

# **Spectrum Analyzer**

# **Analog Demodulation**

## **User's Manual**

This manual applies to:

UTS7000A series

UTS5000A series

UTS3000A series

UTS3000T+ series

UTS3000B/T series

UTS1000B/T series

V1.1

November 11, 2025

## Foreword

Thank you for choosing this brand-new UNI-T instrument. To ensure safe and correct usage, 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.

# 1. User Guide

- Inspect Packing List
- Safety Instruction
- Environmental Requirements
- Connecting Power Supply
- Electrostatic Protection
- Preparation Work
- Usage Tip
- Touch Operation
- Remote Control
- Help Information
- Operation Mode

This chapter introduces the safety instructions and basic information about using the signal analyzer.

## Inspect Packing List

When you received the instrument, please inspect the packaging and packing list as follows:

- Inspect the packaging box for any damage or scratches caused by external forces and check the instrument's appearance for any damage. If you have any questions or issues with the product, please contact the distributor or local office.
- Carefully take out the goods and check them against the packing list.

## Safety Information

This chapter contains information and warnings that must be observed. To ensure that the instrument is operating under the safe conditions. In addition to the safety precautions indicated in

this chapter, you must also follow accepted safety procedures.

Safety Precautions											
<b>Warning</b>	<b>Please follow these guidelines to avoid possible electric shock and risk to personal safety.</b>										
	<p>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 following the safety precautions. This device is designed for professional users and responsible organizations for measurement purposes.</p> <p>Do not use this device in any manner not specified by the manufacturer. This device is intended for indoor use only, unless otherwise stated in the product manual.</p>										
Safety Statements											
<b>Warning</b>	<b>“Warning” indicates the presence of a hazard. It warns 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.</b>										
<b>Caution</b>	<b>“Caution” indicates the presence of a hazard. It warns 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.</b>										
<b>Note</b>	<b>“Note” indicates important information. It reminds users to pay attention to procedures, methods, and conditions, etc. The contents of “Note” should be highlighted if necessary.</b>										
Safety Signs											
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		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.
	<b>Note</b>	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.
	<b>AC</b>	Alternating current of device. Please check the region's voltage range.
	<b>DC</b>	Direct current device. Please check the region's voltage range.
	<b>Grounding</b>	Frame and chassis grounding terminal
	<b>Grounding</b>	Protective grounding terminal
	<b>Grounding</b>	Measurement grounding terminal
	<b>OFF</b>	Main power off
	<b>ON</b>	Main power on
	<b>Power</b>	Standby power supply: When the power switch is turned off, this device is not completely disconnected from the AC power supply.
<b>CAT I</b>		Secondary electrical circuit connected to wall sockets through transformers or similar equipment, such as electronic instruments and electronic equipment with protective measures, and any high-voltage and low-voltage circuits, such as the copier in the office.
<b>CAT II</b>		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.
<b>CAT III</b>		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).

<b>CAT IV</b>		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.
	<b>Certification</b>	CE indicates a registered trademark of EU.
	<b>Certification</b>	UKCA indicates a registered trademark of United Kingdom.
	<b>Certification</b>	Conforms to UL STD 61010-1 and 61010-2-030. Certified to CSA STD C22.2 No.61010-1 and 61010-2-030.
	<b>Waste</b>	Do not place equipment and accessories in the trash. Items must be properly disposed of in accordance with local regulations.
	<b>EEUP</b>	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 environmentally 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.
<b>Safety Requirements</b>		
<b>Warning</b>		
<b>Preparation before use</b>	<p>Please connect this device to AC power supply with the power cable provided.</p> <p>The AC input voltage of the line reaches the rated value of this device. See the product manual for specific rated value.</p> <p>The line voltage switch of this device matches the line voltage.</p> <p>The line voltage of the line fuse of this device is correct.</p> <p>This device is not intended for measuring the main circuit.</p>	
<b>Check all terminal rated values</b>	Please check all rated values and marking instructions on the product to avoid fire and the impact of excessive current. Please consult the product manual for detailed rated values before connection.	
<b>Use the power cord properly</b>	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.	
<b>Instrument</b>	To avoid electric shock, the grounding conductor must be connected to the ground. This product is grounded through the grounding conductor	

<b>Grounding</b>	of the power supply. Please be sure to ground this product before it is powered on.
<b>AC power supply</b>	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.
<b>Electrostatic prevention</b>	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 4 kV for contact discharge and 8 kV for air discharge.
<b>Measurement accessories</b>	Measurement accessories are of lower class, which are not applicable to main power supply measurement, CAT II, CAT III, or CAT IV circuit measurement. Probe subassemblies and accessories within the range of IEC 61010-031 and current sensors within the range of IEC 61010-2-032 can meet its requirements.
<b>Use the input / output port of this device properly</b>	Please use the input / output ports provided by this device in a proper 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.
<b>Power fuse</b>	Please use a power fuse of exact specification. If the fuse needs to be replaced, it must be replaced with another one that meets the specified specifications by the maintenance personnel authorized by UNI-T.
<b>Disassembly and cleaning</b>	There are no components available for operators inside. Do not remove the protective cover. Qualified personnel must conduct maintenance.
<b>Service environment</b>	This device should be used indoors in a clean and dry environment with ambient temperature from 0 °C to +40 °C. Do not use this device in explosive, dusty, or humid air.
<b>Do not operate in humid environment</b>	Do not use this device in a humid environment to avoid the risk of internal short circuit or electric shock.
<b>Do not operate in flammable and</b>	Do not use this device in a flammable and explosive environment to avoid product damage or personal injury.

<b>explosive environment</b>	
<b>Caution</b>	
<b>Abnormality</b>	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.
<b>Cooling</b>	Do not block the ventilation holes at the side and back of this device. Do not allow any external objects to enter this device via ventilation holes. Please ensure adequate ventilation and leave a gap of at least 15 cm on both sides, front and back of this device.
<b>Safe transportation</b>	Please transport this device safely to prevent it from sliding, which may damage the buttons, knobs, or interfaces on the instrument panel.
<b>Proper ventilation</b>	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.
<b>Keep clean and dry</b>	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.
<b>Note</b>	
<b>Calibration</b>	The recommended calibration period is one year. Calibration should only be conducted by qualified personnel.

## Environmental Requirements

This instrument is suitable for the following environment:

- Indoor
- Pollution degree: Class 2
- For overvoltage: This product should be powered from a mains supply that complies with Overvoltage Category II, which is a typical requirement for connecting equipment via power cords and plugs.
- Operating: Altitude below 3,000 meters; non-operating: Altitude below 15,000 meters.
- Unless otherwise specified, the operating temperature is 0 to +40°C; storage temperature is -20 to +70 °C.
- Operating: Humidity at temperatures below +35°C, ≤ 90% RH.; non-operating: Humidity at

temperatures from +35 °C to 40 °C, ≤ 60% RH.

### Note

There are ventilation openings on the rear and side panels of the instrument. Please ensure that air can flow through these vents. To prevent excessive dust from blocking the vents, 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 the AC power supply is as shown in the following table.

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

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

### Connecting to the service cable:

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

Please install the AC power cable as follows:

- Ensure the power cable is in good condition.
- 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 components. Components can be invisibly damaged by electrostatic discharge during transportation, storage, and use.

The following measures can reduce the damage caused by electrostatic discharge:

- Test in an antistatic area as far as possible.
- Before connecting the power cable to the instrument, briefly ground the inner and outer conductors of the instrument to discharge static electricity.
- Ensure all instruments are properly grounded to prevent the accumulation of static.

## Preparation Work

1. Connect the power cable and insert the power plug into a protective grounding outlet.
2. Press the power switch to enter standby mode.
3. Press the soft switch to power on the signal analyzer.

It takes about 30 seconds to initialize the boot, and then the signal analyzer enters the system default menu mode. To ensure optimal performance, it is recommended to warm up the signal analyzer for 45 minutes after powering on.

## Usage Tip

### Use an External Reference Signal

If a user wants to use an external signal source 10 MHz as a reference, please connect the signal source to the **10 MHz In** port on the rear panel. The measuring bar on the top of the screen will indicate "**Freq Ref: Ext.**"

### Activate the Option

If you want to activate an option, you need to input the secret key for the option. Please contact the UNI-T office to purchase it.

Refer to the following steps to activate the option you have purchased:

1. Save the secret key into a USB drive and insert it into the signal analyzer.
2. Press the **[System]** key > **System Information** > **Add Token**.
3. Select the purchased secret key and press the **[ENTER]** key to confirm.

## Touch Operation

Spectrum analyzer has multipoint touch screen for various gesture operating, which includes,

- Tap the top right on the screen to enter the main menu.
- Single tap to zoom in/out the selected window.
- 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.

## Help Information

The spectrum 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.
- After help information displayed on the center of the screen, tap “x” or other key to close the dialog box.

## Operating Mode

Spectrum analyzer provides various operating mode, use **Mode** key to select it:

- Spectrum Analysis
- IQ analysis
- EMI
- Analog Demodulation (refer to Chapter 3 for more details)
- Vector Signal Analysis
- Real-time Spectrum Analysis
- Vector Network Analysis
- Phase Analysis
- Mode Presetting

Mode Presetting: Each operation mode has its own reset mode.

The options include IQ analysis, EMI, analog demodulation, vector signal analysis, and phase analysis, which require purchase to activate.

In different operation modes, the functional keys on the front panel may differ. This manual uses the vector signal analysis mode as an example to introduce the user interface and functional keys.

