

# Ceyear

## 4041 Series Spectrum Analyzer Quick Start Guide



China Electronics Technology Instruments Co., Ltd



## Foreword

Thanks a lot for choosing the 4041 series spectrum analyzer developed and manufactured by CETI.

We are devoted to providing for you high-quality products and first-class after-sales service with your most concerns and demands in mind. Following the consistent tenet of “High Quality and Considerable Service”, we are committed to provide for our customers satisfactory products and services.

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## Manual Authorization

This manual may be subject to change without notice. CETI reserves all the rights to the final explanation for all the information and terminologies referred to in this manual.

This manual is the property of CETI. Without our permission, any organizations or individuals shall neither alter/temper nor duplicate/transmit this manual for profits; otherwise, CETI reserves the right to pursue any liabilities therefrom.

### Product Assurance

The warranty period of the product is 18 months from the date of delivery. During the warranty period, we will repair or replace damaged parts according to actual conditions. For this purpose, the user needs to send the product to the manufacturer and prepay the postage, and the manufacturer will return the postage together with the product after repairing.

### Product Quality Certificate

This product is warranted to meet the requirements in the manual from the date of delivery. Calibration measurement will be completed by units with national qualifications and relevant information may be provided for user access.

### Quality/Environmental Management

The product complies with the quality and environmental management systems during research and development, manufacturing and testing. China Electronics Technology Instruments Co., Ltd. has been certified by ISO 9001 and ISO 14001.

### Quality

## Safety Matters



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.



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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## Chapter 1 Manual Overview

This manual describes the structure and use of the 4041 series spectrum analyzer (hereinafter referred to as 4041 or the spectrum analyzer) from the aspects of instrument panel, power supply, power-on for use, typical applications and after-sales service access. By reading this manual, you can have a relatively systematic understanding of 4041 and can quickly master some basic operations of the spectrum analyzer. For a proper use of this instrument, please read this manual carefully before operating the instrument and follow the directions herein.

*4041 Series Spectrum Analyzer Quick Start Guide* includes the following chapters and sections:

- **Ready to Use**

This chapter introduces 4041 pre-operation preparation, power-on for use, and panel description. By reading this chapter, you can have a perceptual knowledge of 4041 on the whole, and prepare for correct and safe operation of the instrument.

- **Typical Applications**

This chapter details basic measuring method of 4041, elaborates operation steps of 4041 basic measurement function by introducing how to distinguish signals that are close to each other, how to improve the accuracy of frequency measurement and how to measure small signals, and briefly describes the skills used during tests. After reading this chapter, you can use 4041 to complete some typical tests.

- **Getting Help**

This chapter covers after-sales repair and repair methods, focusing on troubleshooting, maintenance and repair of the instrument in use.

## Chapter 2 Ready to Use

The 4041 series spectrum analyzer enjoys such advantages as wide working frequency range, high performance indicator, high sweep speed, multiple test functions, and simple operation. As for performance specifications, it has excellent average noise level, phase noise and extremely fast sweep speed, and multiple measurement functions. With a 12.1-inch liquid crystal and capacitive touch screen, it has a hand-held structure with small volume, light weight, flexible power supply and easy moving so that it is extremely suitable for field use. This chapter will focus on test environment, power supply, structure and battery replacement of the instrument.

### 2.1 Preparation before Operation

This section describes the precautions before initial use of the 4041 series spectrum analyzer. 4041 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.



**To prevent instrument damage and avoid any electric shock, fire or personal injury:**

- Do not turn the instrument on without authorization;
- Do not attempt to disassemble or modify any part not illustrated in this manual. Unauthorized disassembly may result in degradation of electromagnetic shielding efficiency or damages to internal parts of the instrument, thus affecting the reliability of the product. If you disassemble the instrument without authorization, we will no longer provide any repair free of charge even if the product is under warranty.

#### 2.1.1 Environmental requirements

To ensure long service life and effective and accurate measurement of the 4041 series instrument, test it under the following environmental conditions:

##### 1. Temperature range:

Storage temperature range:  $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$

Operating temperature range:  $0^{\circ}\text{C} \sim +50^{\circ}\text{C}$

##### 2. Low atmospheric pressure:

Low atmospheric pressure (altitude):  $0 \sim 4,600\text{m}$

#### 2.1.2 Selection of power lines

The 4041 series spectrum analyzer uses three-core power line complying with international safety standards. When the power line is used, insert it into a suitable power outlet with protection ground so that the power line can ground the instrument housing. It is recommended to use the attached power line of the instrument. When replacing the power line, it is recommended to use the same type of 250V/10A power line.

#### 2.1.3 Power supply requirements

##### ➤ AC power supply

In the case of AC power, the attached power line or the same type, with AC power of 90V~132V or 180V~264V and frequency of 47Hz~440Hz, must be used. The allowable range of steady-state voltage is  $\pm 10\%$  of the rated value, and of steady-state frequency is  $\pm 5\%$  of the rated value.

#### 2.1.4 Electrostatic discharge protection (ESD)

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. Make yourself ground before cleaning or checking the instrument test port or making connection. This may be achieved by grasping the metal housing of the instrument already grounded or the shell of the testing cable connector.

## 2.2 Instructions for Power-on

Check the power supply unit based on the “power supply requirements” in Section 2.1.2 before powering on the 4041. Power on for testing after no problem is found.

Press the POWER key ([] key) for about three seconds and release it after hearing a “click” sound. The spectrum analyzer will take about 30 seconds to start the resident program. In order to stabilize the performance indicator of the components within the instrument for a better test effect, it is recommended that the instrument is preheated for 30 minutes prior to the measurement.

## 2.3 Front Panel Overview

This section details the front panel of 4041, which is shown in Figure 2.1.



Figure 2.1 Front Panel of 4041 Spectrum Analyzer

### 2.3.1 Power key and indicator

Located at the lower left corner of the front panel of the spectrum analyzer. The power indicator is located inside the white power-on key.

### 2.3.2 Function key zone

The function key zone is located at the bottom of the screen for changing the parameter settings of the measurement, including 10 keys:

- **【Freq】** : For setting the measurement frequency range, frequency stepsize, and signal standard, etc.;
- **【Ampt】** : For setting the amplitude parameters of display measurement results, including display format, display scale, and control of preamplifier, etc.;
- **【Marker】** : For setting the specific parameters of the measurement marker;
- **【Sweep】** : For setting the sweep time, sweep type, sweep points, trigger, etc.;
- **【Span】** : For setting the span and IF output, etc.;

- **【BW】** : For setting the RBW, VBW, detection type, average and other parameters of the measurement;
- **【Peak】** : For getting the peak parameters;
- **【Trace】** : For setting the trace display status parameters;
- **【File】** : For saving or reading data files and status files, and for setting the storage locations;
- **【Mode】** : For setting the measurement modes, including spectrum analysis, interference analysis, demodulation analysis, power measurement, channel scanner, and field strength measurement.

### 2.3.3 Reset key

For system reset, system restart, and restoring to the defaults. Press the key and then release it for reset.

### 2.3.4 Numeric key zone

- 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.
- **【.】** : Used to enter a decimal point in the case of a decimal value with decimal digits.
- **【+/-】** : plus/minus, which is used to trigger whether a positive or negative value is entered.
- **【↑】** and **【↓】** : Control the step upward and downward, or select the current item up and down.
- **【Esc】** : 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.
- **【Back】** : In the case of an input area, press the key to clear a character before the marker.
- **【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.

