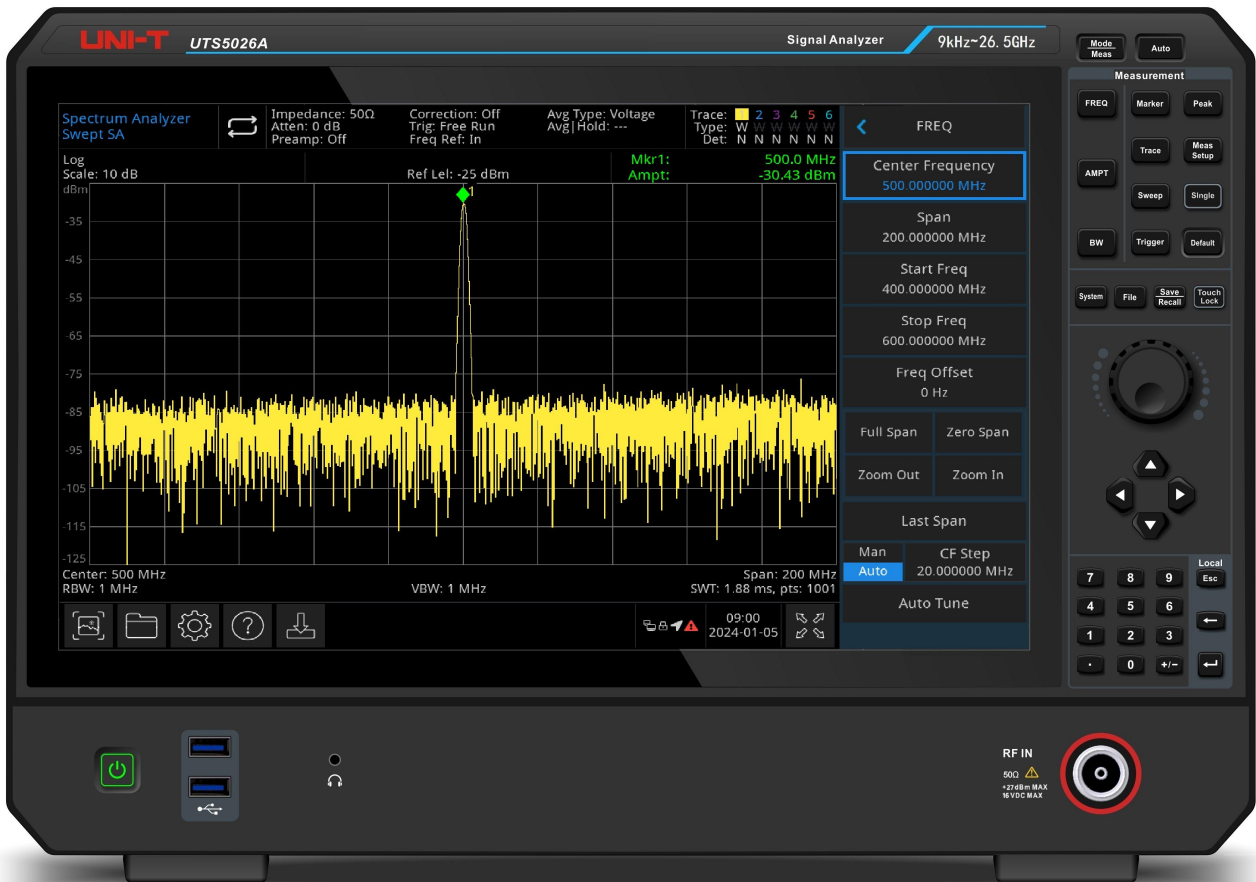UNI-T®

Instruments.uni-trend.com

User's Manual

UTS5000A Series Signal Analyzer

REV 0
2023.10.31

# Foreword

Dear Users,

Hello! Thank you for choosing this brand new UNI-T instrument. In order to use this instrument safely and correctly, please read this manual thoroughly, especially the Safety Requirements part.

After reading this manual, it is recommended to keep the manual at an easily accessible place, preferably close to the device, for future reference.

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# 1. Overview

- ■ UTS5000A
- ■ Front Panel
- ■ User Interface
- ■ Rear Panel

This chapter describes the main functions and features of UTS5000A series signal analyzer, and gives a brief introduction to keys and icons on the front and rear panel.

## UTS5000A

UTS5000A series is a signal analyzer with a frequency range of 9 kHz to 26.5 GHz, which can be used as the main equipment to set up an automatic control system, and it can also meet your different testing and application needs in the test systems required for corporate R&D/factory production/educational research.

### Main Functions & Features

- ■ Windows 10 and above operating system control
- ■ Frequency range: 9 kHz-26.5 GHz
- ■ Displayed average noise level (DANL) reaches to -163 dBm (typical value)
- ■ Phase noise is lower to -107 dBc/Hz (1 GHz, 10 kHz offset)
- ■ Scanning count is higher to 100001
- ■ The minimum of resolution bandwidth is 1 Hz
- ■ The limit value of pass/fail can judge the trace signal whether is pass or fail
- ■ 6 traces can display at the same time
- ■ Advanced one-key measurement (option)
- ■ EMI pre-sweep analysis function (option)
- ■ Analog demodulation analysis (option)
- ■ Digital demodulation analysis (option)
- ■ Real-time spectral analysis (option)
- ■ I/Q analysis (option)
- ■ 15.6 inch 1920×1080 high definition thin film LCD display screen
- ■ Multiple interfaces: keyboard, mouse, storage, upper computer, remote control, Web control, multi-device synchronization, demonstration monitoring and audio buzzer
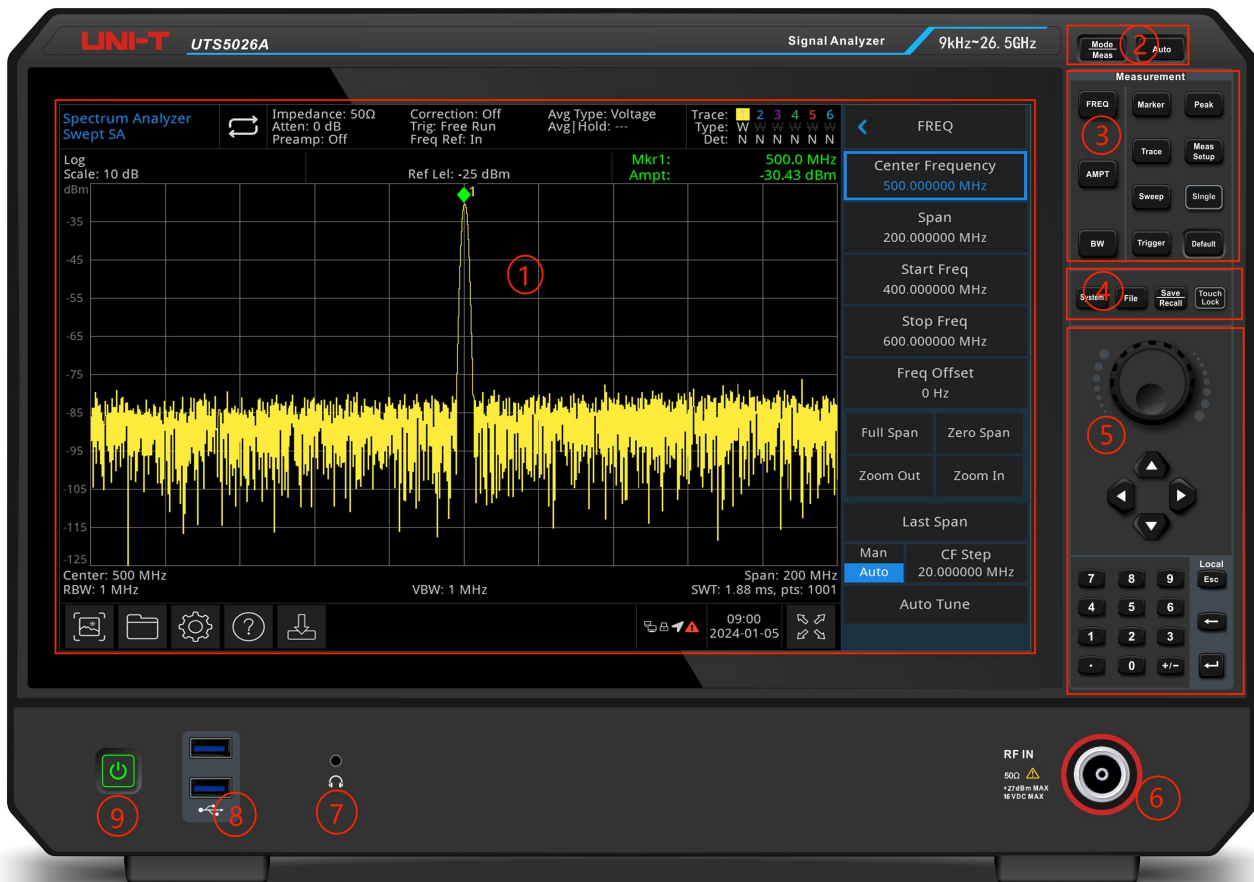
# Front Panel



Figure 1-1 Front Panel

1. **Display screen:** display area, touch screen
2. **Advanced function key:** used to active advanced measurement function of the signal analyzer, which including:
   - **Advanced measurement:** access the menu of functions to measure transmitter power, such as adjacent channel power, occupied bandwidth and harmonic distortion
   - **Mode:** select the measurement mode for the signal analyzer
   - **Auto-tune:** the signal is automatically searched and placed in the center of the screen
3. **Measurement:** used to active the main functions of the signal analyzer, which including:
   - **Frequency (FREQ):** press this key to enable the center frequency function and enter the frequency setup menu
   - **Amplitude (AMPT):** press this key to enable the reference level function and enter amplitude setup menu
   - **Bandwidth (BW):** press this key to enable the resolution bandwidth function and enter control bandwidth and visualize proportions menu
   - **Sweep:** select the sweep menu of the signal analyzer to enter the scanning time
   - **Trigger:** enter the menu of trigger setup, trigger type, trigger parameter
   - **Trace:** enter the menu of control trace, detection mode and trace operation
   - **Marker:** used to select marked number, type, attribute, tag function and list, and to control the

display of these markers
- **Peak:** place a marker at the amplitude peak value of signal and control this marked point to perform its function
- **Measurement setting:** average/hold time and average type, display line and limit value
- **Single:** press this key to perform single sweep, press it again to turn to continuous sweep
- **Reset (Default):** press this key to reset the setting of signal analyzer to the default parameter

4.  **Utility (function key):** used to active the main functions of signal analyzer, which including:
- **System information (System):** enter the system menu and setup its parameter
- **File System (File):** press this key to enter file manager, files can be viewed, created, modified, and deleted; corrections, limits, measurement results, screenshots, traces, status and other files can be saved to internal or external memory and it can be recalled
- **File storage (Save/Recall):** press this key to enter save menu, the types of files includes state, trace line + state, measurement data, limit, correction and export
- **Touch/Lock:** switch of touch screen, this key will illuminate with green when it pressed

5.  **Data control key:** direction key, rotary knob and numerical key are used to adjust the numerical value of the activated function, such as center frequency, start frequency, resolution bandwidth and maker position

    Note

Esc key: If the instrument is in remote control mode, press this key to return to local mode.

6.  **Radio Frequency input terminal (RF input 50Ω):** this port is used to connect the external input signal, the input impedance is 50Ω (NMD2.92 male-head)

    Warning

It is forbidden to load the input port with a signal that does not meet the rated value, and ensure that the probe or other connected accessories are effectively grounded to avoid equipment damage or abnormal function. RF IN port can only withstand an input signal power of no more than +27 dBm or a DC voltage input of 16 V.

    Warning

It is forbidden to load input signals on the output port to avoid damage or abnormal function.

7.  **Headphone jack:** 3.5 mm
8.  **USB 3.0 port:** used to connect external USB, keyboard and mouse
9.  **ON/OFF Switch:** short press to active the signal analyzer, in on-state, short press ON/OFF switch will change the state to standby mode, all function will also be off
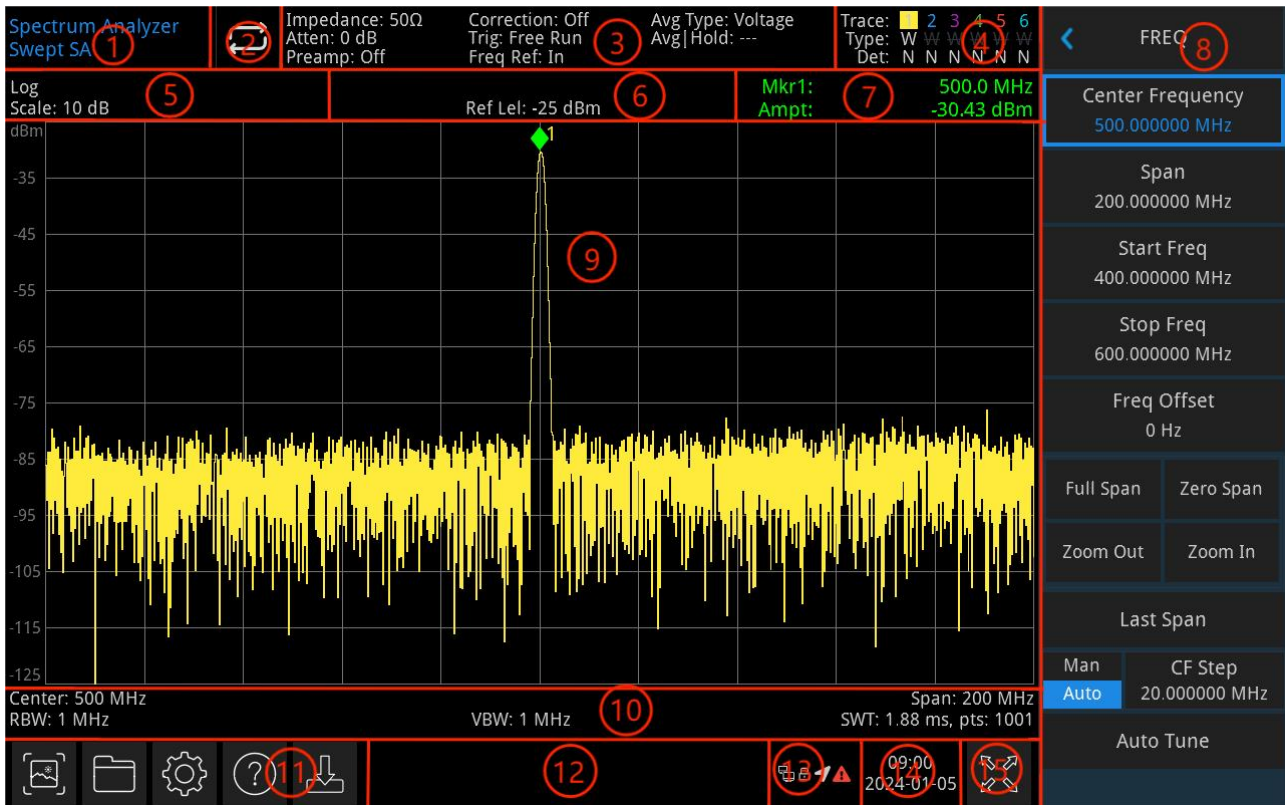
## User Interface



Figure 1-2 User Interface

1. **Working mode:** spectral analysis, EMI, analog demodulation, vector signal analysis and real-time spectral analysis
2. **Sweep/Measuring:** the current sweep mode includes single / continuous, tap the screen icon to quick switch the mode
3. **Measurement menu:** display the measurement information, which including input impedance, input attenuation, presetting, correction, trigger type, reference frequency, average type, and average/hold. Tap the screen icon to quick switch these functions.
4. **Trace indicator:** display the information of trace and detector, which including trace serial number, trace type and detector type

Note

The first line is display the number of trace line, color of number and trace should be the same. The second line is display the corresponding trace type which including W (refresh), A (average trace), M (the maximum hold), m (the minimum hold).
The third line is display the detector type which including S (sampling detection), P (peak value), p (negative value), N (normal detection), A (average), f (trace operation). All detection type are displayed in white letters.

Tap screen icon to quick switch different modes, different letter presents different mode.
- Letter in highlight white color, it presents the trace is being update
- Letter in grey color, it presents the trace is not update
- Letter in grey color with strikethrough, it presents the trace will not be update and display
- Letter in white color with strikethrough, it presents the trace is being update but no display; this case is useful for trace mathematical operation

5. **Display scale:** scale value, scale type (logarithm, linear). Scale value in linear mode cannot be changed
6. **Reference Level:** reference level value, reference level offset value
7. **Result of cursor measurement:** display the current result of cursor measurement, which is frequency, amplitude. Display time in zero span mode
8. **Panel Menu:** menu and function, which includes frequency, amplitude, bandwidth, trace and marker.
9. **Grid display area:** trace display, marker, video triggering level, display line, threshold line, cursor table, peak list
10. **Data display:** center frequency value, sweep width, start frequency, cut-off frequency, frequency offset, RBW, VBW, sweep time and sweep count
11. **Function setting:** quick screenshot, file system, setup system, help system and file storage
    - Quick screenshot 🖼: screenshot will save to the default file; if there has an external storage, it is preferentially saved to external storage device
    - File system 📁: user can use file system to save the correction, limit value, measurement result, screenshot, trace, status and other file into internal or external storage, and it can be recall to use
    - System information ⚙: view the basic and option information
    - Help system ⑦: help guides
    - File storage 📥: import or export state, trace + state, measurement data, limit value and correction
12. **System log dialog box:** Click blank space on the right of file storage to enter system log to check the operation log, alarm and hint information
13. **Connection type:** display connecting state of mouse, USB and screen lock
14. **Date and time:** Display the date and time
15. **Full screen switch:** Open full screen display, the screen is stretched horizontally and the right button is automatically hidden

# Rear Panel



Figure 1-3 Rear Panel

1. **USB 2.0 port:** used to connect USB and keyboard and mouse
2. **HDMI port:** HDMI video signal output port
3. **LAN port:** TCP/IP port for connecting remote control
4. **USB Device port:** signal analyzer can use this interface to connect a PC, which can be remote control by the software on the computer
5. **Ext 1:** when the signal analyzer uses the external trigger mode, the connector receives the rising or falling edge of an external trigger signal, which is fed into the signal analyzer through the BNC cable

Warning

It is forbidden to load the input port with a signal that does not meet the rated value, and ensure that the probe or other connected accessories are effectively grounded to avoid equipment damage or abnormal function.

6. **10 MHz reference input:** signal analyzer can use internal reference source or as an external reference source
■   If the instrument detects that the [10 MHz IN] connector is receiving a 10 MHz clock signal from an external source, the signal is automatically used as an external reference source, and the user interface displays "Frequency reference: external". When the external reference source is lost, overrun, or not connected, the instrument's reference source automatically switches to the internal reference, and the measurement menu displays "Frequency Reference: Internal".

> **Warning**
>
> It is forbidden to load the input port with a signal that does not meet the rated value, and ensure that the probe or other connected accessories are effectively grounded to avoid equipment damage or abnormal function.

7. **Ext 2:** when the signal analyzer uses the external trigger mode, the connector receives the rising or falling edge of an external trigger signal, which is fed into the signal analyzer through the BNC cable

> **Warning**
>
> It is forbidden to load the input port with a signal that does not meet the rated value, and ensure that the probe or other connected accessories are effectively grounded to avoid equipment damage or abnormal function.

8. **10 MHz reference output:** signal analyzer can use internal reference source or as an external reference source
■   If the instrument uses an internal reference source, [10 MHz OUT] connector can output 10 MHz clock signal generated by the instrument's internal reference source, which can be used to synchronize other devices.

> **Warning**
>
> It is forbidden to load the input signal on the output port to avoid equipment damage or abnormal function.

9. **Ground connector:** provides an electrical ground connection point for attaching an antistatic wrist strap to reduce electrostatic damage (ESD) when you are handling or connecting the DUT.
10. **Power port:** power supply terminal
11. **Power Switch:** used to turn on/off the AC power supply. When the switch is turned on, the signal analyzer enters the standby mode while the indicator on the front panel lights up.
12. **Burglar-proof Lock:** protect the instrument away from thief
13. **Dustproof cover:** take off dustproof cover and then to clean the dust
14. **Handle:** easy to move the signal analyzer

# 2. User Guide

- ◼ Inspecting Package and Packing List
- ◼ Safety Requirements
- ◼ Environmental Requirements
- ◼ Connecting Power Supply
- ◼ Electrostatic Protection
- ◼ Preparatory Work
- ◼ Usage Tip
- ◼ Tousch Operation
- ◼ Remote Control
- ◼ Help Information
- ◼ Operation Mode

This chapter describes the safety instructions and basic information about the use of signal analyzer.

## Inspecting Product and Packing List

When you received the instrument, please inspect the packaging and packing list as follows.
- ● Inspect whether the packaging box is broken or scratched caused by external force, and further check whether the instrument appearance is damaged.
  If you have any questions about the product or other problems, please contact with distributor or the local office.
- ● Take out the goods carefully and check with the packing list.

## Safety Information

This chapter contains information and warnings that must be observed. To ensure that the instrument is operating under the safety conditions. In addition to the safety precautions indicated in this chapter, you must also follow accepted safety procedures.