## 2. User Interface

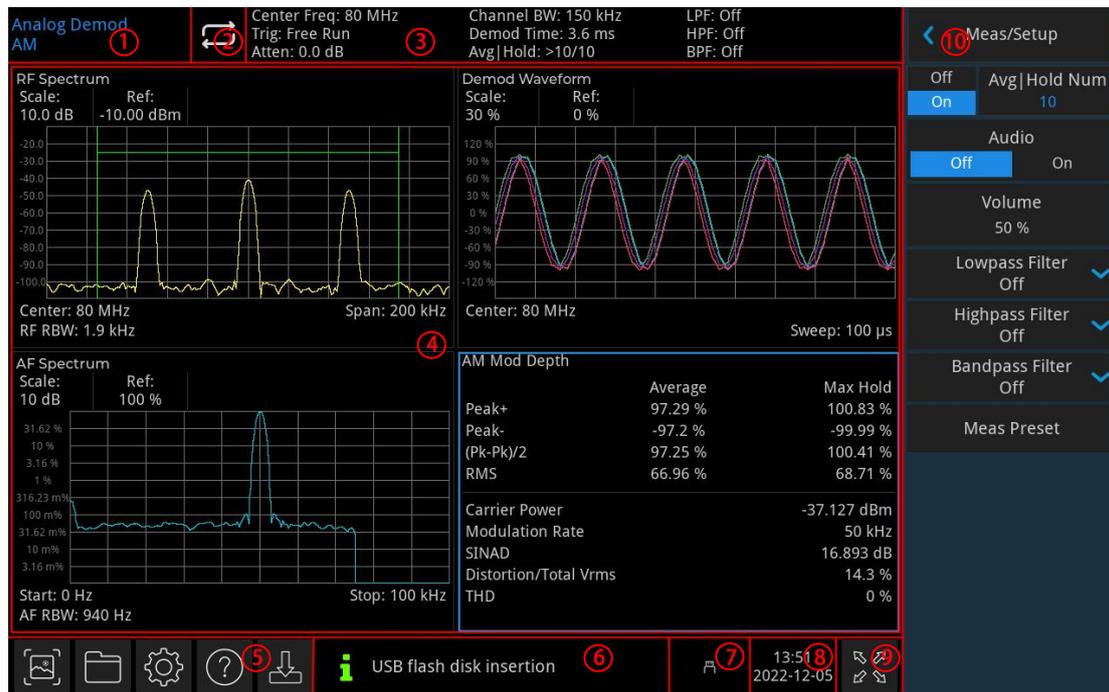


Figure 2-1 User Interface

- 1. Working mode:** Spectrum analysis, vector signal analysis, EMI, analog demodulation
- 2. Sweep/Measuring:** Single / continuous sweep, tap the screen symbol to quick step through the mode
- 3. Measuring bar:** Display the measurement information which includes center frequency, trigger type, attenuation, demodulating bandwidth, demodulating time, average/hold and filter information.
- 4. Measured data display area:** Measured data display in the format of figure or text. Amplitude modulation, frequency modulation and phase modulation demodulation modes. Measured data display area is different, the specific information see the next chapter “[Amplitude Modulation](#)”, “[Frequency Modulation](#)”, “[Phase Modulation](#)”.
- 5. Function setting:** Quick screenshot, file system, setup system, help system and file storage.
  - Quick screenshot : Screenshot will save in the default file; if there has an external storage, it is preferentially saved to external storage.
  - File system : In file system, user can save screenshot, trace or other file into internal or external storage, and it can be recall.

- Setup system : View the basic and option information.
- Help system : Turn on help guides.
- File storage : Import or export status.

**6. 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.

**7. Connection Type:** Display connecting status of mouse, USB and screen lock.

**8. Date and Time:** Display the date and time.

**9. Full Screen Switch:** Open full screen display, the screen is stretched horizontally and the right button is automatically hidden.

**10. Panel Menu:** The menu and function item of function hard key, which includes the function display of frequency, amplitude, bandwidth, sweep and marker.

## Amplitude Modulation

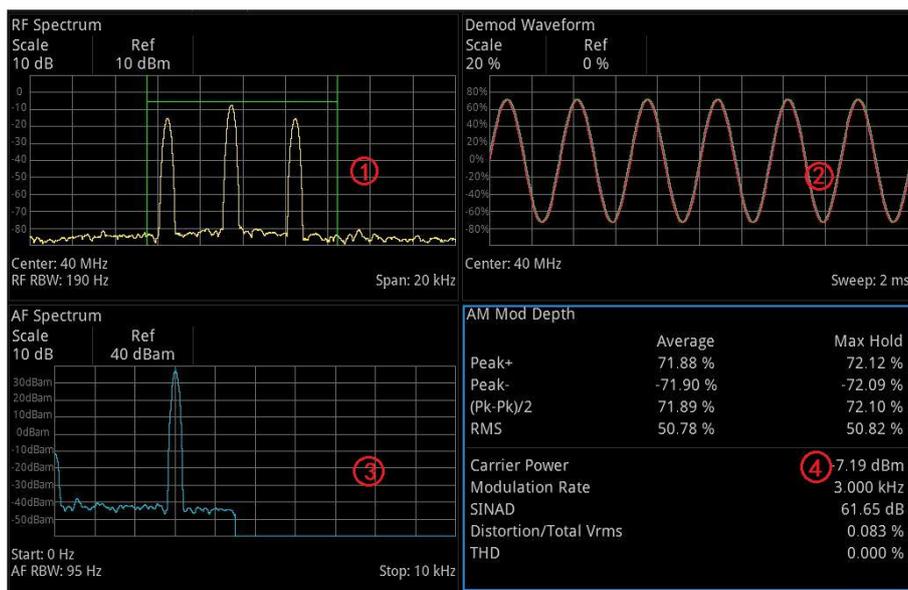


Figure 2-2 Amplitude Modulation Window

1. RF Spectrum Window: Spectrum display is basically similar to the spectrum of the spectrum sweep mode.
2. Demod Waveform Window: Display demodulated signal in time domain.
3. AF Spectrum Window: Display demodulated signal in frequency domain.
4. Demodulated Result Window: Display the demodulated information of modulation depth, carrier power, modulation frequency, SINAD (signal to noise and distortion ratio), modulated distortion, THD (total harmonic distortion).

Each window display as the follows.

## RF Spectrum Window

Window is display the spectrum of input RF signal. Frequency on the horizontal X axis and amplitude on the vertical Y axis. Vertical scale type is logarithm, unit is dBm. Reference value is on the top of the vertical scale at first. This spectrum display is basically similar to the spectrum of the spectrum sweep mode. The difference is that it uses FFT for scanning and does not allow zero sweep width.

Center frequency, sweep width and RF resolution bandwidth BW are marked at the bottom of the RF spectrum window. Reference value and scale/div are marked on the top of the grid. In grid graph, two green vertical lines are centered at the center frequency, the space is equal to demodulation bandwidth. If demodulation bandwidth is greater than sweep width, then the two green vertical lines cannot be seen.

## Demod Waveform Window

In demodulation waveform window, demodulated signal is display on the time domain (zero sweep). Time is on the horizontal X axis and modulated depth (AM) on the vertical Y axis. Y axis is zoomed out linearly in the unit of percentage of AM. In preset, "reference value" is on the center of the vertical scale.

There are four traces on the window. Blue Demod trace is the currently demodulated signal. Green Demod Max trace is the maximum hold value of each point. Red Demod Min trace is the minimum hold value of each point. Purple Demod Avg is the average demodulated signal. If turn off the number of average/hold times, then it only displays blue Demod trace.

Sweep time is marked at the bottom of the window. Reference value and scale/div are marked on the top of the grid.

## AF Spectrum Window

Demodulated signal is display on the frequency domain of the AF frequency spectrum window. X axis is modulated frequency and unit is Hz. Y axis is modulated depth and unit is % or dBam (it

depends on Y axis scale type). Y axis is always zoom out in logarithm. Reference value is on the top of vertical scale at first.

In this viewport, user can observe the spectrum component of modulated signal. The preset start frequency of this window is 0 Hz. AF start frequency, AF cut-off frequency and AF resolution bandwidth are marked at the bottom of the window. Reference value and scale/div are marked on the top of the grid.

#### Note

- The maximum frequency that can be display is (demodulated bandwidth) / 2.

## Demodulated Result Window

This window is display the demodulated result and the data is display as the follows.

#### AM Modulated Depth:

1. Modulated depth positive value: It represent the maximum modulated amount and unit is %. The number of average/hold times is opened by default. The first line includes the average of peak value during sampling period, it greatly improved SNR when measuring cycle signal. If the number of average/hold times is disabled, the first line is display the current peak value. The second line is display the maximum value of the higher peak value. Please Caution that the demodulated depth (also known as % modulated or modulated exponent) is modulated signal with respect to the voltage offset of the original level. If the modulated depth is 100% that means the peak voltage is doubled and the peak power is four times.
2. Modulated depth negative value: It represents the minimum value of modulation in % during sampling period. When the minimum value is negative value then display as negative value.
3. Modulated depth  $(P_k - P_k)/2$ : It represents a half of difference between the modulated depth positive and negative value.
4. Root mean square: It represents modulated root mean square in % during sampling period.

#### Note

- If the average/hold count is closed, the column is marked as "Average" will remark to "Current" and display the modulated depth information in real-time. "Maximum hold" column display will be closed.
- If average/hold count is opened, the column is marked as "Current" will remark to "Average" and the result in the column will take average value in continuously measurement till reach the

average/hold count. If it is not in single measurement mode, the measurement will keep running and exponential average display in continuously result. "Maximum hold" column displays the maximum value of the metric that not average reached since the last reboot.

**Modulation Basic Information:**

1. Carrier power: Average power detected in carrier frequency, average power in integer period of the modulated frequency.
2. Modulated frequency: Modulated frequency that has detected.
3. SINAD: The ratio of the total received power (received signal add noise add distortion power) to received noise add distortion power. The unit is always expressed in dB. Carrier wave restrains the measurement of noise add distortion power is not over than 50 dB, so that it reduces the maximum SINAD.
4. Modulation distortion: Distortion/total voltage (RMS) is the ratio of the unwanted received power (noise add distortion) to the total received power, it expressed in % or dB. So, when it expressed in decibel, the scale value is the negative value of SINAD.
5. Total harmonic distortion: The ratio of RMS of harmonic wave to the voltage of baseline, it expressed in % and dB. Please Caution that the difference of distortion. Denominator of this ration is different.  
The Item in numerator is not include the noise between harmonic waves, it only include harmonic wave itself.

## Frequency Modulation

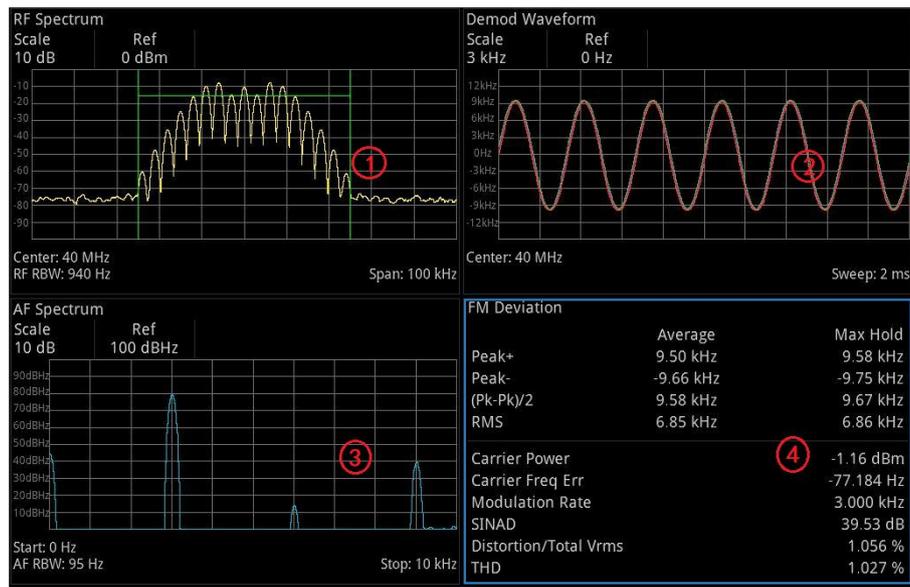


Figure 2-3 Modulated Frequency Window

1. RF Spectrum Window: Spectrum display is basically similar to the spectrum of the spectrum sweep mode.
2. Demod Waveform Window: Display demodulated signal in time domain.
3. AF Spectrum Window: Display demodulated signal in frequency domain.
4. Demodulated Result Window: Display the demodulated information of frequency offset, carrier power, carrier frequency offset, modulated frequency, SINAD (signal to noise and distortion ratio), modulated distortion, THD (total harmonic distortion).