### 2.3.5 Speaker

The 4041 series spectrum analyzer is equipped with a speaker. Keep the speaker opening clean so as not to affect sound effects.

### 2.3.6 Logo display area

It shows the corresponding model, frequency range, label, and name of the 4041 series spectrum analyzer.

## 2.4 Overview of Operation Interface

The 4041 has an integrated 12.1-inch liquid crystal and capacitive touch screen, and the operation interface is shown in Figure 2.2.

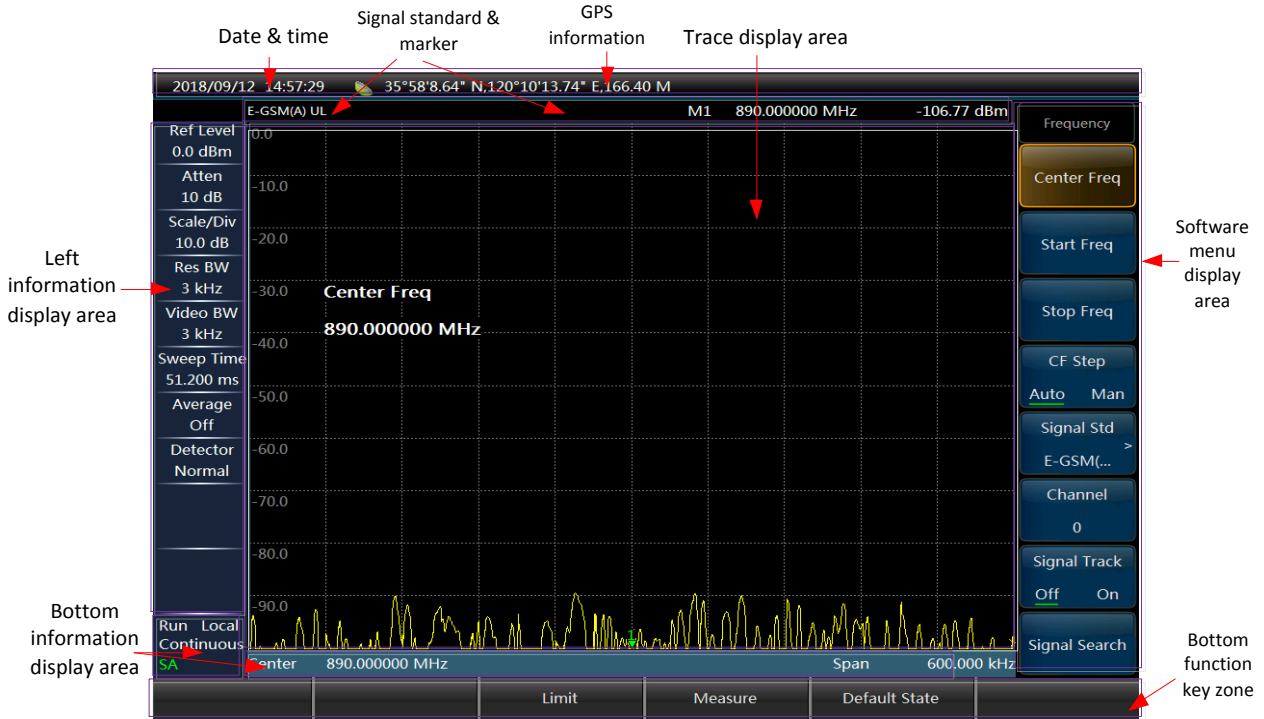


Figure 2.2 Operation Interface of 4041 Series Spectrum Analyzer

## 2.5 Overview of Interface Panel

The peripheral interfaces of the 4041 series spectrum analyzer are mainly located on the rear panel as shown in Figure 2.3, and they are divided into power interfaces, test ports and digital interfaces.

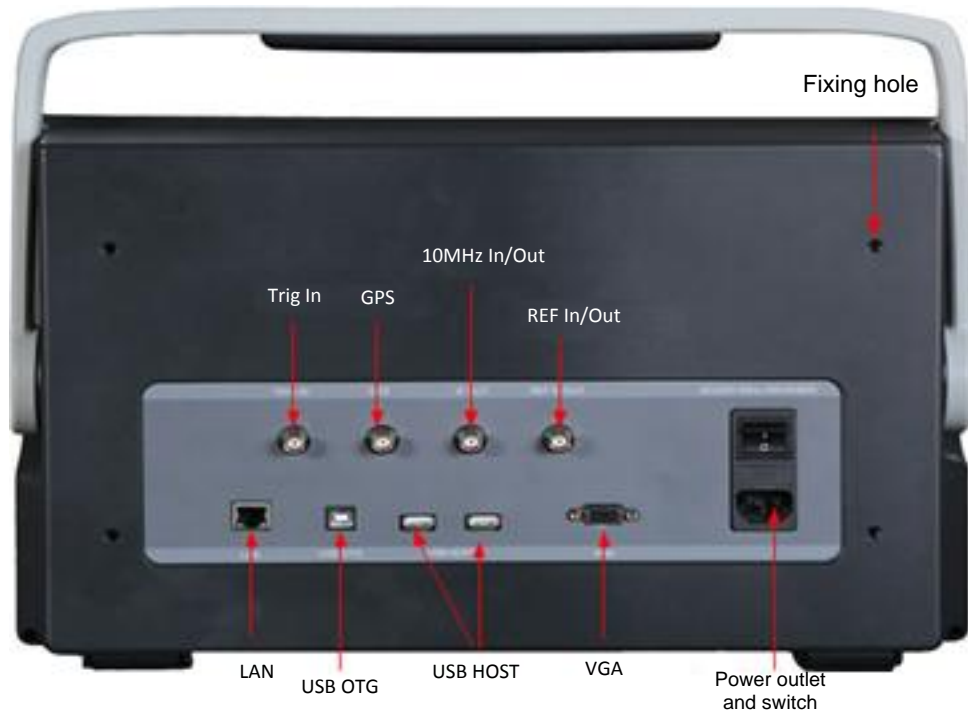


Figure 2.3 Top Panel of 4041 Series Spectrum Analyzer

### 2.5.1 Power interface

This is the power interface of the instrument, and it can be used to supply the spectrum analyzer directly by using external AC power. For the external power interface, the inner conductor is positive, and the outer conductor is grounded.

### 2.5.2 Test ports

- 1) RF input port: For the input of the measured signals. The 4041 series test signal input port is 50Ω. 4041D/E model uses N-type female port, and 4041F/G model uses 2.4mm male port.
- 2) Tracking generator output port (option): For the output of the tracking generator signal. The range of the output signal power is -5dBm ~ -35dBm. 4041 series tracking generator output interface uses N-type female port.
- 3) 10MHz input/output port: For connecting 10MHz signal of the external equipment as a reference signal of the spectrum analyzer; or for the output of the internal 10MHz reference signal from the spectrum analyzer for use by the external equipment.
- 4) IF output port: In the case of zero span, the IF signal output can be provided via software configuration for use by the external equipment.
- 5) Trigger input port: The 4041 series can be set to external trigger mode. The external trigger source is connected to the trigger input port of the spectrum analyzer. The output range of the source must be -5V~+5V. This can be set by the software to use either rising edge trigger or falling edge trigger.
- 6) GPS antenna port: For connecting the GPS antenna so as to locate the current position of the spectrum analyzer.