### Safety Precautions

| | Please follow the following guidelines to avoid possible electric shock and risk to personal safety. |
|---|---|
| Warning | Users must follow the following conventional safety precautions in operation, service and maintenance of this device. UNI-T will not be liable for any personal safety and property loss caused by the user's failure to follow the following safety precautions. This device is designed for professional users and responsible organizations for measurement purposes. |
| | Do not use this device in any way not specified by the manufacturer. This device is only for indoor use unless otherwise specified in the product manual. |

## Safety Statements

| | |
|---|---|
| Warning | "Warning" indicates the presence of a hazard. It reminds users to pay attention to a certain operation process, operation method or similar. Personal injury or death may occur if the rules in the "Warning" statement are not properly executed or observed. Do not proceed to the next step until you fully understand and meet the conditions stated in the "Warning" statement. |
| Caution | "Caution" indicates the presence of a hazard. It reminds users to pay attention to a certain operation process, operation method or similar. Product damage or loss of important data may occur if the rules in the "Caution" statement are not properly executed or observed. Do not proceed to the next step until you fully understand and meet the conditions stated in the "Caution" statement. |
| Note | "Note" indicates important information. It reminds users to pay attention to procedures, methods and conditions, etc. The contents of the "Note" should be highlighted if necessary. |

## Safety Signs

| | | |
|---|---|---|
| | Danger | It indicates possible danger of electric shock, which may cause personal injury or death. |
| | Warning | It indicates that you should be careful to avoid personal injury or product damage. |
| | Caution | It indicates possible danger, which may cause damage to this device or other equipment if you fail to follow a certain procedure or condition. If the "Caution" sign is present, all conditions must be met before you proceed to operation. |
| | Note | It indicates potential problems, which may cause failure of this device if you fail to follow a certain procedure or condition. If the "Note" sign is present, all conditions must be met before this device will function properly. |
| | AC | Alternating current of device. Please check the region's voltage range. |
| | DC | Direct current of device. Please check the region's voltage range. |
| | Grounding | Frame and chassis grounding terminal |
| | Grounding | Protective grounding terminal |
| | Grounding | Measuring grounding terminal |
| | OFF | Main power off |
| | ON | Main power on |
| | Power Supply | Standby power supply: when the power switch is turned off, this device is not completely disconnected from the AC power supply. |
| | CAT I | Secondary electrical circuit connected to wall sockets through transformers or similar equipment, such as electronic instruments and electronic equipment; electronic equipment with protective measures, and any high-voltage and low-voltage circuits, such as the copier in the office. |
| | CAT II | CATII: Primary electrical circuit of the electrical equipment connected to the indoor socket via the power cord, such as mobile tools, home appliances, etc. Household appliances, portable tools (e.g. electric drill), household sockets, sockets more than 10 meters away from CAT III circuit or sockets more than 20 meters away from CAT IV circuit. |

| | | |
|---|---|---|
| CAT III | | Primary circuit of large equipment directly connected to the distribution board and circuit between the distribution board and the socket (three-phase distributor circuit includes a single commercial lighting circuit). Fixed equipment, such as multi-phase motor and multi-phase fuse box; lighting equipment and lines inside large buildings; machine tools and power distribution boards at industrial sites (workshops). |
| CAT IV | | Three-phase public power unit and outdoor power supply line equipment. Equipment designed to "initial connection", such as power distribution system of power station, power instrument, front-end overload protection, and any outdoor transmission line. |
| CE | Certification | CE indicates a registered trademark of EU |
| UKCA | Certification | UKCA indicates a registered trademark of United Kingdom. |
| ETL Intertek 4007682 | Certification | Conformance to UL STD 61010-1, 61010-2-030 and CSA STD C22.2 No.61010-1 and 61010-2-030. |
| Waste | Waste | Do not place equipment and its accessories in the trash. Items must be properly disposed of in accordance with local regulations. |
| 40 | EEUP | This environment-friendly use period (EFUP) mark indicates that dangerous or toxic substances will not leak or cause damage within this indicated time period. The environment-friendly use period of this product is 40 years, during which it can be used safely. Upon expiration of this period, it should enter the recycling system. |

## Safety Requirements

| Warning | |
|---|---|
| Preparation before use | Please connect this device to AC power supply with the power cable provided; The AC input voltage of the line reaches the rated value of this device. See the product manual for specific rated value. The line voltage switch of this device matches the line voltage; The line voltage of the line fuse of this device is correct. It not used for measuring the main circuit. |
| Check all terminal rated values | Please check all rated values and marking instructions on the product to avoid fire and impact of excessive current. Please consult the product manual for detailed rated values before connection. |
| Use the power cord properly | You can only use the special power cord for the instrument approved by the local and state standards. Please check whether the insulation layer of the cord is damaged or the cord is exposed, and test whether the cord is conductive. If the cord is damaged, please replace it before using the instrument. |
| Instrument grounding | To avoid electric shock, the grounding conductor must be connected to the ground. This product is grounded through the grounding conductor of the power supply. Please be sure to ground this product before it is powered on. |
| AC power supply | Please use the AC power supply specified for this device. Please use the power cord approved by your country and confirm that the insulation layer is not damaged. |
| Electrostatic prevention | This device may be damaged by static electricity, so it should be tested in the anti-static area if possible. Before the power cable is connected to this device, the internal and external conductors should be grounded briefly to release static electricity. The protection grade of this device is 4KV for contact discharge and 8KV for air discharge. |
| Measurement accessories | Measurement accessories are of lower class, which are definitely not applicable to main power supply measurement, CAT II, CAT III or CAT IV circuit measurement. |

| | |
|---|---|
| Use the input / output port of this device properly | Please use the input / output ports provided by this device in a properly manner. Do not load any input signal at the output port of this device. Do not load any signal that does not reach the rated value at the input port of this device. The probe or other connection accessories should be effectively grounded to avoid product damage or abnormal function. Please refer to the product manual for the rated value of the input / output port of this device. |
| Power fuse | Please use power fuse of specified specification. If the fuse needs to be replaced, it must be replaced with another one that meets the specified specifications. |
| Disassembly and cleaning | There are no components available to operators inside. Do not remove the protective cover.<br>Maintenance must be carried out by qualified personnel. |
| Service environment | This device should be used indoors in a clean and dry environment with ambient temperature from 0 ℃ to +40 ℃.<br>Do not use this device in explosive, dusty or humid air. |
| Do not operate in humid environment | Do not use this device in a humid environment to avoid the risk of internal short circuit or electric shock. |
| Do not operate in flammable and explosive environment | Do not use this device in a flammable and explosive environment to avoid product damage or personal injury. |
| Caution | |
| Abnormity | If this device may be faulty, please contact the authorized maintenance personnel of UNI-T for testing. Any maintenance, adjustment or parts replacement must be done by the relevant personnel of UNI-T. |
| Cooling | Do not block the ventilation holes at the side and back of this device;<br>Do not allow any external objects to enter this device via ventilation holes;<br>Please ensure adequate ventilation, and leave a gap of at least 15 cm on both sides, front and back of this device. |
| Safe transportation | Please transport this device safely to prevent it from sliding, which may damage the buttons, knobs or interfaces on the instrument panel. |
| Proper ventilation | Poor ventilation will cause the device temperature to rise, thus causing damage to this device. Please keep proper ventilation during use, and regularly check the vents and fans. |
| Keep clean and dry | Please take actions to avoid dust or moisture in the air affecting the performance of this device. Please keep the product surface clean and dry. |
| Note | |
| Calibration | The recommended calibration period is one year. Calibration should only be carried out by qualified personnel. |

# Environmental Requirements

This instrument is suitable for the following environment:

■ Indoor use
■ Pollution level 2
■ In operating: altitude lower to 3000 meters; in non-operating: altitude lower to 15000 meters

■    Unless otherwise specified, operating temperature is 0 to +40℃; storage temperature is -20 to+70℃
■    In operating: humidity temperature below to +35℃, ≤90％ relative humidity
     In non-operating: humidity temperature +35℃ to +40℃, ≤60％ relative humidity

There are ventilation opening on the rear panel and side panel of the instrument. So please keep the air flowing through the vents of the instrument housing. To prevent excessive dust from blocking the vents, please clean the instrument housing regularly. The housing is not waterproof, please disconnect the power supply first and then wipe the housing with a dry cloth or a slightly moistened soft cloth.

# Connecting Power Supply

The specification of AC power supply that can input as the following table.

| Voltage Range | Frequency |
|---|---|
| 100-240 VAC (fluctuate ± 10％) | 50/60 Hz |
| 100-120 VAC (fluctuate ± 10％) | 400 Hz |

Please use the attached power lead to connect to the power port.

### Connecting to service cable

This instrument is a Class I safety product. The supplied power lead has good performance in terms of case ground. This signal analyzer is equipped with a three-prong power cable that meets international safety standards. It provides good case grounding performance for the specification of your country or region.

Please install AC power cable as follows.
■    Ensure the power cable is intact
■    Leave enough space for connecting the power cord
■    Plug the attached three-prong power cable into a well-grounded power socket

# Electrostatic Protection

Electrostatic discharge may cause damage to component. Components can be damaged invisibly by electrostatic discharge during transportation, storage and use.
The following measure can reduce the damage of electrostatic discharge.
■    Testing in antistatic area as far as possible
■    Before connecting the power cable to the instrument, inner and outer conductors of the instrument should be briefly grounded to discharge static electricity
■    Ensure all the instruments are properly grounded to prevent the accumulation of static

## Preparatory Work

1.  Connect the power cable and insert the power plug into protective grounding outlet; use the tilt adjustment bracket as needed for your viewing.



Figure 2-1 Tilt Adjustment

2. Press the switch ▣ on the rear panel, the signal analyzer will enter standby mode.

3. Press the soft switch ⏻ on the front panel, indicator illuminates with green, which means the signal analyzer is powered on.

   It takes about 30 seconds to initialize the boot, and then the signal analyzer enters the system default menu mode. In order to make this signal analyzer perform better, it is recommended that warm up the signal analyzer for 45 minutes after power on.

## Usage Tip

### Use External Reference Signal
If user want to use an external signal source 10 MHz as reference, please connect signal source to the 10 MHz In port on the rear panel. The measuring menu on the top of the screen will indicate **Reference Frequency: External**.

### Activate the Option
If user want to activate the option, you need to input secret key of the option. Please contact UNI-T office to purchase it.
Refer to the following steps to activate the option you have purchased.
1. Save the secret key into USB and then insert it to signal analyzer
2. Press **[System] key > System Information > Add token**
3. Select purchased secret key and then press **[ENTER]** to confirm

### Firmware Upgrade
After downloading the firmware upgrade package from the official website, please refer to the following steps to upgrade.
1.  Extract the upgrade package to the root directory of the USB, including a file: SignalAnalyzerSetup.exe, as shown below.
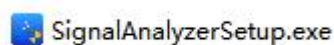


Figure 2-2 Upgrade Package

2.  Plug USB into USB port on the front panel, and turn on USB (on computer) -> Upgrade Package -> Select the file of SignalAnalyzerSetup.exe, double click to open the upgrade file, confirm that the

environment is meet, click "Next step", set the installation directory, click "Install".

3.  The upgrade process may need several minutes, reboot the program when the upgrade is complete.

> **Note**

Use a FAT32 format USB flash drive to copy the upgrade package, keep the power supply on during the upgrade process, keep the USB flash drive stable, and don't do any other operations to prevent the upgrade from failing and causing the device to not work properly.

# Touch Operation

Signal analyzer has 15.6 inch multipoint touch screen for various gesture operating, which includes,

● Tap the top right on the screen to enter the main menu.
● Slide up/down, left/right in waveform area to change the center frequency of X axis or reference level of Y axis.
● Zoom two points in waveform area to change the sweep width of X axis.
● Tap parameter or menu on the screen to select and edit it.
● Turn on and move the cursor.
● Use auxiliary quick key to perform common operation.

Use 【Touch Lock】 to turn on/off touch screen function.

# Remote Control

The UTS5000A series signal analyzers support communication with computers via USB and LAN interfaces. Through these interfaces, users can combine the corresponding programming language or NI-VISA, using the SCPI (Standard Commands for Programmable Instruments) command to remotely program and control the instrument, as well as interoperate with other programmable instruments that support the SCPI command set.

For more information about the installation, remote control and programming, please refer to **UTS5000A Series Programming Manual** on official site http:// www.uni-trend.com.

# Help Information

The signal analyzer's built-in help system provides help information for each function button and menu control key on the front panel.

■ Touch the left of the screen "  ", help dialog box will pop out on the center of the screen. Tap support function to get more detailed help description.
■ When help information displayed on the center of the screen, tap "×" or other key to close the dialog box.

# Operation Mode

The signal analyzer provides several operating modes, which can be selected by the Mode key.

- Spectral analysis, the detail refers to Chapter 4
- Vector signal analysis
- EMI
- Analog demodulation
- IQ analysis
- Real-time spectral analysis
- Reset mode

The vector signal analysis, analog demodulation, real-time spectral analysis ,IQ analysis and EMI are optional and need to be activated by purchasing the option.

The key function on the front panel key may be different in different working modes.

Reset mode: Different working modes have their own independent reset modes.

# 3. Function and Application

- ■ Basic Measurement
- ■ Measuring Multiple Signals
- ■ Measuring Low Level Signal
- ■ Measuring Frequency Shift of Signal Source
- ■ Measuring Signal Distortion
- ■ Measuring Phase Noise
- ■ Checking Catalogue and Storage File

This chapter introduces the main functions of this signal analyzer and how to make basic measurements. In this chapter, we assume that you are familiar with the layout of the front and rear panels of the instrument, as well as the notes on the display screen; if you are not familiar with these, please refer to the "Front Panel".

## Basic Measurement

In this manual, keys label with [ ], such as [FREQ], [AMPT], and [Marker], these are physical keys on the front panel. In most cases, pressing such a key will access a menu of functions that are displayed on the right side of the screen, such as center frequency and reference level, and these are referred to as panel menu.
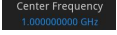
### Using Front Panel

This section describes how to use the basic function of signal analyzer.

### Input Data

There are several common ways to edit data input when you need to input parameter value.

| Rotary Knob | Increase or decrease the current value. |
|---|---|
| Arrow Key | Increase or decrease the current value. |
| Numeric Key | Input the numerical value and confirm (select a virtual key "ENTER" or press the physical button [Enter] to confirm). |
| Virtual Key | Tap the panel menu to pop out the dialog box and touch to input the numerical value and confirm (select a virtual key "ENTER" or press the physical button [Enter] to confirm). |
| Enter Key | If the input value without unit or you want to set the default unit for the input value, press the [Enter] key to setup. |

| | |
|---|---|
| **Using Front Panel** | Press the panel menu (arranged vertically on the right side of the screen) to enter the corresponding function item. The following are examples of panel menu. |
| **Switching** <br> Man <br> Auto | Press this panel menu to switch manual/auto modes. |
| **Submenu** | Press this panel menu to enter the submenu. |
| **Select** <br> Center Frequency <br> 1.000000000 GHz | Tap this option to change the data, the selected menu will be highlight. |
| **Edit** | Double click to pop out the edit menu or you can select the data menu and press the "Enter" key to edit. |

## Reset Signal Analyzer

There are three reset methods for restoring the system setting to the specified state.
Press [System]>Select Reset mode.
When the setting is selected, the system setting of signal analyzer will restore to the default state.
When the data is selected, the saved data of signal analyzer will all be deleted.
When "All" is selected, set all setting to the default state and delete the user data.

## Observing Signal

### Observing a simple signal as following steps
1.  Press the [Default] key to restore the signal analyzer to factory settings.
2.  Connect 10 MHz OUT port on the rear panel to RF IN port on the front panel.

### Set the reference level and center frequency
1.  Press [AMPT]>20 dBm to set the reference level to 20 dBm.
2.  Press [FRQE]>Center Frequency >50 MHz to set the center frequency to 50 MHz.

### Set the sweep width
Press [FRQE]>Sweep Width >100 MHz to set the sweep width to 100 MHz.

> **Note**
>
> Changing the reference level will change the amplitude value of the top grid line, changing the center frequency will change the horizontal position of the signal on the screen, and increasing the sweep width will increase the frequency range that can be displayed horizontally on the screen.

### Read frequency and amplitude value
Press [Peak] to place a marker at the peak of 10 MHz (default: Marker 1).

> **Note**
>
> The frequency and amplitude value of this marker will display at the function area on the right top of the screen.
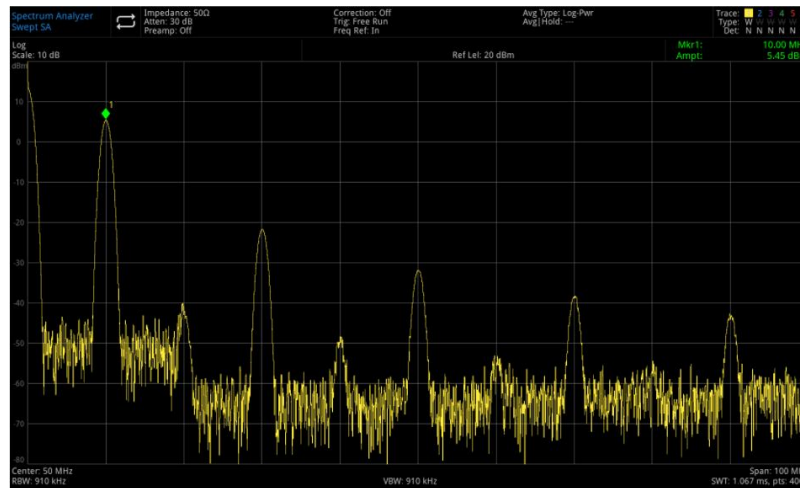
Figure 3-1 Read Frequency and Amplitude

Using the rotary knob, arrow keys or panel menu on the [Peak] menu to move the marker.

### Change the reference level

1. Press [AMPT], please note that the reference level (Ref Level) is at the activated area function.
2. Press [Marker]> Marker→> Reference Level

   Note

Changing the reference level will change the amplitude value of the top grid line.

## Measuring Multiple Signal

This section introduces how to measure multiple signal of different type.

### Using difference value marker Δ to compare the signal on the same screen

With this signal analyzer, you can easily compare frequency and amplitude differences between signals, and the signal analyzer's difference value Δ marker feature allows you to compare two signals on the same screen.

In this example, the harmonic component of the 10 MHz reference signal provided on the rear panel of the signal analyzer is used to measure the frequency and amplitude difference between the two signals on the same screen, and the Delta markers are used to show this difference.

1. Reset the signal analyzer.
   Press [Default]> Reset
2. Connect 10 MHz OUT port on the rear panel to RF IN port on the front panel.
3. Set the center frequency, sweep bandwidth and reference level of signal analyzer for checking the input signal of 10 MHz and its harmonic.
   Press [FREQ]> Center Frequency> 50 MHz
   Press [FREQ]> Sweep Bandwidth > 100 MHz
   Press [FREQ]> Reference Level > 20 dBm
4. Place a marker at the maximum peak (10 MHz).
   Press [Peak] Next Peak on the Left and Next Peak on the Right on the panel menu to move the marker between peaks.
   The marker should at the reference signal of 10 MHz.
5. Lock a marker and activate the second marker.
   Press [Marker]> Mark Mode > Difference value Δ

If a marker has labeled with x, it indicates this is a reference signal.

6. Use the rotary knob or the [Peak] key to move the marker 1Δ2 to the peak of the other signal.
   Press [Peak] Next peak or
   [Peak] Next Peak on the Left or Next Peak on the Right
   or press [Marker]> Marker Δ Frequency> Rotating the rotary knob to next peak
   The amplitude and frequency difference between the two markers is displayed on the screen.
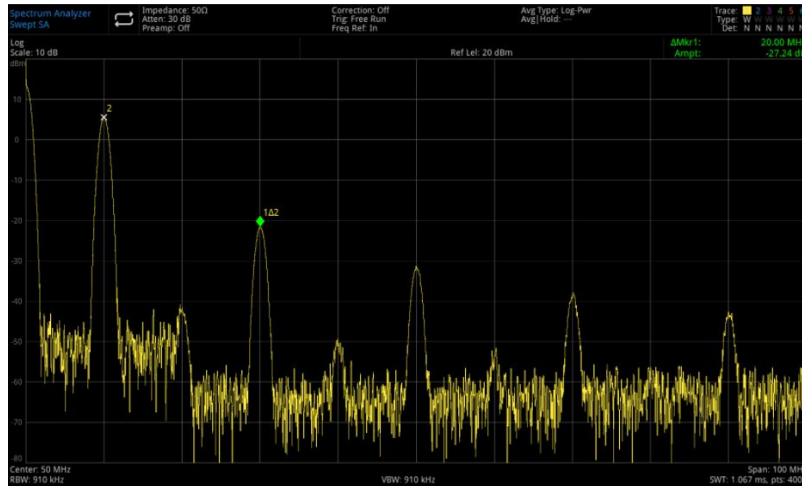

Figure 3-2 Difference Value Δ (Marker Mode) Signal Comparison on the Same Screen

Note

Turn on the frequency meter to increase the resolution of marker reading.

## Using Delta marker to compare the signal on different screen

Using the Delta mark function to measure the difference in frequency and amplitude between two signals that are not on the same screen (this function is suitable for measuring harmonic distortion).
In this example, the amplitude and frequency difference between a signal displayed on the screen and a signal not displayed on the screen is measured by using a 10 MHz signal of the signal analyzer, and Delta markers are used to show this difference.