Each window display as the follows.

### RF Spectrum Window

Window is display the spectrum of input RF signal. Frequency on the horizontal X axis and amplitude on the vertical Y axis. Y axis is always expressed in decibel and unit is dBm. Reference value is on the top of the vertical scale at first. This spectrum display is basically similar to the spectrum of the spectrum sweep mode. The difference is that it uses FFT for scanning and does not allow zero sweep width.

Center frequency, sweep width and RF resolution bandwidth BW are marked at the bottom of the RF spectrum window. Reference value and scale/div are marked on the top of the grid. In grid graph, two green vertical lines are centered at the center frequency, the space is equal to

demodulation bandwidth. If demodulation bandwidth is greater than sweep width, then the two green vertical green lines cannot be seen.

## Demod Waveform Window

In demodulation waveform window, demodulated signal is display on the time domain (zero sweep). Time is on the horizontal X axis and modulated frequency offset (FM) on the vertical Y axis. Y axis is zoomed out linearly in the unit of Hz. In preset, "reference value" is on the center of the vertical scale.

There are four traces on the window. Blue Demod trace is the currently demodulated signal. Green Demod Max trace is the maximum hold value of each point. Red Demod Min trace is the minimum hold value of each point. Purple Demod Avg is the average demodulated signal. If turn off the number of average/hold times, then it only displays blue Demond trace.

Sweep time is marked at the bottom of the window. Reference value and scale/div are marked on the top of the grid.

## AF Spectrum Window

Demodulated signal is display on the frequency domain of the AF frequency spectrum window. X axis is modulated frequency and unit is Hz. Y axis is frequency offset and unit is Hz or dBHz (it depends on Y axis scale type). Y axis is always zoom out in logarithm. Reference value is on the top of vertical scale at first.

In this viewport, user can observe the spectrum component of modulated signal. The preset start frequency of this window is 0 Hz. AF start frequency, AF cut-off frequency and AF resolution bandwidth are marked at the bottom of the window. Reference value and scale/div are marked on the top of the grid.

### Note

- The maximum frequency that can be display is  $(\text{demodulated bandwidth}) / 2$ .

## Demodulated Result Window

This window is display the demodulated result and the data is display as the follows.

## FM Offset

1. Frequency offset positive value: It represent the maximum frequency offset and unit is Hz. The number of average/hold times is opened by default. The first line includes the average of peak value during sampling period, it greatly improved SNR when measuring cycle signal. If the number of average/hold times is disabled, the first line is display the current peak value. The second line is always display the maximum value of the higher peak value.
2. Frequency offset negative value: It represents the minimum frequency offset during sampling period. When the minimum value is negative value then display as negative value.
3. Frequency offset  $(P_k - P_k)/2$ : It represents a half of difference between the modulated frequency offset positive and negative value.
4. Root mean square: It represents modulated root mean square frequency offset during sampling period and unit is Hz.

### Note

- If the average/hold count is closed, the column is marked as "Average" will remark to "Current" and display the modulated depth information in real-time. "Maximum hold" column display will be closed.
- If the average/hold count is opened, the column is marked as "Current" will remark to "Average" and the result in the column will take average value in continuously measurement till reach the average/hold count. If it is not in single measurement mode, the measurement will keep running and exponential average display in continuously result. "Maximum hold" column displays the maximum value of the metric that not average reached since the last reboot.

## Modulation Basic Information

1. Carrier power: Average power detected in carrier frequency, average power in integer period of the modulated frequency.
2. Carrier frequency offset: The difference between the instrument's modulated harmonic center frequency and the detected carrier frequency.
3. Modulated frequency: Modulated speed rate is the modulated frequency that has detected. Sometimes, it also called modulated frequency.
4. SINAD: The ratio of the total received power (received signal add noise add distortion power) to received noise add distortion power. The unit is always expressed in dB. Carrier wave restrains the measurement of noise add distortion power is not over than 50 dB, so that it reduces the maximum SINAD.

5. Modulation distortion: Distortion/total voltage (RMS) is the ratio of the unwanted received power (noise add distortion) to the total received power, it expressed in % or dB. So, when it expressed in decibel, the scale value is the negative value of SINAD.
6. Total harmonic distortion: The ratio of RMS of harmonic wave to the voltage of baseline, it expressed in % and dB. Please Caution that the difference of distortion. Denominator of this ration is different. The Item in numerator is not include the noise between harmonic waves, it only include harmonic wave itself.

## Phase Modulation

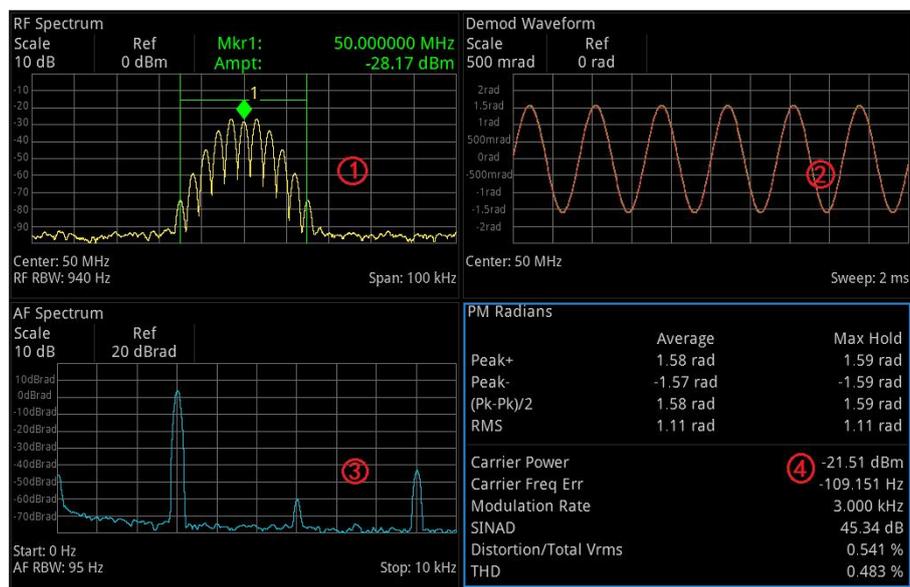


Figure 2-4 Modulated Phase Window

1. RF Spectrum Window: Spectrum display is basically similar to the spectrum of the spectrum sweep mode.
2. Demod Waveform Window: Display demodulated signal in time domain.
3. AF Spectrum Window: Display demodulated signal in frequency domain.
4. Demodulated Result Window: Display the demodulated information of phase offset, carrier power, carrier frequency offset, modulated frequency, SINAD (signal to noise and distortion ratio), modulated distortion, THD (total harmonic distortion).

Each window display as the follows.

## RF Spectrum Window

Window is display the spectrum of input RF signal. Frequency on the horizontal X axis and amplitude on the vertical Y axis. Y axis is always expressed in decibel and unit is dBm. Reference value is on the top of the vertical scale at first. This spectrum display is basically similar to the spectrum of the spectrum sweep mode. The difference is that it uses FFT for scanning and does not allow zero sweep width.

Center frequency, sweep width and RF resolution bandwidth BW are marked at the bottom of the RF spectrum window. Reference value and scale/div are marked on the top of the grid. In grid graph, two green vertical lines are centered at the center frequency, the space is equal to demodulation bandwidth. If demodulation bandwidth is greater than sweep width, then the two green vertical green lines cannot be seen.

## Demod Waveform Window

In demodulation waveform window, demodulated signal is display on the time domain (zero sweep). Time is on the horizontal X axis and modulated frequency offset (PM) on the vertical Y axis. Y axis is zoomed out linearly in the unit of Hz. In preset, "reference value" is on the center of the vertical scale.

There are four traces on the window. Blue Demod trace is the currently demodulated signal. Green Demod Max trace is the maximum hold value of each point. Red Demod Min trace is the minimum hold value of each point. Purple Demod Avg is the average demodulated signal. If turn off the number of average/hold times, then it only displays blue Demond trace.

Sweep time is marked at the bottom of the window. Reference value and scale/div are marked on the top of the grid.

## AF Spectrum Window

Demodulated signal is display on the frequency domain of the AF frequency spectrum window. X axis is modulated frequency and unit is Hz. Y axis is phase offset and unit is rad or dBrad (it depends on Y axis scale type). Y axis is always zoom out in logarithm. Reference value is on the top of vertical scale at first.

In this viewport, user can observe the spectrum component of modulated signal. The preset start frequency of this window is 0 Hz. AF start frequency, AF cut-off frequency and AF resolution bandwidth are marked at the bottom of the window. Reference value and scale/div are marked on the top of the grid.

**Note**

- The maximum frequency that can be display is (demodulated bandwidth) / 2.

## Demodulated Result Window

This window is display the demodulated result and the data is display as the follows.

**PM Radians**

1. PM Radians positive value: It represent the maximum phase offset and unit is rad. The number of average/hold times is opened by default. The first line includes the average of peak value during sampling period, it greatly improved SNR when measuring cycle signal. If the number of average/hold times is disabled, the first line is display the current peak value. The second line is always display the maximum value of the higher peak value.
2. PM Radians negative value: It represents the minimum phase offset during sampling period. When the minimum value is negative value then display as negative value.
3. PM Radians (Pk-Pk)/2: It represents a half of difference between the modulated phase offset positive and negative value.
4. Root mean square: It represents modulated root mean square phase offset during sampling period and unit is rad.

**Note**

- If the average/hold count is closed, the column is marked as "Average" will remark to "Current" and display the modulated depth information in real-time. "Maximum hold" column display will be closed.
- If the average/hold count is opened, the column is marked as "Current" will remark to "Average" and the result in the column will take average value in continuously measurement till reach the average/hold count. If it is not in single measurement mode, the measurement will keep running and exponential average display in continuously result. "Maximum hold" column displays the maximum value of the metric that not average reached since the last reboot.

## Modulation Basic Information

1. Carrier power: Average power detected in carrier frequency, average power in integer period of the modulated frequency.
2. Carrier frequency offset: The difference between the instrument's modulated harmonic center frequency and the detected carrier frequency.
3. Modulated frequency: Modulated speed rate is the modulated frequency that has detected. Sometimes, it also called modulated frequency.
4. SINAD: The ratio of the total received power (received signal add noise add distortion power) to received noise add distortion power. The unit is always expressed in dB. Carrier wave restrains the measurement of noise add distortion power is not over than 50 dB, so that it reduces the maximum SINAD.
5. Modulation distortion: Distortion/total voltage (RMS) is the ratio of the unwanted received power (noise add distortion) to the total received power, it expressed in % or dB. So, when it expressed in decibel, the scale value is the negative value of SINAD.
6. Total harmonic distortion: The ratio of RMS of harmonic wave to the voltage of baseline, it expressed in % and dB. Please Caution that the difference of distortion. Denominator of this ration is different. The Item in numerator is not include the noise between harmonic waves, it only include harmonic wave itself.