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) B-type USB interface: For connecting to the external PC. The PC uses the programmable commands or programmable function library to achieve 4041 series program control or data transmission.

#### CAUTION

The first time you connect the spectrum analyzer to your PC via USB, you need to install a device driver.

- 2) A-type USB interface: For connecting to the USB peripherals, such as USB storage devices, USB power probes, etc.
- 3) LAN (network) port: This is a network port of 10/100Mbps for connecting to the computer (PC) via network cable. The PC uses the programmable commands or programmable function library to achieve 4041 series program control or data transmission.

### 2.5.4 Instrument signs

The instrument signs (warning signs) indicate that the maximum input power of the test port is +30dBm and the maximum input DC level is 16VDC. So the user must not connect signals beyond this range to the ports. Inputs exceeding the above range may burn the instrument!

## Chapter 3 Typical Applications

4041 provides several working modes, including spectrum analysis, interference analysis (option), demodulation analysis (option), power measurement (option) and channel scanning (option), and various intelligent measurement functions are provided in such working modes. This chapter mainly describes basic tests in spectrum analysis mode. Please refer to the *User Manual for 4041 Series Spectrum Analyzer* for detailed operation in each option mode.

### 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. Such keys can be used to set the exact value of the current parameter, and the step key and the knob can also be used to change the center frequency value, as shown in Figure 3.1.

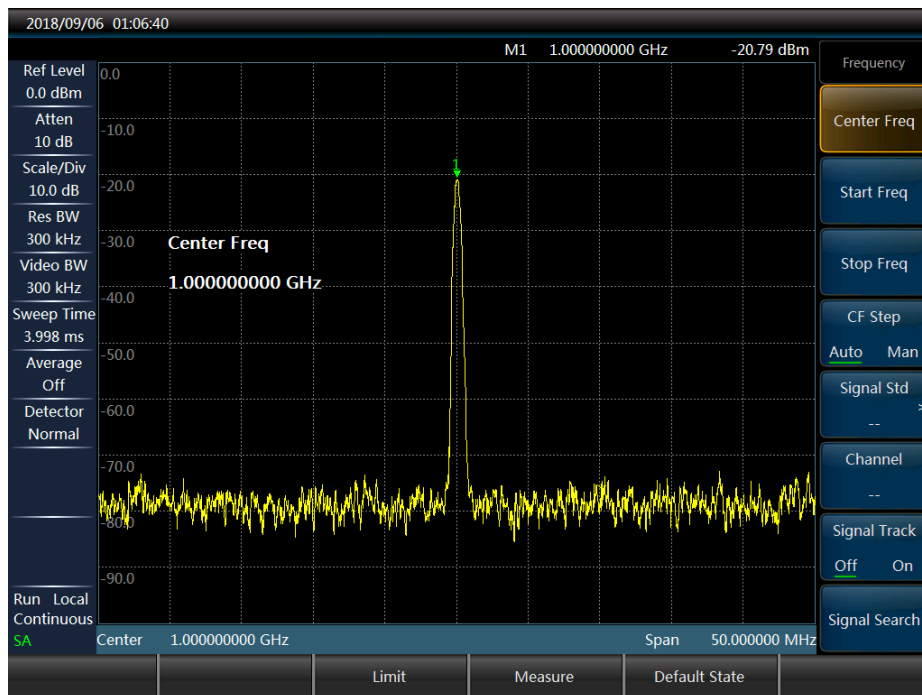


Figure 3.1 Center Frequency of 1 GHz

#### b) Set the span

Press **【Span】**. Check whether the span data is displayed in the active functional area to determine the currently active parameter. If you want to reduce the span, for example, to 10MHz, enter **【1】** **【0】** with the numeric keys and select the unit [MHz], or reduce it to such value by using the **【↓】** key (the data key and the step key can be used to change the value of the current parameter). The display results are shown in Figure 3.2. Check whether the resolution and video bandwidths and the span are

self-adaptive. If yes, they will automatically adjust to suitable values based on a given span value. The sweep time can also be self-adaptive.

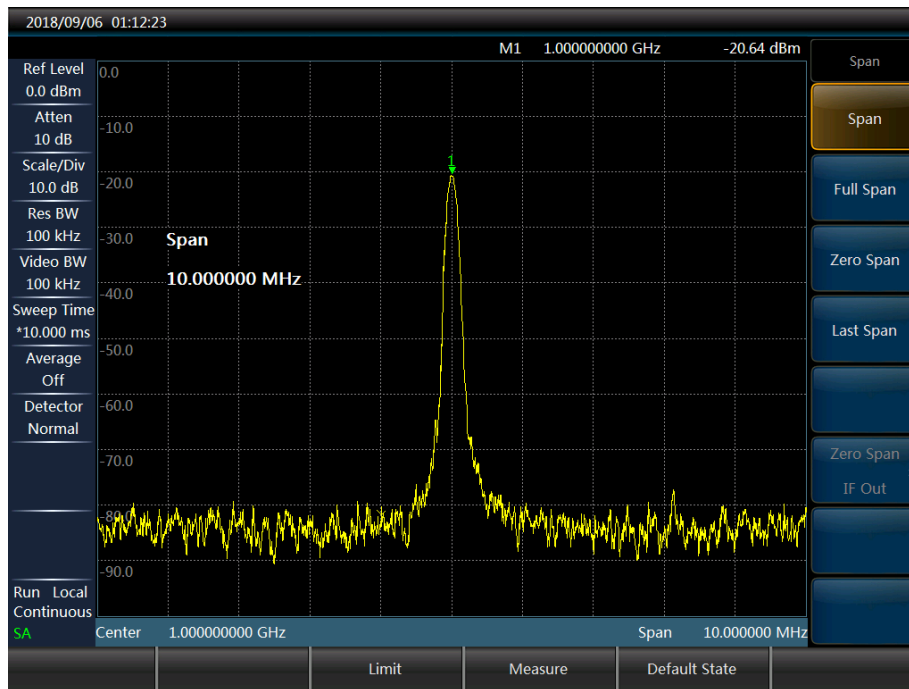


Figure 3.2 Center Frequency of 1GHz and Span of 10MHz

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 is adaptive to other relevant parameter settings.

d) Activate the marker

Press **【Marker】** to activate the general marker and display it at the center position in the horizontal coordinate (read out the frequency and amplitude values based on the marker and display them on the active functional area. At this time, the marker reading frequency is 1GHz and the amplitude is about -20dBm, as shown in Figure 3.3.

If the marker is not on the peak point of the signal, press **【Peak】** key so that the marker automatically jumps to the peak point of the signal, or manually move it to the maximum point of the signal by using the knob on the front panel.

