (need option 63)
S3302-64	10GHz differential antenna assembly	Frequency range: 1GHz-10GHz, including differential antenna components, transport box, high-precision electronic compass, tripod, etc. (need option 63)
S3302-65	18GHz differential antenna assembly	Frequency range: 1GHz-18GHz, including differential antenna components, transport box, high-precision electronic compass, tripod, etc. (need option 63)
S3302-67	ZE9080 Antenna transport box	Used for antenna and amplifier, including option 21, 22, 23, 24, 25

Preface

Thanks for choosing S3302 series handheld spectrum analyzer produced by Saluki Technology Inc. Please read this quick guide carefully for your convenience.

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

Manual No.

S3302-04-01

Version

Rev01 2019.05

Saluki Technology

Manual Authorization

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Product Quality Certificate

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

Quality/Environment Management

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

Precautions

For the purpose of this manual, the following safety symbols apply, and please be familiar with them and their meanings before operating this instrument!

⚠ WARNING	A “WARNING” sign indicates for an existing danger. It reminds the user to pay attention to a certain operation process, operation method or the similar. Any violation against the indicated rules or incorrect operation may lead to personal injury. It is not allowed to proceed until the warning conditions are fully comprehended and satisfied.

CAUTION	A “CAUTION” sign provides prompt on important information but not dangerous situations. It reminds the user to pay attention to a certain operation process, operation method or the similar. Any violation against the indicated rules or incorrect operation may lead to instrument damage or loss of important data. It is not allowed to proceed until the cautioning conditions are fully comprehended and satisfied.

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CONTENTS

Chapter 1 Manual Overview

This manual describes the structure and use of the S3302 series spectrum analyzer (hereinafter referred to as S3302 or the spectrum analyzer) in an all-around and three- dimensional manner from aspects of instrument panel, power supply, start to use, typical applications and after-sales help. By reading this Manual, you will have an overall understanding of S3302 and quickly master the basic operations of this device in a systematic manner. For the convenience of operation, please carefully read the manual before operating the instrument, and properly operating it according to the guidance in the manual.

S3302 Series Spectrum Analyzer Quick Start Guide includes the following chapters and sections:

- **Preparation for Use**

This chapter introduces S3302 preparation before use, start to use, panel introduction and battery replacement. By reading this chapter, you will gain the perceptual knowledge of S3302 as a whole and make preliminary preparations for correct and safe operation of this device.

- **Typical Applications**

This chapter explains basic measurement methods of S3302 and operating steps of basic measurement functions in details through test instances on how to distinguish closely spaced signals, how to improve frequency measurement accuracy and how to measure small signals. In addition, this chapter also briefly describes the skills used in tests. By reading this chapter, you can use S3302 to complete certain typical tests independently.

- **Getting Help**

This chapter consists of after-sales repair and its procedures with the emphasis on problem solving, maintenance and repair of this device during use.

Chapter 2 Ready for Use

The S3302 series spectrum analyzer is characterized by wide operating frequency band, high performance index, fast sweeping, multiple test functions and easy operation. In terms of performance index, this series has good average noise level, phase noise, fast sweep speed and multiple measurement functions. Adopting the 8.4-inch integrated liquid crystal and capacitive touchscreen and portable structure with small volume and light weight, this series features flexible power supply and is particularly suitable for field use. This chapter emphatically introduces the test environment, power supply, structure and battery replacement of this device.

2.1 Preparation before Operation

This section describes the precautions before initial use of the S3302 series spectrum analyzer. S3302 meet the safety requirements of GJB3947A-2009. Please read the following safety instructions carefully so as not to cause damage to the instrument or unintentional personal injury.

WARNING	To prevent damage to the instrument and avoid electric shock, fire and personal injury: ➢ Do not open this device without authorization; ➢ Do not disassemble or modify any part which is not described in this manual. Any disassembly without authorization may result in reduction of electromagnetic shielding performance or damage to the parts inside the device, thus comprising product reliability. We shall not offer free repair service to any product which is disassembled without authorization even if the product is still within warranty period.

2.1.1 Environmental requirements

To ensure long service life and effective and accurate measurement of the S3302 series instrument, test it under the following environmental conditions:

1. Temperature range:

Storage temperature range: -40℃ to +70℃

Operating temperature range: -10℃ to +50℃

Operating temperature range of power supply by Li-ion battery: -10℃ to +50℃

WARNING	As the battery storage temperature range is -20℃ to +60℃, the battery must not work continuously in a long time at high temperature, so as to avoid risks arising from high temperature. It is recommended to use the adapter to supply power.

2. Low atmospheric pressure:

Low atmospheric pressure (altitude): 0 - 4,600m

2.1.2 Power supply requirements

Three power supply forms are supported by S3302:

1. AC power supply and power supply with adapter

The accompanying AC-DC adapter must be used for AC power supply. The input power supply of the adapter is 100~240V, 50/60Hz AC.

When transported and carried in a backpack, please do not connect the AC-DC adapter to the device to avoided overheating. The AC-DC adapter has a wide range of voltage input. When in use, please make sure the power supply voltage is within the scope specified in Table 2.1.

Table 2.1 Power supply requirements

Power supply parameter	Applicable range
Input voltage	100V - 240VAC
Rated input currency	1.7A
Work frequency	50/60Hz
Output Voltage/Current	15.0V/4.0A

CAUTION The working voltage and frequency ranges are subject to the parameters provided on the nameplate of the power adapter.

2. DC power supply

Voltage: 15V

Current: 3A (min.)

3. Power supply with built-in battery

S3302 can be powered by rechargeable li-ion battery. The battery will discharge if it is not used for a long time. Therefore, the battery must be recharged before use. Please refer to Section 2.6 for details about battery use. Basic parameters of accompanying battery are as follows:

Nominal voltage: 10.8V

Nominal capacity: 7,800mAh

CAUTION The rechargeable battery must not be exposed to fire or high-temperature environments (above 70℃), or placed in fresh water or salt water, or made wet. It must be kept away from children.
The rechargeable battery is reusable and should be stored in proper container to avoid short circuit. Heavy metals such as nickel and chromium in the battery can pollute natural environment. Waste battery shall not be discarded but shall be put into a special battery recycle box.

2.1.3 Electrostatic discharge (ESD) protection

Electrostatic discharge is extremely destructive to electronic components and equipment, so the powered instrument must be operated on a workbench with ESD protection. So please pay attention to ensuring ESD protection when using the instrument. The following ESD protection measures can be taken if conditions are met:

1. Before connecting the cable to the instrument for testing, be sure to ground the center conductor of the cable first. The following steps can be used: Connect a short-circuiter at one end of the cable to short the center

conductor and outer conductor of the cable. Wearing wrist straps with ESD protection, grasp the cable connector housing, connect the other end of the cable, and then remove the short-circuiter.

2. The operator should be grounded before cleaning or checking the test port of the device or connection. This can be realized by holding on to the metal casing of grounded device or the casing of test cable connector.

2.2 Description of Start for Use

Check the power supply unit based on the "power supply requirements" in Section 2.1.2 before powering on the S3302. Power on for testing after no problem is found.

Press the POWER key [⏻] on the front panel for more than 3s, a beep can be heard. Then, release the ON/OFF key and the device will enter host program after about 30 seconds. To ensure the stability of performance indexes of parts inside the device in order to achieve better test results, a 30-minute warming period is recommended before measurement..

2.3 Front Panel Overview

The front panel of the S3302 series spectrum analyzer is as shown in Fig. 2.1.