## 3. Key Description

### Amplitude Modulation

AM demodulation measurement is provide demodulated AM signal and display demodulated signal on time and frequency domain. And it also provides the index result of modulated depth, modulated frequency, SINAD, total harmonic distortion and carrier power.

#### Frequency (FREQ)

Press **[FREQ]** key to activate the frequency function and enter the frequency menu. The numerical values of center frequency and sweep width are displayed below the RF Spectrum window grid. AF start frequency and AF cut-off frequency are displayed below AF Spectrum window grid.

**Center Frequency:** Activate the frequency function and set a specific frequency value at the center of RF Spectrum window on the horizontal. Use numeric key, rotary knob, direction key or touch panel menu to change center frequency.

#### Note

- The sweep width remains unchanged when adjusting the center frequency.

**Sweep Width:** This function is to input range value of sweep width. Use numeric key, rotary knob, direction key or touch panel menu to change sweep width. Changing the sweep width will symmetrically change the frequency range according to the center frequency. The reading of sweep width is the total displayed frequency range. To determine the sweep width for each horizontal scale division, the above sweep width should be divided by 10. The sweep width affect RBW and sweep time.

#### Note

- Under the premise of constant sweep width to change the center frequency, it will automatically modify the start and cut-off frequency.
- The minimum sweep width can set to 100Hz. The maximum sweep width refer to the data manual of the corresponding model.

**AF Start Frequency:** To set start frequency on the left side for AF Spectrum window grid. The left/right side of the grid is respectively represent AF start frequency and cut-off frequency. Use numeric key, rotary knob, direction key or touch panel menu to change start frequency.

**AF Cut-off Frequency:** To set cut-off frequency on the right side for AF Spectrum window grid. The left/right side of the grid is respectively represent AF start frequency and cut-off frequency. Use numeric key, rotary knob, direction key or touch panel menu to change cut-off frequency.

#### Note

- The start frequency cannot greater than the cut-off frequency. The start frequency cannot equal to the cut-off frequency.
- The difference of start frequency and cut-off frequency cannot less than 100 Hz. If try to be any one of it, the start frequency and cut-off frequency will be changed to maintain the minimum difference is 100 Hz between start frequency and cut-off frequency.

**Center frequency Stepped:** Set the frequency stepped will change the length when center frequency using direction key to step. Use numeric key, rotary knob, direction key or touch panel menu to change step value. In non-zero sweep width, auto coupling, center frequency step will be set to sweep width 10%.

## Amplitude (AMPT)

Press **[AMPT]** key to activate the reference level function and enter the amplitude menu. The numerical value of reference value and scale will display on the top of RF Spectrum window, Demod Waveform window and AF Spectrum window grid.

**Reference Value:** Set the reference value, press **[AMPT]** key to activate this function. Reference value specifies the amplitude of the signal displayed on the reference grid line. Reference value line is on the top of the grid or center, it depends on the reference belongs to which window. Use numeric key, rotary knob, direction key or touch panel menu to change reference value.

If RF Spectrum window is selected, reference value is the power represented by the grid line on the top of the window. The unit is dBm.

If Demond Waveform window is selected, reference value is the value represented by the grid line

at the center of the window's Y axis. The unit is dBm.

If AF Spectrum window is selected, reference value is the modulated depth represented by the grid line on the top of the window. The unit is %. If scale type is logarithm, the unit is dBam,  $x\%$  will expressed to  $y$  dBam, wherein,  $y = 20 * \log(x)$ .

The reference value widget is only suitable for the selected window. If select demodulated result window, then "reference value" widget cannot be used. This function is depend on the selected window.

### Note

- Reference level is the important parameter of spectrum analyzer, it presents the upper limit of dynamic range of the spectrum 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 spectrum analyzer.
- Changing parameter value will not restart the measurement, instead change all displayed trace and marker to new values. If the change of reference value changes the automatic coupling attenuation value, then the measurement will be restart.

**Scale:** Set the value is corresponding to a grid in the vertical direction of the screen. Use numeric key, rotary knob, direction key or touch panel menu to change the scale value.

If RF Spectrum window is selected, the scale is a value represented by the grid line on vertical square. The unit is dBm.

If Demond Waveform window is selected, the scale is a value represented by the grid line on vertical square. The unit is %.

If AF Spectrum window is selected, the scale is a value represented by the grid line on vertical square. The unit is dB.

The scale widget is only suitable for the selected window. If select demodulated result window, then "scale" widget cannot be used. This function is depend on the selected window.

**Scale Type:** It used only to set AF Spectrum window Y axis scale type, with logarithm and linear options. Y axis unit is % when the linear is selected. Y axis unit is dBam when the logarithm is selected. The Y axis is always scaled in logarithmic.

**Input Attenuation (auto/manual):** Set RF front-end attenuator so that the big signal can pass through the mixer with low distortion (small signals with low noise). Input attenuation can be switched between automatic and manual. When auto is selected, the input attenuation value is linked to the reference level. When manual is selected, use numeric key, rotary knob, direction key or touch panel menu to change the input attenuation value.

#### Note

- When the maximum mixer level and reference level are determined, the minimum of input attenuation of the spectrum analyzer should meet the formula: Reference Level  $\leq$  Input Attenuation- Pre-amplification -10 dBm

**Pre-amplification :** 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. When the measurement signal is small, turning on the preamplifier can reduce the average noise level of the display and thus distinguish the small signal from the noise. The default preplayback gain is 20 dB.

#### Note

- For UTS5000A series models, there are two preamplifiers, one for the low frequency band and one for the full frequency band. Low frequency band preamplifier, which works from 0 Hz to 7.5 GHz; full frequency band preamplifier, which is effective for all frequency bands.

**Impedance:** Set the input impedance when converting voltage to power. The default input impedance is 50  $\Omega$ . If the input impedance of the system under test to the spectrum analyzer is 75  $\Omega$ , then need to use a 75  $\Omega$  to 50  $\Omega$  adapter to connect the system under test to the spectrum analyzer and set the input impedance to 75  $\Omega$ .

## Bandwidth (BW)

Press **[BW]** key to activate the resolution bandwidth (RBW) function, and enter panel menu to control RF resolution bandwidth, AF resolution bandwidth and demodulated resolution. The numerical value of RF RBW, AF RBW will displayed at the left bottom of RF Spectrum window and AF Spectrum window grid.

**RF Resolution Bandwidth (Auto/Manual):** Set the resolution bandwidth used in RF window, to distinguish two signals with similar frequency. In manual mode, use numeric key, rotary knob,

direction key or touch panel menu to change the resolution bandwidth within proper range (refer to the data manual of model). Optional bandwidth values are integers in units of 10. If the input value is not the below value, then select an input value which is close to the optional bandwidth value. The system will correct the sweep time to maintain the calibration of the amplitude when resolution bandwidth is reduced. In auto mode, resolution bandwidth is automatic coupling with sweep width, if sweep width is reduced then the resolution width will be reduced accordingly. For AM, FM, the Span/RBW ratio is about 106:1, when it automatic coupling, the auto-coupling range is limited to no more than 1 MHz.

In manual mode, a "#" mark will appear next to "RF RBW" at the bottom left corner of the RF spectrum window. If it need to re-couple, press auto/manual key to select auto.

**AF Resolution Bandwidth (Auto/Manual):** Set FFT resolution bandwidth of demodulated waveform in AF spectrum window. In manual mode, use numeric key, rotary knob, direction key or touch panel menu to change the resolution bandwidth within proper range (refer to the data manual of model). Optional bandwidth values are integers in units of 10. If the input value is not the below value, then select an input value which is close to the optional bandwidth value.

In auto mode, resolution bandwidth is automatic coupling with AF range (the difference value of AF start frequency and cut-off frequency). The Span/RBW ratio is about 106:1, when it automatic coupling, the auto-coupling range is limited to no more than 1 MHz.

In manual mode, a "#" mark will appear next to "AF RBW" at the bottom left corner of the RF spectrum window. If it need to re-couple, press auto/manual key to select auto.

**Demodulated Bandwidth:** Set the bandwidth for demodulating, it determines the sweep width of the signal being demodulated, which is not the 3 dB bandwidth of the filter, but a useful bandwidth that is distortion-free in terms of phase and amplitude. Use numeric key, rotary knob, direction key or touch panel menu to change demodulated bandwidth. In grid graph of RF Spectrum window, two green vertical lines are centered at the center frequency, the space is equal to demodulation bandwidth. If demodulation bandwidth is greater than sweep width, then the two green vertical green lines cannot be seen.

The recommend of demodulated bandwidth (DBW) setup, for AM demodulation, demodulated bandwidth  $\geq 2 \times$  modulated frequency. In general, the modulated bandwidth should be as narrow as possible to improve SNR. The residual FM caused by the bottom noise and phase noise increases significantly with increasing bandwidth, especially for FM. If DBW is too large, the actual signal is only a small fraction of the demodulation range. This means that any noise or additional signal

fraction may be included in the measurement results, which is the wrong result. A simple way to determine the required DBW is to display the RF spectrum of the input signal. If the entire signal is displayed there and takes up most of the width of the chart, then the DBW should be appropriate.

## Sweep

Press **[Sweep]** key to enter the following panel menu to control sweep time, demodulation time and single/continuous sweep. The numerical value of the demodulated window sweep time is displayed at the bottom left of the Demod Waveform window grid.

**Demodulated Window Sweep Time:** Set display length of demodulated window X axis. Use numeric key, rotary knob, direction key or touch panel menu to change the sweep time.

**Demodulation Time:** Set the minimum length of the data acquisition for demodulation. Use numeric key, rotary knob, direction key or touch panel menu to change the demodulation time.

Increasing the demodulation time will increase the amount of data sampled, thus increasing the actual processing time; reducing the demodulation time will result in faster measurements. Measurement may require more data than the demodulation time specifies. If the resolution bandwidth in the spectrum window is low, or if the demodulation window sweep time is long, then the data required for the measurement may be higher than the demodulation time.

If measurement speed is critical, please make sure to increase the resolution bandwidth and reduce the demodulation window sweep time.

In auto mode, demodulation time is depend on the demodulated window sweep time, equal to demodulated window sweep time \*36.

**Sweep/Measurement:** Set frequency sweep measurement mode to "single" or "continuous". The sweep/measurement bar on the top of the screen will update according to the current sweep mode. Set "Average/hold count" (in measurement setup menu) to "OFF" or "ON" and the count is 1, it will scanning when the trigger condition is met; After the current scan is completed and the trigger condition is met again, the device continues with a new scanning. If "Average/hold count" sets to "ON" and the count >1, it requires multiple scanning (data acquisition). Trigger condition must be met before each scan. When average count k is equal to the number N set by "average/hold count", the scanning will not stop, but digit k will stop to increasing. Measure average value is suitable for the result of all trace and marker and the numerical result. But sometimes it only suitable for the numerical result.

**Note**

- If the device is in single measurement, press continuous/single toggle control will not change the average number k and will not cause a scan reset; the only operating is to make the device enter the continuous measurement.

**Single:** The measurement mode is set to single measurement. Stop after performing one measurement.

**Marker**

Press **[Marker]** key to access the panel menu of marker function, it used to select the mode, trace, position and quantity of the marker. Marker is a rhombic icon as shown in Figure 3-1.