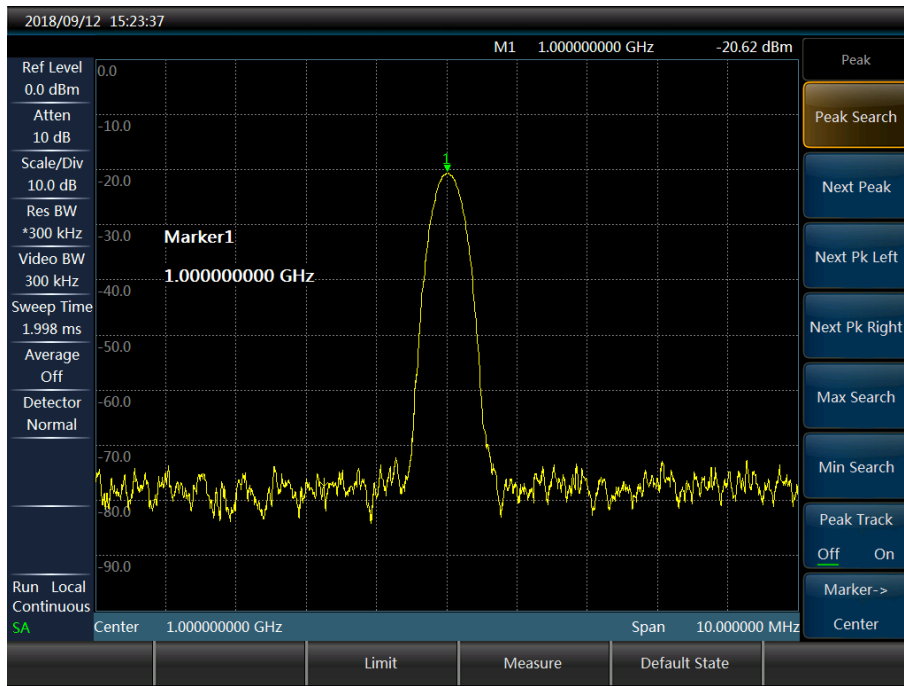


Figure 3.3 Activating the Marker

e) Adjust the amplitude parameter

Generally put the signal peak at the position of the reference level for optimum amplitude measurement accuracy, as shown in Figure 3.4. Press **【Ampt】** → [Ref Level] to set the reference level to the marker amplitude value.

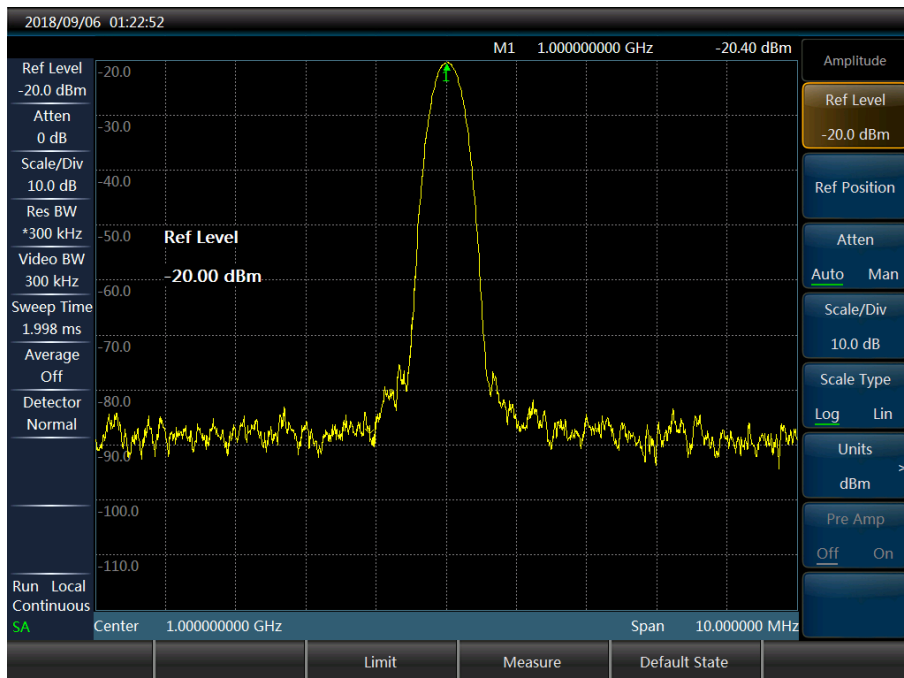


Figure 3.4 -20dBm Reference Level

f) Save the test results

Press **【File】** → [Save Data] (You can also select Save State or Save Pictures) and pop up the interface shown in Figure 3.5, enter a name, and then click [OK] to finish saving.





Figure 3.5 File Saving

### 3.2 How to Improve the Accuracy of Frequency Measurement

Taking the measurement of external 1GHz signals as an example, this section introduces how to improve the reading accuracy of the frequency measurement by using the marker counting function of the spectrum analyzer. The test procedures 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 to 1GHz. Enter **【1】** [GHz] directly with the key in the front panel data zone. Such keys can be used to set the exact value of the current parameter, and the step key and the knob can also be used to change the center frequency value.

- c) Turn on the marker counting function

Press **【Marker】** to activate the marker. Press **【Marker】** → [Counter Mkr Off On] to turn on the marker counting function. Press **【Peak】** to make the marker at the signal frequency, and observe the marker reading at this time. The numerical resolution of the frequency item can be up to 1Hz. As shown in Figure 3.6.



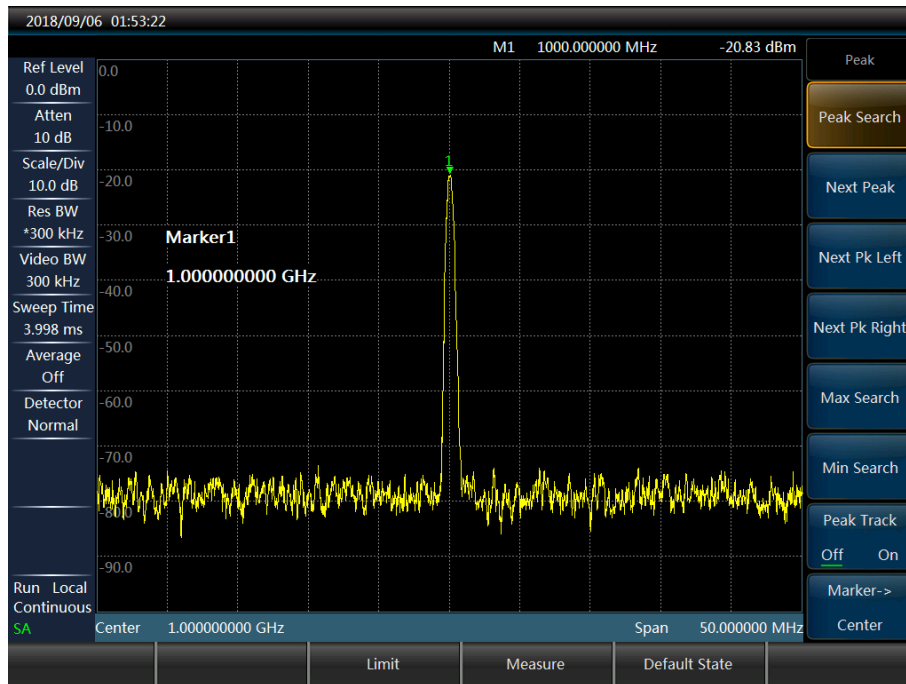


Figure 3.6 Improving the Accuracy of Frequency Measurement by Using Marker Function

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) Turn off the marker counting function

Press **【Marker】** → [Counter Mkr Off On] to turn off the marker counting function.

