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Signal Analyzers

Phase Noise Analysis

User Manual

This manual applies to:

UTS7000A Series

UTS5000A Series

UTS3000A Series

V 1.0

March , 2026

Foreword

Thank you for choosing this UNI-T instrument. For safe and proper use this instrument, please read this manual carefully, especially the safety instructions section.

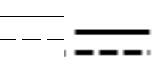
After reading this manual, it is recommended to keep the manual in a convenient location, preferably near the device, for future reference.

Safety Information

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

Safety Precautions

Safety Precautions		
Warning		Please follow these guidelines to avoid possible electric shock and risk to personal safety.
		Users must adhere to standard safety precautions during the operation, servicing, 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. 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.
Safety Statements		
Warning		“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.
Caution		“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.
Note		“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.
Safety Signs		
	Danger	It indicates danger of electric shock, which may cause personal injury or death.

	Warning	It indicates that there are factors you should be cautious of to prevent personal injury or product damage.
	Caution	It indicates danger, which may cause damage to this device or other equipment if you fail to follow a certain procedure or condition. If the “Caution” sign is present, all conditions must be met before you proceed to operation.
	Note	It indicates potential problems, which may cause failure of this device if you fail to follow a certain procedure or condition. If the “Note” sign is present, all conditions must be met before this device will function properly.
	AC	Alternating current of device. Please check the region's voltage range.
	DC	Direct current device. Please check the region's voltage range.
	Grounding	Frame and chassis grounding terminal
	Grounding	Protective grounding terminal
	Grounding	Measurement grounding terminal
	OFF	Main power off
	ON	Main power on
	Power	Standby power supply: When the power switch is turned off, this device is not completely disconnected from the AC power supply.
CAT I	Secondary electrical circuit connected to wall sockets through transformers or similar equipment, such as electronic instruments and electronic equipment with protective measures, and any high-voltage and low-voltage circuits, such as the copier in the office.	
CAT II	Primary electrical circuit of the electrical equipment connected to the indoor socket via the power cord, such as mobile tools, home appliances, etc. Household appliances, portable tools (e.g., electric drill), household sockets, sockets more than 10 meters away from CAT III circuit or sockets more than 20 meters away from CAT IV circuit.	
CAT III	Primary circuit of large equipment directly connected to the distribution board and circuit between the distribution board and the socket (three-phase distributor circuit includes a single commercial lighting circuit). Fixed equipment, such as multi-phase motor and multi-phase fuse box; lighting equipment and lines inside large buildings; machine tools and power distribution boards at industrial sites (workshops).	
CAT IV	Three-phase public power unit and outdoor power supply line equipment.	

		Equipment designed to “initial connection,” such as power distribution system of power station, power instrument, front-end overload protection, and any outdoor transmission line.
	Certification	CE indicates a registered trademark of EU.
	Certification	UKCA indicates a registered trademark of United Kingdom.
	Certification	Conforms to UL STD 61010-1 and 61010-2-030. Certified to CSA STD C22.2 No.61010-1 and 61010-2-030.
	Waste	Do not place equipment and accessories in the trash. Items must be properly disposed of in accordance with local regulations.
	EEUP	This environment-friendly use period (EFUP) mark indicates that dangerous or toxic substances will not leak or cause damage within this indicated time period. The 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.
Safety Requirements		
Warning		
Preparation before use		Please connect this device to AC power supply with the power cable provided. The AC input voltage of the line reaches the rated value of this device. See the product manual for specific rated value. The line voltage switch of this device matches the line voltage. The line voltage of the line fuse of this device is correct. This device is not intended for measuring the main circuit.
Check all terminal rated values		Please check all rated values and marking instructions on the product to avoid fire and the impact of excessive current. Please consult the product manual for detailed rated values before connection.
Use the power cord properly		Users can only use the special power cord for the instrument approved by the local and state standards. Please check whether the insulation layer of the cord is damaged, or the cord is exposed, and test whether the cord is conductive. If the cord is damaged, please replace it before using the instrument.
Instrument Grounding		To avoid electric shock, the grounding conductor must be connected to the ground. This product is grounded through the grounding conductor of the power supply. Please be sure to ground this product before it is powered on.
AC power supply		Please use the AC power supply specified for this device. Please use the power cord approved by your country and confirm that the insulation

	layer is not damaged.
Electrostatic prevention	This device may be damaged by static electricity, so it should be tested in the anti-static area if possible. Before the power cable is connected to this device, the internal and external conductors should be grounded briefly to release static electricity. The protection grade of this device is 4 kV for contact discharge and 8 kV for air discharge.
Measurement accessories	Measurement accessories designated as lower-grade, 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.
Use the input / output port of this device properly	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.
Power fuse	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.
Disassembly and cleaning	There are no components available for operators inside. Do not remove the protective cover. Qualified personnel must conduct maintenance.
Service environment	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 high humidity conditions.
Do not operate in humid environment	Do not use this device in a humid environment to avoid the risk of internal short circuit or electric shock.
Do not operate in flammable and explosive environment	Do not use this device in a flammable and explosive environment to avoid product damage or personal injury.
Caution	
Abnormality	If this device may be faulty, please contact the authorized maintenance personnel of UNI-T for testing. Any maintenance, adjustment or parts replacement must be done by the relevant personnel of UNI-T.
Cooling	Do not block the ventilation holes at the side and back of this device.

	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.
Safe transportation	Please transport this device safely to prevent it from sliding, which may damage the buttons, knobs, or interfaces on the instrument panel.
Proper ventilation	Insufficient ventilation will cause the device temperature to rise, thus causing damage to this device. Please keep proper ventilation during use, and regularly check the vents and fans.
Keep clean and dry	Please take precautions to prevent dust or moisture in the air affecting the performance of this device. Please keep the product surface clean and dry.
Note	
Calibration	The recommended calibration period is one year. Calibration should only be conducted by qualified personnel.