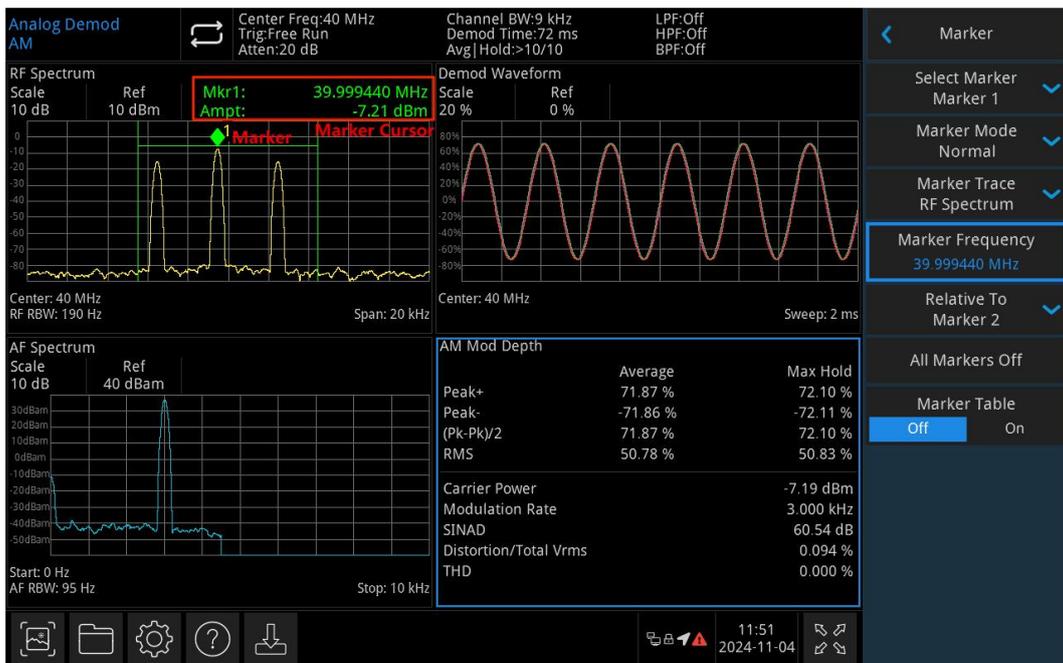


Figure 3-1 Reading of Marker Cursor Reading

It can use 6 markers on the screen at the same time, and only one or a pair of markers can be controlled for each time.

**Marker Selection:** Select one of six markers, marker 1 is the default selection. After selecting the cursor, it can set parameter such as the cursor type, the marked trace and marker frequency. The currently opened cursor will be marked on the trace selected by "Mark Trace" and the reading of the currently active cursor at the marker will be displayed in the current parameter area and on the upper right corner of the window.

The selected marker will also be recorded even if it is not in the marker menu, the currently selected marker will be used for peak search.

### Marker 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". A marker that can be moved to any point on the X axis by specifying its X-axis value, and its Y axis value is the value of trace mark at that X-axis value.

Pay attention to the following points in 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 width, which can be reduced to achieve higher reading resolution.

2. Difference $\Delta$ : 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 "x") and the difference cursor (marked with " $\Delta$ "). A marker that can be moved to any point on the X axis by specifying its X-axis value, and its Y axis value is the value of trace mark at that X-axis value.

3. Fixation: After selecting "fixed" cursor, set the X and Y values of the cursor directly or indirectly, their positions remain 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 "x".

4. OFF: Turn off the currently 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 RF Spectrum, Demod, Demod Avg, Demod Max, Demod Min or AF Spectrum.

**Mark Frequency/Time:** The frequency point or time point of the marker on the trace. Use numeric key, rotary knob, direction key or touch panel menu to change the value. When the mark mode is

increasing, the label will change to "Marker  $\Delta$  Frequency" or "Marker  $\Delta$  Time".

If marker trace is RF Spectrum or AF Spectrum, it is mark frequency; if marker trace is Demod, Demod Avg, Demod Max or Demod Min, it is mark time.

**Mark Amplitude:** If the marker is in fixed mode, the marker is in the amplitude position on the grid graph. Use numeric key, rotary knob, direction key or touch panel menu to change the amplitude value.

If marker trace is RF Spectrum, the marker amplitude unit is dBm; if marker trace is Demod, Demod Avg, Demod Max, Demod Min or AF Spectrum, the marker amplitude unit is %.

**Relative to:** Used to measure the difference value between two cursors. The two cursors can be marked on the different trace at the same time.

**Close All:** Close all the marker point.

**Marker list:** Turn on or off the marker list.

When the marker list is opened, all open cursors are displayed in a list format in the window of the split screen. The display includes cursor number, marker mode, marked trace number, X axis scale type, X axis reading and Y axis reading. The cursor list can be used to view the measured values of multiple measurement points.

## Peak

Press **[Peak]** key to open peak search menu and execute a peak search function.

**Peak Search:** Use the normal mark mode select in the Mark menu, to search for the peak amplitude of the trace in the selected window and display its frequency and amplitude value. 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. If the selected marker is disabled, then enable it as normal cursor and execute peak search.

**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. If the selected marker is "OFF", then open it before performing the minimum search.

**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. If the selected marker is "OFF", then open it before performing the minimum search.

**Minimum Peak:** Find the minimum amplitude value on the trace and mark it with the cursor.

**Peak to Peak Search:** Perform peak search and minimum search at the same time, and marked with the difference cursor, the result of peak search is marked with the reference cursor, the result of minimum search marked with the difference cursor. If the selected marker is disabled, then enable the difference marker and execute peak to peak search. If the selected marker is enabled but not the difference maker, it should change to the difference value and turn on reference marker and then execute peak to peak search.

## Frequency Modulation

FM demodulated measurement is for demodulating FM signal and display the demodulated signal on time and frequency domain. It also provides the index result of FM offset, modulated frequency, modulated distortion, SINAD, total harmonic distortion and carrier power.

### Frequency (FREQ)

Press **[FREQ]** key to activate the frequency function and enter the frequency menu. The numerical value of center frequency and sweep width will display at the bottom of RF Spectrum window grid. AF start and cut-off frequency will display at the bottom of AF Spectrum window grid.

**Center frequency:** Activate the frequency function and set a specific frequency value at the center of RF Spectrum window on the horizontal. Use numeric key, rotary knob, direction key or touch panel menu to change center frequency.

#### Note

- The sweep width remains unchanged when adjusting the center frequency.

**Sweep Width:** This function is to input range value of sweep width. Use numeric key, rotary knob, direction key or touch panel menu to change sweep width. Changing the sweep width will symmetrically change the frequency range according to the center frequency. The reading of sweep

width is the total displayed frequency range. To determine the sweep width for each horizontal scale division, the above sweep width should be divided by 10. The sweep width affect RBW and sweep time.

#### Note

- Under the premise of constant sweep width to change the center frequency, it will automatically modify the start and cut-off frequency.
- The minimum sweep width can set to 100 Hz. The maximum sweep width refer to the data manual of the corresponding model.

**AF Start Frequency:** To set start frequency on the left side for AF Spectrum window grid. The left/right side of the grid is respectively represent AF start frequency and cut-off frequency. Use numeric key, rotary knob, direction key or touch panel menu to change start frequency.

**AF Cut-off Frequency:** To set cut-off frequency on the right side for AF Spectrum window grid. The left/right side of the grid is respectively represent AF start frequency and cut-off frequency. Use numeric key, rotary knob, direction key or touch panel menu to change cut-off frequency.

#### Note

- The start frequency cannot greater than the cut-off frequency. The start frequency cannot equal to the cut-off frequency.
- The difference of start frequency and cut-off frequency cannot less than 100 Hz. If try to be any one of it, the start frequency and cut-off frequency will be changed to maintain the minimum difference is 100 Hz between start frequency and cut-off frequency.

**Center Frequency Stepped:** Set the frequency stepped will change the length when center frequency using direction key to step. Use numeric key, rotary knob, direction key or touch panel menu to change step value. In non-zero sweep width, auto coupling, center frequency step will be set to sweep width 10%.

## Amplitude (AMPT)

Press **[AMPT]** key to activate the reference level function and enter the amplitude menu. The numerical value of reference value and scale will display on the top of RF Spectrum window, Demod Waveform window and AF Spectrum window grid.

**Reference Value:** Set the reference value, press **[AMPT]** key to activate this function. Reference value specifies the amplitude of the signal displayed on the reference grid line. Reference value line is on the top of the grid or center, it depends on the reference belongs to which window. Use numeric key, rotary knob, direction key or touch panel menu to change reference value.

If RF Spectrum window is selected, reference value is the power represented by the grid line on the top of the window. The unit is dBm.

If Demod Waveform window is selected, reference value is the value represented by the grid line at the center of the window's Y axis. The unit is Hz, it indicates the modulated frequency offset.

If AF Spectrum window is selected, reference value is the modulated frequency offset represented by the grid line on the top of the window. The unit is kHz. If scale type is logarithm, the unit is dBHz,  $x\%$  will expressed to  $y$  dBHz, wherein,  $y = 20 * \log(x)$ .

The reference value widget is only suitable for the selected window. If select demodulated result window, then "reference value" widget cannot be used. This function is depend on the selected window.

#### Note

- Reference level is the important parameter of spectrum analyzer, it presents the upper limit of dynamic range of the spectrum 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 spectrum analyzer.
- Changing parameter value will not restart the measurement, instead change all displayed trace and marker to new values. If the change of reference value changes the automatic coupling attenuation value, then the measurement will be restart.

**Scale:** Set the value is corresponding to a grid in the vertical direction of the screen. Use numeric key, rotary knob, direction key or touch panel menu to change the scale value.

If RF Spectrum window is selected, the scale is a value represented by the grid line on vertical square. The unit is dBm.

If Demod Waveform window is selected, the scale is a value represented by the grid line on vertical square. The unit is Hz.

If AF Spectrum window is selected, the scale is a value represented by the grid line on vertical

square. The unit is dB.

The scale widget is only suitable for the selected window. If select demodulated result window, then "scale" widget cannot be used. This function is depend on the selected window.

**Scale Type:** It used only to set AF Spectrum window Y axis scale type, with logarithm and linear options. Y axis unit is Hz when the linear is selected. Y axis unit is dBHz when the logarithm is selected. The Y axis is always scaled in logarithmic.

**Input Attenuation (auto/manual):** Set RF front-end attenuator so that the big signal can pass through the mixer with low distortion (small signals with low noise). Input attenuation can be switched between automatic and manual. When auto is selected, the input attenuation value is linked to the reference level. When manual is selected, use numeric key, rotary knob, direction key or touch panel menu to change the input attenuation value.

#### Note

- When the maximum mixer level and reference level are determined, the minimum of input attenuation of the spectrum analyzer should meet the formula: Reference Level  $\leq$  Input Attenuation- Pre-amplification -10 dBm

**Pre-amplification:** 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. When the measurement signal is small, turning on the preamplifier can reduce the average noise level of the display and thus distinguish the small signal from the noise. The default preplayback gain is 20 dB.