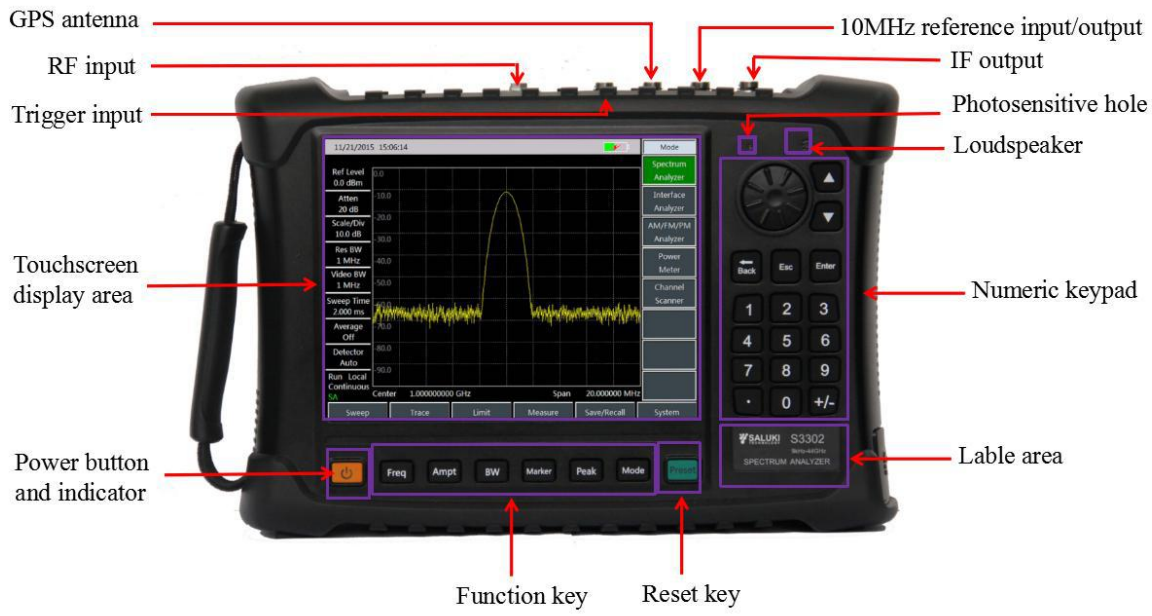

Fig.2.1 Front panel of S3302 series spectrum analyzer

2.3.1 Power key and indicator

Power key and the indicator are located at the lower left of the front panel. The power indicator is inside the yellow power key. The indicator for power off is yellow and that for power on is green. The correlation between color of the indicator and physical status of the device is shown in the Table2.2.

Table 2.2 Description of indicator status

Instrument status	Indicator status	Physical status of the Spectrum Analyzer
Power off	Off	➢ battery installed, power not connected. ➢ battery not installed, power not connected.
	Yellow normally on	a) battery not installed, power connected. b) battery installed and full, power connected.
	Yellow flickering	Battery installed but not full, power connected.
Power on Status	Green normally on	a) battery not installed, power connected. b) battery installed and full, power connected. c) battery installed, power not connected.
	Green flickering	Battery installed but not full, power connected.

2.3.2 Function key zone

Commonly-used functional keys are described as follows:

- 【Freq】: Set the scope of frequency measured, frequency step, signal standard, etc.
- 【 Ampt 】 : Set the amplitude of measurement results displayed, including display format, display scale and control of pre-amplifier.
- 【 BW 】 : Set the resolution bandwidth, video bandwidth, detector type, average value and other measurement parameters.
- 【 Marker 】 : Enable function menu related to the marker. When enabled, the marker can be operated by dragging, clicking or other touch modes.
- 【Peak】: Enable the peak search function.
- 【Mode】: Select the operating mode of the device, including spectrum analyzer, interference analyzer, AM-FM-PM analyzer, power meter, channel scanner and other modes.

2.3.3 Preset key

Preset or reboot the system to restore to default initial state. Preset can be realized by pressing and releasing this key.

2.3.4 Photosensitive hole

This hole can sense the intensity of external light for auto adjustment of liquid crystal brightness.

2.3.5 Numeric keypad

- Numeric keys: the value corresponding to the selected parameter can be input via the numeric keys on the front panel, and the corresponding unit can be selected in the soft menu.
- 【•】: Input the decimal point for decimal value when entering a decimal value with a decimal point.
- 【+/-】: Positive/negative sign, before inputting a numerical value, you can use this key to input a positive or negative value.
- 【↑】and 【↓】: Control the step upward and downward, or select the current item up and down.

- 【Cancel】: Used to exit any functional operation without changing the current parameter. Deactivate the function, exit the digital zone operation, and exit the file dialog box.
- 【Backspace】: Remove a character before the marker in the input area.
- 【Enter】: In the case of an input area, press the key to receive data in accordance with the default unit.
- Knob: Used to move the marker and change the current parameter value. It is generally used for fine tuning of the parameters to optimum values.

2.3.6 Loudspeaker

The S3302 series spectrum analyzer is equipped with a speaker. Keep the speaker opening clean so as not to affect sound effects.

2.3.6 Label display area

It shows the corresponding model, frequency range, label, and name of the S3302 series spectrum analyzer.

2.4 Operation Interface Overview

The S3302 series spectrum analyzer has an integrated 8.4-inch integrated liquid crystal and capacitive touch screen, and the operation interface is shown in Fig.2.2.

Fig.2.2 Operation interface of S3302 series spectrum analyzer

2.5 Top Panel Overview

The top panel of S3302 is shown in Fig. 2.3 and it consists of a power interface, a digital interface and a test port.

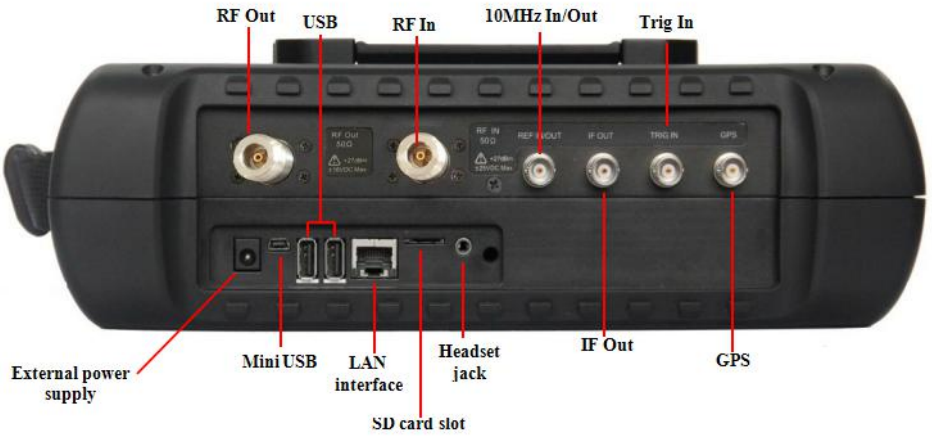

Fig.2.3 Top Panel of S3302 Series Spectrum Analyzer

2.5.1 Power interface

The power interface of the device is for powering the device through DC output of AC-DC adapter or through external DC power source. The conductor inside the external power interface is positive and the external conductor is grounded.

2.5.2 Test ports

(1) RF input port: This port is for inputting tested signal. The test signal input port of S3302 is 50Ω. 4GHz, 6.5GHz, 9GHz, 20GHz and 26.5GHz models use N type female port, 32GHz and 44GHz models use 2.4mm male port, 50GHz and 67GHz models use 1.85mm male port.

(2) RF output port: This port is for signal output. 50Ω impedance, N-type female port, provided only when customers need the tracking generator option.

(3) 10MHz input/output port: This port is for connecting 10MHz signal of other devices as the reference signal of the analyzer. It can also be used for outputting the internal 10MHz reference signal for other devices.

(4) IF output port: Under zero span, this port can be used for outputting the IF signals for other devices through software configuration.

(5) Trigger input port: External trigger mode can be set for S3302. The scope of trigger source must be -5V to +5V when connecting the external trigger source to the trigger input port of the Spectrum Analyzer. Rising edge trigger or fall edge trigger can be set by the software.

(6) GPS antenna port: This port can be used for connecting GPS antenna device for locating current position of the Spectrum Analyzer.

WARNING

In order to protect the spectrum analyzer, the instrument test ports are provided with some signs. To use the spectrum analyzer, be sure to read these signs to avoid permanent damage to the instrument.
For details of the instrument signs, see section 2.5.4.

2.5.3 Digital interfaces

(1) Mini USB interface: This interface is used for connecting external PC which realizes program control or data transmission for S3302 through program control commands or function library.

CAUTION	Equipment drive should be installed for connecting the device to PC through USB interface for the first time.

(2) A-type USB interface: This interface is used for connecting USB peripheral equipment, such as USB storage device, USB power detector.

(3) LAN (network) port: This interface is a 10/100Mbps network interface through which a PC can be connected to the device through a network cable. PC can realize program control or data transmission for S3302 through program control commands or function library.

(4) SD card slot: This Micro SD card slot can be used to extend the storage space of the device.

(5) Headset jack: This is a standard headset jack for 3.5mm/3 line for audio output of FM/AM/SSB demodulation. When a headset is not connected to this jack, the audio output will be realized through the loudspeaker of the device. When a headset is connected to this jack, audio output will be automatically switched from the loudspeaker to the headset.

2.5.4 Device symbols

Device symbols indicated in the Fig. below indicate that the maximum power of RF IN and the maximum input DC level. When the device is in operation, the user is not allowed to connect signal exceeding this range to the port. Otherwise, the device may be destroyed.

2.6 Battery Installation or Replacement

S3302 accompanies with a large-capacity rechargeable Li-ion battery with a battery life of 2.5 hours. For field test for long period, it is recommended to purchase a battery of same mode as a standby battery.