1. Reset the signal analyzer.
   Press [Default]> Reset
2. Connect 10 MHz OUT port on the rear panel to RF IN port on the front panel.
3. Set the center frequency, sweep bandwidth and reference level of signal analyzer for checking the input signal of 10 MHz and its harmonic.
   Press [FREQ]> Center Frequency> 50 MHz
   Press [FREQ]> Sweep Bandwidth > 100 MHz
   Press [FREQ]> Reference Level > 20 dBm
4. Place a marker at the maximum peak (10 MHz) and set the stepped center frequency to the frequency at the marker.
   Press [Peak]> Marker> Stepped Center Frequency
5. Turn on the difference value Δ function
   Press [Marker]> Mark Mode>Difference Value Δ
6. Use the center frequency to increase 10 MHz
   Press [FREQ]>Center Frequency, [▲]
   at this point, the first marker moves to the left side of the screen at the peak of the first signal (10 MHz) until the center frequency is 90 MHz. The frequency of ΔMkr1 is 80 MHz, which is

marker at the harmonic component of 90 MHz. The annotation of ∆Mkr1 displays the amplitude and frequency difference between the 10 MHz signal peak and the 90 MHz signal peak.
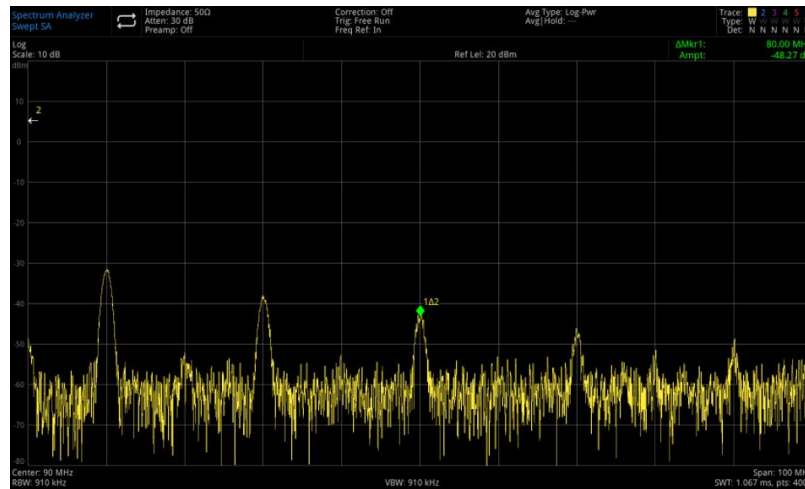


Figure 3-3 Delta Mark of Reference Signal Outside of Screen

7.  Turn off the marker: Press [Marker]> Close all or [Marker]> Mark Mode> OFF.

## Identifying the signal with the same amplitude

This example distinguishes two signals of the same amplitude and 100 kHz apart in frequency by reducing the resolution bandwidth and video bandwidth.

Note: The resolution bandwidth value ultimately chosen for resolving signals is equal to the frequency difference between the two input signals, while the video bandwidth is slightly narrower than the resolution bandwidth.
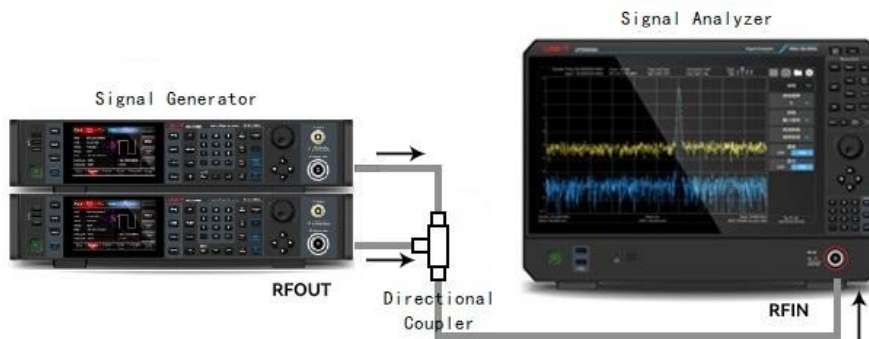


Figure 3-4 Instrument Setting for Acquiring Two-channel's Signal

1.  As shown in Figure 3-4, connecting two signal sources to the RF IN port of the signal analyzer via a directional coupler.
2.  Set the frequency of one source to 300 MHz and the frequency of the other signal source to 300.1 MHz, set the amplitude of the two signal sources to 20 dBm and turn on the signal output.
3.  Set the signal analyzer to observe the signal.
    Press [Default]> Reset
    Press [FREQ]> Center Frequency> 300 MHz, Sweep Width>1 MHz
    Press [BW]> 100 kHz
    At this time, you can see a single envelope signal.
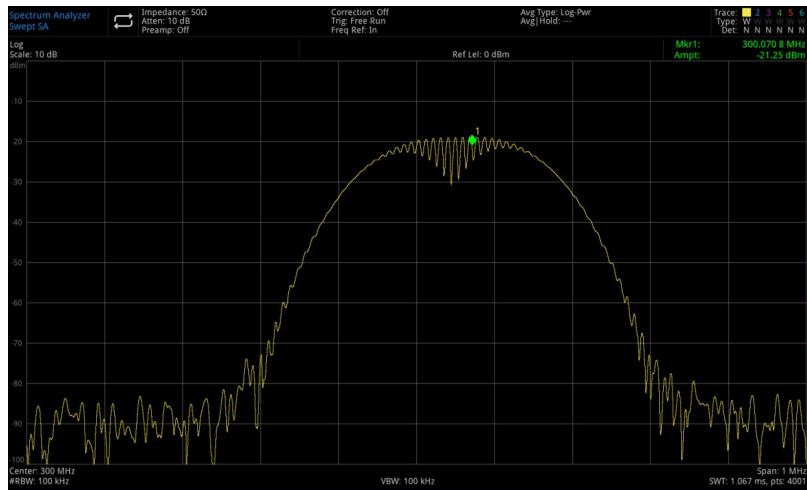
Figure 3-5 Two equi-amplitude signal are not distinguished

4.  Set resolution bandwidth (RBW) to 30 kHz, adjust it to lower than or equal to the frequency interval of the two input signals.

    Press [ BW ]> Resolution Bandwidth >30 kHz

    As shown in Figure 3-6, the peak of the two signals can be seen at the same time, and the resolution bandwidth can be further reduced by using the knobs or arrow keys on the front panel to better distinguish between the two signals.
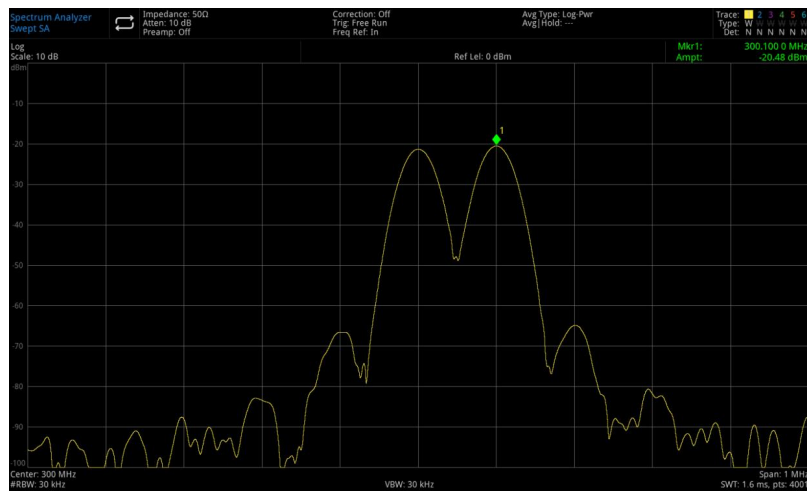


Figure 3-6 Two equi-amplitude signal are distinguished (1)
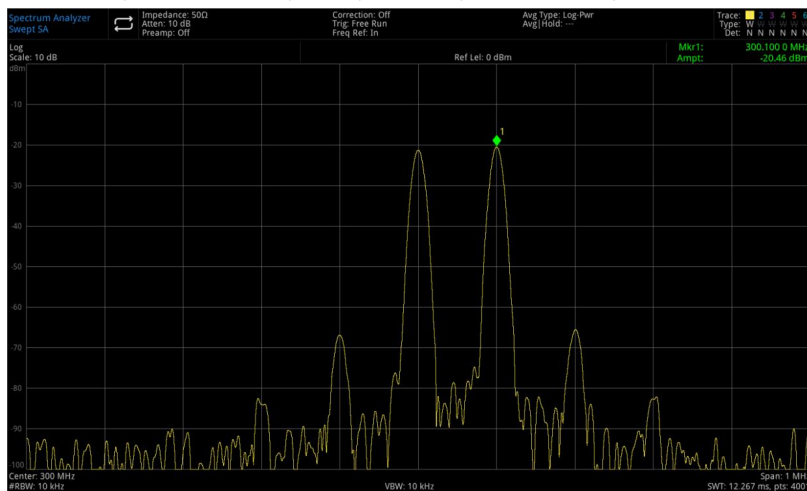


Figure 3-7 Two equi-amplitude signal are distinguished (2)

As the resolution decreases, the sweep time increases and the displayed signal becomes smoother. For the

fastest measurement, use the largest resolution bandwidth as far as possible, which is the resolution coupled to the sweep width at the factory setting.

## Identifying the small signal hidden in the big signal

In this example, use a narrow resolution bandwidth to recognize between two signals with a frequency difference of 10 kHz and an amplitude difference of 50 dBm.

1.  As shown in Figure 3-4, connecting two signal sources to the input port of the signal analyzer.
2.  Set the frequency and amplitude of one signal source to 100 MHz and –10 dBm, and the other to 100.01 MHz and –60 dBm, and turn on the signal output.
3.  Set the signal analyzer as the following steps.
    Press [Default]> Reset
    Press [FREQ]> Center Frequency> 100> MHz, Sweep Width> 200> kHz
    Press [BW]> 30> kHz
4.  Set the signal of 100 MHz to be reference level.
    Press [Peak]>Marker➞> Reference Level

> **Note**
>
> The UTS5000A's filter has a shape factor of 4.1:1. When the resolution bandwidth is 30 kHz, its 60 dB bandwidth is 144 kHz. Half of this bandwidth (77 kHz) is greater than the frequency difference between the two signals (10 kHz), so the two input signals cannot be distinguished.



Figure 3-8 S A small signal is not distinguished from a large signal

5.  You can decrease the resolution bandwidth to checking the hidden small signal.
    Press [BW]> 3 kHz
    Press [Peak]
    Press [Marker]>Mark Mode> Difference Value Δ
    Press [Marker]> Mark frequency> 10 kHz
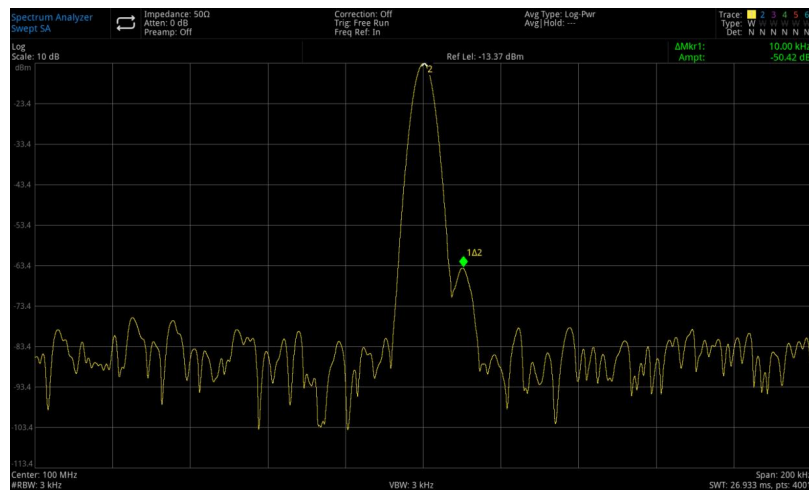
Figure 3-9 Recognize a small signal from a larger signal

Note

The UTS5000A's filter has a shape factor of 4.1:1. When the resolution bandwidth is 3 kHz, its 60 dB bandwidth is 14.4 kHz. Half of this bandwidth (7.2 kHz) is greater than the frequency difference between the two signals (10 kHz), so the two input signals can be distinguished.

## Measuring Low Level Signal

This section introduces how to measure a low level signal and how to distinguish it from spectral noise. The main methods used to measure low level signals are given below.

### Decreasing Input Loss

A signal analyzer's ability to measure low level signals is limited by the noise which generates internally. A signal as it passes through a signal analyzer, its level will be affected by the input attenuator, and if a signal is very close to the ground noise floor, reducing the input loss can distinguish the signal from the noise.

Caution

The RF IN port on the front panel can only withstand an input signal power of no more than +27 dBm or a DC voltage input of 16 V, otherwise the internal circuitry may be damaged and malfunction.

1.  Press [ Default ]> Reset to restore the signal analyzer.
2.  Set the frequency and amplitude of signal to 300 MHz, -80 dBm, connect RF OUT port of the signal source to the RF IN port of signal analyzer and turn on the signal output.
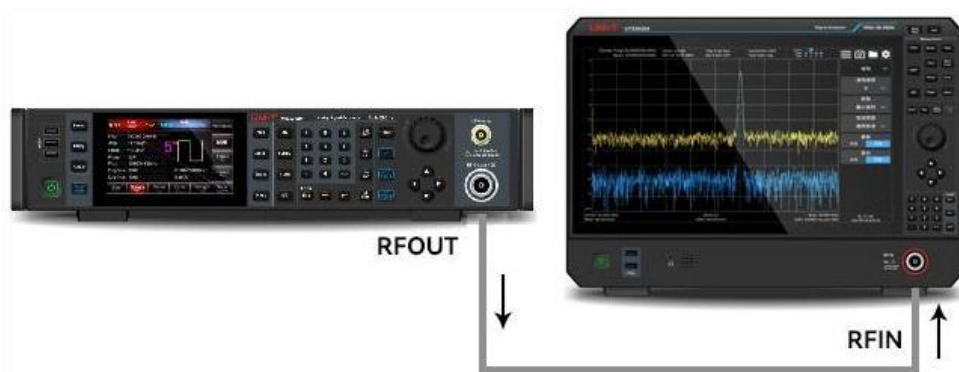


Figure 3-10 Instrument's Setting for Acquiring Single Signal

3.  Set the center frequency, sweep bandwidth and reference level
    Press [ FREQ ]> Center Frequency> 300 MHz, Sweep Bandwidth > 5 MHz

Press [AMPT]> Reference Level> -40dBm

4.  Move the selected peak (which is 300 MHz in this example) to the center of the screen

    Press [Peak]> Marker→> Center Frequency

5.  Decrease the sweep bandwidth to 500 kHz (as shown in Figure 3-11)

    Press [FREQ]> Sweep Bandwidth> 500> kHz

6.  Set the attenuation to 20 dB

    Press [AMPT]> Input Attenuation> 20> dB
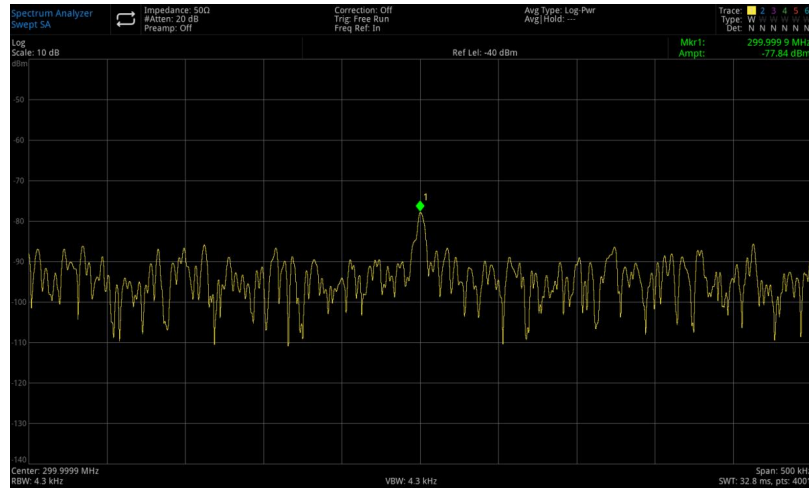


Figure 3-11 Signal Close to Ground Noise

Note

**When the attenuation value is increased, it will make the ground noise close to the signal level.**

7.  To see the signal more clearly, set the attenuation to 0 dB.

    Press [AMPT]> Attenuation> 0> dB
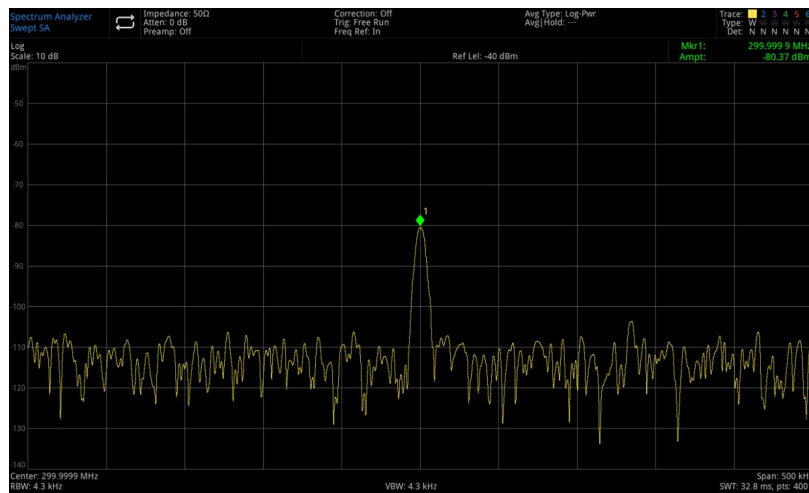


Figure 3-12 Measuring Small Signal in 0 dB Attenuation

## Decreasing Resolution Bandwidth

The internal noise level is affected by the resolution bandwidth, but a signal with a continuous waveform is not affected by the resolution bandwidth. Reducing the RBW bandwidth by a factor of 10, the ground noise will reduce by 10 dB.

1.  Refer to "Decreasing Input Loss" in this section and follow the steps to set.

2   Decrease the resolution bandwidth.

    Press [BW] to select the resolution bandwidth

As the noise level decreases, the low level signal will become clearer at this point.
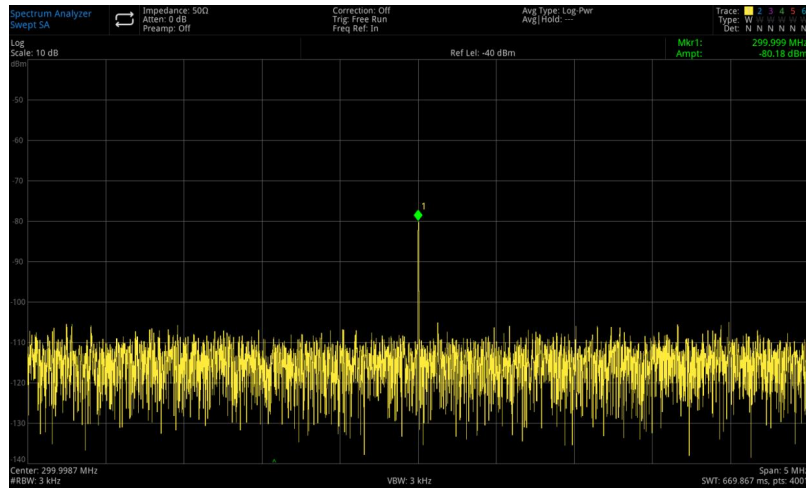


Figure 3-13 Decreasing Resolution Bandwidth

Note: There is a "#" symbol next to the RBW in the left bottom of the screen, indicating that the resolution bandwidth is uncoupled and manually adjusted.

> **Note**
>
> **You can change the resolution bandwidth of the signal analyzer by using the up and down arrow keys with a sequence of 1-3-10, its rectangularity factor (the ratio of the filter's 60 dB bandwidth and 3 dB bandwidth) is 4.1:1, and the maximum value of RBW is 3 MHz and the minimum value of RBW is 1 Hz.**

## Trace Average

Trace average is a digital process, select the average operation to take average of the current value of every trace points plus the averaged value of previous trace points. When the signal analyzer is automatic coupling, set the detection mode to sampling mode, which to make the displayed noise level become smooth. This is a trace processing function that is different from the average detection introduced earlier.

1.   Refer to "Decreasing Input Loss" in this section and follow the steps to set.

2    Open the average function.

     Press [Trace]>Trace Type>Trace Average

3    Set the average number to 20.

     Press [Meas/Setup]> Average/Hold Number> 20> ⏎

     Since the average operation make the trace become smooth, the low level signal will become more clearly visible (as shown in 3-14).
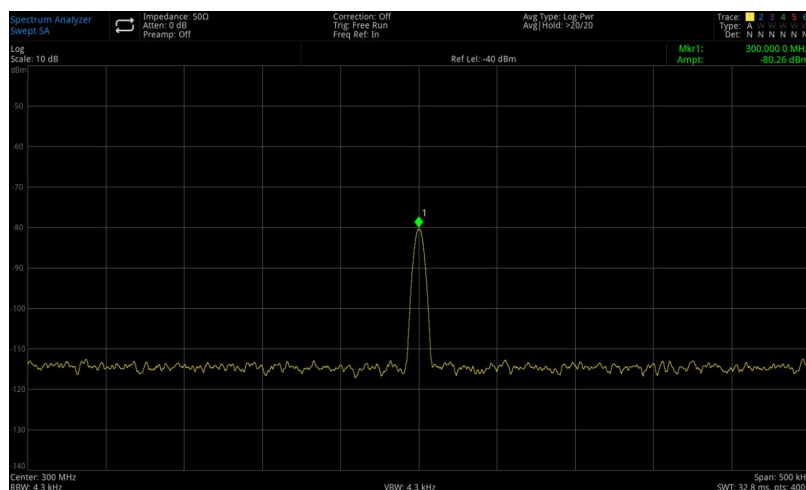


Figure 3-14 Trace Average

### Tracing Drifting Signal

This section introduces how to measure and trace the drifting signal.