Environmental Requirements

This instrument is suitable for the following environment:

- Indoor use
- 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, operating temperature is 0 to +40°C; storage temperature is -20 to +70°C.

Operating: Humidity at temperature below to +35°C, ≤90% RH.; non-operating: Humidity at temperature from +35°C to +40°C, ≤60% RH.

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

Connecting Power Supply

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

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

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

Connecting to service cable

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

Please install the AC power cable as follows.

- Ensure the power cable is in good condition.
- Leave enough space to connect 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 damaged invisibly by electrostatic discharge during transportation, storage and use.

The following measure can reduce the damage of electrostatic discharge.

- Testing in anti-static areas as far as possible.
- Before connecting the power cable to the instrument, inner and outer conductors of the instrument should be briefly grounded to discharge static electricity.
- Ensure all the instruments are properly grounded to prevent the accumulation of static electricity.

1. User Guide

- Inspecting Package and Packing List
- Preparatory Work
- Instructions
- Touch Operation
- Help Information
- Operation Mode

Inspecting Package and Packing List

When you receive the instrument, please check the packaging and list in the following steps.

1. Check whether the packing box and padding material have been compressed or damaged by external forces and inspect the appearance of the instrument. If you have any questions about the product or need consulting services, please contact the distributor or local office.
2. Carefully take out the item from the packaging and verify it against the packing list.

Preparatory Work

1. Connect the power cable and plug it into a protected grounding outlet.
2. Press the power switch to put the signal analyzer into standby mode.
3. Press the soft switch to power on the signal analyzer.

The signal analyzer requires approximately 30 seconds to complete initialization before entering the default spectrum analysis mode. For optimal performance, it is recommended to allow the instrument to warm up for at least 45 minutes after it is powered on.

Instructions

Use External Reference Signal

If the instrument is using an external 10 MHz signal source as the reference, connect the signal source to the 10 MHz IN port on the rear panel. The measurement menu at the top of the screen will then display **Reference Frequency: External**.

Activate the Option

To activate an option, enter its license key. The required license can be purchased by contacting the UNI-T office. Follow these steps to activate a purchased option:

1. Copy the license file (provided in the accessories) to the root directory of a USB flash drive.
2. Plug the USB flash drive into the USB port on the front panel of the instrument.
3. Press the System key on the front panel to open the System Settings window.
4. Select System Information. In the Option Information table, click Add License to open the Add License dialog box.
5. Locate and select the license file on the USB drive, then check the box to confirm.
6. Upon successful activation, the status of the corresponding option in the Option Information table will update to Activated.

Touch Operation

Press the **[Touch Lock]** key to enable or disable touchscreen function.

The signal analyzer provides a variety of gesture-based operations, including:

- Tap the top-right corner of the screen to open the main menu.
- Click a parameter or menu to select or edit it.
- Move and drag the cursor.
- Use auxiliary shortcut keys to perform common operations efficiently.

Help Information

The signal analyzer includes a built-in help system that provides contextual assistance for each function button and menu control key on the front panel.

- Tap the question icon  at the bottom left of the screen to open the Help dialog box in the center of the display. Tap any supported function to view detailed help related to that feature.
- To close the Help dialog box, tap the ✕ icon or press any other key.

Operation Mode

The signal analyzer supports multiple operating modes, which can be accessed by pressing the **Mode** key:

- Spectrum Analysis
- IQ Analysis
- EMI

- Analog Demodulation
- VSA (Vector Signal Analysis)
- Phase Noise Analysis (see Chapter 4 for details)
- VNA (Vector Network Analysis, available only for UTS3000A)
- LTE FDD
- LTE TDD
- NR

The IQ Analysis, EMI, Analog Modulation, Vector Signal Analysis, Phase Noise Analysis, LTE, and NR are optional features. These functions require activation through the purchase of a corresponding license.

The key functions on the front panel may vary depending on the selected operating mode. This manual primarily introduces the user interface and key functions in phase noise analysis mode.