CAUTION	To guarantee the longer service life of the battery, the battery should be removed from battery holder during the transportation and long-time storage, and try not to make the battery power less than 5%, otherwise the battery may not be able to charge.

Installation or replacement of battery can be carried out by reference to Fig. 2.4 for battery installation or replacement of S3302.

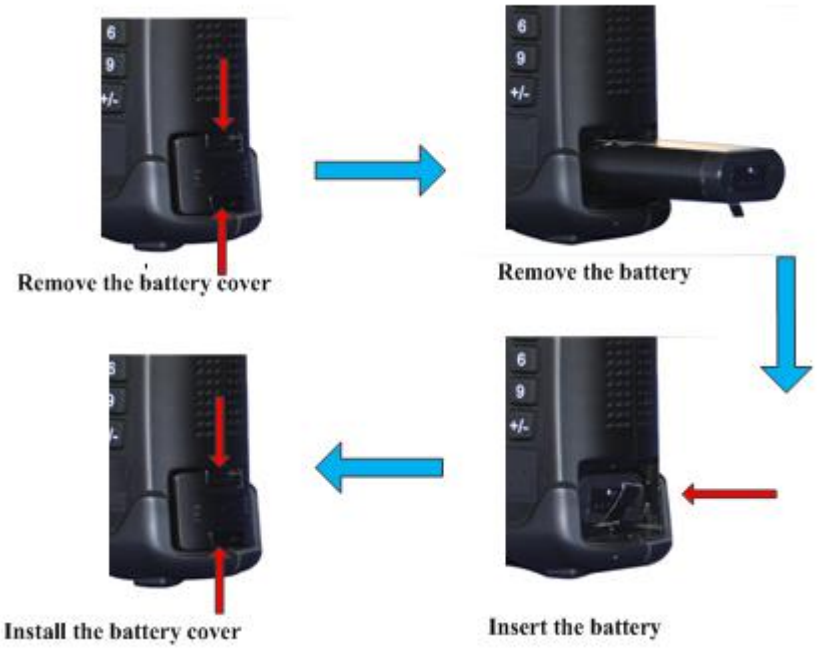

Fig. 2.4 Install or replace the battery

Chapter 3 Typical Application

The S3302 series spectrum analyzer provides several working modes, including spectrum analysis, interference analyzer (option), AM-FM-PM analyzer (option), power meter (option) and channel scanner (option). Several intelligent measurement functions are provided for each working mode. This chapter mainly describes basic tests under spectrum analyzer mode. For detailed operation of each optional mode, please refer to the *User Manual of S3302 Spectrum Analyzer*.

CAUTION

In this guide, the keys on the front panel are indicated in the form of 【XXX】, and XXX is the name of the key; the bottom keys on the touch screen are indicated in the form of 【XXX】, and XXX is the name of the key; the menu buttons on the right are indicated in the form of [XXX], and XXX is the menu name.

3.1 Basic Signal Measurement

The basic measurement includes the frequency and amplitude of the signal marked on the spectrum analyzer screen with markers. Follow the procedures below to measure the input signal and save the current measurement result by using the file menu:

a) Set the center frequency

Set the frequency of the external signal generator to 1GHz. Set the center frequency of the spectrum analyzer. Press 【Freq】, select [Center Freq] and set the center frequency to 1GHz. Enter 【1】[GHz] directly with the key in the front panel data zone. These numerical keys can be used for setting the exact value of current parameter. The value of center frequency can also be changed by the step key and knob, as shown in Fig. 3.1.

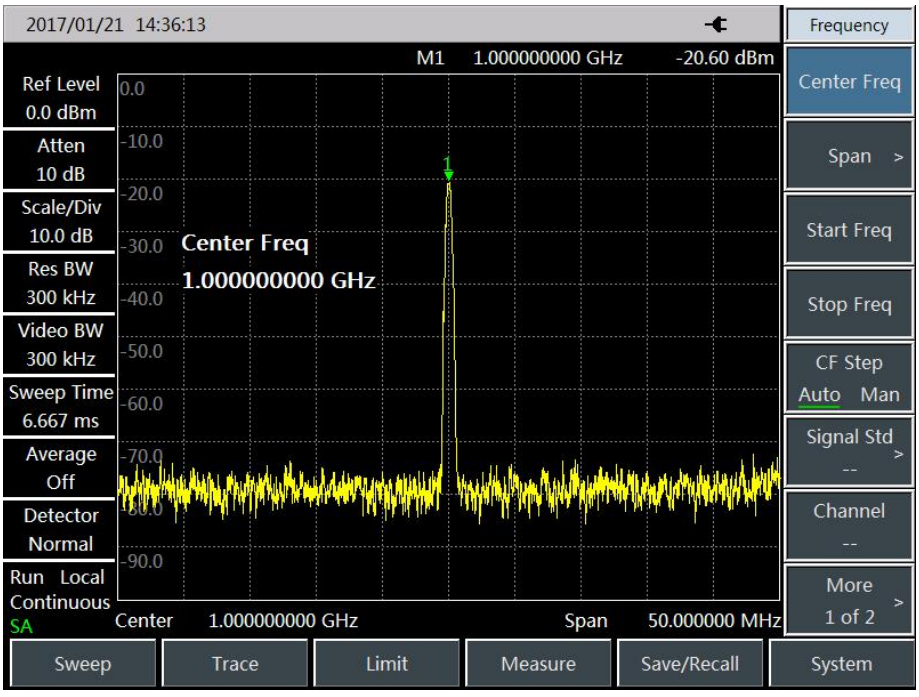

Fig. 3.1 Center Frequency of 1 GHz

b) Set the span

Press 【Freq】 →[Span]. Please note if the span is shown in the active function area in order to confirm currently activated parameter. To reduce the span to, for example, 10MHz, you can input [1] [0] using the numerical keypad and select the unit as [MHz], or you can use 【 ↓ 】 key to reduce to this value by step (the numerical keys and step keys can be used for changing the value of current parameter). The result is shown in Fig. 3.2. Attention should be paid to check if the resolution bandwidth and the video bandwidth are adaptable to the span as they will be automatically adjusted to a proper value based on the given span value. The sweep time is also adaptable.

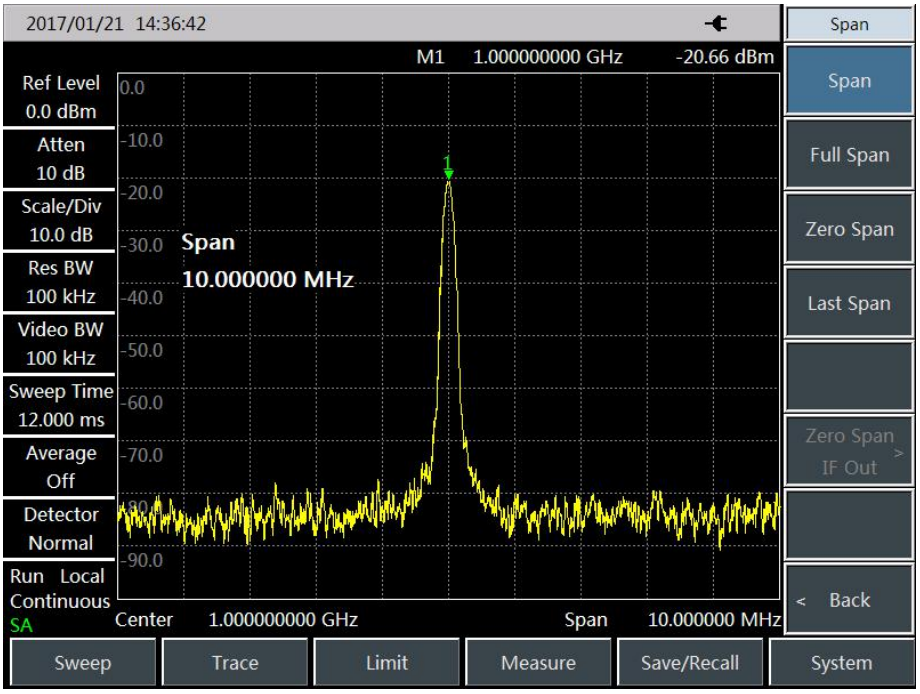

Fig. 3.2 Center Frequency of 1GHz and Span of 10MHz

c) Set the sweep time

Press 【Sweep】key and select [Sweep Time Auto Man] soft key. The soft key can be used to set auto or manual control of the sweep time, and the currently active option is underlined. For example, when "Auto" is underlined, the sweep time will be automatically adaptable to other relevant parameter settings.

d) Activate the marker

By pressing 【Marker】, common marker will be activated and displayed in the center of the horizontal coordinates (the frequency and amplitude will be read by the marker and shown in the active function area). The marker reads the frequency as 1GHz and amplitude as -20dBm, as shown in Fig. 3.3.