# Measuring Frequency Drifting of Signal Source

This signal analyzer measures the stability of a signal source and using the maximum hold function, displays and holds the maximum amplitude level and its frequency drift of an input signal trace.

1.  Connect the signal generator to the RF IN port of the signal analyzer.
2.  Set the frequency and amplitude of output signal to 300 MHz, -20 dBm.
3.  Set the center frequency of the signal analyzer, sweep width and reference level.

     Press [Default]> Reset

     Press [FREQ]> Center Frequency > 300 MHz, Sweep Bandwidth > 1 MHz

     Press [AMPT]> Reference Level > -10 dBm
4.  Place a marker at the peak of signal and turn on continuous peak search function.

     Press [Peak]
5.  Use the maximum hold to measure the drifting of signal.

     Press [Trace]> Trace Type > Maximum Hold

     When the signal

     The maximum hold function is used to maintain the maximum response of the input signal when the signal changes, and the trace mode is shown in the annotation on the top right of the screen. It includes trace, trace type and detection.
6.   Activate refresh trace 2 and set it to continuous sweep.

     Press [Trace] > Select Trace > Trace 2

     Press Trace Type > Refresh

     Trace 1 stays at the maximum hold mode for displaying the drifting of signal.
7.   Slowly change the frequency of signal source.
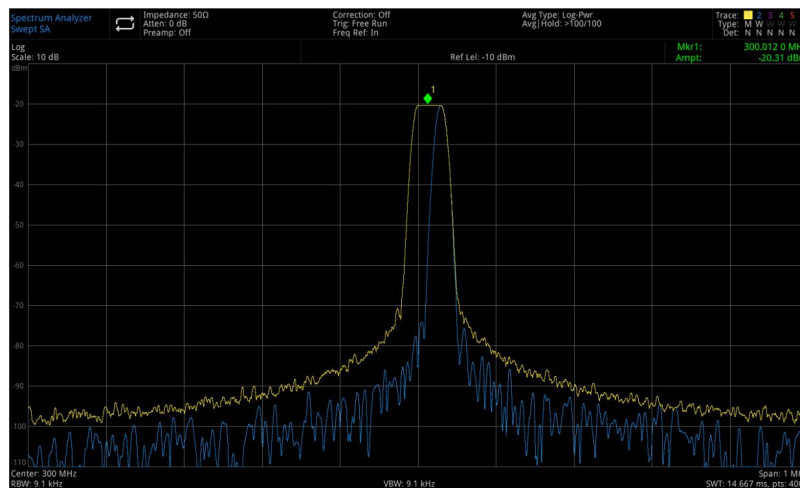


Figure 3-15 Observing Signal Drifting by Maximum Hold and Refresh

# Measuring Signal Distortion

This section introduces how to recognize and measure the signal distortion.

### Recognizing the distortion generates by the signal analyzer

A high level input signal may cause the signal analyzer to generate a distortion signal that masks the true distortion to be measured on the input signal. If the distortion is present, which a distortion produced

internally by the instrument. The user can use the trace and RF attenuator to recognize the signal. If there is In this example, use an output signal of signal generator to recognize whether the harmonic distortion component is generated by the signal analyzer.

1.    Connect the signal generator to the RF IN port of the signal analyzer.
2.    Set the frequency and amplitude of output signal to 200 MHz, 0 dBm.
3.    Set the center frequency and sweep bandwidth of signal analyzer.
        Press【Default】> Reset
        Press【FREQ】> Center Frequency > 400 MHz, Sweep Bandwidth > 500 MHz
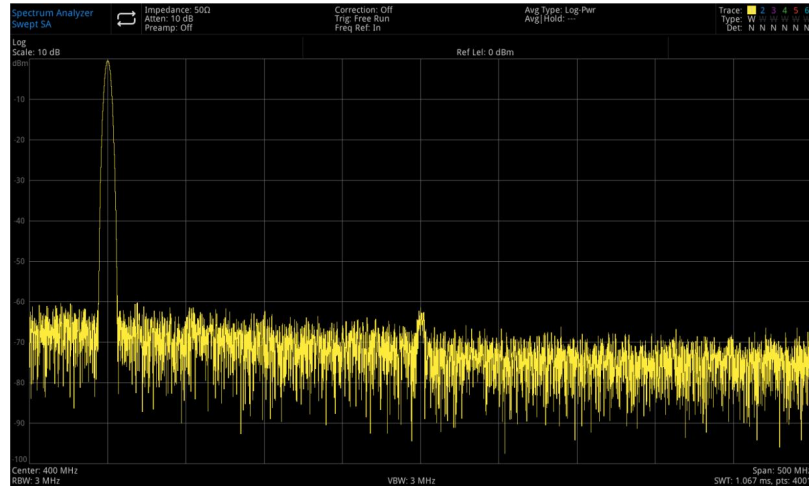


Figure 3-16 Harmonic Distortion

The harmonic distortion component generated by this signal at the input mixer of the signal analyzer (lined up in 200 MHz intervals with the original 200 MHz signal).

4.    Set the center frequency to the frequency value of the first harmonic
        Press【Peak】> Next Peak
        Press【Marker】> Maker→> Center Frequency
5.    Set the sweep bandwidth to 50 MHz and redisplay the signal in the center of the screen.
        Press【FREQ】> Sweep Bandwidth >50 MHz
        Press【Peak】> Maker→> Center Frequency
6.    Set the attenuation to 0 dB
        Press【AMPT】> Attenuation > 0d B
7.    To recognize whether the harmonic distortion component is generated by the signal analyzer, display the input signal at the trace 2 at first.
        Press【Trace】> Select Trace > Trace 2
        Press【Trace】> Trace Type > Refresh
        Press【Trace】> Refresh > ON
        Press【Trace】> Display > ON
8.    Refresh the trace 2 (sweep two times at least) and save the data of trace 2, and then place a marker at the harmonic component of trace 2.
        Press【Trace】> Refresh > OFF
        Press【Peak】
        Press【Marker】> Mark Mode > Difference Value Δ
        At the current, the signal analyzer shows the waveform data stored in trace 2 and the data being measured in trace 1, ΔMkr1 indicating a reading of the amplitude difference between the reference marker and the currently active marker.

9. Set the RF attenuation increase to 10 dB.

Press [AMPT]> Attenuation > 10dB

Note: ΔMkr1 indicating a reading, this reading is the difference amplitude of the harmonic distortion component when the input attenuation is set to 0 dB and 10 dB respectively.

If the absolute amplitude of ΔMkr1 is approximately ≥ 1 dB with a change in input attenuation, it can be assumed that at least part of this the harmonic distortion component is generated by the signal analyzer (as shown in Figure 3-17), in which case the input attenuation should be increased.
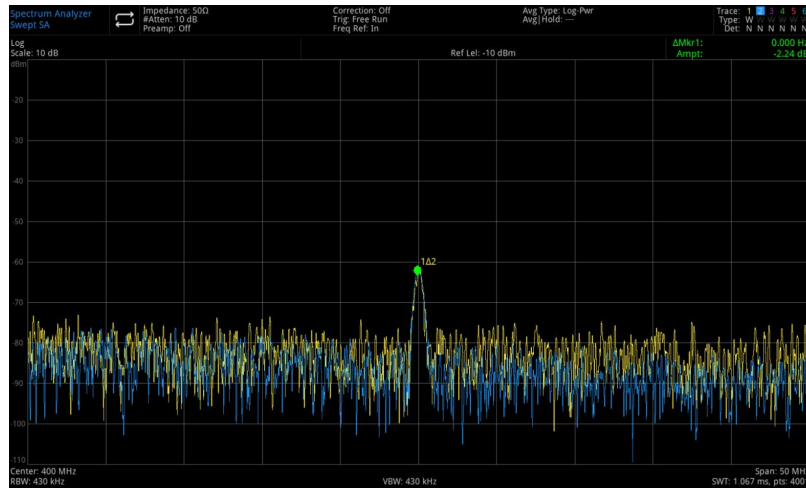


Figure 3-17 the harmonic distortion component

The amplitude difference readings of ΔMkr1 are affected by the following factors.

1. Increasing the input attenuation worsens the signal-to-noise ratio, resulting in a positive ΔMkr1 reading.

2. The loss of harmonics from the internal circuit of the signal analyzer results in a negative ΔMkr1 reading.

A large ΔMkr1 reading indicates a significant test error and can be minimized by setting the input attenuation.

## Third-order Intercept Point Distortion

Measurements of two-tone third-order intercept point distortion are common in communication systems. When two signals are fed into a nonlinear system, they may produce third-order intercept point components (TOI) on the frequency spectrum which proximate to the original signals due to their interaction, and these distortions are generated by system components such as amplifiers and mixers.

To quickly set up a TOI measurement, see "Third-order intercept point" under one-key measurements.

This example introduces how to make a third-order intercept point distortion of one instrument, the frequency of the two signal sources used were 299.95 and 300.05 MHz.

1. Connect the instrument as shown in Figure 3-18, the two signal generators are connected to the input of a directional coupler through a low-pass filter, and the output of the coupler is a two-tone signal source with very low intermodulation distortion. Although the distortion performance of this connection is better than that of the signal analyzer, it is still useful to measure the TOI of the source/signal analyzer combination. After calibrating the TOI performance of the source/signal analyzer combination, the instrument under test (DUT) (e.g., an amplifier) is inserted between the output of the directional coupler and the input of the signal analyzer.
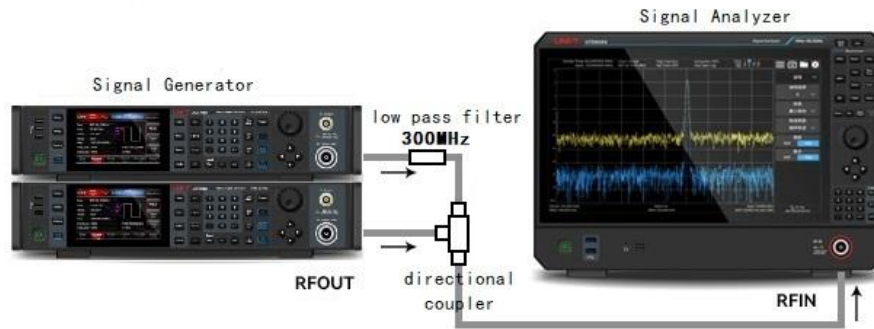
Figure 3-18 Instrument's Setting of Third-order Intercept Point Signal

    Note

Directional couplers must have a high degree of isolation between the two inputs so that the two source signals are not intermodulation.

2.  Set the frequency of one signal source (signal generator) to 299.95 MHz and the frequency of the other signal source to 300.05 MHz, so that the frequency interval is 100 kHz, and the amplitude of the two sources is set to the same value (in this case, the amplitude is set to -5 dBm).

3.  Set the center frequency and sweep bandwidth of the signal analyzer.

    Press [Default]> Reset

    Press [FREQ]> Center Frequency > 300> MHz, Sweep Bandwidth > 500 kHz

4.  Decrease the resolution bandwidth until to see the distortion product.

    Press [BW]> Rotating Rotary Knob

5.  Move the signal to the reference level.

    Press [Peak]> Marker→>→Reference Level

6.  Decrease the resolution bandwidth until to see the distortion.

    Press [BW]> Rotating Rotary Knob

7.  Activate the second marker and move the next peak to the peak of distortion signal.

    Press [Marker]> Mark Mode > Difference Value Δ

    Press [Peak]> Next Peak

8.  Measure another distortion signal

    Press [Marker]> Mark Mode > Normal

    Press [Peak]> Next Peak

9.  Measure the difference between this measured signal and the second distortion signal.

    Press [Marker]> Mark Mode > Difference Value Δ

    Press [Peak]> Next Peak
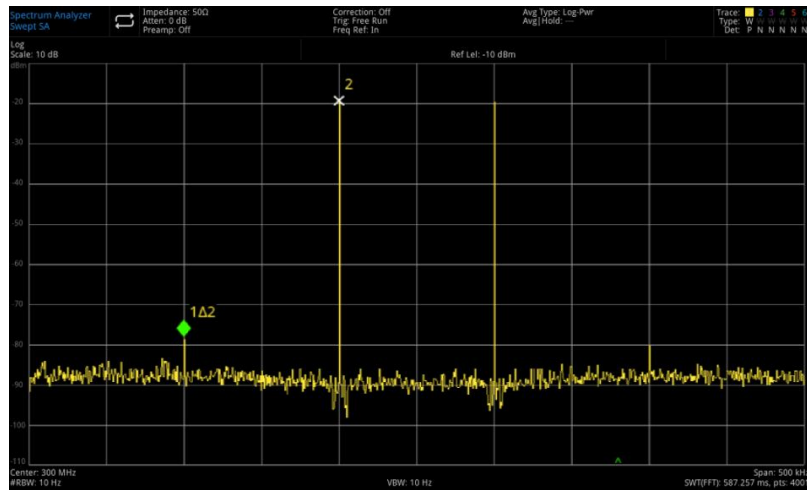
Figure 3-19 Measure Distortion Product

## Measuring Phase Noise

The phase noise measurement measures the stability in the frequency domain, and specify phase noise as the single-sideband power with respect to the fundamental RF output frequency, measured at various offsets from the carrier frequency and normalized to 1 Hz in the measurement bandwidth.

1.  Press [Default] to reset the signal analyzer
2.  Connect the output of the signal generator to the RF IN port of the signal analyzer with a cable
3.  Press [FREQ] > Center Frequency > 1 GHz, Sweep Bandwidth > 100 kHz
4.  Press [Trace] > Trace Type > Trace Average; Detection > Average
5.  Press [Peak] to place a marker at the peak of signal
6.  Press [Marker]> Mark Mode > Difference value Δ; Mark Δ Frequency > 10 kHz
7.  Open Mark Function > Mark Noise as shown in Figure 3-20
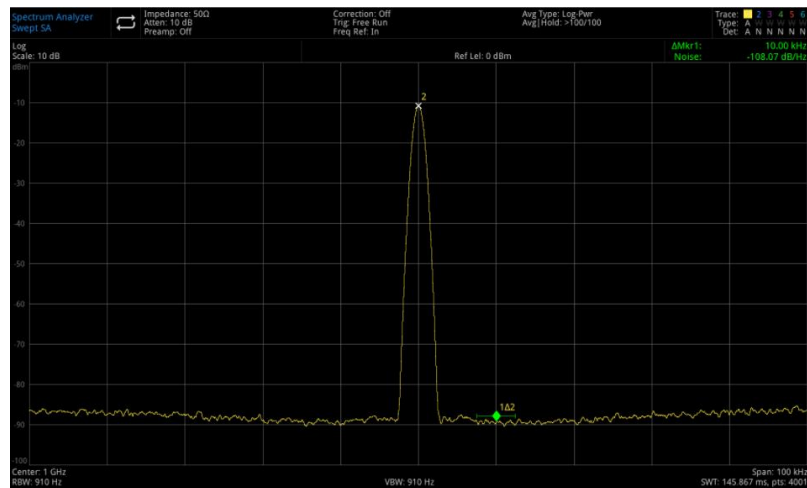


Figure 3-20 Phase Noise

## Checking Catalogue and Saved File

This signal analyzer saves and acquires data in a similar way as a personal computer: it has an internal memory and a USB flash drive. This signal analyzer allows you to view and save files in the internal memory or on the USB flash drive, and this section shows you how to save files and find directory.

## Find File in Catalogue

Tap the icon on the left bottom of the screen: find the file in the file folder 

This signal analyzer contains six types of files:

**State:** save the settings of signal analyzer and the file suffix is .state

**Trace + State:** save the trace and the file suffix is .trace

**Limits:** confirm the trace whether is over the limit of preset setting and the file suffix is .limit

**Correction:** used for amplitude correction settings to compensate the gain or loss of external device and the file suffix is .corr

**Measurement data:** save the trace, peak list or marker list and the file suffix is .csv

### New File Folder

Create a new file folder.

1. Press   > LocalDisk > UTS5026A to select the catalogue of file folder
2. Tap "New File Folder" to create a new file folder

### Multiple Choice (ON/OFF)

1. Press   > LocalDisk > UTS5026A or select USB
2. Open "Multiple Choice" menu
3. Select the file or folder you want to multi-select by ticking √ in the dialog box in front of the file or folder name

### Copy

If you need to copy files from the internal memory to a USB flash drive, please refer to the following steps.

1. Press   > LocalDisk > UTS5026A to select the file or file folder
2. Insert a USB to the USB port on the instrument
3. Select the file and tap "Copy" on the screen
4. Select the copied catalogue and tap " Paste" to complete the copy operation of file

### Move

If you need to move files, file folders or move to a USB flash drive, please refer to the following steps.

1. Press   > LocalDisk > UTS5026A to select the file or file folder
2. Select the file and tap "Move" on the screen, the system automatically pops up a dialog box
3. If you want to move the file or file folder to a USB, please insert it to the USB port on the instrument, and pull down the menu of LocalDisk to select a USB to be saved
4. Select the catalogue to be moved and ticking √ the dialog box to complete

> **Note**
>
> When moving files to external memory (USB), do not disconnect the USB device during the saving process to prevent unnecessary data loss and file corruption.

### Delete

1. Press   > LocalDisk >UTS5026A select the file or file folder to be deleted
2. Tap "Delete" on the panel menu to delete the selected file
3. If you want to multiple files, you can open "Multiple Choices" and ticking √ in the dialog box in front of the file name

4. Tap "Delete" on the panel menu to delete multiple files

### Load

1. Press 🗀 > LocalDisk > UTS5026A to select the file
2. Tap "Load" to load the data of file, which includes state, trace, screen and limits

### Rename

Rename the file or file folder.

1. Press 🗀 > LocalDisk > UTS5026A to select the file or file folder to be renamed
2. Select "Rename" to change the name of file or file folder

### Import/Export File

Export/import the file according to the export

Set the file type to export/import files according to the export status type (which contains state, trace + state, measurement data, limits and correction).

If an external memory exists, it will be preferentially saved to external storage.

For details, please refer to the button description in chapter "File Storage (Save)".

# Calibration

Tap the panel menu to extend the menu to select the calibration function to open the calibration menu and other function item, which includes calibration signal, automatic calibration and instant calibration.

**Calibration signal**: this function is used to verify whether the device can search a signal. With no signal input, turn on the calibration signal and a 50 MHz sine wave signal was automatically input, this sine wave signal should appear on the spectrogram.

**Automatic calibration**: turn on/off automatic calibration, if the automatic calibration is enabled, the device self-calibrates at regular intervals using an internal calibration source to maintain normal use.

**Instant calibration**: the signal analyzer will immediately using internal calibration source to perform self-calibration after press this key.

# 4. Key Function (Spectral Analysis)

- ■ Frequency (FREQ)
- ■ Amplitude (AMPT)
- ■ Bandwidth (BW)
- ■ Sweep
- ■ Trigger
- ■ Trace
- ■ Marker
- ■ Peak
- ■ Measurement Setup (Meas/Setup)
- ■ Single
- ■ Default Setup (Default)
- ■ System Setup (System)
- ■ File System (File)
- ■ File Storage (Save/Recall)
- ■ Touch/ Lock Screen
- ■ Mode (Mode/Meas)
- ■ Automatic Tuning (Auto)

**Note**

The key is for the scanning mode of signal analyzer spectrum.

## Frequency (FREQ)

Press the [FREQ] key to activate the center frequency function and enter the frequency menu. The numerical values of center frequency, sweep bandwidth start frequency and cut-off frequency are displayed at the bottom of the screen.

**Center frequency:** activate the center frequency to set a specified frequency at the center of the screen on the horizontal, and respectively display the center frequency and sweep bandwidth at the left side and the right side of the bottom grids. The user can change the center frequency by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Note**

- ● Modifying the center frequency will automatically modify the start frequency and cut-off frequency while keeping the sweep bandwidth unchanged.
- ● Modifying the center frequency is equivalent to panning the current channel, the adjustable range is limited by the frequency range listed in the signal analyzer specifications.
- ● In the zero sweep bandwidth mode, the value of start frequency, cut-off frequency and center frequency are the same.

**Sweep bandwidth:** used to input the range value of sweep bandwidth. The user can change the sweep bandwidth by using the numeric key, rotary knob and arrow key or touch the panel menu. The sweep

bandwidth will be symmetrically changed according to the center frequency. The reading of sweep bandwidth is the total displayed frequency range. To determine the sweep bandwidth for each horizontal scale division, the total displayed frequency range should be divided by 10.