#### CAUTION

If the user finds that the sweep speed of the spectrum analyzer is slow when performing the frequency counting function, it is normal because the analyzer is taking a long time to accurately position the signal and count the intermediate frequency in the background!

#### CAUTION

When the frequency counting function is being performed, the test signal generator and the spectrum analyzer shall have the same time base in order to accurately measure the frequency.

### 3.3 How to Measure Small Signals

The noise generated inside the spectrum analyzer determines its ability to measure small signals. The following methods are always used to change the measurement settings to improve the measurement sensitivity of the spectrum analyzer.

#### 3.3.1 Measuring small signals by reducing the attenuation of the radio frequency attenuator

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

#### 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 the bandwidth

Press **【BW】** to set the bandwidth to 30kHz. If necessary, repeat the step c) to ensure that the peak of the signal is at the center frequency of the spectrum analyzer. As shown in Figure 3.7.

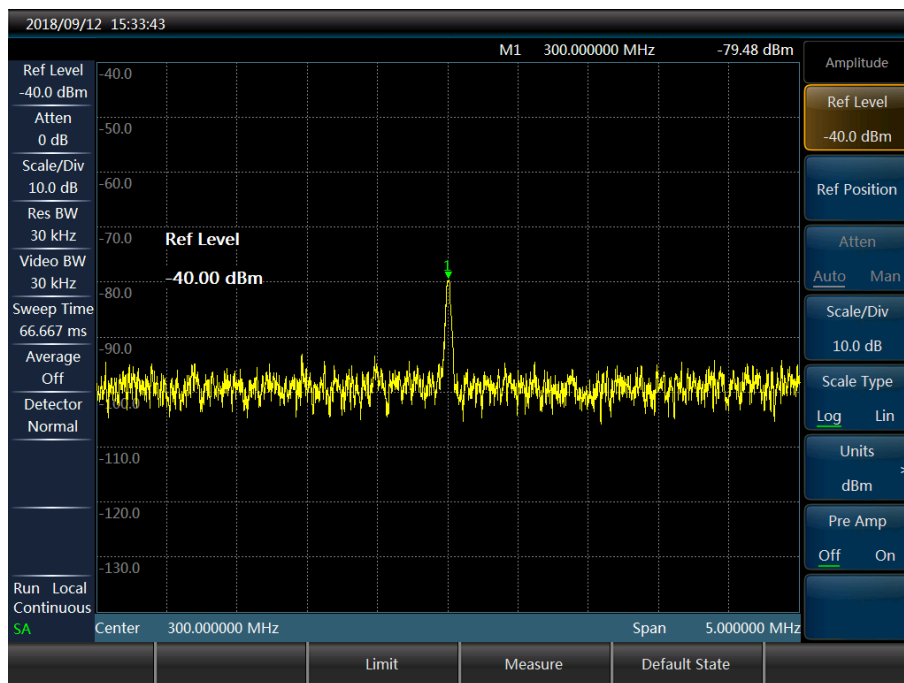


Figure 3.7 Small Signals when the Reference Level is -40dBm and the Preamplifier is Off

e) Turn the preamplifier on

On this basis, it is possible to further turn the preamplifier on. Press **【Ampt】** →[Pre Amp Off On], as shown in Figure 3.8.

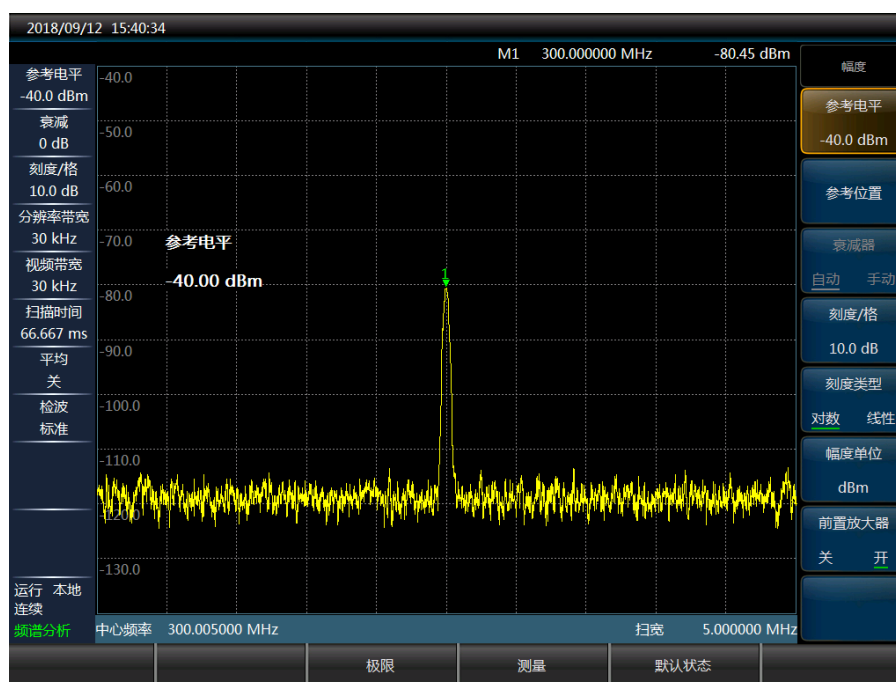


Figure 3.8 Small Signals when the Reference Level is -40dBm and the Preamplifier is On

### CAUTION

At the end of the test, remember to increase the attenuation of the spectrum analyzer to protect its radio frequency input end.

### 3.3.2 Measuring small signals by reducing resolution bandwidth

The resolution bandwidth affects the noise floor inside the spectrum analyzer, but it has no impact on the level of the measured continuous wave signal. The relationship between the noise reduction amount and the resolution bandwidth can be expressed by the following formula:

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

Where,  $\Delta L$ — is the change of the noise amplitude, expressed in dB.

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

So the noise floor drops by 10dB when the resolution bandwidth is reduced by 10 times.

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 Figure 3.9, it can be seen that the signal becomes clear since the noise floor is reduced.