2. User Interface

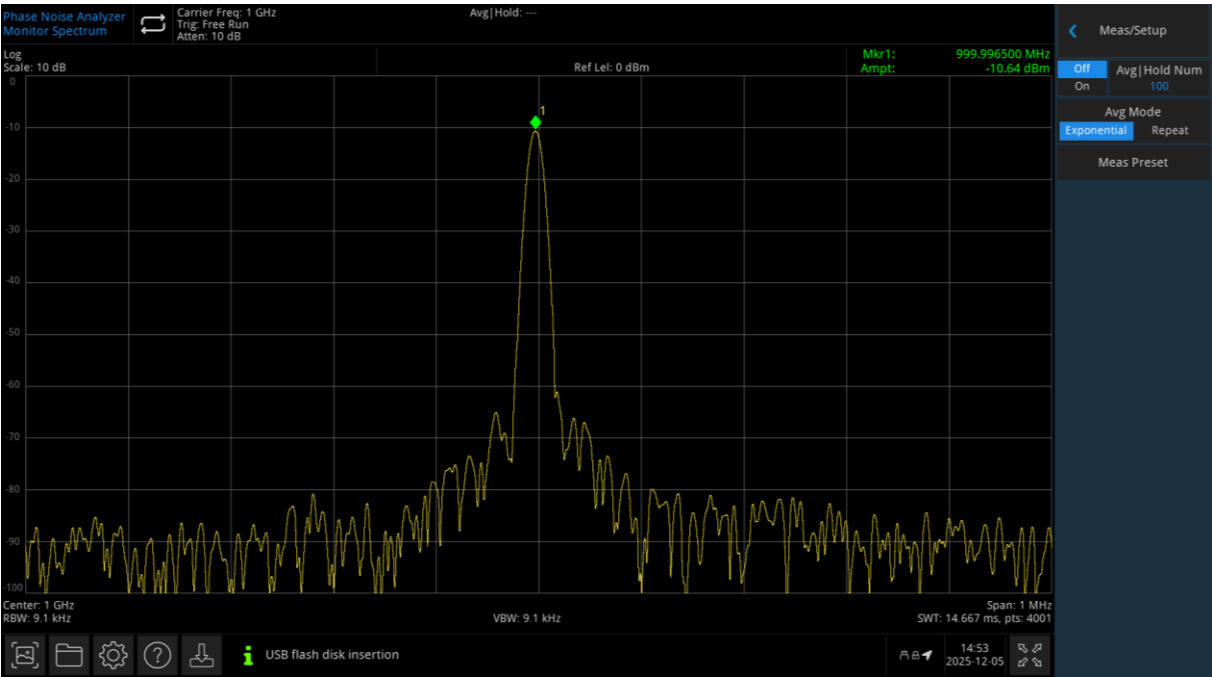


Figure 2-1 Phase Noise Analysis - Spectrum Monitor

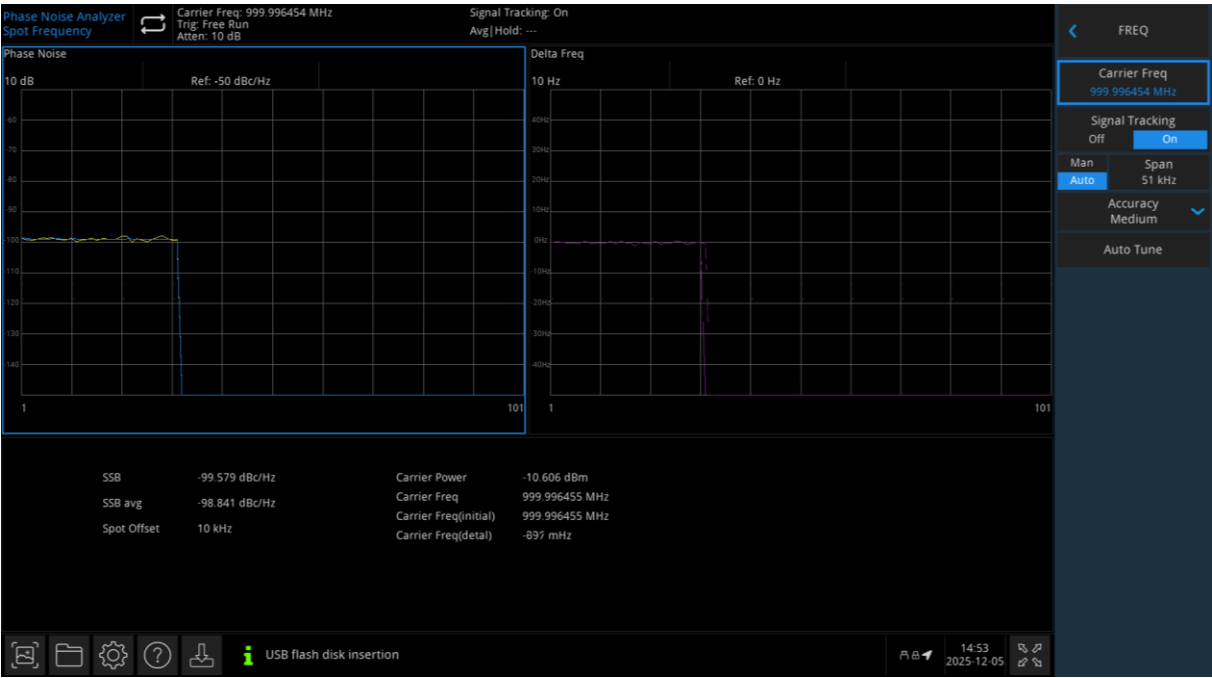


Figure 2-2 Phase Noise Analysis - Point Frequency Measurement

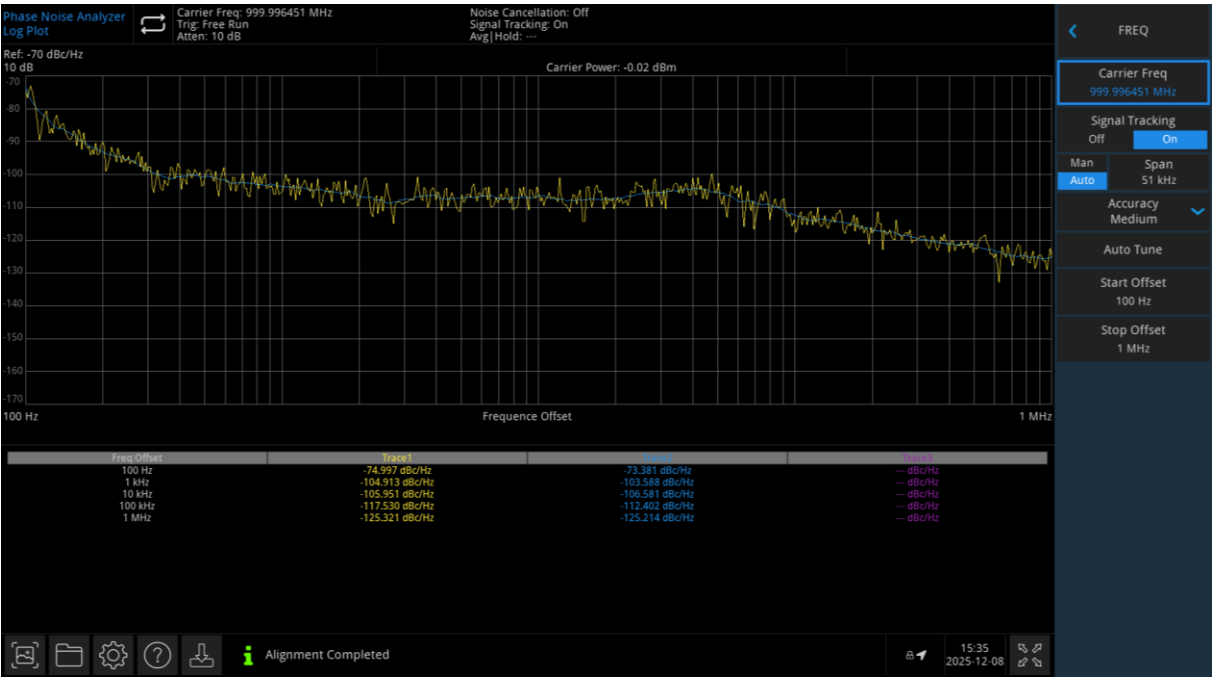


Figure 2-3 Phase Noise Analysis - Logarithmic Plot

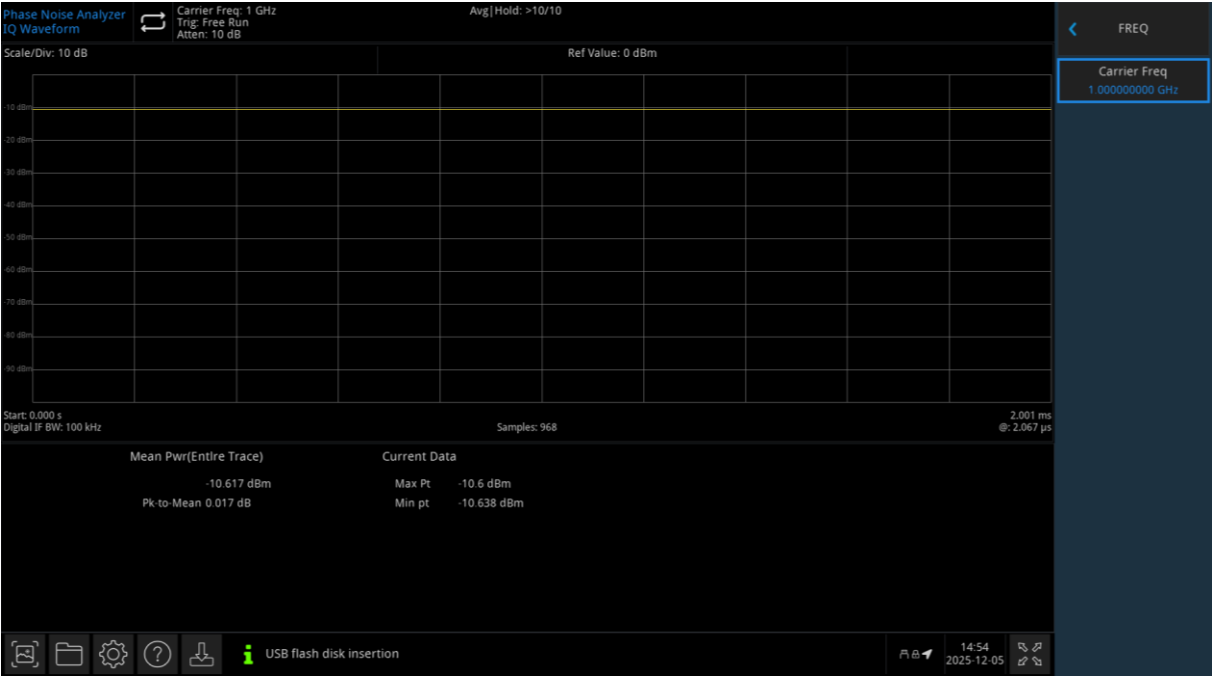


Figure 2-4 Phase Noise Analysis – IQ Waveform

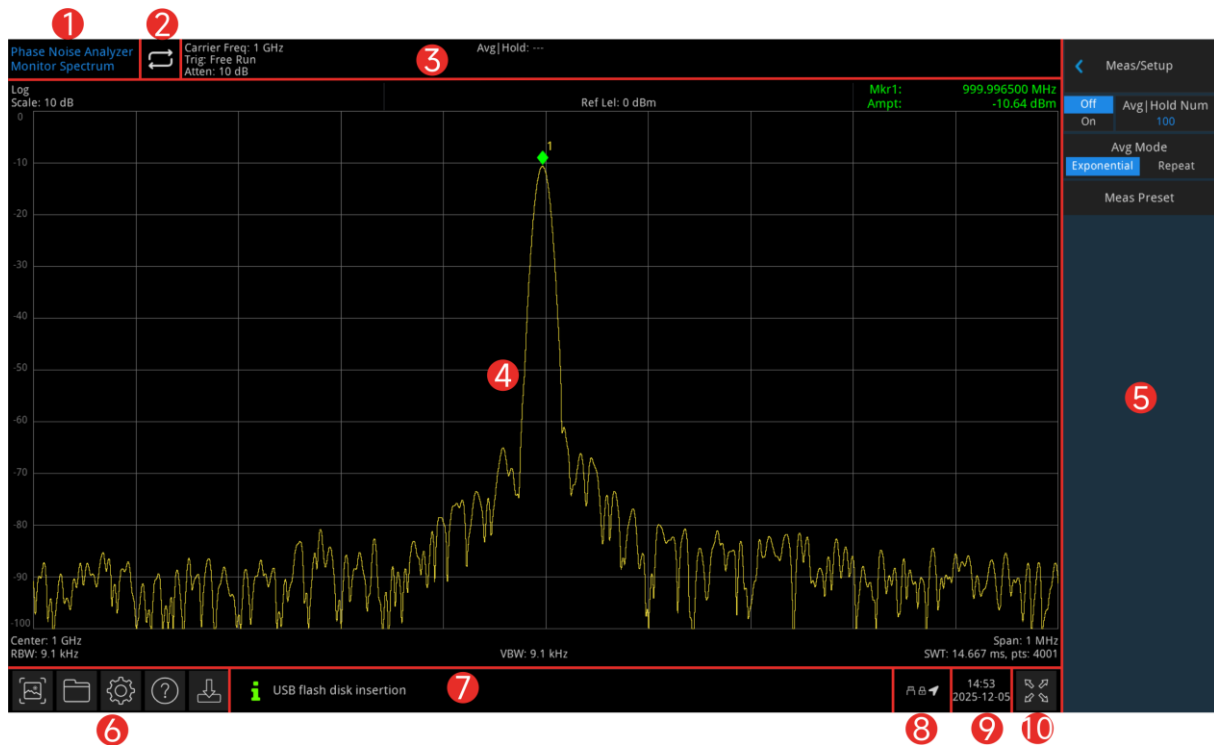


Figure 2-5 Phase Noise Analysis

1. Operation mode: Switch between phase noise analysis and various other operating modes.
2. Sweep/Measurement: Current sweep modes include Single and Continuous. Tap the on-screen icon to switch between them quickly.
3. Measurement bar: Displays measurement settings, including center frequency, trigger, attenuation, etc.
4. Measurement display area: Spectrum monitor, point frequency measurement, Logarithmic Plot, and IQ waveform.
5. Panel menu: Corresponds to the menu and function items associated with the current function keys.
6. Function settings: Quick screenshot, file system, system settings, help system, and file storage.
7. System log dialog: Tap the blank area to the right of file storage to open the system log and view the instrument's operation log, alarms, prompts, and other information.
8. Connection type: Displays connection status, including mouse, USB flash drive, screen lock, etc.
9. Date/Time: Displays the current date and time.
10. Full screen on/off: Enables full-screen display; the screen stretches horizontally, and the right-side keys are automatically hidden.

3. Function Key

- Spectrum Monitoring
- Point Frequency Measurement
- Logarithmic Plot
- IQ Waveform
- Single
- Default Setting
- System Setting
- File Management (Save)
- Touch Lock
- Mode

Note

1. This section provides descriptions for the buttons related to the four different measurement modes in phase noise analysis Mode.
2. Parameter settings and their available ranges may vary depending on the equipment model. For detailed specifications, please refer to the corresponding data sheet for each model.

Spectrum Monitoring

Frequency (FREQ)

Press the **[FREQ]** key to access the frequency function menu and configure the frequency settings.

Carrier Frequency: Activates the center frequency, configure a specific frequency at the center of the screen's horizontal axis. The center frequency can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Span: Specifies the frequency range of the sweep bandwidth. The sweep bandwidth value can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