Note
● Modifying the sweep bandwidth will automatically modify the start frequency and cut-off frequency while keeping the center frequency unchanged.
● In non-zero sweep bandwidth mode, the minimum sweep bandwidth can be se to 10 Hz，if the sweep bandwidth is set to the maximum, the signal analyzer will enter the full sweep bandwidth mode.
● You can manually set the sweep bandwidth to 0 Hz, or you can press the zero sweep bandwidth menu to enter the zero sweep bandwidth mode.
● Change the sweep bandwidth in non-zero sweep bandwidth mode, if the stepping center frequency and RBW are automatic, it will be changed by automatically and VBW (in automatic) will change with RBW.
● The scanning time will be change by one of the changing of sweep bandwidth, RBW and VBW.

**Start frequency:** the start frequency is at the left side, the start frequency and cut-off frequency is respectively at the left side and the right side of the gird. When these frequency is set, it will display at the bottom of the screen at replace the previous the center frequency and sweep bandwidth. The user can change the start frequency by using the numeric key, rotary knob and arrow key or touch the panel menu.

Note
● The sweep bandwidth and center frequency will change with the start frequency, and other system parameter will be affected by the change of sweep bandwidth.
● In the zero sweep bandwidth mode, the value of the start frequency, center frequency and cut-off frequency are the same and will be changed together.

**Cut-off frequency:** the cut-off frequency is at the right side, the start frequency and cut-off frequency is respectively at the left side and the right side of the gird. When these frequency is set, it will display at the bottom of the screen at replace the previous the center frequency and sweep bandwidth. The user can change the cut-off frequency by using the numeric key, rotary knob and arrow key or touch the panel menu.

Note
● The sweep bandwidth and center frequency will change with the cut-off frequency, and other system parameter will be affected by the change of sweep bandwidth.
● In the zero sweep bandwidth mode, the value of the start frequency, center frequency and cut-off frequency are the same and will be changed together.

**Frequency offset:** A frequency offset value is set to account for the frequency conversion between the device under test and the signal analyzer input. The user can change the frequency offset by using the numeric key, rotary knob and arrow key or touch the panel menu.

Note
● This parameter will not affect any hardware setting of the signal analyzer, it only change with the displayed value of the center frequency, start frequency and cut-off frequency.
● If you need to eliminate the frequency offset, you can set the frequency offset to 0 Hz.

**Full sweep bandwidth:** change the sweep bandwidth of signal analyzer to display the sweep bandwidth of all

frequency ranges.

**Zero sweep bandwidth:** set the sweep bandwidth to zero. In this mode, the envelope of time-domain signal will be displayed, which equivalent of an oscilloscope.

> Note

In the zero sweep bandwidth mode, it displays the time-domain feature of the fixed frequency components of the signal, it is very different from the non-zero sweep bandwidth mode.

The following function is not valid in the zero sweep bandwidth.

- "Marker->"(except -> reference level) in the [Marker] menu
- Scanning time and sweep mode in the [Sweep] menu

**Zoom-in sweep bandwidth:** the sweep bandwidth is set to double the current sweep bandwidth value to make it easy to observe more signals.

**Zoom-out sweep bandwidth:** the sweep bandwidth is set to the half of the current sweep bandwidth value to make it easy to observe more signal details.

**Previous sweep bandwidth:** set the sweep bandwidth to be the previous sweep bandwidth

**Stepped center frequency:** stepped frequency setup will change the length of center frequency, start frequency and cut-off frequency when using the arrow keys. The user can change the stepped value by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Automatic tuning:** help you quickly find the signal that you are most likely to be of interest and optimally place them on the display.

## Amplitude (AMPT)

Press the [AMPT] key to activate the reference level and enter the amplitude setup menu.

**Reference level**: Press the [AMPT] key to activate the reference level. The reference level is on the top of the screen, which indicates power or voltage value (the unit is the selected amplitude unit). The user can change the reference level by using the numeric key, rotary knob and arrow key or touch the panel menu.

> Note

- Reference level is the important parameter of signal analyzer; it represents the upper limit of dynamic range of the signal analyzer at the current. When the energy of the signal to be measured exceeds the reference level, it may cause non-linear distortion or even overload alarms. The nature of the signal to be measured should be understood and carefully select reference level, in order to perform the best measurement effect and protect the signal analyzer.

**Input attenuation (auto/manual):** set the RF front-end attenuator, so that large signals can pass through the mixer with low distortion (small signals can pass through the mixer with low noise). The input attenuation can be switched between automatic and manual. When it set to automatic, the input attenuation is linked with the reference level. When it set to manual, the user can change the input attenuation by using the numeric key, rotary knob and arrow key or touch the panel menu.

> Note

- When the maximum mixer level and the reference level is confirmed, the minimum of instrument's input attenuation should meet the formula: the reference level ≤ the input attenuation - Preamplifier – 10 dBm

**Preamplifier:** there are two preamplifiers, one for the low frequency band and one for the full frequency band. Control the switch of the instrument's internal preamplifier, turn on to generate the gain to compensate for the preamplifier, so that the reading of amplitude value is the actual value of the input signal.

Low frequency band preamplifier, which works from 0 Hz to 7.5 GHz; full frequency band preamplifier, which is effective for all frequency bands. When the preamplifier is turned on, the measurement bar area of the screen displays **preamplifier: on**.

**Scale:** set the logarithmic value corresponding to a grid on the vertical direction of the screen. The scale function is only available when the scale type is logarithmic. The user can change the scale by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Display scale:** when the scale type is logarithmic, it can use the logarithmic value corresponding to a grid on the vertical direction of the screen, the value range is 0.1-20 dB of per scale division. When the linear is selected, the gird on the vertical direction turn to the linear scale and the default amplitude unit is Volt V. The top grid is the set reference level, and the bottom grid is the zero level. Each grid is one-tenth of the reference level, and the unit is V

**Y-axis unit:** change the amplitude unit. It can be used in logarithmic and linear mode. The unit contains dBm, dBmV, dBµV, V and W. The default unit is dBm.

**Reference level offset:** when there is gain or loss between the device under test and the signal analyzer input, an offset value is added to the reference level to compensate for the resulting gain or loss. This value does not change the position of the trace and modified reference level and the amplitude reading of the cursor.

**Impedance:** set the input impedance when converting voltage to power. The default input impedance is 50 Ω. If the input impedance of the DUT to the spectrum analyzer is 75 Ω, then need to use a 75 Ω to 50 Ω adapter to connect the DUT to the signal analyzer and set the input impedance to 75 Ω.

**Correction:** Enter the amplitude correction to set the compensation of the gain or loss for external devices, such as antennas and cables. When the correction is enabled, the trace and the corresponding measurement results will all be corrected.
1.  Select correction: the signal analyzer provides 10 correction factors and each factor can be edit independently.
2.  Correction (ON/OFF): correction switch, the default is OFF
3.  Close all: close all the correction has been turned on
4.  Edit correction, it includes

| Select | Provides 10 data to save, default: correction 1 |
|---|---|
| Select row | Select the serial number of correction row |
| Insert row | Add correction point |
| Delete row | Delete the current selected correction row |
| Delete correction data | Delete the current correction data |

5.  Delete all the correction data: delete all the saved correction data

**Calibrating signal:** this function is used to verify the device whether can search the signal. In the case of no signal input, the calibration signal is turned on and a 50 MHz sine wave signal is automatically input, which is observed on the spectrogram.

## Bandwidth (BW)

Press the [BW] key to activate the resolution bandwidth and enter the panel menu to control the resolution bandwidth and video bandwidth.

**Resolution bandwidth (auto/manual):** set the resolution bandwidth to recognize two signal with similar frequency.
In the manual mode, the user can change the resolution bandwidth from 1 Hz to 8 MHz by using the numeric key, rotary knob and arrow key or touch the panel menu. Under 1 kHz, the available bandwidth values are 1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, or 300 Hz. If the input value is not the above value, then select an input value close to the available bandwidth. When the resolution bandwidth is decreasing, the system will correct the scanning time to maintain the amplitude correction, the resolution bandwidth is also related to the sweep bandwidth, and when the sweep bandwidth decreases, the resolution bandwidth will also decreases. In the automatic coupling mode, the video bandwidth will change with the resolution bandwidth, so that the ratio of video bandwidth and resolution bandwidth can be constant.
If the video bandwidth and resolution bandwidth are not coupling, a "#" icon appears next to "RBW" on the right bottom of the screen. When recoupling is required, press Manual/Auto key again and select Auto.

**Video bandwidth (auto/manual):** set the video bandwidth to filter out the noise except the video band.
In the manual mode, the user can change the video bandwidth from 1 Hz to 3 MHz by using the numeric key, rotary knob and arrow key or touch the panel menu. If the input value is not an available value, then select an input value close to the available bandwidth. When the video bandwidth is decreasing, the system will correct the scanning time to maintain the amplitude correction.

If the video bandwidth and resolution bandwidth are not coupling, a "#" icon appears next to "VBW" on the bottom of the screen. When recoupling is required, press Manual/Auto key again and select Auto.

**VBW: 3dB RBW:** select the ratio for the video bandwidth and resolution bandwidth.
If the signal is close to the noise level, the signal response displayed on the screen is fuzzy, the ratio can be set to less than 1 to reduce noise. When use the [Default] key to reset, the ratio will set to 1.000. The user can change the ratio by using the numeric key, rotary knob and arrow key or touch the panel menu.

**RBW filter type:** set the filter type of RBW. UTS5000A series supports two filters, Gaussian window and Flat window.
- Gaussian window: is a kind of exponential window, the main flap is wider, so the frequency resolution is low; there is no negative side flap, the first side flap attenuation up to -55dB, which is often used to truncate some non-periodic signals, such as exponential attenuation signals and so on.
- Flat window: the flat-top window behaves like its name with very small passband fluctuations when in the frequency domain.

## Sweep

Press the [Sweep] key to enter the following panel menu to select the sweep mode and trigger mode of the signal analyzer.

**Scanning time (auto/manual):** select the scanning time of the signal analyzer to display the sweep bandwidth (or when the sweep bandwidth is zero, the time of the signal analyzer to scan the full screen), decreasing the scanning time will increase the scanning frequency. In the manual mode, the user can change the scanning time by using the numeric key, rotary knob and arrow key or touch the panel menu.

1. **When the sweep bandwidth is not zero**

When the scanning time is automatic, the signal analyzer selects an optimal (shortest) scanning time for the current setting, which is influenced by the following factors.

1. The maximum tuning frequency of the signal analyzer
2. Selected video bandwidth filter and resolution
3. The maximum sampling rate of analog-to-digital converter
4. Scanning point
5. The scale of amplitude (logarithm or linear)
6. Detection mode

    You can select a scanning time that is less than the auto-coupling value; however, this may produce some measurement errors, the minimum scanning time is 1 ms.

2. **When the sweep bandwidth is zero**

The minimum scanning time is determined by the maximum sample rate of the analog-to-digital converter and the scanning points.

The minimum scanning time is 1 us, the maximum scanning time is 4000 s.

**Scanning time (common/precise):** the sweep mode divide to the common sweeping and precise sweeping.

The common sweeping is for acquiring faster scanning speeds and the precise sweeping is for acquiring greater measurement accuracy.

**Sweep/Measurement (single/continuous):** set the sweep mode to single or continuous and the default is the continuous sweeping.

The state and the selected mode will display on the top of the screen.

**Continuous**: set the sweep mode to the continuous sweeping, an icon  indicates the continuous, the system automatically sends a trigger initialization signal and directly enters the trigger condition judgment process after each scan.

**Single**: set the sweep mode to the single sweeping, an icon  indicates a single window, the single indicator will be illuminated after click the "single window".

If the system is currently in single scanning mode and not in a measurement state, press the "single" key and perform the scan when the trigger condition is met.

If the system is currently in single scanning mode and in a measurement state, press the "single" key and perform the scan and measurement when the trigger condition is met.

**Sweep mode (auto/manual):** the sweep mode includes automatic, sweeping frequency and FFT.

1. Automatic: the signal analyzer automatically selects the sweeping frequency or FFT mode according to the current resolution bandwidth, in order to achieve the fastest possible sweeping speed. When RBW is greater than 200 Hz, it automatically selects the sweeping frequency mode. When RBW is less than 200 Hz, it automatically selects FFT mode.
2. Sweeping frequency: performed in a point-by-point scanning manner, which is suitable for when the RBW is large.
3. FFT: performed in a parallel scanning manner, which is suitable for when the RBW is small.

**Point:** set the number of points obtained from each scan, i.e. the number of points of the current trace. The user can change the point value by using the numeric keys or touching the panel menu.

1. As the number of scanning points increases, the frequency resolution of the marked points increases, but the scanning speed decreases.

2. The scanning time may become longer when the number of scanning points is increased due to the limitation of the minimum scanning point interval time.
3. Changing the number of scanning points affects several parameters of the system, so the system will be re-scanned and re-measured.

**Demodulation:** set the demodulation type to "demodulation amplitude (AM)" or "demodulation frequency (FM)" or turn off the demodulation function. The default setting is "OFF".
1. When AM (or FM) demodulation is turned on, the system will perform AM (or FM) demodulation at the center frequency for that frequency point.
2. The machine is equipped with a headphone jack, which can output the demodulated signal in audio mode through the headphone. The audio frequency indicates the frequency of the modulated signal, and the audio strength indicates the amplitude of the modulated signal.

# Trigger

Press the **[Trigger]** key to enter the trigger menu and to set the trigger parameter.

**Trigger type:** arbitrary trigger, external trigger and video trigger
1. **Arbitrary trigger:** any moments are satisfied with the trigger conditions, that is continue to generate the trigger signal, no need to set the trigger conditions. After each frame is scanned, the next frame will be scanned automatically.
2. **Video trigger:** when the detected video signal voltage exceeds the set video trigger level, a trigger signal is generated.
   **Trigger level:** when the video trigger is selected, the trigger level line and the value of the trigger level are displayed in the screen. The user can change the trigger level by using the numeric key, rotary knob and arrow key or touch the panel menu.
3. **External Trigger:** an external signal (TTL signal) is input through the **[TRIG1]** connector on the rear panel, and a trigger signal is generated when the signal meets the set trigger edge condition.
   **Trigger edge (rising edge/falling edge):** set the trigger edge for external triggering to the rising or falling edge of the pulse, and generate a trigger signal when the signal meets the set trigger edge condition.
   **Trigger delay:** set the trigger delay time.
4. **Periodic Trigger:** when the periodic trigger is selected, the analyzer will use the built-in periodic timer signal as a trigger. The trigger event is set by the periodic timer signal, and the periodic timer signal is set by the offset and synchronous source. When a period signal is available but no reliable signal, use this trigger to synchronize the periodic signal with an external event (using a periodic synchronization source) to more closely approximate a reliable trigger signal. If the synchronous source is not selected (it is "OFF"), then the internal timer will not be synchronized with any external timing events.
   **Period:** set the period for the internal periodic timer. For digital communication signal, this is usually set to the frame period of the current input signal.
   If the synchronization source is not set to OFF and the rate of external synchronization source is changed for some reason, the periodic timer is synchronized by resetting the timer circuit's internal state, the periodic timer is synchronized at each external synchronization pulse.
   **Offset:** adjust the accumulated offset between the periodic timer events and trigger events.
   **Synchronous source:** Use this drop-down list to select the synchronous source of the periodic timer. Select a source to synchronize the periodic timer trigger, otherwise, the trigger could be generated anywhere in the frame. Synchronization reduces the accuracy required for period settings.
   **Trigger delay:** set the trigger delay time.

# Trace

Press the [Trace] key to select and control the trace and detection menu. Each trace consists of a series of data points with amplitude information, and with each scan, the signal analyzer refreshes its information for any valid trace.

**Select trace:** select the trace, it includes 6 traces

**Trace type:** set the type of the currently selected trace, and the system will display the scanned data according to the selected trace type after adopting the calculation method. The trace type includes refresh, trace average, maximum hold and minimum hold. Each type has a corresponding parameter on the upper right side of the screen.

1.  Refresh

    Take the real-time data after sweeping of each point of the trace.

2.  Trace average

    Each point of the trace displays the result of averaging the data after multiple sweeps. As the time of average sweep increases, the waveform becomes smoother.

3.  Maximum hold

    Each point of the trace keeps displaying the maximum value in multiple sweeps, and updates the data display when a new maximum value is generated.

4.  Minimum hold

    Each point of the trace keeps displaying the minimum value in multiple sweeps, and updates the data display when a new minimum value is generated.

**Detector:** set the detection mode of the current measurement and apply the detection mode to the current trace. The optional detector type includes sampling, peak, negative peak, normal detection, and average.

1.  Sampling

    For each point on the trace, the sampling shows the transient energy corresponding to a fixed time point (usually the first sampling point in the time period) in the corresponding time interval, and sampling applies to noise or noise-like signals.

2.  Peak

    For each point on the trace, the peak detection shows the maximum value of the sampled data within the corresponding time interval.

3.  Negative peak

    For each point on the trace, the negative peak detection shows the minimum value of the sampled data within the corresponding time interval.

4.  Normal detection

    The normal detection are displayed by selecting the maximum and minimum values of the sampled data segments in turn, i.e., for each odd-numbered point on the trace, the minimum value of the sampled data is displayed; for each even-numbered point on the trace, the maximum value of the sampled data is displayed. Using the normal detection can directly observed the upper and lower range of the amplitude change of the signal.

5.  Average

    For each data point, the detector will take average value by sampling data in the time interval. The average effect is different for different data types. The average type can set by the [Meas/Setup] key.

**Refresh (ON/OFF):** when it set to ON, clear any previously stored data in the selected trace and continuously displays any signals during the signal analyzer's scanning period.

When it set to OFF, hold and display the amplitude data for the selected trace, the trace register is not

refreshed with scanning.

**Display (ON/OFF):** set ON/OFF for the selected trace

**Trace operation:** the trace operation function performs mathematical operations between traces or between traces and the specified offsets.

1. Off: turn off the operation function
2. Power difference (A-B): calculating the power difference of the operand A and the operand B and save it to the target trace. In the sweeping, the following calculation is performed for each point.
   $Trace=10log(10^{A/10}-10^{B/10})$
   Above the formula, the unit of the parameter is the logarithmic power decibel value, if the value at one point of A is the maximum trace value, then the difference result is also the maximum trace value; if the difference result is less than or equal to 0, then the result is the minimum trace value.
3. Power sum (A+B): calculating the power sum of the operand A and the operand B and save it to the target trace. In the sweeping, the following calculation is performed for each point.
   $Trace=10log(10^{A/10}+10^{B/10})$
   Above the formula, the unit of the parameter is the logarithmic power decibel value, if a point of A or Bone point of A is the maximum trace value, then the sum result is also the maximum trace value.
4. Logarithmic difference (A-B+offset): In the logarithmic difference function, the operand A is subtracted from the operand B and an offset is added, and the result is stored in the target trace. In the sweeping, the following calculation is performed for each point.
   Trace=A-B+offset
   Above the formula, the unit of trace data is dBm.
5. A+offset: calculating the power sum of the operand A and the offset and save it to the target trace. In the sweeping, the following calculation is performed for each point.
   Trace=A+offset
   Above the formula, the unit of trace data is dBm.

   Note

The trace operation functions are mutually exclusive, i.e., when an operation function is applied to a trace, the last selected operation function is turned off.

**Operand A**: set the operation trace 1 in operation function. Trace 1, Trace 2, Trace 3, Trace 4, Trace 5 and Trace 6 are available.

**Operand B**: set the operation trace 2 in operation function. Trace 1, Trace 2, Trace 3, Trace 4, Trace 5 and Trace 6 are available.

**Offset:** set the logarithmic offset in operation function. The unit is dB. The user can change the offset by using the numeric key, rotary knob and arrow key or touch the panel menu.

# Marker

Press the **[Marker]** key to access the marker panel menu to select the marker type and number. A marker is a rhombic icon, as shown in the following Figure 4-1.
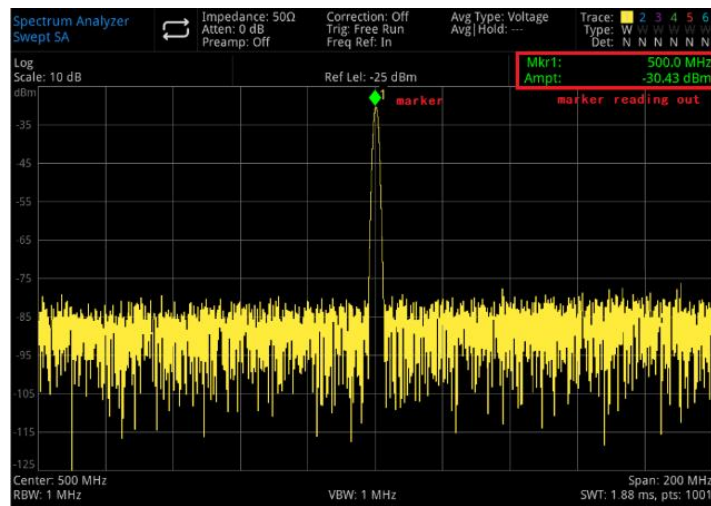
Figure 4-1 Mark Cursor Reading

Ten markers can be used on the screen at the same time, and only one or a pair of markers can be controlled at one time.

**Select marker:** select one of the ten cursors. The default is signed as marker 1. After selecting the cursor, it can set parameters such as the cursor type, the marked trace, and the reading mode. The currently open cursor will be marked on the trace selected by "Mark Trace", the current parameter area and upper right corner of the screen will display the current activated cursor reading at the marker.