If the marker is not at the peak, you can press 【Peak】 key to enable the marker to automatically jump to the peak of the signal or use the knob on the front panel to manually position the marker on the maximum value of the signal.

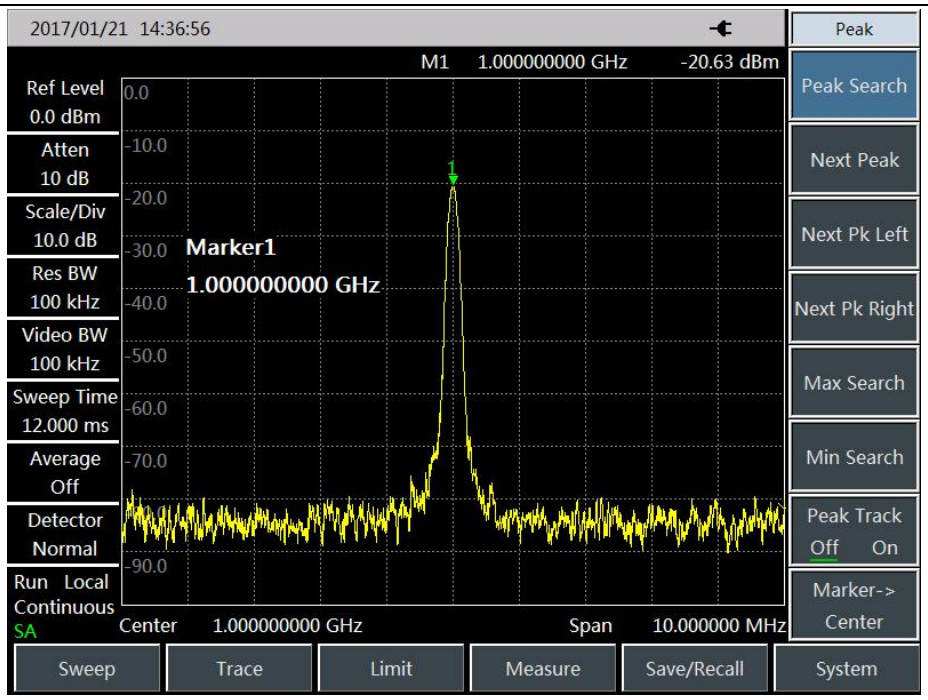

Fig. 3.3 Activating the Marker

e) Adjust the amplitude parameter

Generally, optimal amplitude measurement accuracy can be obtained by putting the signal peak at the reference level position, as shown in Fig. 3.4. Press 【 Ampt 】 →[Ref Level] to set the reference level as the amplitude of the marker.

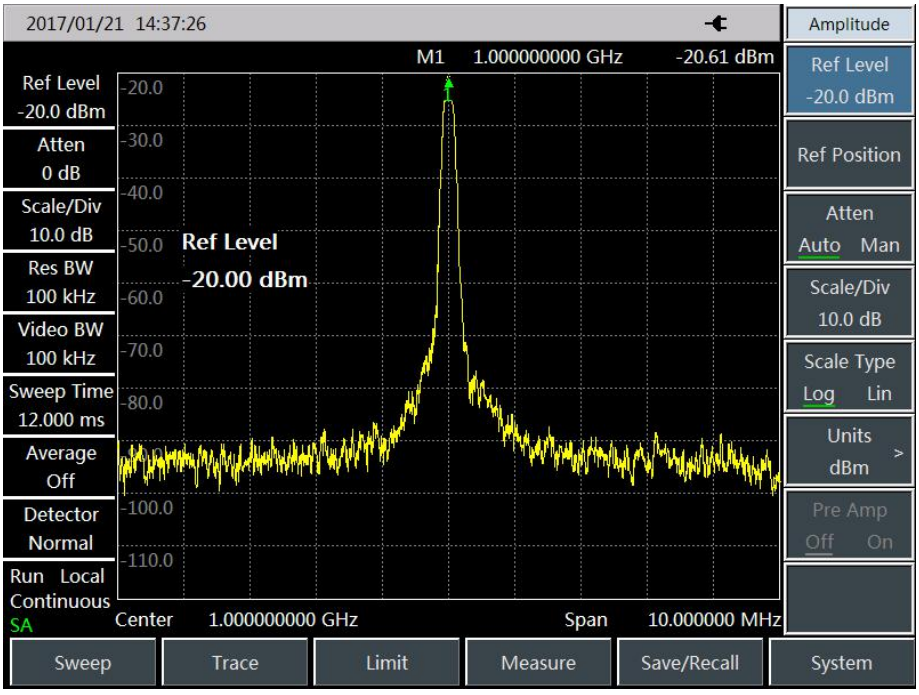

Fig. 3.4 -20dBm Reference Level

f) Save the test results

Press 【File】→[Save Data] (or select the save state or picture) and an interface shown in Fig. 3.5 will pop up.

Input the name on the interface and then press [OK] to save.

Fig. 3.5 File Saving

3.2 How to Improve the Accuracy of Frequency Measurement

This section will take the measurement of external 1GHz signal as an instance to describe how to use the marker count function to improve the frequency reading accuracy for measurement. The test steps are as follows:

a) Reset the spectrum analyzer

Press 【Preset】key to restart the spectrum analyzer.

b) Set the center frequency

Set the frequency of the external signal generator to 1GHz. Set the center frequency of the Spectrum Analyzer. Press 【Freq】, select [Center Freq] and set the center frequency as 1GHz. Or you can directly input [1] [GHz] using the keys in numerical keypad on the front panel. These numerical keys can be used for setting the exact value of current parameter. The value of center frequency can also be changed by the step key and knob.

c) Enable the marker count function

Press 【Marker】 to activate the marker. Press 【Marker】→[Counter Mkr Off On] to enable the marker count function. Press 【 Peak 】 to position the marker on the signal frequency. Observe the reading of the marker and the resolution of frequency can reach 1Hz. As shown in Fig.3.6.

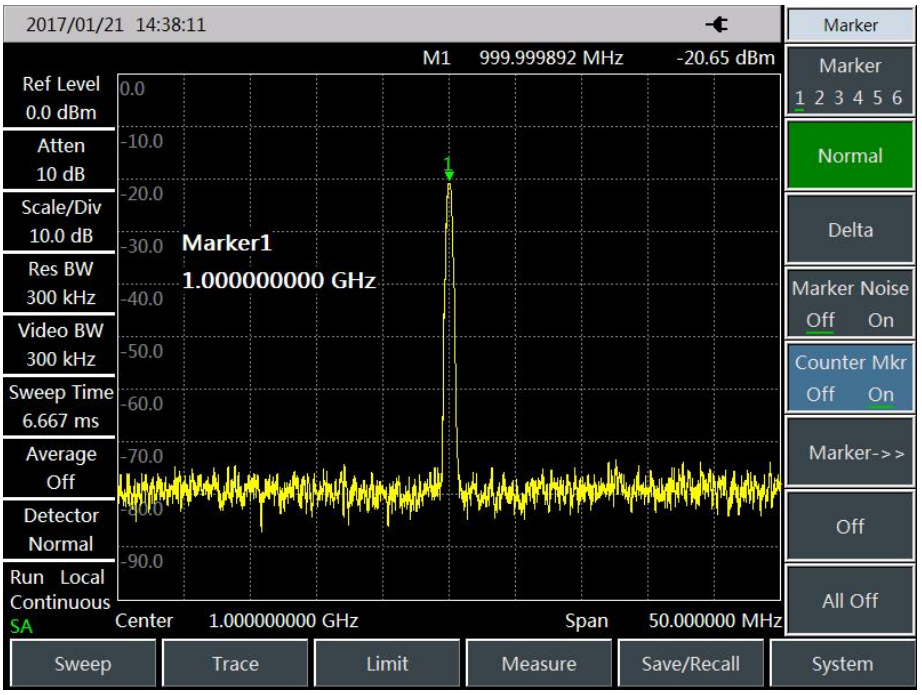

Fig. 3.6 Improving the Accuracy of Frequency Measurement by Using Marker Function

The marker counting function can be only used to measure continuous wave signals or discrete spectrum components that their amplitudes are greater than -50dBm and such amplitudes must be 30dB higher than noise levels.

d) Disable the marker counter function

Press 【Marker】→[Counter Mkr Off On] to disable the marker count function.

CAUTION When executing frequency count function, if the sweep speed of the Spectrum Analyzer slows down, this is normal as the Spectrum Analyzer is taking some time for accurate positioning of signal and IF count in the background!

CAUTION When executing frequency count function, to accurately measure the frequency, the tested signal generator should share the same time base with the Spectrum Analyzer!