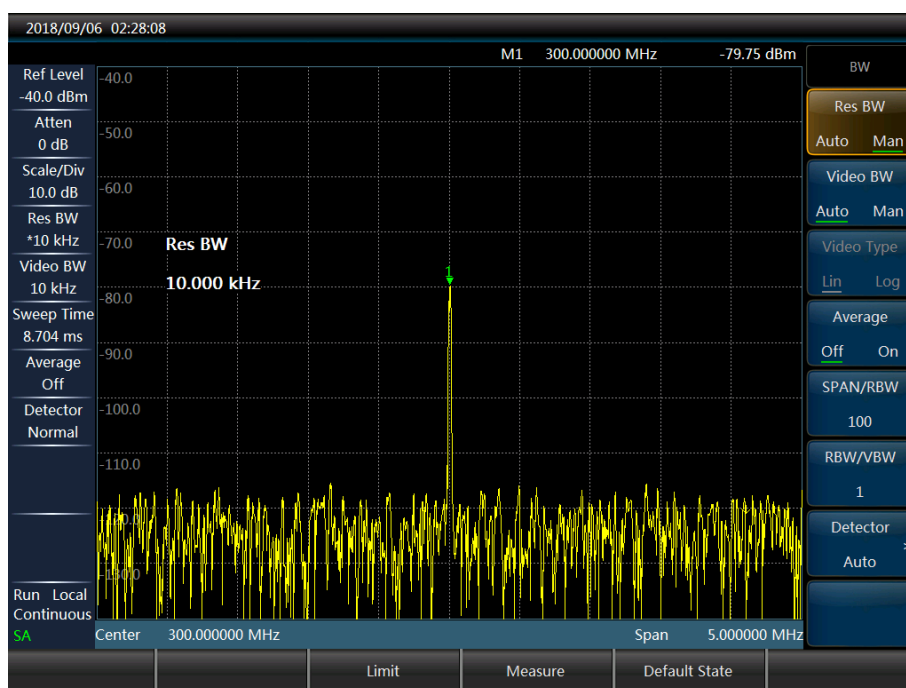


Figure 3.9 Measuring Small Signals by Reducing Resolution Bandwidth

The reduction of the resolution bandwidth will cause the increase of the sweep time. In the 4041 series spectrum analyzer, the resolution bandwidths ranging from 1Hz to 10MHz are increased with the steps of 1-3-10. Selecting a suitable resolution bandwidth can keep a balance between the sweep time and the 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 detection method 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

Video average means the average of current swept trace point and the historical average of the same point by using a digital processing method. When you turn on the video average function, you can set the number of the video average. The effects of the video average function and the average detection are different.

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) Turn on 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

Enter the number 25 via the digital input area on the front panel, and then press **【Enter】** or the [OK] key in the soft menu, as shown in Figure 3.10. At this time, the number of averages appears in the annotation window at the left of the display screen area. Once the number of averages you set is reached, the spectrum analyzer will continue to perform an average operation on that data basis. If you want to stop measurement after the number of averages is reached, you can use the single sweep function. Press **【Sweep】** , [Sweep Cont Single].

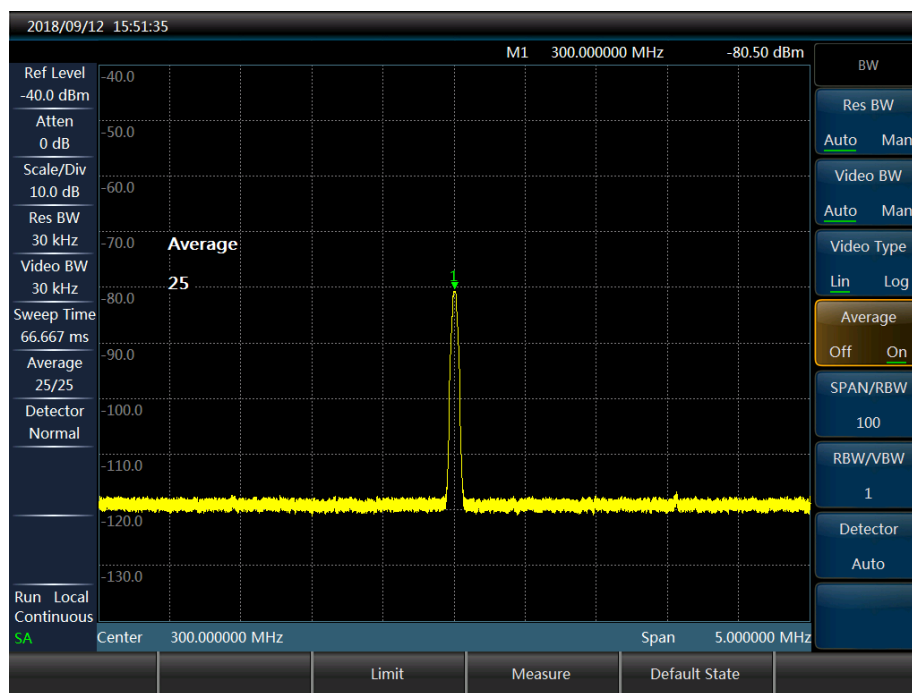


Figure 3.10 Measuring Small Signals by Using Track Average

### 3.4 How to Distinguish Signals that Their Frequencies Are Very Close

#### 3.4.1 Description of resolution bandwidth

The signal resolution capability is determined by the intermediate frequency (IF) filter bandwidth, i.e., resolution bandwidth (RBW), of the spectral analyzer. When a signal passes through the IF filter, the spectrum analyzer sweeps the band-pass shape of the IF filter by using the signal. Thus, when the spectrum analyzer receives two signals with the same amplitude and the very close frequencies, the top of the bandpass filter waveform scanned from one of the signals almost covers that of the other signal to make the two signals look like a signal. If two signals have unequal amplitudes and very close frequencies, it is possible that a small signal is submerged by the response of a large signal.

### 3.4.2 Measurement for distinguishing two signals with equal amplitude

In general, the resolution bandwidth must be equal to or less than the frequency interval of two signals if you want to distinguish such two signals with equal amplitude. For example, the user shall select a RBW of 100kHz or below in the spectrum analyzer if two signals with equal amplitude have a frequency interval of 100kHz.

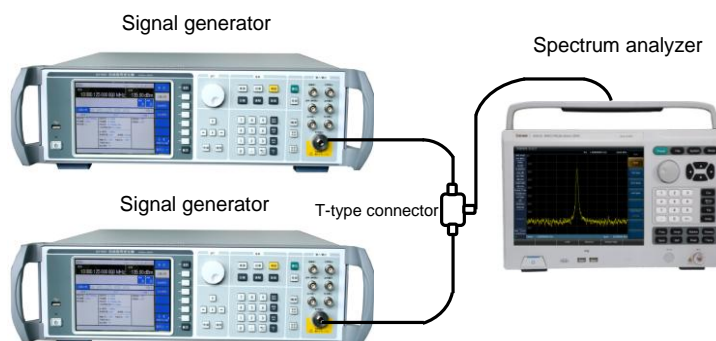


Figure 3.11 Connection Diagram of Instrument for Testing Two Input Signals

- a) Reset the spectrum analyzer

Press **【Preset】** key to restart the spectrum analyzer.

- b) Set the signal generator

Connect the output of the two signal generators to the radio frequency input end of the spectrum analyzer with a T-connector, as shown in Figure 3.11. Set the frequencies of such two signal generators to 300MHz and 300.1MHz respectively, set the output amplitudes of the two signal generators to -20dBm, adjust the signal output amplitudes of the two signal generators, and observe the display signal of the spectrum analyzer to ensure that the amplitudes of the two signals displayed by the spectrum analyzer are equal.

- 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

It can now be seen that there is only one signal peak in the display screen of the spectrum analyzer, but it is not possible to distinguish two signals with a very close frequency interval, as shown in Figure 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. It can now be seen that two signals appear on the screen, as shown in Figure 3.13. You can see two signals more clearly after continually reducing the resolution bandwidth by using the knob on the front panel or the **【↓】** key.

For the spectrum analyzer with a resolution bandwidth step of 1-3-10, its resolution bandwidth must be set to 100kHz to distinguish two signals with a frequency interval of 200kHz. Since the frequency of the primary filter on the spectrum analyzer is 300kHz and exceeds the frequency interval of 200kHz, two signals cannot be distinguished.