#### Note

- For UTS5000A series models, there are two preamplifiers, one for the low frequency band and one for the full frequency band. Low frequency band preamplifier, which works from 0 Hz to 7.5 GHz; full frequency band preamplifier, which is effective for all frequency bands.

**Impedance:** Set the input impedance when converting voltage to power. The default input impedance is 50  $\Omega$ . If the input impedance of the system under test to the spectrum analyzer is 75  $\Omega$ , then need to use a 75  $\Omega$  to 50  $\Omega$  adapter to connect the system under test to the spectrum analyzer and set the input impedance to 75  $\Omega$ .

## Bandwidth (BW)

Press **[BW]** key to activate the resolution bandwidth (RBW) function, and enter panel menu to control RF resolution bandwidth, AF resolution bandwidth and demodulated resolution. The numerical value of RF RBW, AF RBW will displayed at the left bottom of RF Spectrum window and AF Spectrum window grid.

**RF Resolution Bandwidth (Auto/Manual):** Set the resolution bandwidth used in RF window, to distinguish two signals with similar frequency. In manual mode, use numeric key, rotary knob, direction key or touch panel menu to change the resolution bandwidth within proper range (refer to the data manual of model). Optional bandwidth values are integers in units of 10. If the input value is not the below value, then select an input value which is close to the optional bandwidth value. The system will correct the sweep time to maintain the calibration of the amplitude when resolution bandwidth is reduced. In auto mode, resolution bandwidth is automatic coupling with sweep width, if sweep width is reduced then the resolution width will be reduced accordingly. For AM, FM, the Span/RBW ratio is about 106:1, when it automatic coupling, the auto-coupling range is limited to no more than 1 MHz.

In manual mode, a "#" mark will appear next to "RF RBW" at the bottom left corner of the RF spectrum window. If it need to re-couple, press auto/manual key to select auto.

**AF Resolution Bandwidth (Auto/Manual):** Set FFT resolution bandwidth of demodulated waveform in AF spectrum window. In manual mode, use numeric key, rotary knob, direction key or touch panel menu to change the resolution bandwidth within proper range (refer to the data manual of model). Optional bandwidth values are integers in units of 10. If the input value is not the below value, then select an input value which is close to the optional bandwidth value.

In auto mode, resolution bandwidth is automatic coupling with AF range (the difference value of AF start frequency and cut-off frequency). The Span/RBW ratio is about 106:1, when it automatic coupling, the auto-coupling range is limited to no more than 1 MHz.

In manual mode, a "#" mark will appear next to "AF RBW" at the bottom left corner of the RF spectrum window. If it need to re-couple, press auto/manual key to select auto.

**Demodulated Bandwidth:** Set the bandwidth for demodulating, it determines the sweep width of the signal being demodulated, which is not the 3 dB bandwidth of the filter, but a useful bandwidth that is distortion-free in terms of phase and amplitude. Use numeric key, rotary knob, direction key or touch panel menu to change demodulated bandwidth. In grid graph of RF Spectrum window, two

green vertical lines are centered at the center frequency, the space is equal to demodulation bandwidth. If demodulation bandwidth is greater than sweep width, then the two green vertical green lines cannot be seen. The demodulated bandwidth value will display in the measurement bar on the top of the screen.

The recommend of demodulated bandwidth (DBW) setup, for FM demodulation, demodulated bandwidth  $\geq 2 \times (\text{frequency offset} + \text{modulated frequency})$ . In general, the modulated bandwidth should be as narrow as possible to improve SNR. The residual FM caused by the bottom noise and phase noise increases significantly with increasing bandwidth, especially for FM. If DBW is too large, the actual signal is only a small fraction of the demodulation range. This means that any noise or additional signal fraction may be included in the measurement results, which is the wrong result. On the other hand, if DBW is too small, the partial signal is cut-off, so it is not included in the measurement results. A simple way to determine the required DBW is to display the RF spectrum of the input signal. If the entire signal is displayed there and takes up most of the width of the chart, then the DBW should be appropriate.

## Sweep

Press **[Sweep]** key to enter the following panel menu to control sweep time, demodulation time and single/continuous sweep. The numerical value of the demodulated window sweep time is displayed at the bottom left of the Demod Waveform window grid. The demodulated time value will display in the measurement bar on the top of the screen.

**Demodulated Window Sweep Time:** Set display length of demodulated window X axis. Use numeric key, rotary knob, direction key or touch panel menu to change the sweep time.

**Demodulation Time:** Set the minimum length of the data acquisition for demodulation. Use numeric key, rotary knob, direction key or touch panel menu to change the demodulation time.

Increasing the demodulation time will increase the amount of data sampled, thus increasing the actual processing time; reducing the demodulation time will result in faster measurements. Measurement may require more data than the demodulation time specifies. If the resolution bandwidth in the spectrum window is low, or if the demodulation window sweep time is long, then the data required for the measurement may be higher than the demodulation time.

If measurement speed is critical, please make sure to increase the resolution bandwidth and reduce the demodulation window sweep time.

In auto mode, demodulation time is depend on the demodulated window sweep time, equal to

demodulated window sweep time \*36.

**Sweep/Measurement:** Set frequency sweep measurement mode to “single” or “continuous”. The sweep/measurement bar on the top of the screen will update according to the current sweep mode. Set “Average/hold count” (in measurement setup menu) to “OFF” or “ON” and the count is 1, it will scanning when the trigger condition is met; After the current scan is completed and the trigger condition is met again, the device continues with a new scanning. If “Average/hold count” sets to “ON” and the count >1, it requires multiple scanning (data acquisition). Trigger condition must be met before each scan. When average count k is equal to the number N set by “average/hold count”, the scanning will not stop, but digit k will stop to increasing. Measure average value is suitable for the result of all trace and marker and the numerical result. But sometimes it only suitable for the numerical result.

#### Note

- If the device is in single measurement, press continuous/single toggle control will not change the average number k and will not cause a scan reset; the only operating is to make the device enter the continuous measurement.

**Single:** The measurement mode is set to single measurement. Stop after performing one measurement.

## Marker

Press **[Marker]** key to access the panel menu of marker function, it used to select the mode, trace, position and quantity of the marker. Marker is a rhombic icon as shown in Figure 3-2.



Figure 3-2 Reading of Marker Cursor

It can use 6 markers on the screen at the same time, and only one or a pair of markers can be controlled for each time.

**Marker Selection:** Select one of six markers, marker 1 is the default selection. After selecting the cursor, it can set parameter such as the cursor type, the marked trace and marker frequency. The currently opened cursor will be marked on the trace selected by "Mark Trace" and the reading of the currently active cursor at the marker will be displayed in the current parameter area and on the upper right corner of the window.

The selected marker will also be recorded even it not in the marker menu, the currently selected marker will be used for peak search.

### Marker 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". A marker that can be moved to any point on the X axis by specifying its X-axis value, and its Y axis value is the value of trace mark at that X-axis value.

Pay attention to the following points in 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 width, which can be

reduced to achieve higher reading resolution.

2. **Differential Value $\Delta$ :** 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 "x") and the difference cursor (marked with " $\Delta$ "). A marker that can be moved to any point on the X axis by specifying its X-axis value, and its Y axis value is the value of trace mark at that X-axis value.

3. **Fixation:** After selecting "fixed" cursor, set the X and Y values of the cursor directly or indirectly, their positions remain 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 "x".

4. **OFF:** Turn off the currently 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 RF Spectrum, Demod, Demod Avg, Demod Max, Demod Min or AF Spectrum.

**Mark Frequency/Mark Time:** The frequency point or time point of the marker on the trace. Use numeric key, rotary knob, direction key or touch panel menu to change the value. When the mark mode is increasing, the label will change to "Marker  $\Delta$  Frequency" or "Marker  $\Delta$  Time".

If marker trace is RF Spectrum or AF Spectrum, it is mark frequency; if marker trace is Demod, Demod Avg, Demod Max or Demod Min, it is mark time.

**Mark Amplitude:** If the marker is in fixed mode, the marker is in the amplitude position on the grid graph. Use numeric key, rotary knob, direction key or touch panel menu to change the amplitude value.

If marker trace is RF Spectrum, the marker amplitude unit is dBm; if marker trace is Demod, Demod Avg, Demod Max, Demod Min or AF Spectrum, the marker amplitude unit is Hz.

**Relative to:** Used to measure the difference value between two cursors. The two cursors can be marked on the different trace at the same time.

**Close All:** Turn off all markers.

**Marker List:** Turn on/off marker list.

When the marker list is opened, all open cursors are displayed in a list format in the window of the split screen. The display includes cursor number, marker mode, marked trace number, X axis scale type, X axis reading and Y axis reading. The cursor list can be used to view the measured values of multiple measurement points.

## Peak

Press **[Peak]** key to open peak search menu and execute a peak search function.

Use the normal mark mode select in the Mark menu, to search for the peak amplitude of the trace in the selected window and display its frequency and amplitude value. 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. If the selected marker is disabled, then enable it as normal cursor and execute peak search.

**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. If the selected marker is "OFF", then open it before performing the minimum search.

**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. If the selected marker is "OFF", then open it before performing the minimum search.

**Minimum Peak:** Find the minimum amplitude value on the trace and mark it with the cursor. If the selected marker is "OFF", then open it before performing the minimum search.

**Peak to Peak Search:** Perform peak search and minimum search at the same time, and marked with the difference cursor, the result of peak search is marked with the reference cursor, the result of minimum search marked with the difference cursor. If the selected marker is disabled, then enable the difference marker and execute peak to peak search. If the selected marker is enabled but not the difference maker, it should change to the difference value and turn on reference marker and then execute peak to peak search.

## Phase Modulation

Phase modulation demodulation measurements provide the ability to demodulate the phase modulation signal and display the demodulated signal in both the time and frequency domains. It also provides results for metrics such as PM offset, modulation frequency, modulation distortion, SINAD, total harmonic distortion, and carrier power.

### Frequency (FREQ)

Press **[FREQ]** key to activate the frequency function and enter the frequency menu. The numerical value of center frequency and sweep width will display at the bottom of RF Spectrum window grid. AF start and cut-off frequency will display at the bottom of AF Spectrum window grid.

**Center frequency:** Activate the frequency function and set a specific frequency value at the center of RF Spectrum window on the horizontal. Use numeric key, rotary knob, direction key or touch panel menu to change center frequency.

#### Note

- The sweep width remains unchanged when adjusting the center frequency.

**Sweep Width:** This function is to input range value of sweep width. Use numeric key, rotary knob, direction key or touch panel menu to change sweep width. Changing the sweep width will symmetrically change the frequency range according to the center frequency. The reading of sweep width is the total displayed frequency range. To determine the sweep width for each horizontal scale division, the above sweep width should be divided by 10. The sweep width affect RBW and sweep time.

#### Note

- Under the premise of constant sweep width to change the center frequency, it will automatically modify the start and cut-off frequency.
- The minimum sweep width can set to 100 Hz. The maximum sweep width refer to the data manual of the corresponding model.