3.3 How to Measure Small Signals

The noise generated inside the spectrum analyzer determines its ability to measure small signals. The following methods can be used to change the measurement setting, thus improving the measurement sensitivity of the Spectrum Analyzer.

3.3.1 Reduce RF attenuation decrement to measure small signals

The input attenuator affects the signal level of the input instrument. If the input signal is very close to the noise base, by reducing the decrement of the attenuator, the signal can be extracted from the noise.

CAUTION The total power of all signals input to the spectrum analyzer shall be less than +30dBm (1W).

a) Reset the spectrum analyzer

Press 【Preset】key to restart the spectrum analyzer.

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

Set the frequency of the external signal generator to 300MHz and set the amplitude to -80dBm, and connect the radio frequency output end of the signal generator to the radio frequency input end of the spectrum analyzer. Set the center frequency of the spectrum analyzer. Press 【Freq】 and select [Center Freq] to set the center frequency to 300MHz, and then select 【Span】 to set the span to 5MHz. Press 【Ampt】and select [Ref Level] to set the reference level to -40dBm.

c) Move the signal peak to the center frequency (300MHz in this case)

Press 【Peak】and [Marker→Center] to move the signal peak to the center frequency.

d) Reduce bandwidth

Press 【BW】and set the bandwidth as 1MHz. If necessary, repeat Step c) to ensure that the signal peak is the center frequency of the Spectrum Analyzer. As shown in Fig. 3.7.

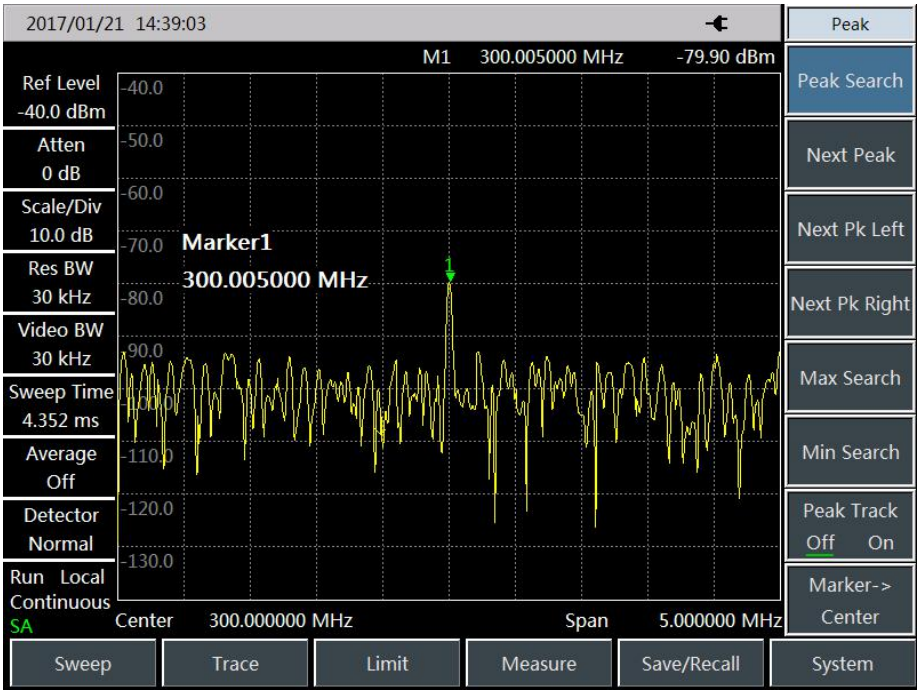

Fig. 3.7 Small Signals when pre-amplifier Off

e) Enable the pre-amplifier

On this basis, you can further enable the pre-amplifier by pressing 【 Ampt 】 →[Pre Amp Off On], as shown in Fig. 3.8.

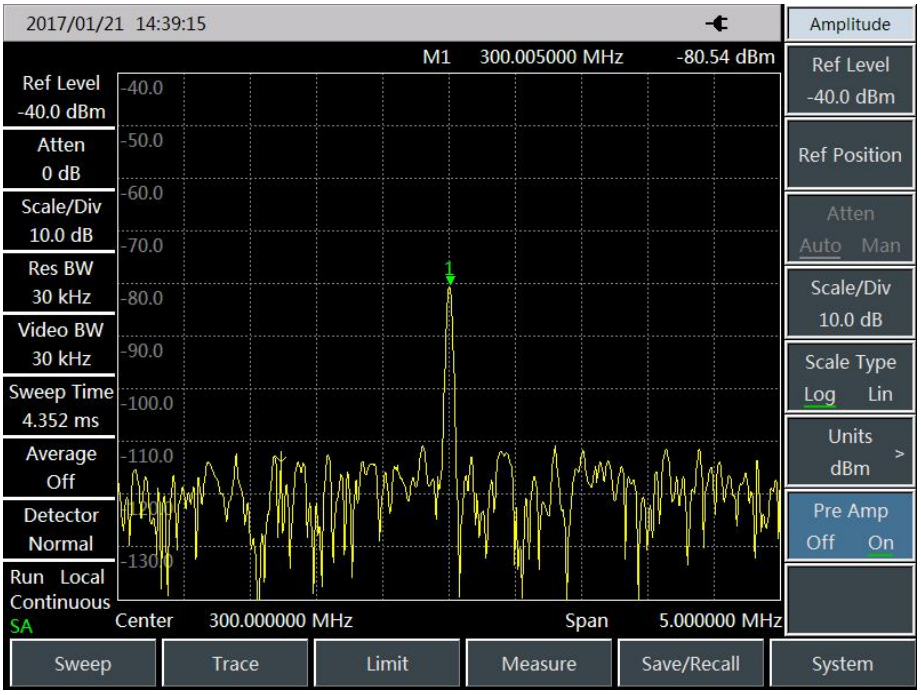

Fig. 3.8 Small Signals when pre-amplifier On

CAUTION	After finishing the test, please remember to increase the attenuation of the Spectrum Analyzer to protect the RF input port of the Spectrum Analyzer.

3.3.2 Reduce resolution bandwidth to measure small signals

The resolution bandwidth affects the internal noise base of the Spectrum Analyzer but will not affect the level of measured continuous wave signal. The relation between noise reduction and resolution bandwidth can be expressed with the following formula:

$$\Delta L = 10 \log \frac{BW_1}{BW_2}$$

Where, ΔL is the change of the noise amplitude, expressed in dB.

BW_1, BW_2 are different resolution bandwidths, expressed in Hz.

Therefore, when the frequency bandwidth is reduced by 10 times, the noise floor will be reduced by 10 dB.

a) Reset the spectrum analyzer

Press 【Preset】key to restart the spectrum analyzer.

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

Set the frequency of the external signal generator to 300MHz and set the amplitude to -80dBm, and connect the radio frequency output end of the signal generator to the radio frequency input end of the spectrum analyzer. Set the center frequency of the spectrum analyzer. Press 【Freq】 and select [Center Freq] to set the center frequency to 300MHz, and then select 【Span】 to set the span to 5MHz. Press 【Ampt】and select [Ref Level] to set the reference level to -40dBm.

c) Reduce the resolution bandwidth with the step key 【↓】

As shown in Fig. 3.9, the noise floor reduces and therefore we can see the signal more clearly.

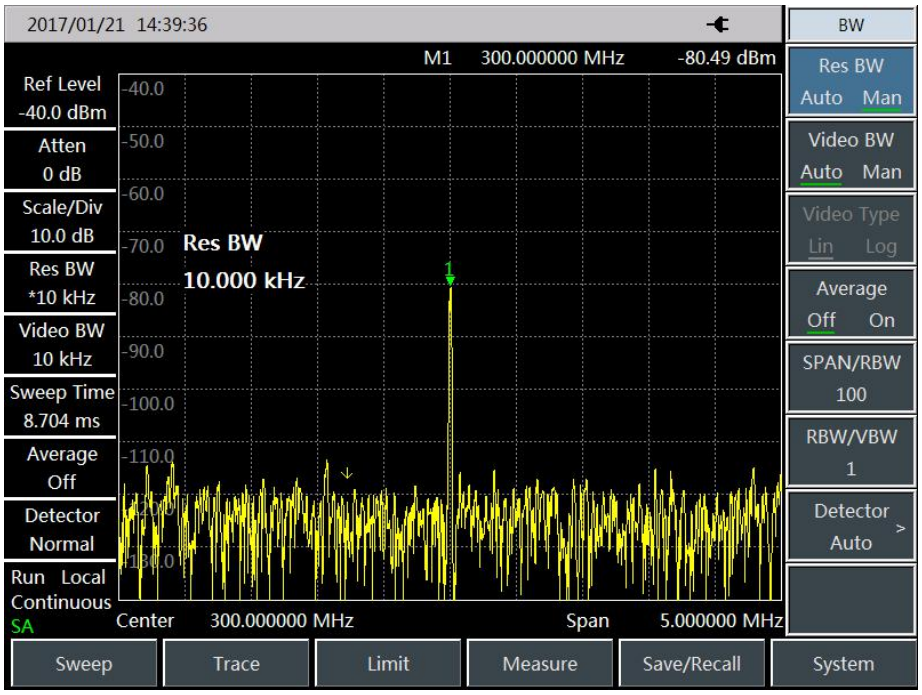

Fig. 3.9 Measuring Small Signals by Reducing Resolution Bandwidth

As the reduction of resolution bandwidth will increase the sweep time, in the S3302 Spectrum Analyzer, resolution bandwidth 1Hz - 10MHz is realized by step 1-3-10. Proper resolution bandwidth should be selected to realize delicate compromise between sweep time and resolution bandwidth.