#### Mark Mode

1.  Normal: for measuring X (frequency or time) and Y (amplitude) values in a point of trace. After selecting normal, a cursor identified by the current cursor number will appear on the trace, such as "1", pay attention to the following points when using.
    - If no activated cursor at the current, then activate a cursor at the center frequency of the current trace.
    - The reading of the current cursor will display on the upper right of the screen.
    - The resolution of X-axis (time or frequency) reading is related to the sweep bandwidth, which can be reduced to achieve higher reading resolution.
2.  Difference value △: used to measure the difference between "reference point" and a "point on the trace": X (frequency or time) and Y (amplitude) values.
    After selecting "Difference", a pair of cursors will appear on the trace: the reference cursor (marked with "×") and the difference cursor (marked with "△").
3.  Fixed: after selecting "fixed" cursor, the X and Y values of the cursor will changed by directly or indirectly, but their positions are unchanged. Y value does not change with the trace. The fixed cursor is generally used as the reference cursor of the difference cursor, and the fixed cursor is marked with "×".
4.  OFF: Turn off the selected cursor, the cursor information displayed on the screen and the related function will also be closed.

**Mark trace:** select the trace marked by the current cursor as Trace 1, Trace 2, Trace 3, Trace 4, Trace 5 or Trace 6

**Mark frequency:** mark the frequency point on the trace. The user can change the frequency by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Relative to:** for measuring the difference between two cursors and the two cursors can be marked on the different trace at the same time.

**Close All:** close all the markers.

**Marker->**: use the value of the current cursor to set other system parameters of the signal analyzer (such as the center frequency, reference level, etc.). If no cursor is available at the current, press the **Marker** menu to activate a cursor automatically.

1. ->Center frequency: set the center frequency of signal analyzer to the frequency at the current cursor.
- Select the "Normal" cursor, the center frequency is set to the frequency at the cursor.
- Select the "Difference" cursor, the center frequency is set to the frequency at the difference cursor.
- This function is not valid in the zero sweep bandwidth.

2. ->Stepped center frequency: set the stepped center frequency of signal analyzer to the frequency at the current cursor.
- Select the "Normal" cursor, the stepped center frequency is set to the frequency at the cursor.
- Select the "Difference" cursor, the stepped center frequency is set to the frequency difference between the difference cursor and reference cursor.
- This function is not valid in the zero sweep bandwidth.

3. ->Start frequency: set the start frequency of signal analyzer to the frequency at the current cursor.
- Select the "Normal" cursor, the start frequency is set to the frequency at the cursor.
- Select the "Difference" cursor, the start frequency is set to the frequency at the difference cursor.
- This function is not valid in the zero sweep bandwidth.

4. ->Cut-off frequency: set the cut-off frequency of signal analyzer to the frequency at the current cursor.
- Select the "Normal" cursor, the cut-off frequency is set to the frequency at the cursor.
- Select the "Difference" cursor, the cut-off frequency is set to the frequency at the difference cursor.
- This function is not valid in the zero sweep bandwidth.

5. ->Reference level: set the reference level of the signal analyzer to the amplitude of the valid marker and move the marker to the reference level (on the top of the grid).
- Select the "Normal" cursor, set the mark amplitude of the signal analyzer to the amplitude of the current reference level.
- Select the "Difference" cursor, set the reference level to the amplitude difference between markers.

**Marker list**: turn on/off the marker list

When the marker list is enabled, display all open cursors as a list in the lower window of the split screen. The display content includes the cursor number, mark mode, trace number of maker, X-axis scale type, X-axis reading and amplitude. Use the cursor list to check the measuring value of multiple measurement points.
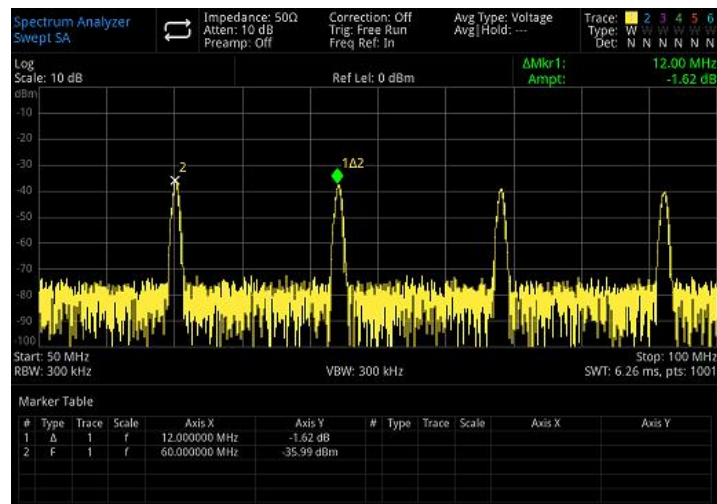
Figure 4-2 Marker List

**Attribute: it contains X-axis scale selection, X-axis scale (manual/automatic) and marker line switch.**

1.   X-axis scale: frequency, period, time, reverse time and marker will change the reading unit by X-axis scale.

  ● Frequency: when this type of reading is selected, the "Normal" and "Fixed" cursors shows the absolute frequency. The "Difference" cursors shows the frequency difference of the difference cursor relative to the reference cursor.

  ● Period: when this type of reading is selected, the "Normal" and "Fixed" cursors shows the reciprocal of the cursor frequency. The "Difference" cursors shows the reciprocal of the frequency difference. When the frequency difference is zero, its reciprocal is infinite and the reading displays "---".

  ● Time: when this type of reading is selected, the "Normal" and "Fixed" cursors shows the time difference between the cursor and start sweeping. The "Difference" cursors shows the scanning time difference between the difference cursor and the reference cursor. In the zero sweep bandwidth mode, the default reading method is "Time".

  ● Reverse time: when this type of reading is selected, display the reciprocal of the scanning time difference between the difference cursor and the reference cursor. When the time difference is zero, its reciprocal is infinite and the reading displays "---".

2.   X-axis scale (auto/manual): select auto or manual, when X-axis scale is set to auto, and the sweep bandwidth is set to the zero sweep bandwidth, the marker reading will automatically turns to "Time".

3.   Marker line (OFF/ON): turn on/off the marker line

  ● When the marker line is opened, the cross line is displayed at the amplitude point indicated by the cursor. The width of the horizontal line and the height of the vertical line are consistent with the grid length and height of the waveform display area.

  ● If the cursor is not at the visible area, then extend the marker line to the display area. This feature is useful for cursors outside the display area, where the cursor extension line indicates the cursor's amplitude for comparison.

**Mark function: mark noise, in-band power and in-band density, bandwidth point and frequency meter of N dB, frequency meter threshold.**

1.   Mark noise: perform the marking noise for the selected cursor and then reads the normalized noise power density value at the cursor.
     If the currently selected cursor is disabled in the Marker menu, pressing the "Mark Noise", "Normal" will

automatically turn on, and then measuring the averaged noise level at the frequency point of the measurement cursor and normalized to a 1 Hz bandwidth. At the same time, some compensation is made for different detection methods and trace types. The noisy cursor measurement is more accurate when the "RMS average" or "sampling" mode is used.

2. In-band power: in the non-zero sweep bandwidth mode, calculating the total power of the signal within a certain bandwidth.
   In the zero sweep bandwidth mode, calculating the average power within a certain bandwidth.

3. In-band density: in the non-zero sweep bandwidth mode, in-band density is the total power in the bandwidth to be measured divided by the measured bandwidth.
   In the zero sweep bandwidth mode, in-band density is the in-band power measured at first and then divided by Bn (Bn refers to the noise bandwidth of the RBW filter).

4. N dB point (ON/OFF): turn on the N dB bandwidth measurement function, or set the value of N dB. N dB bandwidth refers to the frequency difference between two points of N dB amplitude down (N<0) or up (N>0) to the left or right of the current cursor frequency point.
   The user can change the value of N by using the numeric key, rotary knob and arrow key or touch the panel menu.

5. Frequency meter (OFF/ON): turn on the frequency counting of the cursor, the cursor displays the exact frequency of the frequency point where the energy of the frequency point is the largest. The scanning speed will be affected when the frequency meter is enabled .

6. Frequency meter threshold: set the counting time of frequency meter

# Peak

Press the [Peak] key to turn on the peak search menu and execute a peak search.

**Mark frequency:** mark the frequency point on the trace. The user can change the frequency value by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Marker->:** refer to the [Marker] key at the panel menu " <u>Marker -></u> ".

**Peak search:** use the normal cursor mode to search for the highest amplitude in the trace and display its frequency and amplitude value, then press peak search to perform it one time.

**Next peak:** find the peak on the trace that is second only to the amplitude to the current peak and meets the search criteria, and mark it with the cursor. Without this peak, the marker will not move.

**Next peak on the left:** find the current peak on the left side and search the close peak that meet the search criteria on the trace, and mark it with the cursor.

**Next peak on the right:** find the current peak on the right side and search the close peak that meet the search criteria on the trace, and mark it with the cursor.

**Minimum peak:** find the minimum amplitude value on the trace and mark it with the cursor.

**Peak-to-peak search:** peak and minimum searches are performed at the same time and marked with a "difference" cursor, where the peak search result is marked with a reference cursor and the minimum search result is marked with a difference cursor.

**Continuous peak search (ON/OFF):** turn on/off the continuous peak search and the default setting is off. When the continuous peak search is enabled, the signal analyzer will automatically execute one peak search for tracing the measurement signal.

**Peak list (ON/OFF):** turn on/off the peak list, and the default setting is OFF.

Turn on the peak list, which displays a list of peaks (frequency and amplitude) that meet the search parameters, display up to a maximum of 20 eligible peaks in a split screen window.
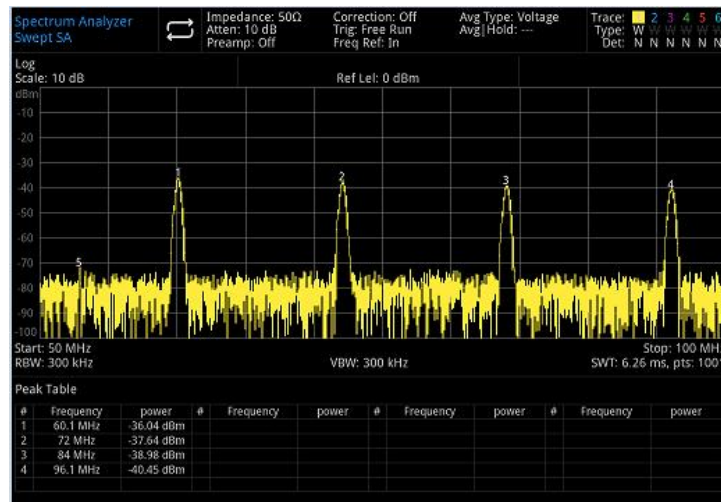
Figure 4-3 Peak List

**Search standard:** threshold line, peak threshold and peak offset

1. Threshold line (ON/OFF): set whether to display the indicator line of peak threshold and peak offset the threshold line displays the peak offset value, the default setting is OFF.
2. Peak threshold (auto/manual): automatically or manually specify the minimum of the peak amplitude, only the peak that are greater than the peak threshold can be judged as peak. The user can change the peak threshold by using the numeric key, rotary knob and arrow key or touch the panel menu.
3. Peak offset (auto/manual): automatically or manually specify the difference between the peak and the minimum amplitude on the left and right side, only the peak that are greater than the peak difference can be judged as peak. The user can change the peak offset by using the numeric key, rotary knob and arrow key or touch the panel menu.

# Measurement Setup (Meas/Setup)

Press the [Meas/Setup] key to turn on the parameter panel menu, it includes the following settings.

**Average/Hold time:** set the average time for the trace. The user can change the average time by using the numeric key, rotary knob and arrow key or touch the panel menu. Select multiple average times reduces the effect of noise or other random signals, thus highlighting the stable signal characteristics in the signal, and the larger the number of averages, the smoother the trace.

### Average Type

1. Logarithmic power average: indicating take the average of the logarithmic amplitude values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to video detection, for the stochastic noise, logarithmic average = power average - 2.5 dB = voltage average –1.45. Thus, it can reduce the display level of noise (not the actual level of noise), it is suitable for observing low energy narrowband signals, especially those close to noise.
2. Power average: indicating take the average of the power of signal. The average detection turns to RMS (power) detection. The power average is the actual power for noise, it suitable for measuring the real-time power of complex signal.
3. Voltage average: indicating take the average of the voltage values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to voltage detection. The voltage average display in linear, it suitable for observing AM signal or the rising and falling condition of pulse demodulation signal (such as radar, TDMA ejector).

**Display line (ON/OFF):** set to change the display position of display line level. The display line is a reference horizontal line with an amplitude value equal to the set value, and the corresponding amplitude unit is the same as the Y-axis unit. The user can change the display line level by using the numeric key, rotary knob and arrow key or touch the panel menu.

Note

The display line is a reference horizontal line with an amplitude value equal to the set value, and the corresponding amplitude unit is the same as the Y-axis unit.

If the display line is outside the visual range, then it display at the top or bottom of the grid and indicated by direction.

**Limits:** set the parameter of limits, press the [Default] key to turn off the limits measurement, and the limits data will be saved.

1.  Select: select the current limits, it can select 6 limits and the default is 1.
2.  Limits (ON/OFF): turn on/off the limits line, when the limit line is enabled, the limit line displays on the measurement interface, the trace will perform test according to the current limit line. Each limit line is shown in a different color.
3.  Test trace: set the test trace for the current limit line, and the default trace is 1.
4.  Tolerance (ON/OFF): turn on/off the tolerance display, when the tolerance is enabled, the tolerance line displays on the measurement interface; when the tolerance is disabled, the tolerance is invalid.
5.  Type (upper/lower): select the current limit line to "Upper" or "Lower", if the trace amplitude is greater than the amplitude of upper limit line or less than the amplitude of lower limit line, then the test fails.
6.  Edit limits: press this key to enter the menu to turn on the limits line window, the current limit line will appear and the peak list will be turned off.

     Turn on the trace is corresponding to the limit line, it includes

●   Select: select the limit line to be edited, and the default limit line is 1.
●   Select row: select the row of limit list.
●   Frequency: edit the frequency for the current point. The user can change the frequency by using the numeric key, rotary knob and arrow key or touch the panel menu.
●   Amplitude: edit the amplitude for the current point. The user can change the amplitude by using the numeric key, rotary knob and arrow key or touch the panel menu.
●   X offset: set the frequency offset for the current line.
●   Y offset: set the amplitude offset for the current line.
●   Apply offset: X offset and Y offset data to each point of the current limit line, and then reset X offset and Y offset to 0.
●   Insert row: insert a editing point
●   Delete row: delete the currently selected
●   Delete limits: delete the current limit line, the data of the current limit line will be deleted
7.  Test limits (ON/OFF): turn on/off the test of the current limit line
8.  Copy limits: copy the limit line from the selected limit line
9.  Limits make-up: make-up the limit line from the selected limit line
10. Delete all limits: after deleting all limit lines, the data of all limit lines are cleared and changed to factory settings.
11. **Measurement preset:** restore the measurement mode/setting to the factory settings.

# Single

The [Single] key is the quick sweep mode key. The details refer to the section "Sweep/Measurement" in

chapter 4.

## Default Setting

Press the [Default] key to provide an easy environment for measurement.

Press [Default]> Factory Setting, reset as the following steps.

1.  Rest the signal analyzer to signal analyzer mode (SA)
2.  Enter the frequency menu
3.  Set the default parameter for some conditions
4.  Execute the test of processor and not affect the correction data
5.  Delete the cache and all trace data of input and output
6.  The amplitude of trace 2, 3, 4, 5 and 6 will not display
7.  The amplitude correction factor will be turned off, but remains in the memory of the signal analyzer
8.  The limit test will be turned off, but the limit line list remains in the memory of the signal analyzer
9.  The state directly set to 0

The default values of the key parameters after reset are as follows.

| Menu | Parameter | Default value |
| --- | --- | --- |
| Frequency | Start frequency | 10 MHz |
| Frequency | Cut-off frequency | 26.5 GHz |
| Frequency | Frequency offset | 0 Hz |
| Amplitude | Reference level | 0 dBm |
| Amplitude | Input attenuation | Auto /10 dB |
| Amplitude | Pre-amplification | OFF |
| Amplitude | Reference level offset | 0 dB |
| Amplitude | Impedance | 50 Ω |
| Bandwidth | Resolution bandwidth | Auto/3 MHz |
| Bandwidth | Video bandwidth | Auto/3 MHz |
| Sweep | Scanning time | Auto/11 ms |
| Sweep | Sweep mode | Auto/frequency sweep |
| Sweep | Sweep count | 4001 |
| Sweep | Trigger type | Arbitrary trigger |
| Trace | Select trace | 1 |
| Trace | Trace type | Refresh |
| Trace | Trace detector | Normal detection |
| Trace | Trace refresh | ON |
| Trace | Trace display | ON |
| Measurement | Measurement type | Frequency sweep |
| Measurement Setup | Average/hold time | 100 |
| Measurement Setup | Average type | Voltage |

# System Setup

Press the 【System】 key to enter the setup menu, it can access the system information, basic setting and network setting of the signal analyzer.

System information: enter the system information panel menu to check basic and option information.
1.   Basic information: product name, manufacturer, product model, serial number, software version number, medium frequency hardware version number, radio frequency hardware version number, medium frequency logical version number, radio frequency logical version number, etc.
2.   Option information: check the version number and state of the option.

**Setting**: enter the setup panel menu to set up the basic and network setting
1.   Basic Setting.
      **Language:** simplified Chinese, English, German.
      **Time format:** 12 hours and 24 hours.
      **Date/Time:** tap this area to pop out the Windows system time setting window, modify the time and date in the time setting window.
      **Picture format:** set the format of screenshot, it has bmp and png for selection.
      **Power-on parameter:** set the system parameter settings that are loaded after power on, the default setting can set to previous or preset.
      **Backlight:** swipe the scroll bar to change the backlight of the screen.
      **Sound:** swipe the scroll bar to change the sound.
      **HDMI:** HD multimedia interface, touch "□" to tick it, it indicates the interface is turned on.
      **Screenshot inverse color:** set the inverse color of screenshot.
      **Preset file:** When the power-on parameter is set to preset, this configuration file will use to set the parameter when the instrument is turned on.

2.   Network Setting
      **Adopter:** that is LAN switch, touch "open" to enter the network setting window of Windows, modify the network configuration in the network setting window.
      **DHCP:** touch "open" to enter the network setting window of Windows, modify the network configuration in the network setting window.
      **IPV4 address:** the format of IP address is nnn.nnn.nnn.nnn, the first nnn range is 1 to 223, and the other three nnn ranges are 0 to 255. It is recommended to consult network administrator for an available IP address.
      **Subnet mask:** the format of subnet mask is nnn.nnn.nnn.nnn, nnn range is 0 to 255. It is recommended to consult network administrator for an available subnet mask address.
      **Gateway setting:** the format of gateway is nnn.nnn.nnn.nnn, the first nnn range is 1 to 255, and the other three nnn ranges are 0 to 255. It is recommended to consult network administrator for an available gateway address.
      **MAC address:** the physical address to confirm the location of a network device which is also called hardware address, the length is 48 bits (6 bytes). It consists of hexadecimal digits, including the first 24 digits and the last 24 digits, in the format of xx-xx-xx-xx-xx-xx. The first 24 bits are called organization-unique identifiers, while the last 24 bits are assigned by the manufacturer and called extended identifiers.

3.   Port Setting
      **Web login user name:** set the user name for logging in the browser. Web address http://IP:9000, where IP is the IPv4 address of the network settings, e.g.: http://192.168.20.117:9000.

**Web login password:** the password for logging in the browser. After successful login, you can control the instrument, execute SCPI commands, network settings, etc. on the browser.

After the Web login user name and password are set, the device can be remotely controlled using a Web browser on a PC or mobile terminal, which mimics the touch screen/mouse clickable display function, just like a physical instrument, and operates as follows.

(1)    Access Local Area Network

The computer and the oscilloscope are under the same LAN. Check the IP address through the system menu of the signal analyzer, and then the browser accesses the signal analyzer by http://ip:9000 port.