**AF Start Frequency:** To set start frequency on the left side for AF Spectrum window grid. The left/right side of the grid is respectively represent AF start frequency and cut-off frequency. Use

numeric key, rotary knob, direction key or touch panel menu to change start frequency.

**AF Cut-off Frequency:** To set cut-off frequency on the right side for AF Spectrum window grid. The left/right side of the grid is respectively represent AF start frequency and cut-off frequency. Use numeric key, rotary knob, direction key or touch panel menu to change cut-off frequency.

#### Note

- The start frequency cannot greater than the cut-off frequency. The start frequency cannot equal to the cut-off frequency.
- The difference of start frequency and cut-off frequency cannot less than 100 Hz. If try to be any one of it, the start frequency and cut-off frequency will be changed to maintain the minimum difference is 100 Hz between start frequency and cut-off frequency.

**Center Frequency Stepped:** Set the frequency stepped will change the length when center frequency using direction key to step. Use numeric key, rotary knob, direction key or touch panel menu to change step value. In non-zero sweep width, auto coupling, center frequency step will be set to sweep width 10%.

## Amplitude (AMPT)

Press **[AMPT]** key to activate the reference level function and enter the amplitude menu. The numerical value of reference value and scale will display on the top of RF Spectrum window, Demod Waveform window and AF Spectrum window grid.

**Reference Value:** Set the reference value, press **[AMPT]** key to activate this function. Reference value specifies the amplitude of the signal displayed on the reference grid line. Reference value line is on the top of the grid or center, it depends on the reference belongs to which window. Use numeric key, rotary knob, direction key or touch panel menu to change reference value.

If RF Spectrum window is selected, reference value is the power represented by the grid line on the top of the window. The unit is dBm.

If Demond Waveform window is selected, reference value is the value represented by the grid line at the center of the window's Y axis. The unit is rad, it indicates the modulated phase offset.

If AF Spectrum window is selected, reference value is the modulated phase offset represented by the grid line on the top of the window. When the scale type is linear, the unit is rad. If scale type is logarithm, the unit is dBrad, x% will expressed to y dBrad, wherein,  $y = 20 * \log(x)$ .

The reference value widget is only suitable for the selected window. If select demodulated result window, then “reference value” widget cannot be used. This function is depend on the selected window.

**Note**

- Reference level is the important parameter of spectrum analyzer, it presents the upper limit of dynamic range of the spectrum 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 spectrum analyzer.
- Changing parameter value will not restart the measurement, instead change all displayed trace and marker to new values. If the change of reference value changes the automatic coupling attenuation value, then the measurement will be restart.

**Scale:** Set the value is corresponding to a grid in the vertical direction of the screen. Use numeric key, rotary knob, direction key or touch panel menu to change the scale value.

If RF Spectrum window is selected, the scale is a value represented by the grid line on vertical square. The unit is dBm.

If Demond Waveform window is selected, the scale is a value represented by the grid line on vertical square. The unit is rad.

If AF Spectrum window is selected, the scale is a value represented by the grid line on vertical square. The unit is dB.

The scale widget is only suitable for the selected window. If select demodulated result window, then “scale” widget cannot be used. This function is depend on the selected window.

**Scale Type:** It used only to set AF Spectrum window Y axis scale type, with logarithm and linear options. Y axis unit is rad when the linear is selected. Y axis unit is dBrad when the logarithm is selected. The Y axis is always scaled in logarithmic.

**Input Attenuation (auto/manual):** Set RF front-end attenuator so that the big signal can pass through the mixer with low distortion (small signals with low noise). Input attenuation can be switched between automatic and manual. When auto is selected, the input attenuation value is linked to the reference level. When manual is selected, use numeric key, rotary knob, direction key or touch panel menu to change the input attenuation value.

**Note**

- When the maximum mixer level and reference level are determined, the minimum of input attenuation of the spectrum analyzer should meet the formula: Reference Level  $\leq$  Input Attenuation- Pre-amplification -10 dBm

**Pre-amplification:** 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. When the measurement signal is small, turning on the preamplifier can reduce the average noise level of the display and thus distinguish the small signal from the noise. The default preplayback gain is 20 dB.

**Note**

- For UTS5000A series models, there are two preamplifiers, one for the low frequency band and one for the full frequency band. Low frequency band preamplifier, which works from 0 Hz to 7.5 GHz; full frequency band preamplifier, which is effective for all frequency bands.

**Impedance:** Set the input impedance when converting voltage to power. The default input impedance is 50  $\Omega$ . If the input impedance of the system under test to the spectrum analyzer is 75  $\Omega$ , then need to use a 75  $\Omega$  to 50  $\Omega$  adapter to connect the system under test to the spectrum analyzer and set the input impedance to 75  $\Omega$ .

**Bandwidth (BW)**

Press **[BW]** key to activate the resolution bandwidth (RBW) function, and enter panel menu to control RF resolution bandwidth, AF resolution bandwidth and demodulated resolution. The numerical value of RF RBW, AF RBW will displayed at the left bottom of RF Spectrum window and AF Spectrum window grid.

**RF Resolution Bandwidth (Auto/Manual):** Set the resolution bandwidth used in RF window, to distinguish two signals with similar frequency. In manual mode, use numeric key, rotary knob, direction key or touch panel menu to change the resolution bandwidth within proper range (refer to the data manual of model). Optional bandwidth values are integers in units of 10. If the input value is not the below value, then select an input value which is close to the optional bandwidth value. The system will correct the sweep time to maintain the calibration of the amplitude when resolution bandwidth is reduced. In auto mode, resolution bandwidth is automatic coupling with sweep width, if sweep width is reduced then the resolution width will be reduced accordingly. For AM, FM, PM,

the Span/RBW ratio is about 106:1, when it automatic coupling, the auto-coupling range is limited to no more than 1 MHz.

In manual mode, a "#" mark will appear next to "RF RBW" at the bottom left corner of the RF spectrum window. If it need to re-couple, press auto/manual key to select auto.

**AF Resolution Bandwidth (Auto/Manual):** Set FFT resolution bandwidth of demodulated waveform in AF spectrum window. In manual mode, use numeric key, rotary knob, direction key or touch panel menu to change the resolution bandwidth within proper range (refer to the data manual of model). Optional bandwidth values are integers in units of 10. If the input value is not the below value, then select an input value which is close to the optional bandwidth value.

In auto mode, resolution bandwidth is automatic coupling with AF range (the difference value of AF start frequency and cut-off frequency). The Span/RBW ratio is about 106:1, when it automatic coupling, the auto-coupling range is limited to no more than 1 MHz.

In manual mode, a "#" mark will appear next to "AF RBW" at the bottom left corner of the RF spectrum window. If it need to re-couple, press auto/manual key to select auto.

**Demodulated Bandwidth:** Set the bandwidth for demodulating, it determines the sweep width of the signal being demodulated, which is not the 3 dB bandwidth of the filter, but a useful bandwidth that is distortion-free in terms of phase and amplitude. Use numeric key, rotary knob, direction key or touch panel menu to change demodulated bandwidth. In grid graph of RF Spectrum window, two green vertical lines are centered at the center frequency, the space is equal to demodulation bandwidth. If demodulation bandwidth is greater than sweep width, then the two green vertical green lines cannot be seen. The demodulated bandwidth value will display in the measurement bar on the top of the screen.

The recommend of demodulated bandwidth (DBW) setup, for PM demodulation, demodulated bandwidth  $\geq 2 \times$  modulated frequency. In general, the modulated bandwidth should be as narrow as possible to improve SNR. The residual FM caused by the bottom noise and phase noise increases significantly with increasing bandwidth, especially for FM. If DBW is too large, the actual signal is only a small fraction of the demodulation range. This means that any noise or additional signal fraction may be included in the measurement results, which is the wrong result. On the other hand, if DBW is too small, the partial signal is cut-off, so it is not included in the measurement results. A simple way to determine the required DBW is to display the RF spectrum of the input signal. If the entire signal is displayed there and takes up most of the width of the chart, then the DBW should be appropriate.

## Sweep

Press **[Sweep]** key to enter the following panel menu to control sweep time, demodulation time and single/continuous sweep. The numerical value of the demodulated window sweep time is displayed at the bottom left of the Demod Waveform window grid. The demodulated time value will display in the measurement bar on the top of the screen.

**Demodulated Window Sweep Time:** Set display length of demodulated window X axis. Use numeric key, rotary knob, direction key or touch panel menu to change the sweep time.

**Demodulation Time:** Set the minimum length of the data acquisition for demodulation. Use numeric key, rotary knob, direction key or touch panel menu to change the demodulation time.

Increasing the demodulation time will increase the amount of data sampled, thus increasing the actual processing time; reducing the demodulation time will result in faster measurements. Measurement may require more data than the demodulation time specifies. If the resolution bandwidth in the spectrum window is low, or if the demodulation window sweep time is long, then the data required for the measurement may be higher than the demodulation time.

If measurement speed is critical, please make sure to increase the resolution bandwidth and reduce the demodulation window sweep time.

In auto mode, demodulation time is depend on the demodulated window sweep time, equal to demodulated window sweep time \*36.

**Sweep/Measurement:** Set frequency sweep measurement mode to "single" or "continuous". The sweep/measurement bar on the top of the screen will update according to the current sweep mode. Set "Average/hold count" (in measurement setup menu) to "OFF" or "ON" and the count is 1, it will scanning when the trigger condition is met; After the current scan is completed and the trigger condition is met again, the device continues with a new scanning. If "Average/hold count" sets to "ON" and the count >1, it requires multiple scanning (data acquisition). Trigger condition must be met before each scan. When average count k is equal to the number N set by "average/hold count", the scanning will not stop, but digit k will stop to increasing. Measure average value is suitable for the result of all trace and marker and the numerical result. But sometimes it only suitable for the numerical result.

### Note

- If the device is in single measurement, press continuous/single toggle control will not change

the average number k and will not cause a scan reset; the only operating is to make the device enter the continuous measurement.

**Single:** The measurement mode is set to single measurement. Stop after performing one measurement.

## Marker

Press **[Marker]** key to access the panel menu of marker function, it used to select the mode, trace, position and quantity of the marker. Marker is a rhombic icon as shown in Figure 3-3.



Figure 3-3 Reading of Marker Cursor

It can use 6 markers on the screen at the same time, and only one or a pair of markers can be controlled for each time.

**Marker Selection:** Select one of six markers, marker 1 is the default selection. After selecting the cursor, it can set parameter such as the cursor type, the marked trace and marker frequency.

The currently opened cursor will be marked on the trace selected by "Mark Trace" and the reading of the currently active cursor at the marker will be displayed in the current parameter area and on the upper right corner of the window.

The selected marker will also be recorded even it not in the marker menu, the currently selected marker will be used for peak search.

## Marker 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". A marker that can be moved to any point on the X axis by specifying its X-axis value, and its Y axis value is the value of trace mark at that X-axis value.

Pay attention to the following points in 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 width, which can be reduced to achieve higher reading resolution.