3.3.3 Measuring small signals by using average detection and increasing sweep time

When the noise floor of the spectrum analyzer masks small signals, the noise can be smoothed by using the average detector and increasing the sweep time so as to improve the visibility of such signals. A slower sweep speed can result in a better mean square error of noise.

a) Reset the spectrum analyzer

Press 【Preset】key to restart the spectrum analyzer.

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

Set the frequency of the external signal generator to 300MHz and set the amplitude to -80dBm, and connect the radio frequency output end of the signal generator to the radio frequency input end of the spectrum analyzer. Set the center frequency of the spectrum analyzer. Press 【Freq】 and select [Center Freq] to set the center frequency to 300MHz, and then select 【Span】 to set the span to 5MHz. Press 【Ampt】and select [Ref Level] to set the reference level to -40dBm.

c) Select the detection method of the spectrum analyzer to the average detection.

Press 【BW】, [Detector] and [Average] to select the average detection method. At this time, the information bar at the left of the display screen appears “Detection Average”, showing it is set to the mean detection

manually.

d) Increase the sweep time of the spectrum analyzer

Press 【Sweep】and [Sweep Time Auto Man] and increase the sweep time with the step key 【↑】. By increasing the sweep time, there may be more time for averaging data at each trace pixel point.

3.3.4 Measuring small signals by using video average

In video average function, digital method is used to average the mean values of current trace point for sweeping and previous same trace position. Enable video average to set the number of video average. The video average gets different result from the average detector.

a) Reset the spectrum analyzer

Press 【Preset】key to restart the spectrum analyzer.

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

Set the frequency of the external signal generator to 300MHz and set the amplitude to -80dBm, and connect the radio frequency output end of the signal generator to the radio frequency input end of the spectrum analyzer. Set the center frequency of the spectrum analyzer. Press 【Freq】 and select [Center Freq] to set the center frequency to 300MHz, and then select 【Span】 to set the span to 5MHz. Press 【Ampt】and select [Ref Level] to set the reference level to -40dBm.

c) Enable the video average function

Press 【BW】 and [Average On Off]. As the average program averages the trace, the small signal becomes clearer. The default number of averages is 16.

d) Set the number of averages to 25

Input the number 25 by the numerical keypad on the front panel and press [ok], or【 Enter 】key on the soft menu, as shown in Fig. 3.10. The Remarks window at the left of the screen will display the number of average. Once the set number of average is reached, the Spectrum Analyzer will continue to perform average computation on this data basis. If you want to stop the measurement after the number of average is reached, you may use single sweep function. Press 【Sweep】and [Sweep Cont Single].

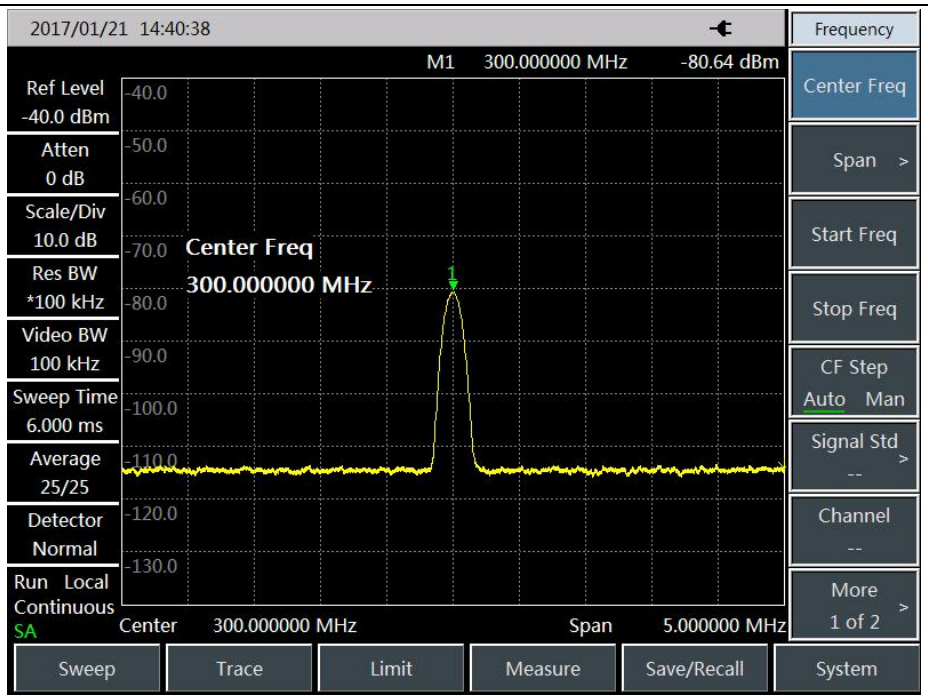

Fig. 3.10 Measuring Small Signals by Using Track Average

3.4 How to Identify Signal with Closely Spaced Frequency

3.4.1 Description of resolution bandwidth

Signal resolution is determined by the bandwidth of IF filter of the Spectrum Analyzer, i.e. the resolution bandwidth (RBW) When a signal passing through the IF filter, the Spectrum Analyzer uses the signal to sweep the band pass shape of the IF filter. When the Spectrum Analyzer receives two signals with the same amplitude and closely spaced frequency, the top of a band pass filter waveform swept by one signal will cover the other signal, and as a result, the two signals may look like one signal. If the two signals have different amplitudes but the frequency is still close, then the small signal may be covered up by the response of large signal.

3.4.2 Measurement for distinguish two signals with same amplitude

In general, in order to distinguish two signals of same amplitude, the resolution bandwidth must be less than or equal to the frequency spacing of two signals. Taking distinguishing signals of same amplitude with a spacing of 100 kHz as an example, the user should select the resolution bandwidth of the Spectrum Analyzer as less than or equal to 100 kHz.

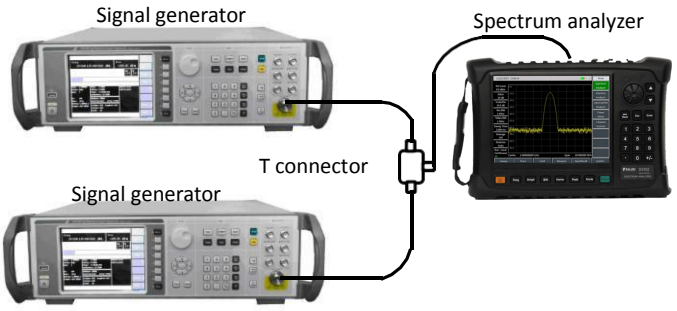

Fig. 3.11 Test instrument connection diagram of two input signals

a) Reset the spectrum analyzer

Press 【Preset】key to restart the spectrum analyzer.

b) Set the signal generator

Use a T connector to connect the output of two signal generators to the RF input port of the Spectrum Analyzer, as shown in Fig. 3.11. Set the frequency of one signal generator as 300MHz and the other as 300.1MHz and set the output amplitude of two signal generators as -20dBm. Adjust the signal output amplitude of two signal generators and observe the signal displayed on the Spectrum Analyzer so that the amplitude of these two signals displayed on the Spectrum Analyzer is the same.

c) Set the center frequency, span and resolution bandwidth of the spectrum analyzer

Press 【Freq】and [Center Freq] to set the center frequency of the spectrum analyzer to 300MHz, select 【Span】 to set the span to 2MHz, and press【BW】 and [RBW Auto Man] to set the RBW to 300kHz.

d) Observe the signal in the spectrum analyzer

On the display screen of the Spectrum Analyzer, only one signal peak can be seen and signals with close frequency spacing cannot be distinguished, as shown in Fig. 3.12.

e) Adjust the resolution bandwidth

Press 【BW】and [RBW Auto Man] to adjust the resolution bandwidth to 100kHz so that the resolution bandwidth is less than or equal to the frequency interval of such two signals. It can now be seen that the signal peak on the screen becomes flat, which indicates that there may be two signals.

f) Reduce the video bandwidth

Press【BW】and [VBW Auto Man] to adjust the video bandwidth to 10kHz. wo signals can be seen on the screen, as shown in Fig. 3.13. Use the knob or 【 ↓ 】 key on the front panel to continue to reduce the resolution bandwidth to show two signals more clearly.