Example

Computer IP: 192.168.20.3

Signal analyzer IP: 192.168.20.117

PC browser using 192.168.20.117:9000 to access the signal analyzer to checking the basic information and control parameter of the instrument, such as network setting, password and SCPI, as shown in the following Figure 4-4.
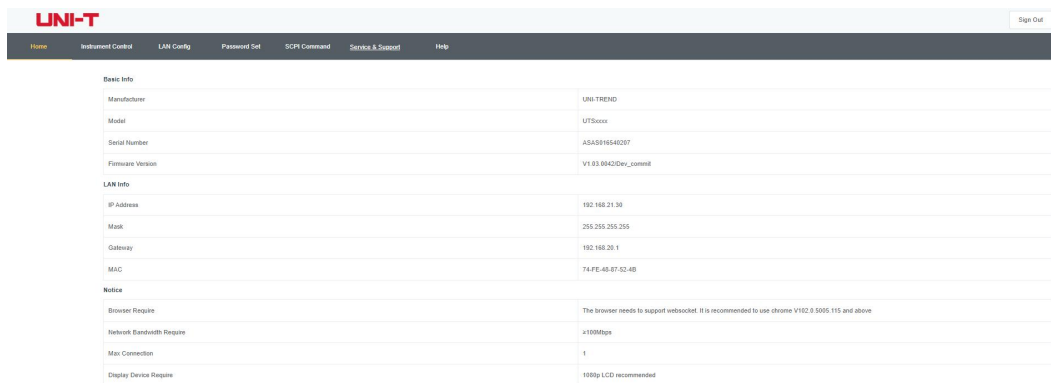


Figure 4-4 Web Basic Information

Log in to check the network and password and SCPI setting of the instrument. Web user name and password refer to port setting, as shown in the following Figure 4-5.
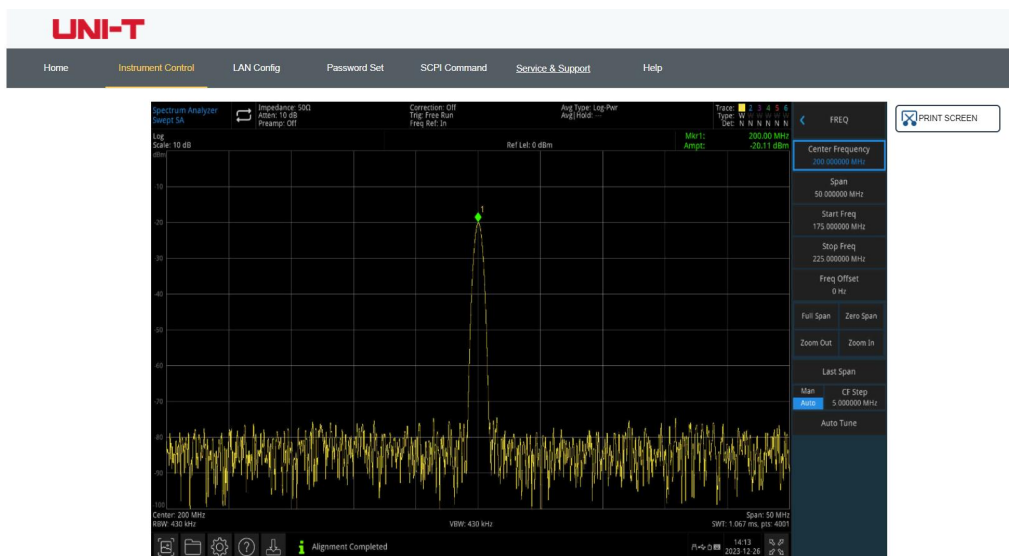


Figure 4-5 Web Control

The operations that can be performed on the touch screen of the physical instrument, such as selecting menu panels, clicking on function keys, entering numbers and characters, dragging marks, etc., can also be performed on this Web page, as well as printing the screen.

(2) Access Outer Network
   a.  plug the network cable into the signal analyzer and the network can be access internet
   b.  open the frp proxy service on the server
   c.  configure the frp proxy IP and port of signal analyzer
   d.  the browser can access http://IP:web_port, and the access interface is consistent with the above.

Note

(3) This signal analyzer uses frp intranet penetration way to achieve external network access. frp version is 0.34.0. This machine with frp-0.34.0 client, it need use with the server, the server needs to open frp server, the client connects to the frp server port is 7000, so the server needs to configure bind_port = 7000.

(4) Network Setting
   Modify the network and Frp agent network information of signal analyzer, as shown in the following Figure 4-6.



Figure 4-6 Web Network Setting

(5) Password Setting
   Modify Web login password of the signal analyzer, as shown in the following Figure 4-7, the original password can be viewed under Physical Instruments->System->Setting->Interface Settings.

Figure 4-7 Web Password Setting

(6)  SCPI

Execute the SCPI command, as shown in the following Figure 4-8, enter the command in the SCPI command edit box, click the "Send Command" button, and the execution result will be printed in the report column as below.



Figure 4-8 SCPI Contro

**Restore default setting:** enter the restore default menu to perform this function
1.    Restore the system setting, the system setting of the signal analyzer will restore to the default state.
2.    Clear data, all the stored data of the signal analyzer will be deleted.
3.    Restore all the setting, all the setting of the signal analyzer will restore to the default state and empty user's data.

# File System

Press the [File] key to enter the file system to check, create, delete, copy and move.
**Check**: check each file and file folders in the file system

**Create**: in the file system, under any directory, press the blank space on the touch screen, and select "New" -> "Folder" in the pop-up menu to create a new folder

**Delete**: in the file system, under any directory, select the file or file folders to be deleted, long press the touch screen to pop out the menu, select "Delete" and confirm the selected

**Copy**: in the file system, under any directory, select the file or file folders to be copied, long press the touch screen to pop out the menu, select "Copy" and confirm the selected

**Move**: in the file system, under any directory, select the file or file folders to be moved, long press the touch screen to pop out the menu, select "Move" and confirm the selected

# File Storage (Save/Recall)

Press the **[Save/Recall]** key to enter the save menu, the types of files that can be saved in the instrument are state, trace + state, measurement data, limits, correction and export. Long press this key to screenshot.

**State:** press the state panel menu to access the save menu of state. Save the state into the instrument.
1.  Press the **Export** key, the instrument will save the current state by the default file name or the filename entered by the user.
2.  After the state file is selected, press the **Import** key to read the current state file.

**Trace + State**: press the **Trace + State** panel menu to enter the save menu of Trace + State. The instrument's state and the selected trace can save to a file.
There are six traces for selection.
1.  Press the **Export** key, the instrument will save the current state and trace by the default file name or the filename entered by the user.
2.  After this file is selected, press the **Import** key to read the current Trace + State file.

**Measurement data:** press the panel menu of **measurement data** to access the save menu of the measurement data. The selected measurement data type (such as trace, measurement result, peak list or cursor list) can be saved into the specified file. The instrument will save the corresponding data in .csv (data separated by comma) format for data analysis by using Excel software.

There are six traces for selection.
Data type: trace, peak list and marker list
1.  Press the **Export** key, the instrument will save the currently selected measurement data by the default file name or the filename entered by the user.
2.  After this file is selected, press the **Import** key to read the current measurement data file.

**Limits:** press the panel menu of **limits** to access the save menu of the limits, save the selected limit line to the file.
Select limits: six limit data
1.  Press the **Export** key, the instrument will save the current limit by the default file name or the filename entered by the user.
2.  After this file is selected, press the **Import** key to read the current limit file.

**Correction:** press the panel menu of **correction** to access the save menu of the correction, save the selected corrected value to the file.
Select correction: 10 corrected data

1.  Press the **Export** key, the instrument will save the current corrected data by the default file name or the filename entered by the user.
2.  After this file is selected, press the **Import** key to read the current correction file.

**Export:** export the currently selected file
**Import:** import the currently selected file (this key is hidden when no file is selected)

## Screen Lock (Touch Lock)

Press the [Touch Lock] key, if the key indicator turns to green which indicating touch function is locked, if the key indicator is extinguished which indicating touch function is enabled.

## Mode/Measurement (Mode/Meas)

Press the [Mode/Meas] key to open the Mode Select window. For spectrum analysis mode, you can select channel power, time domain power, occupied bandwidth, third-order intermodulation, adjacent channel power, spectrum monitoring, carrier-to-noise ratio, and harmonic measurements, refer to "One-key Measurement" in the chapter 5 for more information about these measurements.

Mode: spectrum analysis, EMI, analog demodulation, vector signal analysis, real-time spectrum analysis ,IQ analysis (there are some options that need to be activated separately.) Please go to the official website to download the required instructions

## Automatic Tuning (Auto)

Press the [Auto] key to enable the automatic tuning to check the input signal.

1.  Perform the peak search in the full sweep bandwidth mode
2.  Operating marker >Center frequency
3.  Operating marker >Reference level
4.  Set other setting to automatic to observe the signal

  Note

The effective frequency range of the auto-tuning function is from 10 MHz to 26.5 GHz, and the minimum amplitude of the signal at which it can automatically detect is -65 dBm.

# 5. One-key Measurement

- ■ Frequency Sweep
- ■ Channel Power
- ■ Time-domain Power
- ■ Occupied Bandwidth
- ■ Third-order Intermodulation
- ■ Adjacent Channel Power
- ■ Frequency Monitoring
- ■ Carrier-to-noise Ratio
- ■ Harmonic Wave

This chapter describes how to make one-key measurement by using the [Meas] key on the front panel (spectrum analysis mode).

## Frequency Sweep

Press [Meas] > Frequency Sweep

Using the sweep analysis (frequency domain), FFT analysis (frequency domain), or zero sweep bandwidth analysis (time domain) for measurement. When the frequency sweep is selected, the advanced measurement is OFF by default.

The details refer to "Chapter 4 ".

Press the [Meas/Setup] key to set the parameter of frequency sweep analysis, Press this button for other measurement settings for subsequent one-touch measurements.
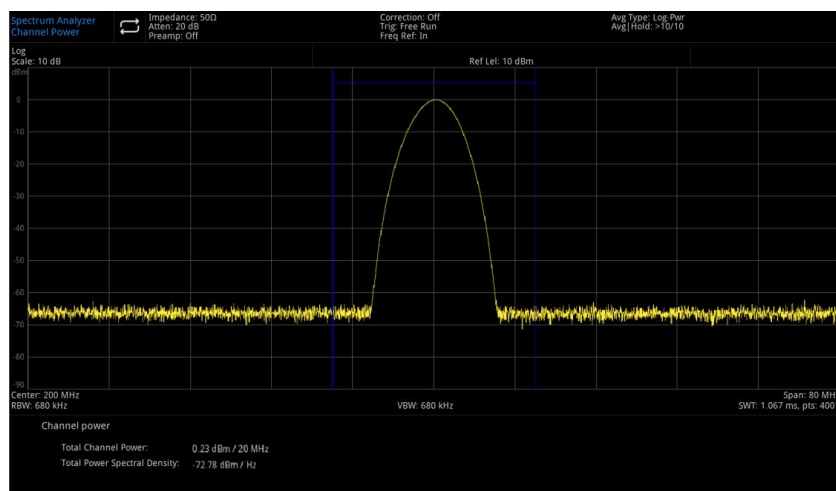
## Channel Power



Figure 5-1 Channel Power

Measure the power and power spectral density within a user-specified channel bandwidth. A pair of vertical lines on the display indicates the boundaries of the channel bandwidth, and you need to set the center frequency, reference level, and channel bandwidth.

Press **[Meas] > Channel Power** to enter the following panel menu.

Measurement Setup

**Average/Hold time (ON/OFF):** press the average number (ON) to specify the average number of scans used to calculate the measurement results, the scan number range is from 1 to 10,000. The user can change the average time by using the numeric key, rotary knob and arrow key or touch the panel menu. The average of the measurements will be displayed after each scan. Select (OFF) to turn off this function.

**Average mode (exponential/repeat):** switching between the exponential and repeat mode, this averaging mode is used to determine the average mode of operation of the signal analyzer when the specified number of averaging scans has been reached.

When the exponential mode is selected, after the specified average number of scans is reached, each channel trace data is exponentially weighted, added to the previous average and averaged.

When the repeat mode is selected, the weights of the new data are larger than the weights of the old data, which facilitates the tracking of slowly changing signals, and this averaging result will be displayed at the end of each scan.

When the repeat mode is selected, and the specified average number of scans is reached, all previous data is cleared and a rescan will be performed.

**Average type:** logarithmic power average is take the average of the logarithmic amplitude values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to video detection.

Power average is take the average of the power (square of amplitude) signal. The average detection turns to RMS (power) detection.

Voltage average is take the average of the voltage values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to voltage detection.

**Integral bandwidth:** used to specify the range of integral when calculating the power in a channel, such as set the main channel bandwidth.

Note: the integral bandwidth is displayed in a blue box on the screen.

At this time, the sweep bandwidth should be set between 1 and 10 times of the integration bandwidth. The user can change the sweep bandwidth by using the numeric key, rotary knob, arrow key or touching the panel menu.

**Measurement preset: restore the measurement mode/setting to the factory settings.**
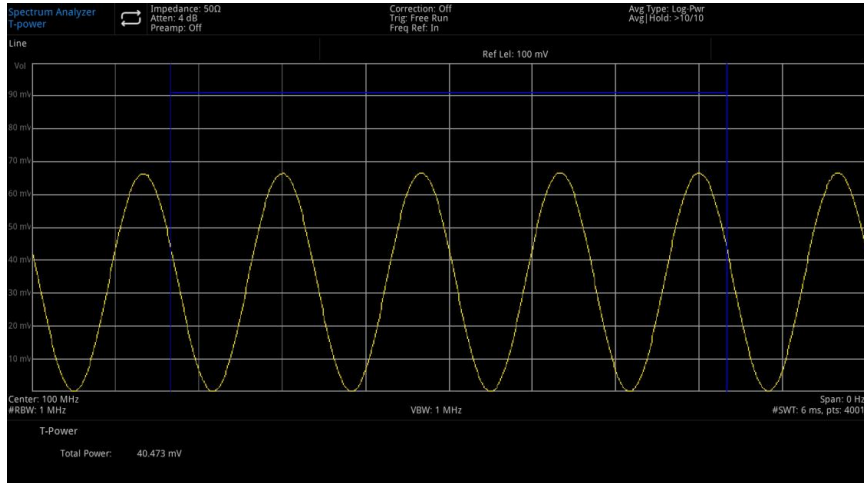
# Time-domain Power



Figure 5-2 Time-domain Power

Press **[Meas] > Time-domain Power**, the system enters the zero sweep bandwidth mode and calculate the power in the time-domain.

## Measurement Setup

**Average/Hold time (ON/OFF):** press the average number (ON) to specify the average number of scans used to calculate the measurement results, the scan number range is from 1 to 10,000. The user can change the average time by using the numeric key, rotary knob and arrow key or touch the panel menu. The average of the measurements will be displayed after each scan. Select (OFF) to turn off this function.

**Average mode (exponential/repeat):** switching between the exponential and repeat mode, this averaging mode is used to determine the average mode of operation of the signal analyzer when the specified number of averaging scans has been reached.

When the exponential mode is selected, after the specified average number of scans is reached, each channel trace data is exponentially weighted, added to the previous average and averaged.

When the repeat mode is selected, the weights of the new data are larger than the weights of the old data, which facilitates the tracking of slowly changing signals, and this averaging result will be displayed at the end of each scan.

When the repeat mode is selected, and the specified average number of scans is reached, all previous data is cleared and a rescan will be performed.

**Average type:** logarithmic power average is take the average of the logarithmic amplitude values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to video detection.

Power average is take the average of the power (square of amplitude) signal. The average detection turns to RMS (power) detection.

Voltage average is take the average of the voltage values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to voltage detection.

**Start time:** set the left boundary of the time-domain power measurement in terms of time. The data calculation range for time domain power measurements is from the start line to the end line. The default value is 0 s. The user can change the left boundary by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Stop time:** set the right boundary of the time-domain power measurement in terms of time. The data

calculation range for time domain power measurements is from the start line to the end line. The default value is10 ms. The user can change the right boundary by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Measurement preset:** restore the measurement mode/setting to the factory settings.
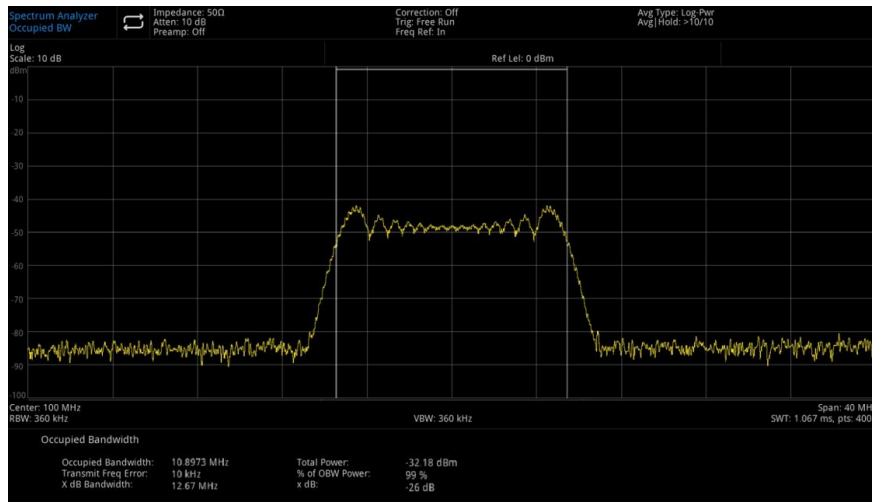
# Occupied Bandwidth



Figure 5-3 Occupied Bandwidth

The occupied bandwidth calculates the power of the spectrum shown on the screen at first and places two markers on the spectrum. The power percentage between the two frequency indicated by the markers as a percentage of the overall spectrum power is specified by the user.

During the test, the default percentage is 99%. Power- bandwidth program calculates the power sum of all signal on the trace at first.

For 99% of the occupied power bandwidth, the markers are placed at two frequency on the left and right side. The power percentage between the two frequency accounts for 99% of the overall spectral power, while the remaining 1% of the power is evenly distributed beyond the markers. The frequency difference between the two markers is the 99% power bandwidth and is displayed on the screen.

The occupied bandwidth function can also be used to indicate the frequency difference between the signal analyzer's center frequency and the channel's center frequency. If the two boundary frequency of the occupied bandwidth are denoted as F1 and F2, the "Transmit Freq Error" (transmit frequency error) is defined as the difference between (F1+F2)/2 and the center frequency of the signal analyzer.

The occupied bandwidth measurement can be performed in single scan mode or continuous scan mode, and the user must set the center frequency, reference level, and channel interval.

Press [Meas] > Occupied Bandwidth to enter the following panel menu.

### Measurement Setup
**Average/Hold time (ON/OFF):** press the average number (ON) to specify the average number of scans used to calculate the measurement results, the scan number range is from 1 to 10,000. The user can change the average time by using the numeric key, rotary knob and arrow key or touch the panel menu. The average of the measurements will be displayed after each scan. Select (OFF) to turn off this function.

**Average mode (exponential/repeat):** switching between the exponential and repeat mode, this averaging mode is used to determine the average mode of operation of the signal analyzer when the specified number of averaging scans has been reached.

When the exponential mode is selected, after the specified average number of scans is reached, each channel trace data is exponentially weighted, added to the previous average and averaged.

When the repeat mode is selected, the weights of the new data are larger than the weights of the old data, which facilitates the tracking of slowly changing signals, and this averaging result will be displayed at the end of each scan.

When the repeat mode is selected, and the specified average number of scans is reached, all previous data is cleared and a rescan will be performed.

**Average type:** logarithmic power average is take the average of the logarithmic amplitude values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to video detection.

Power average is take the average of the power (square of amplitude) signal. The average detection turns to RMS (power) detection.

Voltage average is take the average of the voltage values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to voltage detection.

**Percentage of occupied power (% of OBW Power):** used to change the percentage of signal power when determining the occupied bandwidth. The user can change the percentage by using the numeric key, rotary knob and arrow key or touch the panel menu.

**x dB:** the number of dB that defines the highest point in the signal (P1) and is used to measure the transmit bandwidth.

This transmit bandwidth should be within the OBW span, this function is independent of the OBW calculation, the result of the XdB bandwidth calculation is also known as the transmit bandwidth, and EBW.

Place a directional marker (F1 and F2) at each of the two frequency to the left and right side of the highest point (P1), where the amplitude is dB below the highest point (P1) in the signal by the same number of dB as the user-specified dB value, and calculate the total power between the two directional markers.

The frequency F1 and F2 defines as the XdB farthest frequency below and above the P1 frequency respectively, and the transmit bandwidth is the difference of F2-F1, the range is from -100.0 to -0.1 dB. The user can change the XdB by using the numeric key, rotary knob and arrow key or touch the panel menu.

> **Note**

An asterisk next to the XdB bandwidth value indicates that this result was not obtained with the optimal signal analyzer settings.

If your primary concern is transmit bandwidth, select Maximum Hold and press [Trace] > Detector > Peak Detect. The peak data acquired will ensure the accuracy of the transmit bandwidth measurement.

**Measurement preset:** restore the measurement mode/setting to the factory settings.
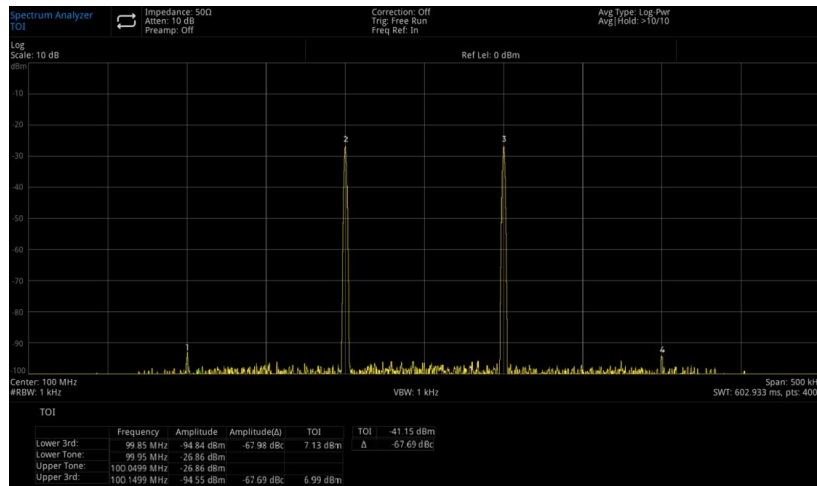
# Third-order Intermodulation



Figure 5-4 Third-order Intermodulation

Third-order Intermodulation (TOI) is used to calculate and display the output cut-off point (IP3) and placed on the trace to indicate the direction of the signal under test and its third order products.

Press [Meas] > Third-order Intermodulation to enter the following panel menu.