The sweep bandwidth changes symmetrically around the center frequency. The displayed sweep

bandwidth represents the total frequency range shown on the screen.

To calculate the frequency range per horizontal division, divide the total sweep bandwidth by 10.

Full Span: Sets the signal analyzer to display the entire frequency range of the instrument.

Last Span: Restores the span to the most recently modified value.

Amplitude (AMPT)

Press the **[AMPT]** key to activate the reference level function and access the amplitude setting menu. The amplitude parameters are independent for each trace window. Select the desired trace window to modify its specific amplitude settings.

Reference Value: Press the **[AMPT]** key to activate the reference setting. The reference level can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Reference Position: Sets the Y-axis position for the reference level, which can be set to top, middle, or bottom.

Attenuation: Sets the RF front-end attenuator to allow large signals to pass through the mixer with minimal distortion (and small signals with low noise). The input attenuation can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu. Default: 10 dB.

Preamplifier (On/Off): Controls the internal preamplifier. When enabled, the instrument automatically compensates for the preamplifier gain, ensuring the displayed amplitude matches the actual input signal. Available for the low-frequency band and full-frequency band.

Scale: Sets the logarithmic value per vertical grid on the screen. The scale can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Auto Scale: Automatically adjusts the scale and reference level of the currently selected trace, ensuring it is displayed at an appropriate size for easy viewing.

Bandwidth (BW)

Press the **[BW]** key to activate the resolution bandwidth. The RBW can be set manually.

Resolution Bandwidth (Auto/Manual): Sets the resolution bandwidth (RBW) to differentiate between two signals with similar frequencies.

In manual mode, the RBW can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

When the resolution bandwidth is reduced, the sweep time is automatically adjusted to maintain amplitude accuracy. The resolution bandwidth is also related to the span: as the span decreases, the resolution bandwidth decreases accordingly.