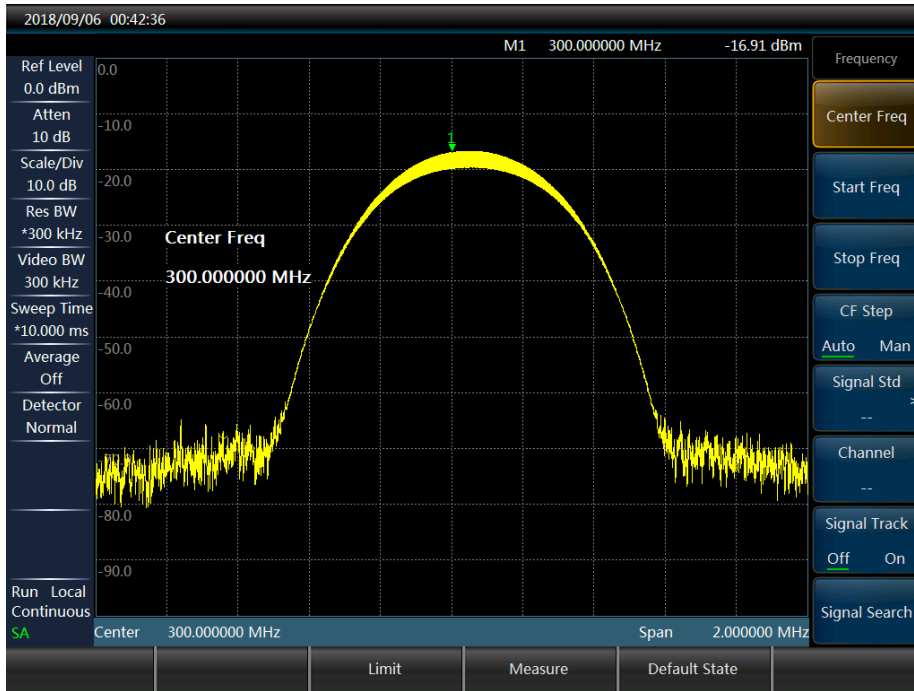


Figure 3.12 Indistinguishable Two Signals with Equal Amplitude

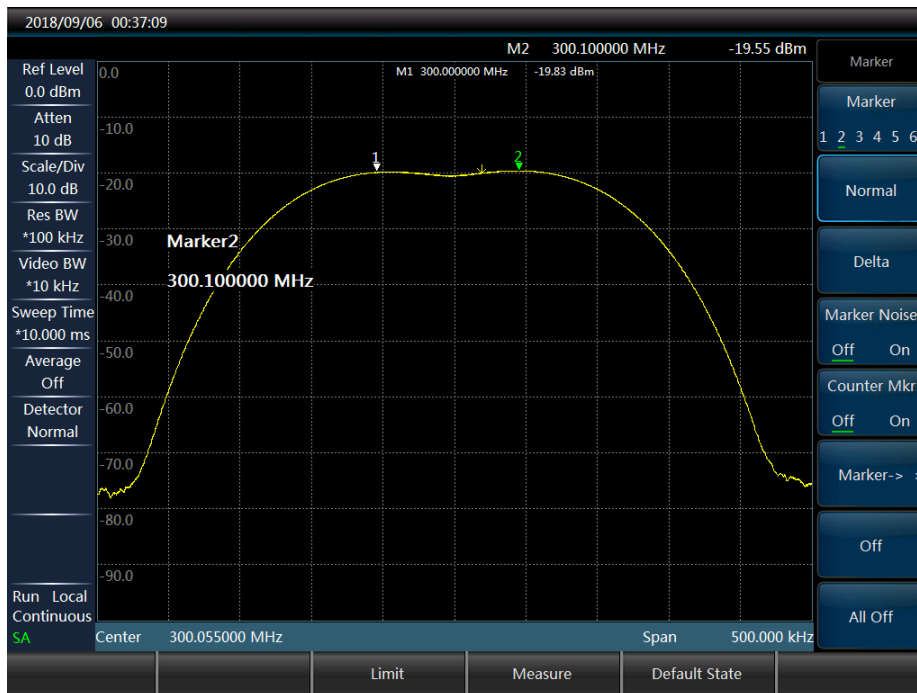


Figure 3.13 Distinguishable Two Signals with Equal Amplitude



## Chapter 4 Getting Help

In general, once a problem arises from hardware, software or improper use, you may observe the fault message and save it, analyze possible causes and troubleshoot such problem by referring to the methods given in “4.1 Basic Inspection”. You may also contact our customer service center and provide the collected fault information, and we will help you solve the problem as soon as possible. Refer to Section 4.2 for specific contact information, or query our website [www.ceyear.com](http://www.ceyear.com) online so as to get the contact information of the nearest technical support center.

### 4.1 Basic Inspection

If there is a problem with the 4041 series you use, you can check it according to the following tips. If the problem still exists, please contact us.

- ◇ If the 4041 series can't be started after the power button is pressed down, please check whether the power supply is normal. If there is no problem, the device will be deemed to have faults, please contact us for repair.
- ◇ If the 4041 series can't enter the system or application procedure after start, please press **【Preset】** button to make it return to a known state. If it can't normally work yet, it will be deemed to have faults, please contact us for repair.
- ◇ Press **【System】** -[More 1/2]-[System Info] to observe the self-test information of the relevant part. If the self-test fails, press **【Preset】** key to return 4041 to a known state. If the self-test still fails, it will be deemed to have faults, please contact us for repair.
- ◇ If the 4041 touch screen response fails, press **【Preset】** key to return 4041 to a known state. If it can't normally work yet, it will be deemed to have faults, please contact us for repair.
- ◇ If the performance indicator of 4041 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 4041 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 the light does not flash, check the LAN cable and its connection. If it can't normally work yet, it will be deemed to have faults, please contact us for repair.



## 4.2 Help Information

4041 has the “Error Log” function. When a problem occurs, the instrument will automatically generate an “Error Log” recording the hardware abnormality, file missing, program control operation and other abnormalities in the instrument; the information is classified into three levels, namely HINT, WARNING and Error, to aid in fault analysis of the instrument. You can view the error log by pressing **【System】** →[More 1/2]→[Error Log].

In addition, our customer service support center can help you at any time. We set up points-of-sale and offices in China. Technical support personnel at each point-of-sale and office can quickly arrive the user’s site for technical exchange, training and product maintenance, etc. We can provide you with comprehensive and convenient technical support and related services.

### Qingdao:

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**Postcode:** 266555

In addition, you can also log in [www.ceyear.com](http://www.ceyear.com) our website to get online consultation and help through QQ online customer service.

All instruments supplied by us pass inspection by the Quality and Safety Department of the Institute, and they are guaranteed for 18 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

It is hereby declared that you shall assume responsibilities for instrument damage or personal injury due to improper operation or violation operation!

## 4.3 Repair Methods

Please contact us by phone or fax when your 4041 incurs an unsolvable problem. If the instrument has to be repaired, please pack it according to the following steps:

- 1) Prepare a paper document describing the malfunction of the instrument and put it in the packaging box with the spectrum analyzer;
- 2) Wrap the instrument with the original packaging material to reduce possible damage;
- 3) Put the linings at four corners of the outer packaging box, and put the instrument in the outer packaging box;
- 4) Seal the packaging box with tapes, and reinforce it with nylon tape;
- 5) Mark “Fragile! No Touch! Handle with Care!” on the box;
- 6) Consign for shipment as the precision instrument, and keep copies of all transport documents.