Measurement Setup

**Average/Hold time (ON/OFF):** press the average number (ON) to specify the average number of scans used to calculate the measurement results, the scan number range is from 1 to 10,000. The user can change the average time by using the numeric key, rotary knob and arrow key or touch the panel menu. The average of the measurements will be displayed after each scan. Select (OFF) to turn off this function.

**Average mode (exponential/repeat):** switching between the exponential and repeat mode, this averaging mode is used to determine the average mode of operation of the signal analyzer when the specified number of averaging scans has been reached.

When the exponential mode is selected, after the specified average number of scans is reached, each channel trace data is exponentially weighted, added to the previous average and averaged.

When the repeat mode is selected, the weights of the new data are larger than the weights of the old data, which facilitates the tracking of slowly changing signals, and this averaging result will be displayed at the end of each scan.

When the repeat mode is selected, and the specified average number of scans is reached, all previous data is cleared and a rescan will be performed.

**Average type:** logarithmic power average is take the average of the logarithmic amplitude values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to video detection.

Power average is take the average of the power (square of amplitude) signal. The average detection turns to RMS (power) detection.

Voltage average is take the average of the voltage values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to voltage detection.

**Measurement preset:** restore the measurement mode/setting to the factory settings.
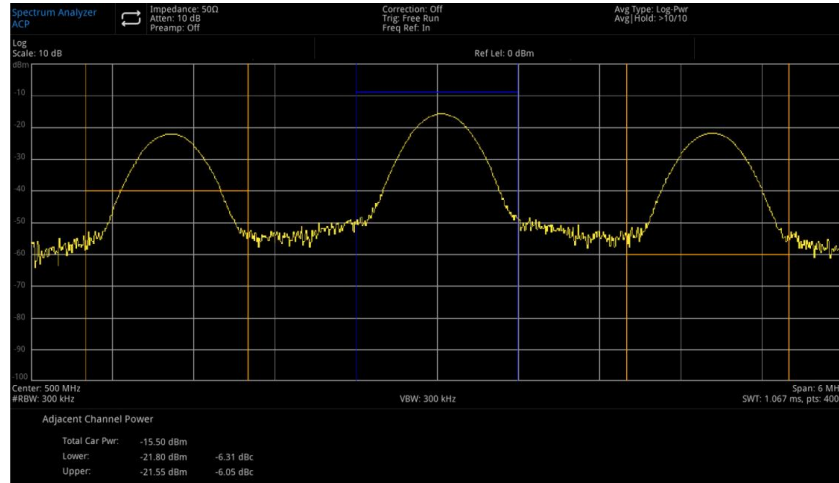
# Adjacent Channel Power Ratio



Figure 5-5 Adjacent Channel Power Ratio

To measure the main channel power, the previous channel and the next channel power.

To respectively give an adjacent channel to the main channel and the left and right channels, the main channel is centered on the center frequency point, and the left and right adjacent channels are symmetric with respect to the main channel.

The channel parameters are changed by setting the main channel bandwidth, the adjacent channel bandwidth and the adjacent channel interval (distance between adjacent channels and the center of the main channel), and calculate the individual channel power in the same way as the channel power algorithm, the ratio of the adjacent channel power to the main channel power is the adjacent channel power ratio.

Press [Meas] > Adjacent Channel Power Ratio to enter the following panel menu.

### Measurement Setup

**Average/Hold time (ON/OFF):** press the average number (ON) to specify the average number of scans used to calculate the measurement results, the scan number range is from 1 to 10,000. The user can change the average time by using the numeric key, rotary knob and arrow key or touch the panel menu. The average of the measurements will be displayed after each scan. Select (OFF) to turn off this function.

**Average mode (exponential/repeat):** switching between the exponential and repeat mode, this averaging mode is used to determine the average mode of operation of the signal analyzer when the specified number of averaging scans has been reached.

When the exponential mode is selected, after the specified average number of scans is reached, each channel trace data is exponentially weighted, added to the previous average and averaged.

When the repeat mode is selected, the weights of the new data are larger than the weights of the old data, which facilitates the tracking of slowly changing signals, and this averaging result will be displayed at the end of each scan.

When the repeat mode is selected, and the specified average number of scans is reached, all previous data is cleared and a rescan will be performed.

**Average type:** logarithmic power average is take the average of the logarithmic amplitude values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to video detection.

Power average is take the average of the power (square of amplitude) signal. The average detection turns to RMS (power) detection.

Voltage average is take the average of the voltage values (unit is dB) of the signal envelopes measured in a

signal collection unit. The average detection turns to voltage detection.

**Noise bandwidth:** set the bandwidth of the main channel, the power of which is an integral of this bandwidth (default value: 2 MHz). The user can change the bandwidth of the main channel by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Integral bandwidth:** set the frequency width of the adjacent channel, the bandwidth of the adjacent channel is linked with the bandwidth of the main channel. The user can change the bandwidth of the adjacent channel by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Frequency offset:** the interval of the main channel and the center frequency of the adjacent channel, adjusting the channel interval will simultaneously adjust the distance between the previous channel and the next channel from the main channel. The user can change the interval of the adjacent channel by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Offset side:** specify the offset side to be measured.
Negative: only negative (lower) sidebands.
Positive: positive (upper) sideband only.
Both sides: measure both positive and negative sidebands.

**Measurement preset: restore the measurement mode/setting to the factory settings.**

# Frequency Monitoring
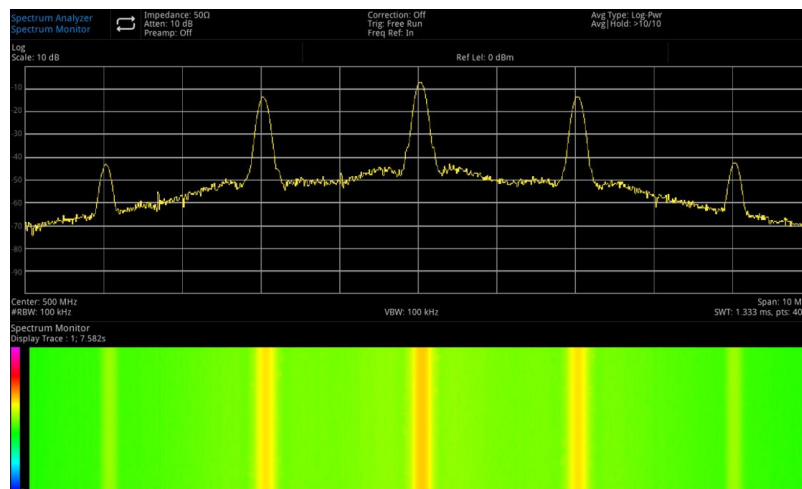


Figure 5-6 Frequency Monitoring

The horizontal axis represents the frequency. The vertical axis represents time. The color represents the energy strength of frequency spectrum.

It used to detect intermittent spectrum, spectrum monitoring help you to observe how the signal changes over time.

Press **[Meas] > Frequency Monitoring** to enter the following panel menu.

## Measurement Setup
**Average/Hold time (ON/OFF):** press the average number (ON) to specify the average number of scans used to calculate the measurement results, the scan number range is from 1 to 10,000. The user can change the average time by using the numeric key, rotary knob and arrow key or touch the panel menu. The average of the measurements will be displayed after each scan. Select (OFF) to turn off this function.

**Average mode (exponential/repeat):** switching between the exponential and repeat mode, this averaging mode is used to determine the average mode of operation of the signal analyzer when the specified number of averaging scans has been reached.

When the exponential mode is selected, after the specified average number of scans is reached, each channel trace data is exponentially weighted, added to the previous average and averaged.

When the repeat mode is selected, the weights of the new data are larger than the weights of the old data, which facilitates the tracking of slowly changing signals, and this averaging result will be displayed at the end of each scan.

When the repeat mode is selected, and the specified average number of scans is reached, all previous data is cleared and a rescan will be performed.

**Average type:** logarithmic power average is take the average of the logarithmic amplitude values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to video detection.

Power average is take the average of the power (square of amplitude) signal. The average detection turns to RMS (power) detection.

Voltage average is take the average of the voltage values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to voltage detection.

**Measurement preset:** restore the measurement mode/setting to the factory settings.

# Carrier to Noise Ratio
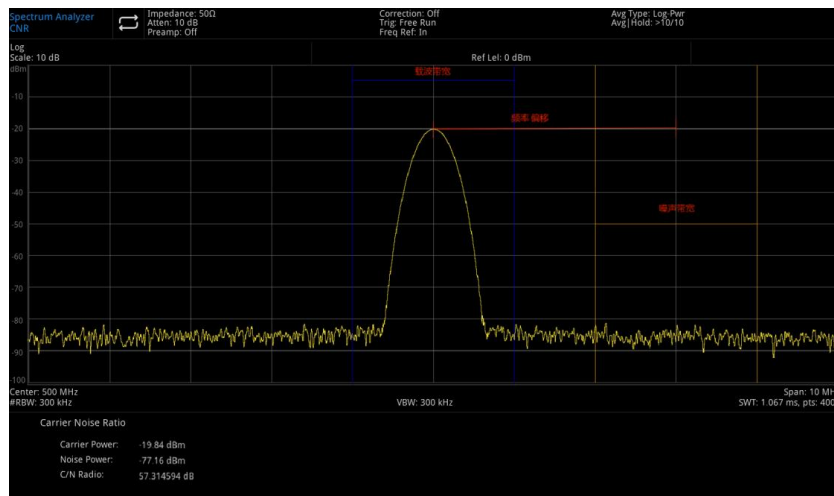


Figure 5-7 Carrier to Noise Ratio

Carrier to noise ratio measurement: carrier wave power, noise power and carrier to noise ratio

Search for the maximum positive peak f1 as a carrier within the screen range and calculate the power within the carrier bandwidth centered on f1, which is the carrier power.

Set the frequency offset so that there is no carrier signal within the noise bandwidth, calculate the power within the noise bandwidth centered on f1+frequency offset, which is the noise power, and divide the carrier power by the noise power, which is the carrier-to-noise ratio.

Press **[Meas] > Carrier to Noise Ratio** to enter the following panel menu.

### Measurement Setup

**Average/Hold time (ON/OFF):** press the average number (ON) to specify the average number of scans used to calculate the measurement results, the scan number range is from 1 to 10,000. The user can change the average time by using the numeric key, rotary knob and arrow key or touch the panel menu. The average of

the measurements will be displayed after each scan. Select (OFF) to turn off this function.

**Average mode (exponential/repeat):** switching between the exponential and repeat mode, this averaging mode is used to determine the average mode of operation of the signal analyzer when the specified number of averaging scans has been reached.

When the exponential mode is selected, after the specified average number of scans is reached, each channel trace data is exponentially weighted, added to the previous average and averaged.

When the repeat mode is selected, the weights of the new data are larger than the weights of the old data, which facilitates the tracking of slowly changing signals, and this averaging result will be displayed at the end of each scan.

When the repeat mode is selected, and the specified average number of scans is reached, all previous data is cleared and a rescan will be performed.

**Average type:** logarithmic power average is take the average of the logarithmic amplitude values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to video detection.

Power average is take the average of the power (square of amplitude) signal. The average detection turns to RMS (power) detection.

Voltage average is take the average of the voltage values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to voltage detection.

**Carrier bandwidth:** set the bandwidth for the carrier wave to be measured, the carrier wave bandwidth is linked with the sweep bandwidth, and the noise bandwidth is linked with the frequency offset. The user can change the carrier wave bandwidth by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Noise bandwidth:** set the bandwidth for the noise to be measured, the noise bandwidth is linked with the sweep bandwidth, and the carrier wave bandwidth is linked with the frequency offset. The user can change the noise bandwidth by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Frequency offset:** set the difference value between the center frequency of carrier wave and the center frequency of the noise, the frequency offset is linked with the sweep bandwidth, and the carrier wave bandwidth is linked with the noise bandwidth. The user can change the frequency offset by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Measurement preset:** restore the measurement mode/setting to the factory settings.
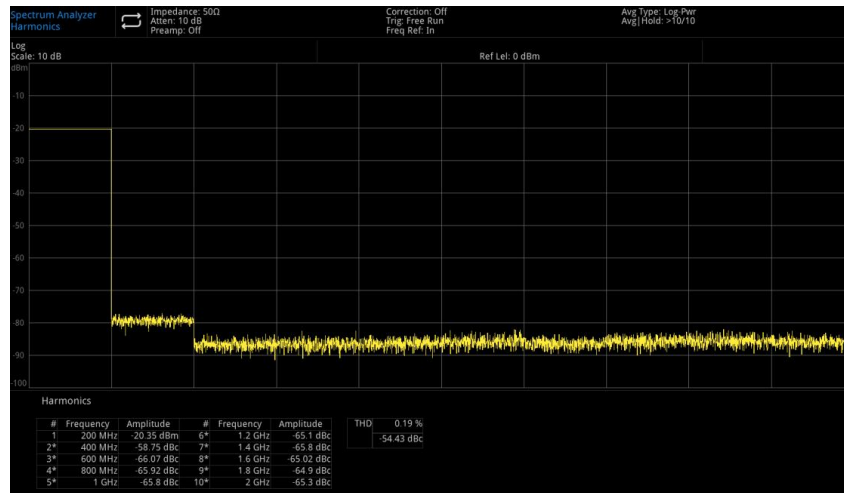
# Harmonic Wave



Figure 5-8 Harmonic Wave Measurement

Harmonic wave measurement: the amplitude of each harmonic and the total harmonic distortion of the carrier signal can be measured up to 10 harmonics.

THD is the total harmonic distortion

The harmonic analysis waveform is displayed as the concatenation of the zero sweep bandwidth waveforms of the individual harmonics. All the key in the [FREQ] menu will be hidden.

Press [Meas] > Harmonic Wave to enter the following panel menu.

### Measurement Setup

**Average/Hold time (ON/OFF):** press the average number (ON) to specify the average number of scans used to calculate the measurement results, the scan number range is from 1 to 10,000. The user can change the average time by using the numeric key, rotary knob and arrow key or touch the panel menu. The average of the measurements will be displayed after each scan. Select (OFF) to turn off this function.

**Average mode (exponential/repeat):** switching between the exponential and repeat mode, this averaging mode is used to determine the average mode of operation of the signal analyzer when the specified number of averaging scans has been reached.

When the exponential mode is selected, after the specified average number of scans is reached, each channel trace data is exponentially weighted, added to the previous average and averaged.

When the repeat mode is selected, the weights of the new data are larger than the weights of the old data, which facilitates the tracking of slowly changing signals, and this averaging result will be displayed at the end of each scan.

When the repeat mode is selected, and the specified average number of scans is reached, all previous data is cleared and a rescan will be performed.

**Average type:** logarithmic power average is take the average of the logarithmic amplitude values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to video detection.

Power average is take the average of the power (square of amplitude) signal. The average detection turns to RMS (power) detection.

Voltage average is take the average of the voltage values (unit is dB) of the signal envelopes measured in a signal collection unit. The average detection turns to voltage detection.

**Basic harmonic:** set the frequency of basic harmonic. By default, other harmonic measurements will be

taken at multiples of the specified fundamental frequency. The user can change the basic harmonic by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Harmonic wave:** set the harmonic time of measured carrier wave for calculating the total harmonic. The user can change the harmonic time by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Dwell time:** set the dwell time for the specified harmonic. In the zero sweep bandwidth, it will automatically achieve an equilibrium between the measuring speed and the precision. Increasing the dwell time decreases the measurement speed while improving the precision. The user can change the dwell time by using the numeric key, rotary knob and arrow key or touch the panel menu.

**Measurement preset:** restore the measurement mode/setting to the factory settings.

# 6. System Prompt and Troubleshooting

## System Prompt

The system prompts that the parameter settings of all working mode are invalid and use default values.

| Name | Minimum | Maximum |
|---|---|---|
| Center frequency | -79.999995 Hz | 26.699999995 GHz |
| Sweep bandwidth | zero sweep bandwidth | 26.780000000 GHz |
| Start frequency | -80 MHz | 26.699999990 GHz |
| Cut-off frequency | -79.999990 MHz | 26.7 GHz |
| Frequency offset | -100G Hz | 100 GHz |
| Stepped center frequency | 1Hz | 26.7 GHz |
| reference level | -170 dBm | 30 dBm |
| Input attenuation | 0 dB | 50 dB |
| Scale | 0.1 dB | 20 dB |
| Reference level offset | -327.6 dB | 327.6 dB |
| Resolution bandwidth | 1 Hz | 8 MHz |
| Video bandwidth | 1 Hz | 8 MHz |
| VBW: 3 dB RBW | 0.0000001 | 8000000 |
| Scanning time | 1 ms | 4 ks |
| Scanning count | 31 | 100001 |
| Trace operation offset | -100 dB | 100 dB |
| In-band bandwidth | 0Hz | 53.0 GHz |
| N dB point | -140 dB | -0.01 dB |
| Peak threshold | -697.6 dBm | 457.6 dBm |
| Peak offset | 0 dBm | 100 dBm |
| Average/Hold time | 1 | 10000 |
| Display line | -697.6 dBm | 457.6 dBm |
| Integral bandwidth | 10Hz | 26.78 GHz |
| Start time | 0 s | 10 ms |
| Stop time | 0 s | 10 ms |
| % OBW power | 10% | 99.99% |
| x dB | -100 dB | -0.1 dB |
| Noise bandwidth (adjacent channel power) | 10 Hz | 26.78 GHz |
| Integral bandwidth (adjacent channel power) | 10 Hz | 26.78 GHz |
| Frequency offset (adjacent channel power) | 0 Hz | 13.389999995 GHz |

| Carrie wave bandwidth (carrier to noise ratio) | 10 Hz | 26.779999980 GHz |
|---|---|---|
| Noise bandwidth (carrier to noise ratio) | 10 Hz | 13.389999995 GHz |
| Frequency offset (carrier to noise ratio) | 10 Hz | 13.389999995 GHz |
| Basic harmonic | 100 Hz | 13.250000000 GHz |
| Harmonic | 2 | 10 |

# Troubleshooting

This chapter lists the possible faults and troubleshooting methods of the signal analyzer.

Please follow the corresponding steps to handle it, if these methods is not work, please contact UNI-T and provide your machine device information (acquisition method: [System] >System Information).

1. After press the power soft switch, the signal analyzer still display a blank screen, and nothing is displayed.
    a. Check whether the power connector is properly connected and the power switch is turned on.
    b. Check whether the power supply meets the requirements.
    c. Check whether the fuse of the machine is installed or blown.
2. Press the power switch, if the signal analyzer still display blank screen and nothing is displayed.
    a. Check the fan. If the fan is rotating but the screen is off, the cable to the screen may be loose.
    b. Check the fan. If the fan does not rotate and the screen is off, it represents the instrument is not enabled.
    c. In case of the above faults, do not disassemble the instrument by yourself. Please contact UNI-T immediately.
3. Spectral line is not updated for a long time.
    a. Check whether the current trace is in update state or multiple averaging state.
    b. Check whether the current is meet the restriction conditions. Check the restriction settings and whether there are restriction signals.
    c. In case of the above faults, do not disassemble the instrument by yourself. Please contact UNI-T immediately.
    d. Check whether the current mode is in the single sweep state.
    e. Check whether the current sweep time is too long.
    f. Check whether the demodulation time of the demodulation listening function is too long.
    g. Check whether the EMI measurement mode is not sweeping.
4. The measurement results are incorrect or not accurate enough.
    Users can obtain detailed descriptions of technical index from the back of this manual to calculate system errors and check measurement results and accuracy problems. To achieve the performance listed in this manual, you need:
    a. Check whether external device is properly connected and work.
    b. Have a certain understanding of the measured signal and set appropriate parameters for the instrument.
    c. Measurement should be performed under certain conditions, such as preheating for a period of time after starting up, specific working environment temperature, etc.
    d. Calibrate the instrument regularly to compensate for measurement errors caused by instrument aging.

If you need calibrate the instrument after the guarantee calibration period, please contact UNI-T company or obtain paid service from authorized measurement institutions.

# 7. Appendix

## Maintenance and Cleaning

(1)   General Maintenance
       Keep the instrument away from the direct sunlight.
       **Caution**
       Keep sprays, liquids and solvents away from the instrument or probe to avoid damaging the instrument or probe.
(2)   Cleaning
       Check the instrument frequently according to the operating condition. Follow these steps to clean the external surface of the instrument.
       Please use a soft cloth to wipe the dust outside the instrument.
       When cleaning the LCD screen, please pay attention and protect the transparent LCD screen.
       When cleaning the dust screen, use a screwdriver to remove the screws of the dust cover and then remove the dust screen. After cleaning, install the dust screen in sequence.
       Please disconnect the power supply, then wipe the instrument with a damp but not dripping soft cloth.
       Do not use any abrasive chemical cleaning agent on the instrument or probes.
       **Warning**
   Please confirm that the instrument is completely dry before use, to avoid electrical shorts or even personal injury caused by moisture.

## Contact Us

If the use of this product has caused any inconvenience, if you in mainland China you can contact UNI-T company directly.
Service support: 8am to 5.30pm (UTC+8), Monday to Friday or via email. Our email address is infosh@uni-trend.com.cn
For product support outside mainland China, please contact your local UNI-T distributor or sales center.
Many UNI-T products have the option of extending the warranty and calibration period, please contact your local UNI-T dealer or sales center.

To obtain the address list of our service centers, please visit our website at URL:
http://www.uni-trend.com