In auto coupling mode, the video bandwidth changes together with the resolution bandwidth to maintain a constant ratio between them.

If RBW and VBW are decoupled, a "#" icon will appear next to RBW at the bottom-left corner of the screen. To re-enable coupling, press the Manual/Auto key again and select Auto.

Video Bandwidth (Auto/Manual): Sets the video bandwidth (VBW) to filter out the noise outside the video band.

In manual mode, the VBW can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu. If the input value is not a valid bandwidth, the system will automatically select the closest available bandwidth value. When the video bandwidth decreases, the system will increase the sweep time to maintain amplitude calibration.

If RBW and VBW are decoupled, a "#" icon will appear next to VBW at the bottom-left corner of the screen. To re-enable coupling, press the Manual/Auto key again and select Auto.

VBW: 3dB RBW (Auto/Manual): Selects the ratio of Video Bandwidth (VBW) to Resolution Bandwidth (RBW). When the signal and noise levels are close, resulting in a blurred signal response on the screen, the user can set the ratio to less than 1 to reduce noise. When reset with **[Default]**, the ratio is set to 1.000.

In manual mode, the ratio can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

In auto mode, the default ratio is 0.1 if the trace detector is set to Average, and 1 for other detectors.

RBW Filter Type: Two filter types are available in spectrum monitor mode: Gaussian and Flat-top. These can be switched depending on the measurement requirements.

Sweep

Press the **[Sweep]** key to access the sweep menu and configure the sweep, control, and trigger functions.

Sweep Time (Auto/Manual): Sets the time taken by the signal analyzer to sweep the displayed span (or the full-screen sweep time when the span is zero). Reducing the sweep time increases the sweep rate. In manual mode, the sweep time can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Sweep/Measurement (Single/Continuous): Sets the sweep mode to Single or Continuous.

Default: Continuous. The corresponding status of the selected mode is displayed at the top of the screen.

Continuous Sweep: The icon  on the screen indicates continuous mode. The system automatically sends a trigger initialization signal and directly enters trigger condition judgment after each sweep. This is a global setting and applies to all active traces.