## Appendix 1: Technical Specifications

The 4041 series spectrum analyzer has been subject to strict test of technical specifications before delivery, and the user can choose to prove the technical specifications given in this manual by test. For the main technical specifications of the 4041 series spectrum analyzer, see the table below.

### CAUTION

The 4041 series spectrum analyzer, after being stored at ambient temperature 2h and then preheated for 30 min, meet all the technical specifications within the given working temperature range.

Additional features expressed by typical values are for reference only, and does not constitute subject of proof.

Attached Table 1 Technical Specifications of 4041Series Spectrum Analyzer

Test Item	Technical Specifications
Model	4041D/E/F/G
Frequency range	4041D: 9kHz~20GHz 4041E: 9kHz~26.5GHz 4041F: 9kHz~32GHz 4041G: 9kHz~44GHz
Frequency reference	Nominal frequency: 10MHz Frequency reference error: $\pm$ (Time to last calibration date * Aging rate + Temperature stability + Calibration accuracy) Aging rate: $\pm 5 \times 10^{-7}$ /year Temperature stability: $\pm 1 \times 10^{-7}$ (0°C ~ 50°C, relative to 25 $\pm$ 5°C) Initial calibration accuracy: $\pm 3 \times 10^{-7}$ Note: The time to last calibration date is 1 year by default
Frequency readout accuracy	$\pm$ (Frequency reading $\times$ frequency reference error +2% $\times$ span +10% $\times$ resolution bandwidth)
Frequency span	Range: 100Hz~the upper limit of the frequency of the corresponding model ; 0Hz (zero span) Tuning resolution: 1Hz Accuracy: $\pm 2.0\%$
Sweep Time	Range: 10 $\mu$ s~600s (zero span) Accuracy: $\pm 2.00\%$ (zero span)
Resolution Bandwidth	Range: 1Hz~10MHz (1-3 times step) Accuracy (3.0dB): $\pm 10\%$ 1kHz~3MHz $\pm 20\%$ 10MHz
SSB phase noise (Carrier 1 GHz, 20°C~30°C)	$\leq -102$ dBc/Hz@10 kHz frequency offset $\leq -106$ dBc/Hz@100 kHz frequency offset $\leq -111$ dBc/Hz@1MHz frequency offset $\leq -123$ dBc/Hz@10MHz frequency offset
Displayed average noise level (50 $\Omega$ input end load, 0dB input attenuation, average detection, video type logarithm, RBW normalized to 1Hz, 20°C~30°C, tracking generator off)	Pre-amplifier off $\leq -138$ dBm (10MHz~20GHz) $\leq -135$ dBm (20GHz~32GHz) $\leq -127$ dBm (32GHz~40GHz) $\leq -120$ dBm (40GHz~44GHz) Pre-amplifier on $\leq -157$ dBm (10MHz~20GHz) $\leq -154$ dBm (20GHz~32GHz) $\leq -148$ dBm (32GHz~40GHz) $\leq -140$ dBm (40GHz~44GHz)

Test Item	Technical Specifications
Second harmonic distortion (0dB attenuation, -30dBm input signal)	<-60dBc
Third-order intermodulation distortion (-15dBm double tone signal, 100kHz interval, 0dB attenuation, preamplifier off)	$\geq +7$ dBm    50MHz~4GHz $\geq +6$ dBm    4GHz~13GHz $\geq +6$ dBm    13GHz~44GHz
1dB gain compression (Dual-tone method test, signal interval 10 MHz)	$\geq -2$ dBm    50MHz~4GHz $\geq -3$ dBm    4GHz~13GHz $\geq -3$ dBm    13GHz~44GHz
Image, multiple and out-of-band response (-10dBm mixer level)	$\leq -65$ dBc    10MHz~20GHz $\leq -60$ dBc    20GHz~44GHz
Residual response (RF input matching, 0dB attenuation, tracking generator off)	(Exceptional frequency: 3,200MHz) Preamplifier    On: $\leq -100$ dBm    (10MHz~20GHz) $\leq -95$ dBm    (20GHz~44GHz) Preamplifier    off: $\leq -90$ dBm    (10MHz~13GHz) $\leq -85$ dBm    (13GHz~20GHz) $\leq -80$ dBm    (20GHz~44 GHz)
Reference Level	Range: Logarithmic scale: -120dBm~+30dBm, 1dB step Linear scale: 22.36uV~7.07V, 0.1% step Switching uncertainty: $\pm 1.20$ dB (reference level: 0dBm~-60dBm)
Scale fidelity	$\pm 1.00$ dB
Total level uncertainty (after 30 minute warm-up, input signal 0dBm ~-50dBm, all set as auto coupling, 20°C~30°C)	$\pm 1.80$ dB (10MHz~13GHz) $\pm 2.30$ dB (13GHz~40GHz)
Input attenuator	Attenuation range: 0dB~50dB, 10dB step Switching uncertainty: $\pm 1.20$ dB
Input voltage standing wave ratio (>10dB input attenuation)	$\leq 1.80:1$ (50MHz~20GHz) $\leq 2.20:1$ (20GHz~44GHz)
Maximum safe input level (CW input)	+30dBm, typical value ( $\geq 10$ dB attenuation, preamplifier off ) +23dBm, typical value (<10dB attenuation, preamplifier off ) +13dBm, typical value (preamplifier on)
Displayed scale	Logarithmic scale: 0.1dB ~10dB per division, minimum 0.1dB step (10-division display) Linear scale: 10-division display Scale unit: dBm, dBV, dBmV, dB $\mu$ V, dBW, dBA, dBmA, dB $\mu$ A, V, W, A
Video Bandwidth	1Hz~10MHz (1-3 times step)

## Appendix 2: List of Accessories/Options

Attached Table 2 List of Accessories/Options of 4041 Series Spectrum Analyzer

Classification	Accessory or Option Number	Accessory/Option
Accessory	---	Power line assembly * 1
	---	USB interface cable * 1
	---	4041 Spectrum Analyzer Quick Start Guide * 1
	---	Certificate of conformity * 1
	4041-H01	Tracking Generator Option
	4041-001	Options of English version
	4041-002	User Manual (Chinese Version)
	4041-003	User Manual (English Version)
	4041-004	Programming Manual (Chinese Version)
	4041-005	Programming Manual (English Version)
	4041-006	Purple UTP network cable
	4041-007	GPS antenna
	4041-008	USB power measurement function option
	4041-009	87230 USB continuous wave power probe
	4041-010	87231 USB continuous wave power probe
	4041-011	87232 USB continuous wave power probe
	4041-012	87233 USB continuous wave power probe
	4041-013	Interference analysis function option
	4041-014	Analog demodulation function option
	4041-015	Channel scanning function option
	4041-016	List scanning function option
	4041-017	Field strength measurement function option
	4041-018	Zero span intermediate frequency output
	4041-019	89101A antenna
	4041-020	89101B antenna
4041-021	89101C antenna	
4041-022	89101D antenna	
4041-023	89401 antenna amplifier	
4041-024	89901 antenna	
4041-025	89902 antenna	