For spectrum analyzer which the resolution bandwidth steps in the form of 1-3-10, to distinguish two signals with the frequency spacing of 200 kHz, the resolution bandwidth must be 100 kHz. As the primary filter on the spectrum analyzer is 300 kHz which is higher than the 200 kHz frequency spacing, the two signals cannot be distinguished.

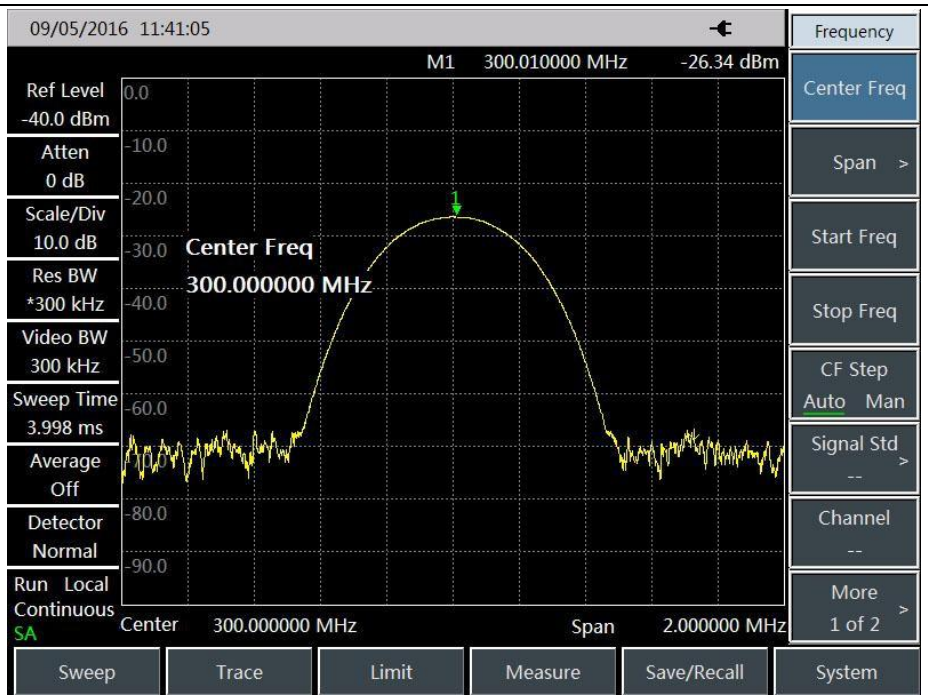

Fig. 3.12 Unable to distinguish two signals of same amplitude

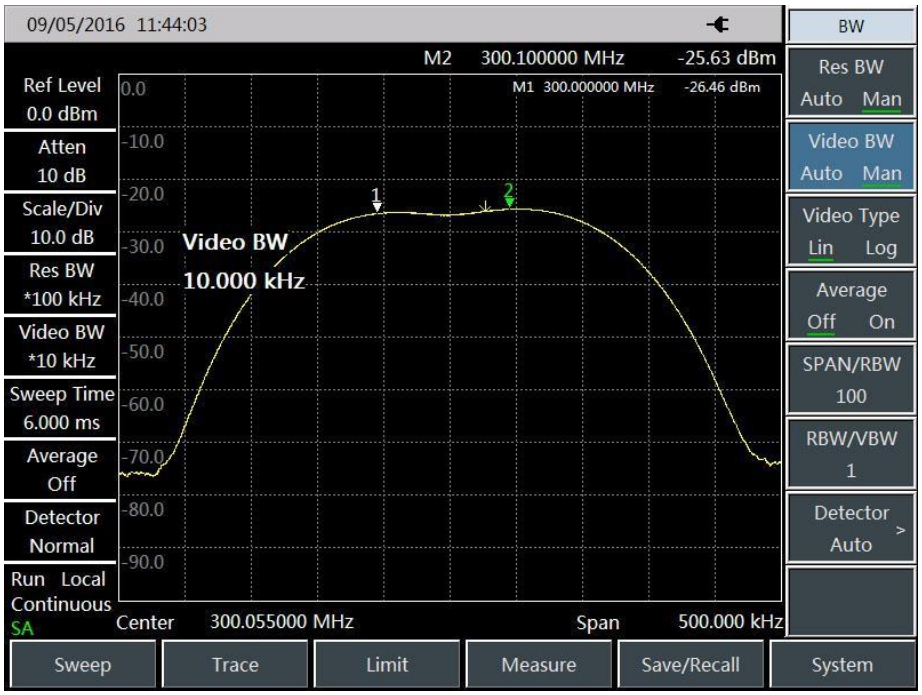

Fig. 3.13 Distinguishable two signals with same amplitude

Chapter 4 Getting Help

In general, once a problem arises from hardware, software or improper use. In case of any problem, check and save error information, analyze possible causes, and perform preliminary troubleshooting with reference to the method prescribed in "4.1 Basic inspection". You can also contact our customer service center and provide the collected error information. We will assist you to solve the problem as soon as possible. Refer to Section 4.2 for specific contact information, or query our website www.salukitec.com online so as to get the contact information of the nearest technical support center.

4.1 Basic Inspection

You can inspect the S3302 as per the following instructions in the case of any failure in your device. Please contact us if the failure cannot be removed.

- If the S3302 series can't be started when the Power key is pressed, check whether the power supply is normal, whether the adapter indicator is ON and whether the power supply battery is normal. If the above items are normal, the instrument failure may occur. In this case, contact us for repair.

- If the S3302 series can't enter the system or application procedure after start, please press【Preset】button to restore the S3302 to a known state. If S3302 still cannot work properly, an instrument failure may occur. In this case, contact us for repair.

- Press 【System】-[More 1/2]-[System Info], and you can view details about self- inspection of relevant parts. If self-inspection fails, please press【Preset】key to restore the S3302 to a known state. If self-inspection still fails, an instrument failure may occur. In this case, contact us for repair.

- If there is something wrong with the response of S3302 touch screen, please press 【Preset】 key to restore the S3302 to a known state. If it still fails, an instrument failure may occur. In this case, contact us for repair.

- If the performance indicator of S3302 is abnormal, please check whether the test tools and test environment conform to the requirements, whether the test connector is damaged and whether the performance indicator of the test unit is normal. If there is no problem, the device will be deemed to have faults, please contact us for repair.

- If S3302 fails to communicate via the LAN, firstly confirm the IP address setting of the spectrum analyzer and check the yellow LED next to the LAN interface on the rear panel. If this indicator is off, check LAN cable and connection. If it still fails, an instrument failure may occur. In this case, contact us for repair.

4.2 Help Information

S3302 series spectrum analyzer has the "Error Log" function. When a problem occurs, the instrument will automatically generate an "Error Log" which will record abnormalities such as hardware, file loss and program control operation of the instrument. The log has three levels which are prompting, warning and error for assisting the analysis of instrument fault. The user can view the error log through 【System】→ [Page Down] → [Error Log].

In addition, our customer service support center can help you at any time. We can provide you with comprehensive and convenient technical support and related services.

Contacts:

Service Tel:	886.909 602 109
Website:	www.salukitec.com
Email:	sales@salukitec.com
Address:	No. 367 Fuxing N Road, Taipei 105, Taiwan (R.O.C.)

All instruments supplied by us pass inspection by the Quality and Safety Department of the company, and they are guaranteed for 36 months from the date of delivery and maintained for a long time. During the warranty period, the instrument will be repaired free of charge if its failure is caused for non-human causes. If the warranty period expires, the instrument repair will be charged according to the repair cost. Depending on different failures of the instrument, the problems you have encountered will be solved in different ways including answering by telephone or on-site repair.

In addition, please contact us in time in the case of the instrument failure. We will provide you with the help you need and, if necessary, you may return it to the factory for repair. The user is strictly forbidden to disassemble the instrument to avoid damages to internal circuits and components due to improper operation.

WARNING We shall not be held responsible for any damage to the instrument or personal injury caused by improper operation or rule-breaking operations!

4.3 Repair Methods

Please contact us by phone or email when your S3302 incurs an unsolvable problem. If the instrument has to be repaired, please pack it according to the following steps:

(1) Write a hard copy of file describing the failure phenomenon of this instrument and put it into the packing box with the Spectrum Analyzer.