Single Sweep: Press this key to perform a single sweep or measurement. The icon  indicates single-window mode. After pressing the Single key, its backlight turns on.

If the system is in single sweep mode and not measuring, pressing the key starts a sweep when trigger conditions are met.

If the system is in single sweep mode and measuring, pressing the key starts both a sweep and measurement when trigger conditions are met.

This is a global setting and applies to all active traces.

Sweep Point: Sets the number of points acquired per sweep (i.e., the number of points in the current trace). The value can be adjusted using the numeric keypad or the touch panel menu.

1. As the sweep points increase, the frequency resolution of the markers improves, but the sweep speed decreases.
2. Due to the minimum sweep point interval limitation, increasing sweep points may lengthen the sweep time.
3. Changing the sweep points affects multiple system parameters; therefore, the system will perform a new sweep and measurement.

Trace

Press the **[Trace]** key to enter the trace setting menu, which allows for control of trace acquisition, display, storage, detection, and trace data operations. Each trace consists of a series of data points containing amplitude information. With each sweep, the signal analyzer refreshes the data for all active traces.

For slower sweeps, a visual indicator appears on the trace while new data is being written: a green caret (^) symbol that moves along the bottom grid of the display at the current trace point.

Trace: Select a trace from up to three available traces.

Trace Type: Select the type for the currently active trace. The system displays the acquired data based on the selected trace type and applies to the corresponding calculation method. Available trace types include refresh, trace average, maximum hold, and minimum hold. The relevant parameter for each type is shown in the upper-right corner of the screen.

1. Refresh

Displays real-time data for each sweep of the trace.

2. Trace Average

Each trace point represents the average value over multiple sweeps. Increasing the number of sweeps results in a smoother waveform.

3. Maximum Hold

Each trace point retains the highest value recorded over multiple sweeps. The trace updates when a new maximum is detected.

4. Minimum Hold

Each trace point retains the lowest value recorded over multiple sweeps. The trace updates when a new minimum is detected.

Detector: Select the detection mode for the current measurement. The selected mode is applied to the active trace. Available detector types include sampling, peak, negative peak, normal detection, and average.

1. Sampling

Each trace point reflects the instantaneous amplitude at a fixed sampling moment (typically the first sample within each time interval). This mode is suitable for measuring noise or noise-like signals.

2. Peak

Each trace point displays the maximum value of the sampled data within the corresponding time interval.

3. Negative Peak

Each trace point displays the minimum value of the sampled data within the corresponding time interval.

4. Average

Each trace point represents the average value of the sampled data within the corresponding time interval. The effect of averaging varies depending on the signal type. The averaging method can be set using the **[Meas/Setup]** key.

Auto Detector: Enables or disables automatic detector selection for trace lines. By default, the instrument operates in automatic detection mode. If the detection type is set to manual, the auto detector function is disabled for the corresponding trace.

Refresh (On/Off): When set to On, the selected trace is cleared of any previously stored data and continuously updated with incoming signals during the signal analyzer's sweep.

When set to Off, the trace holds and displays the last captured amplitude data. The trace register is no longer updated during subsequent sweeps.

Display (On/Off): Toggles the on/off mode for the selected trace.

Marker

Press the **[Marker]** key to access the marker panel menu to select the marker type and number. A marker is a rhombic icon. Up to six markers can be displayed on the screen simultaneously, but only one marker or a pair of markers can be controlled at a time.

Select Marker: Choose one of the ten available markers. Marker 1 is selected by default. After selecting a marker, the user can configure parameters such as marker type, the trace to be marked, and the reading mode. The active marker will be placed on the trace selected in Marked Trace. The current reading of the active marker at the marked position will be displayed both in the parameter area and in the upper-right corner of the screen.

Marker Mode

1. Normal: Used to measure X-axis (frequency or time) and Y-axis (amplitude) values at a specific point on the trace. When Normal mode is selected, a cursor marked with its number (e.g., "1") will appear on the trace.

Note:

- If no cursor is active, one will automatically be placed at the center frequency of the trace.
- The current reading of the active cursor is displayed in the upper-right corner of the screen.
- The resolution of the X-axis (time or frequency) is determined by the sweep bandwidth.

Reducing sweep bandwidth improves reading resolution.

2. Difference Value Δ : Used to measure the difference in X (frequency or time) and Y (amplitude) values between a reference point and another point on the trace. When Delta mode is selected, a pair of cursors appears:
 - The reference cursor, marked with "x".
 - The delta cursor, marked with " Δ ".

3. **OFF:** Disables the selected cursor. All on-screen cursor information and related functions will be hidden.

Marked Trace: Select the trace marked by the current marker: Trace 1, Trace 2, or Trace 3.

Marker Frequency: The frequency point of the marker on the trace. The frequency can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu. When the marker mode is set to differential, the label changes to “Marker Δ Frequency”.

Relative to: Used to measure the difference between two marker points. The two markers can be placed on different traces simultaneously.

Marker (ON/OFF): Disables all markers.

Marker Function

1. **Mark Noise:** Performs noise marking at the selected cursor and displays the normalized noise power density at that point.

If the currently selected cursor is disabled in the Marker menu, pressing Mark Noise will automatically enable it in Normal mode. The system measures the average noise level at the cursor frequency and normalizes it to a 1 Hz bandwidth. Compensation is applied based on the selected detection method and trace type. For higher accuracy, it is recommended to use RMS Average or Sampling mode during noise measurements.

2. **In-band Power:** In non-zero span mode, calculate the total signal power within the specified bandwidth.
In zero span mode, calculate the average power within the defined bandwidth.
3. **In-band Density:** In non-zero span mode, in-band density is defined as the total power within the measured bandwidth divided by the measurement bandwidth.
In zero span mode, in-band density is calculated as the measured in-band power divided by Bn, where Bn refers to the noise bandwidth of the RBW filter.