2. Differential Value $\Delta$ : 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 "x") and the difference cursor (marked with " $\Delta$ "). A marker that can be moved to any point on the X axis by specifying its X-axis value, and its Y axis value is the value of trace mark at that X-axis value.

3. Fixation: After selecting "fixed" cursor, set the X and Y values of the cursor directly or indirectly, their positions remain 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 "x".

4. OFF: Turn off the currently 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 RF Spectrum, Demod, Demod Avg, Demod Max, Demod Min or AF Spectrum.

**Mark Frequency/Mark Time:** The frequency point or time point of the marker on the trace. Use numeric key, rotary knob, direction key or touch panel menu to change the value. When the mark mode is increasing, the label will change to "Marker  $\Delta$  Frequency" or "Marker  $\Delta$  Time".

If marker trace is RF Spectrum or AF Spectrum, it is mark frequency; if marker trace is Demod, Demod Avg, Demod Max or Demod Min, it is mark time.

**Mark Amplitude:** If the marker is in fixed mode, the marker is in the amplitude position on the grid graph. Use numeric key, rotary knob, direction key or touch panel menu to change the amplitude value.

If marker trace is RF Spectrum, the marker amplitude unit is dBm; if marker trace is Demod, Demod Avg, Demod Max, Demod Min or AF Spectrum, the marker amplitude unit is Hz.

**Relative to:** Used to measure the difference value between two cursors. The two cursors can be marked on the different trace at the same time.

**Close All:** Turn off all markers.

**Marker List:** Turn on/off marker list.

When the marker list is opened, all open cursors are displayed in a list format in the window of the split screen. The display includes cursor number, marker mode, marked trace number, X axis scale type, X axis reading and Y axis reading. The cursor list can be used to view the measured values of multiple measurement points.

## Peak

Press **[Peak]** key to open peak search menu and execute a peak search function.

Use the normal mark mode select in the Mark menu, to search for the peak amplitude of the trace in the selected window and display its frequency and amplitude value. 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. If the selected marker is disabled, then enable it as normal cursor and execute peak search.

**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. If the selected marker is "OFF", then open it before performing the minimum search.

**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. If the selected marker is "OFF", then open it before performing the minimum search.

**Minimum Peak:** Find the minimum amplitude value on the trace and mark it with the cursor. If the selected marker is "OFF", then open it before performing the minimum search.

**Peak to Peak Search:** Perform peak search and minimum search at the same time, and marked with the difference cursor, the result of peak search is marked with the reference cursor, the result of minimum search marked with the difference cursor. If the selected marker is disabled, then enable the difference marker and execute peak to peak search. If the selected marker is enabled but not the difference maker, it should change to the difference value and turn on reference marker and then execute peak to peak search.

## Measurement Setup (Meas/Setup)

**Average/Hold Count:** Specify the number of counts N for trace averaging, maximum holding and minimum holding. Use numeric key, rotary knob, direction key or touch panel menu to change the average count. Measure the average type with different averaging methods according to different windows, such as RF Spectrum window use the average power, Demod Waveform window use the arithmetic mean, AF Spectrum window use logarithmic mean.

When average/hold count is opened, the trace of RF Spectrum and AF Spectrum will be averaged, Demod Waveform window displays the current trace, in addition to displaying the average trace, the maximum hold trace and the minimum trace. All the measured result is averaged, the measured result displays "average" column and "maximum hold" column. "Maximum hold" column displays the maximum value of the metric that not average reached since the last reboot. And the measured result is shown as four significant digits. The measurement bar displays average/hold count (and the sweep count that has acquired.)

If average/hold time is disabled, the trace of RF Spectrum and AF Spectrum is not averaged, Demod Waveform window is only display the current trace. The measured result is only display a "Current" column. The measurement bar displays average/hold count as "----".

**Audio Play (ON/OFF):** Turn on/off headphones and loudspeaker. In demodulated mode, "Audio" function is opened, it can hear the demodulated signal from headphones or loudspeaker.

### Note

- In system setting, the volume should set correctly.

**Volume:** Adjust the volume of headphones or loudspeaker. Use numeric key, rotary knob, direction key or touch panel menu to change the volume. The volume is synchronizing with the system.

## Filter Setting

**Low-pass Filter:** This parameter can adjust the low-pass filter after demodulated. The low-pass filter can effectively remove unwanted high frequency component from the modulated signal. There are 300 Hz, 3 kHz, 15 kHz, 30 kHz, 80 kHz, 100 kHz, 300 kHz and off for selection (refer to the data manual of model.) Open any of low-pass filter will turn off the band-pass filter. If the band-pass filter is turned off, then no display hint message.

**High-pass Filter:** This parameter can adjust the high-pass filter after demodulated. The high-pass filter can effectively remove unwanted low frequency component from the modulated signal. There are 20 Hz, 50 Hz, 300 Hz, 400 kHz and off for selection (refer to the data manual of model.) Open any of high-pass filter will turn off the band-pass filter. If the band-pass filter is turned off, then no display hint message.

**Band-pass Filter :** This parameter can adjust the band-pass filter after demodulated. The band-pass filter can apply for the industry-defined filter. There are A weighting, C weighting, CCIR-1k weighting, CCIR-2k weighting, CCIR no weighting and off for selection (refer to the data manual of model.) Open any band-pass filter will turn off the high-pass and low-pass filter.

## Preset Measurement

Preset all the parameters of the current measurement mode to the factory setting.

## Restart Measurement

Re-measure, if the average is opened, the average count is reset and the count is restarted.

## Single

**[Single]** is quick sweep mode key.

## Default Setting (Default)

Press **[Default]** key to provide a convenient start environment for measurement.

Press [Default]> Restore to the factory setting, as the follows.

1. Reset the spectrum analyzer to AM demodulated mode.
2. Enter frequency menu.
3. Set the default parameter value for some environments.
4. Perform processor test but not affect the correction data.
5. Clear the input and output caches and all trace data.
6. RF Spectrum displays a trace, Demond Waveform window displays four traces Demod, Demod Avg, Demod Max and Demod Min; AF Spectrum window displays a trace.

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

Menu	Name of Parameter	Default Value
Frequency	Center frequency	64MHz
Frequency	Sweep width	200kHz
Frequency	AF start frequency	0Hz
Frequency	AF cut-off frequency	20kHz
Frequency	Center frequency stepped	1MHz
Amplitude	Reference Level	0dBm
Amplitude	Scale	10dB
Amplitude	Scale type	Linear
Amplitude	Input attenuation	Auto/10dB
Amplitude	Pre-amplification	OFF
Amplitude	Impedance	50Ω
Bandwidth	RF resolution bandwidth	Auto /1.9kHz
Bandwidth	AF resolution bandwidth	Auto /200Hz
Bandwidth	Demodulated bandwidth	20kHz
Sweep	Demodulated window sweep time	2ms
Sweep	Demodulation time	Auto /72ms
Sweep	Sweep/measurement	Continuous
Marker	Select marker	Marker 1
Marker	Mark mode	Normal

Marker	Mark trace	RF Spectrum
Marker	Relative to	Marker 2
Marker	Marker list	OFF
Measurement	Measurement mode	Modulated amplitude
Measurement Setup	Number of average/hold times	ON/10
Measurement Setup	Audio play	OFF
Measurement Setup	Low-pass filter	OFF
Measurement Setup	High-pass filter	OFF
Measurement Setup	Band-pass filter	OFF

Note: This table shows the parameters of UTS3000B after reset

## System Setting (System)

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 3-4.

The screenshot shows the UNI-T web interface. At the top, there is a navigation bar with the UNI-T logo and a 'Sign Out' button. Below the navigation bar, there are several menu items: Home, Instrument Control, LAN Config, Password Set, SCPI Command, Service & Support, and Help. The main content area is divided into three sections: Basic Info, LAN Info, and Notice. Each section contains a table of key-value pairs.

Basic Info	
Manufacturer	UNI-TREND
Model	UTSxxxx
Serial Number	ASAS018540207
Firmware Version	V1.03.00420Dev_commit

LAN Info	
IP Address	192.168.21.30
Mask	255.255.255.255
Gateway	192.168.20.1
MAC	74-FE-40-87-52-4B

Notice	
Browser Require	The browser needs to support websocket. It is recommended to use chrome V102.0.5005.115 and above
Network Bandwidth Require	>100Mbps
Max Connection	1
Display Device Require	1080p LCD recommended

Figure 3-4 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 3-5.



Figure 3-5 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

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`.

## (3) Network Setting

Modify the network and Frp agent network information of signal analyzer, as shown in the following Figure 3-6.

The screenshot displays the UNI-T web interface with a navigation bar at the top containing 'Home', 'Instrument Control', 'LAN Config', 'Password Set', 'SCPI Command', 'Service & Support', and 'Help'. The 'LAN Config' section is active, showing a 'Type' dropdown menu set to 'DHCP'. Below this is a table for LAN configuration with the following data:

Item	Value
IP	192.168.21.30
Mask	255.255.255.255
Gateway	192.168.20.1

Buttons for 'Modify LAN Config' and 'Confirm' are located below the table. The 'Frp Proxy Info' section follows, with a table containing the following data:

Item	Value
Frp IP	121.37.220.55
Web Port	9000
Pic Port	9002
Ctrl Port	9001

Buttons for 'Modify Frp Proxy', 'Query Frp Used Port', and 'Confirm' are located below this table.

Figure 3-6 Web Network Setting

#### (4) Password Setting

Modify Web login password of the signal analyzer, as shown in the following Figure 3-7, the original password can be viewed under Physical Instruments->System->Setting->Interface Settings.

Item	Value
Old Password	<input type="text"/>
New Password	<input type="text"/>
Confirm New Password	<input type="text"/>

Figure 3-7 Web Password Setting

(5) SCPI

Execute the SCPI command, as shown in the following Figure 3-8, 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.

SCPI Command

\*idn?

UNI-TREND, UTSxxxx, ASAS016540207, V1.03.0042/Dev\_commit

Figure 3-8 SCPI Control

**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 (File)

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 **[Save]** to enter the storage interface, the instrument can save the status file. Long press this key to screenshot.

**Status:** Press status panel menu to enter save status menu. The status can save in the instrument.

1. Press **Export** key, the instrument will save the current status with the default filename or input filename.
2. After select the status file, press **Import** key to read the current status file.

**Export:** Export the currently selected file.

**Import:** Import the currently selected file data. This key is hidden when no file is selected.

## Screen Lock (Touch Lock)

**[Touch Lock]** key, if the key indicator is red which means the lock function is locked. The indicator

is light off which means the lock function is enabled.

## Mode (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.

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

### Note

- This button is designed for the UTS5000A series and UTS7000A series models.
- For UTS3000B/T, UTS3000A, UTS1000B/T series models, **[Mode]** and **[Meas]** are two separate keys. Press the **[Meas]** key, 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. Press the **[Mode]** key, spectrum analysis, EMI, analog demodulation, vector signal analysis, real-time spectrum analysis, IQ Analyzer.

## 4. 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

- a. Please use a soft cloth to wipe the dust outside the instrument.
- b. When cleaning the LCD screen, please pay attention and protect the transparent LCD screen.
- c. 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.
- d. 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.**

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