(2) Use the original packaging materials to pack the instrument properly to minimize damage.

(3) Place pads properly in the four corners of the external packaging before the instrument is put into the external packaging;

(4) Seal the external packaging with adhesive tape and secure it with nylon tape;

(5) Mark “Fragile! No touch! Handle with Care” on the packing case.

(6) Ship this instrument as a precision instrument, and keep a copy of all the shipping documents.

Appendix 1 Technical Specifications

The technical indexes of S3302 series spectrum analyzer are subject to strict test when ex-factory. The user can test and verify the device based on the technical indexes in this manual. Main technical indexes of S3302 are shown in the table below.

Table 1 Technical Specifications of S3302 Series Spectrum Analyzer

Test Item	Technical Specifications
Model	S3302SA/SB/SC, S3302A/B/C/D/E/F
Frequency range	S3302SA: 9 kHz - 4 GHz S3302SB: 9kHz - 6.5GHz S3302SC: 9kHz - 9GHz S3302A: 9 kHz - 20 GHz S3302B: 9 kHz - 26.5 GHz S3302C: 9 kHz - 32 GHz S3302D: 9 kHz - 44 GHz S3302E: 9 kHz - 50 GHz S3302F: 9 kHz - 67 GHz
Frequency readout accuracy	± (Frequency reading × frequency reference error + 2% × span + 10% × resolution bandwidth)
Frequency reference	Frequency reference error: ± (Last calibration date × aging rate + temperature stability + calibration accuracy) Aging rate: $\pm 5\times10^{-7}$/year Temperature stability: $\pm 1\times10^{-7}$(-10°C ~ 50°C, relative to 25±5°C) Initial calibration accuracy: $\pm 3\times10^{-7}$ Note: The default time elapsed since the last calibration date is one year.
Frequency span	Range: 100 Hz - upper limit of the frequency of the corresponding model; 0 Hz (zero span) Accuracy: ±2.0%
Sweep Time	Range: 10 μs - 600 s (zero span) Accuracy: ±2.00% (zero span)
Resolution Bandwidth	Range: 1 Hz - 10 MHz (1-3 times step)
Video Bandwidth	Range: 1 Hz - 10 MHz (1-3 times step)
SSB phase noise (Carrier 1 GHz, 20℃-30℃)	S3302SA/SB/SC : ≤-108 dBc/Hz@10 kHz frequency offset ≤-112 dBc/Hz@100 kHz frequency offset ≤-118 dBc/Hz@1MHz frequency offset ≤-129 dBc/Hz@10MHz frequency offset

	S3302A/B/C/D/E/F : ≤-102 dBc/Hz@10 kHz frequency offset ≤-106 dBc/Hz@100 kHz frequency offset ≤-111 dBc/Hz@1MHz frequency offset ≤-123 dBc/Hz@10MHz frequency offset	
Displayed average noise level (50Ω load at the input end, 0dB input attenuation, average detector mode, logarithmic Video Type, RBW normalized to 1 Hz, 20℃-30℃, tracking generator off)	S3302SA/SB/SC: Preamplifier off ≤-140 dBm (10 MHz - 3 GHz) ≤-138 dBm (3 GHz - 9 GHz) Preamplifier on ≤-160 dBm (10 MHz - 3 GHz) ≤-157 dBm (3 GHz - 9 GHz)	
	S3302A/B/C/D: Preamplifier off ≤-138 dBm (10 MHz - 20 GHz) ≤-135 dBm (20 GHz - 32 GHz) ≤-127 dBm (32 GHz - 40 GHz) ≤-120 dBm (40 GHz - 44 GHz) Preamplifier on ≤-157 dBm (10 MHz - 20 GHz) ≤-154 dBm (20 GHz - 32 GHz) ≤-148 dBm (32 GHz - 40 GHz) ≤-140 dBm (40 GHz - 44 GHz)	
	S3302E/F: Preamplifier off ≤-136 dBm (10 MHz - 20 GHz) ≤-135 dBm (20 GHz - 32 GHz) ≤-130 dBm (32 GHz - 40 GHz) ≤-121 dBm (40 GHz - 46 GHz) ≤-116 dBm (46 GHz - 60 GHz) ≤-102 dBm (60 GHz - 67 GHz) Preamplifier on ≤-154 dBm (10 MHz - 32 GHz) ≤-148 dBm (32 GHz - 40 GHz) ≤-143 dBm (40 GHz - 46 GHz) ≤-135 dBm (46 GHz - 60 GHz) ≤-123 dBm (60 GHz - 67 GHz)	
Second harmonic distortion (0 dB attenuation, -30 dBm input signal)	S3302SA/SB/SC/E/F : <-65 dBc	S3302A/B/C/D : <-60 dBc
Third-order intermodulation distortion (-15 dBm double tone signal, 100 kHz interval, 0 dB attenuation, preamplifier off)	S3302SA/SB/SC : ≥+10 dBm 50 MHz - 9 GHz	S3302A/B/C/D : ≥+7 dBm 50 MHz - 4 GHz ≥+6 dBm 4 GHz - 13 GHz ≥+6 dBm 13 GHz - 44 GHz

1 dB gain compression (Dual-tone method test, signal interval 10 MHz)	S3302SA/SB/SC : ≥+2 dBm 50 MHz - 9 GHz	S3302A/B/C/D : ≥-2 dBm 50 MHz - 4 GHz ≥-3 dBm 4 GHz - 13 GHz ≥-3 dBm 13 GHz - 44 GHz
Image, multiple and out-of-band response (-10 dBm mixer level)	≤-65 dBc 10 MHz - 20 GHz ≤-60 dBc 20 GHz - 44 GHz	
Residual response (RF input matching, 0 dB attenuation, Tracking Generator off)	S3302SA/SB/SC : Exceptional frequency 3,200 MHz Preamplifier on: ≤-95 dBm 10 MHz - 9 GHz Preamplifier off: ≤-82 dBm 10 MHz - 9 GHz	S3302A/B/C/D : Exceptional frequency 3,200 MHz Preamplifier on: ≤-100 dBm 10 MHz - 20 GHz ≤-95 dBm 20 GHz - 44 GHz Preamplifier off: ≤-90 dBm 10 MHz - 13 GHz ≤-85 dBm 13 GHz - 20 GHz ≤-80 dBm 20 GHz - 44 GHz
Scale fidelity	±1.00 dB	
Total level uncertainty (after 30 minute warm-up,input signal 0 dBm to -50 dBm, all set as auto coupling,20℃-30℃)	±1.8 dB (10 MHz - 13 GHz) ±2.3 dB (13 GHz - 40 GHz) ± 2.7dB (40 GHz - 50 GHz) ± 3.0dB (50 GHz - 67 GHz)	
Input attenuator	S3302SA/SB/SC/E/F : Attenuation range: 0 dB - 30 dB, 5 dB step Conversion uncertainty: ±1.20 dB	S3302A/B/C/D : Attenuation range: 0 dB - 50 dB, 10 dB step Conversion uncertainty: ±1.20 dB
Maximum safe input level (CW input)	S3302SA/SB/SC/E/F : +27dBm, typical value (≥10dB attenuation, pre-amplifier off)	S3302A/B/C/D : +30dBm, typical value (≥10dB attenuation, pre-amplifier off)
Reference Level	Logarithmic scale: -120 dBm to +30 dBm, 1 dB step Linear scale: 22.36 uV - 7.07 V, 0.1% step Conversion uncertainty: ±1.20 dB (reference level: 0 dBm to -60 dBm)	
Input voltage standing-wave ratio (>10 dB input attenuation)	≤ 1.80:1 50 MHz - 20 GHz ≤ 2.20:1 20 GHz - 44 GHz	
Display scale	Logarithm scale 0.1-10dB per scale, 0.1dB step minimum (10 - scale display) Linear scale: 10 scale display	

		Scale unit: V, A, W, dBm, dBW, dBV, dBmV, dBuV, dBA, dBmA, dBuA
Tracking Generator (Option)	Frequency range	S3302SA: 9 kHz - 4 GHz S3302SB: 9kHz - 6.5GHz S3302SC: 9kHz - 9GHz
	Amplitude range	0 dBm to -40dBm
	Minimum Amplitude step	0.1dB
	Amplitude accuracy	±2.50dB（Frequency Range 10MHz - 9GHz, Amplitude Range 0dBm to -40dBm ,20℃-30℃）
	Sideband noise	1GHz frequency point, 0dBm output: ≤-90dBc/Hz@10kHz frequency offset ≤-95dBc/Hz@100kHz frequency offset ≤-110dBc/Hz@1MHz frequency offset

- End of Document -