Peak

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

Trigger

Trigger Type

1. **Free Run Trigger:** The trigger condition is always satisfied, meaning trigger signals are

generated continuously. No trigger condition needs to be set. A new frame sweep starts automatically after the completion of each frame sweep.

2. **Video Trigger:** A trigger signal is generated when the detected video signal voltage exceeds the set video trigger level.

Trigger Level: When the video trigger is selected, the trigger level line and its value are displayed on the screen. The trigger level can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

3. **External Trigger:** An external signal (TTL signal) is input through the **[TRIG1]** connector on the rear panel. A trigger signal is generated when the signal meets the set trigger edge condition.

Trigger Edge (Rising / Falling): Sets the trigger edge for the external trigger to either the rising or falling edge of the pulse. A trigger signal is generated when the signal meets the set trigger edge condition.

Trigger Delay Switch: Enables or disables the trigger delay function. When enabled, the trigger delay time can be set.

Trigger Delay: Sets the waiting time between the generation of a trigger signal that meets the conditions and the start of the instrument sweep. The trigger delay can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

4. **External Trigger 2:** Same as External Trigger, but input is via the **[TRIG2]** connector on the rear panel.

5. **Periodic Trigger:** When periodic trigger is selected, the analyzer uses the internal periodic timer signal as the trigger.

Trigger Period: Sets the trigger period.

Offset: Sets the offset.

Sync Source: Selects the synchronization signal input from External 1 or External 2 port.

Trigger Delay: Sets the trigger delay time.

Measurement (Meas)

Press the **[Mode/Meas]** key to access the measurement menu. There are four measurement modes available: Spectrum Monitor, Point Frequency Measurement, Logarithmic Plot, and IQ Waveform.

Measurement Setting (Meas Setup)

Press the **[Meas Setup]** key to access the measurement parameter menu.

Average/Hold Count: Sets the averaging count for the trace. The average count can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu. Increasing the averaging count reduces the impact of noise and other random signals, helping to highlight stable signal characteristics. A higher average count results in a smoother, more consistent trace.

Average Mode: Switches between Exponential and Repeat average modes. This mode determines how the signal analyzer performs averaging after the specified number of average sweeps is reached.

Exponential: After the specified number of average sweeps is completed, exponential weighting is applied to each channel trace data point, which is then combined with the previous average value for further averaging. In Exponential Average mode, new data is given higher weight than old data, which is beneficial for tracking slowly varying signals. The average result is displayed after each sweep.

Repeat: After the specified number of average sweeps is reached, all previous data is cleared, and a new sweep starts.

Measurement Preset: Resets all measurement and configuration parameters of the current measurement mode to their factory default settings.

Point Frequency Measurement

Frequency (FREQ)

Press the **[FREQ]** key to access the frequency function menu and configure the frequency settings.

Carrier Frequency: Activates the center frequency, configure a specific frequency at the center of the screen's horizontal axis. The center frequency can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Span (Auto/Manual): Used to set the span range. The span can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

The carrier signal is searched between Carrier Frequency – (Span / 2) and Carrier Frequency + (Span / 2). A smaller span results in more accurate signal tracking.

When a non-default value is set, Span Auto mode is turned OFF. When AUTO is selected, the span value returns to the default.

Auto Tune: Automatically searches for the carrier signal across the full frequency band and

optimizes frequency and amplitude parameters to achieve the best performance. One-key operation completes the signal search and automatic parameter configuration.

During the auto search, parameters such as span, reference level, scale, and input attenuation are adjusted.

Signal Tracking: Enables or disables the instrument's tracking of a slowly drifting signal.

When disabled, the instrument performs measurements at a fixed frequency. When enabled, the instrument repeatedly measures the center frequency of the carrier signal during each acquisition to detect any changes and retunes to the new frequency if necessary.

Signal tracking also controls the signal tracking view display. When disabled, the previous view is shown. Selecting any other view will disable signal tracking.

It is assumed that new acquisitions occur continuously without pausing. If acquisition is paused, the frequency drift may exceed the expectations of the tracking algorithm, and the instrument may lose the carrier frequency. In this case, users can perform an Auto Tune to locate the carrier again.

When signal tracking is ON, repeated retuning of the carrier signal results in a slightly longer measurement time compared to when it is OFF.

Precision: Sets the carrier frequency precision (difference) to high, medium, or low for signal tracking.

Amplitude (AMPT)

Press the **[AMPT]** key to activate the reference level function and access the amplitude setting menu. The amplitude parameters are independent for each trace window. Select the desired trace window to modify its specific amplitude settings.

Reference Level: Press the **[AMPT]** key to activate the reference level setting. The reference level represents the power ratio displayed by the reference grid lines on the screen. Default unit: dBc/Hz. The reference level can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Attenuation: Sets the RF front-end attenuator to allow large signals to pass through the mixer with minimal distortion (and small signals with low noise). The input attenuation can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Scale: Sets the logarithmic value per vertical grid on the screen. This function is available only when the scale type is set to logarithmic. The scale can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Auto Scale (On/Off): Automatically adjusts the scale and reference level of the currently selected trace, ensuring it is displayed at an appropriate size for easy viewing.

Bandwidth (BW)

Press the **[BW]** key to activate the resolution bandwidth. In point frequency mode, only the VBW: 3dB RBW can be configured.

VBW: 3dB RBW (Auto/Manual): Selects the ratio of Video Bandwidth (VBW) to Resolution Bandwidth (RBW). When the signal and noise levels are close, resulting in a blurred signal response on the screen, the user can set the ratio to less than 1 to reduce noise.

In manual mode, the ratio can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu. In auto mode, the default ratio is 0.1.

Sweep

Press the **[Sweep]** key to access the sweep menu and configure the sweep, control, and trigger functions.

Sweep Time (Auto/Manual): Sets the time taken by the signal analyzer to sweep the displayed span (or the full-screen sweep time when the span is zero). Reducing the sweep time increases the sweep rate. In manual mode, the sweep time can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Sweep/Measurement (Single/Continuous): Sets the sweep mode to Single or Continuous. Default: Continuous. The corresponding status of the selected mode is displayed at the top of the screen.

Continuous Sweep: The icon  on the screen indicates continuous mode. The system automatically sends a trigger initialization signal and directly enters trigger condition judgment after each sweep. This is a global setting and applies to all active traces.

Single Sweep: Press this key to perform a single sweep or measurement. The icon  indicates single-window mode. After pressing the Single key, its backlight turns on.

If the system is in single sweep mode and not measuring, pressing the key starts a sweep when trigger conditions are met.

If the system is in single sweep mode and measuring, pressing the key starts both a sweep and

measurement when trigger conditions are met.

This is a global setting and applies to all active traces.

Pause: Pauses trace sweeping.

Trigger

Trigger Type

1. **Free Run Trigger:** The trigger condition is always satisfied, meaning trigger signals are generated continuously. No trigger condition needs to be set. A new frame sweep starts automatically after the completion of each frame sweep.
2. **Video Trigger:** This mode is unavailable in the gray state.
Trigger Level: When the video trigger is selected, the trigger level line and its value are displayed on the screen. The trigger level can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.
3. **External Trigger:** An external signal (TTL signal) is input through the **[TRIG1]** connector on the rear panel. A trigger signal is generated when the signal meets the set trigger edge condition.
Trigger Edge (Rising / Falling): Sets the trigger edge for the external trigger to either the rising or falling edge of the pulse. A trigger signal is generated when the signal meets the set trigger edge condition.
Trigger Delay Switch: Enables or disables the trigger delay function. When enabled, the trigger delay time can be set.
Trigger Delay: Sets the waiting time between the generation of a trigger signal that meets the conditions and the start of the instrument sweep. The trigger delay can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.
4. **External Trigger 2:** Same as External Trigger, but input is via the **[TRIG2]** connector on the rear panel.
5. **Periodic Trigger:** When periodic trigger is selected, the analyzer uses the internal periodic timer signal as the trigger.
Trigger Period: Sets the trigger period.
Offset: Sets the offset.
Sync Source: Selects the synchronization signal input from External 1 or External 2 port.
Trigger Delay: Sets the trigger delay time.

Measurement (Meas)

Press the **[Mode/Meas]** key to access the measurement menu. There are four measurement modes available: Spectrum Monitor, Point Frequency Measurement, Logarithmic Plot, and IQ Waveform.

Measurement Setting (Meas/Setup)

Press the **[Meas Setup]** key to access the measurement parameter menu.

Average/Hold Count: Sets the averaging count for the trace. The average count can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu. Increasing the averaging count reduces the impact of noise and other random signals, helping to highlight stable signal characteristics. A higher average count results in a smoother, more consistent trace.

Average Mode: Switches between Exponential and Repeat average modes. This mode determines how the signal analyzer performs averaging after the specified number of average sweeps is reached.

Exponential: After the specified number of average sweeps is completed, exponential weighting is applied to each channel trace data point, which is then combined with the previous average value for further averaging. In Exponential Average mode, new data is given higher weight than old data, which is beneficial for tracking slowly varying signals. The average result is displayed after each sweep.

Repeat: After the specified number of average sweeps is reached, all previous data is cleared, and a new sweep starts.

Measurement Type: Phase noise and DANL are available for selection. Phase Noise indicates the short-term frequency stability of a signal, evaluating the signal purity near the ideal center frequency, and appears as noise side bands on both sides of the carrier. DANL refers to the sensitivity limit of the analyzer itself, reflecting the inherent noise floor generated by the analyzer's internal circuits, and defines the minimum signal level that the instrument can measure. Select Phase Noise if the measurement goal is to evaluate the quality of an oscillator or signal source and verify its spectral purity. Select DANL if you want to check the instrument's sensitivity, or confirm whether an extremely weak signal will be buried by the instrument's noise floor before measurement.

Point Frequency Offset: Specifies the frequency offset for phase noise measurements.

Measurement Preset: Resets all measurement and configuration parameters of the current measurement mode to their factory default settings.

Logarithmic Plot

Frequency (FREQ)

Press the **[FREQ]** key to access the frequency function menu and configure the frequency settings.

Carrier Frequency: Activates the center frequency, configure a specific frequency at the center of the screen's horizontal axis. The center frequency can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Span (Auto/Manual): Used to set the span range. The span can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

The carrier signal is searched between Carrier Frequency – (Span / 2) and Carrier Frequency + (Span / 2). A smaller span results in more accurate signal tracking.

When a non-default value is set, Span Auto mode is turned OFF. When AUTO is selected, the span value returns to the default.

Start Offset: Sets the start frequency offset for the logarithmic plot, relative to the carrier frequency on the upper sideband. The start frequency offset can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Stop Offset: Sets the stop frequency offset for the logarithmic plot, relative to the carrier frequency on the upper sideband. The stop frequency offset can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Auto Tune: Automatically searches for the carrier signal across the full frequency band and optimizes frequency and amplitude parameters to achieve the best performance. One-key operation completes the signal search and automatic parameter configuration.

During the auto search, parameters such as span, reference level, scale, and input attenuation are adjusted.

Signal Tracking: Enables or disables the instrument's tracking of a slowly drifting signal.

When disabled, the instrument performs measurements at a fixed frequency. When enabled, the instrument repeatedly measures the center frequency of the carrier signal during each acquisition to detect any changes and retunes to the new frequency if necessary.

Signal tracking also controls the signal tracking view display. When disabled, the previous view is

shown. Selecting any other view will disable signal tracking.

It is assumed that new acquisitions occur continuously without pausing. If acquisition is paused, the frequency drift may exceed the expectations of the tracking algorithm, and the instrument may lose the carrier frequency. In this case, users can perform an Auto Tune to locate the carrier again.

When signal tracking is ON, repeated retuning of the carrier signal results in a slightly longer measurement time compared to when it is OFF.

Precision: Sets the carrier frequency precision (difference) to high, medium, or low for signal tracking.

Amplitude (AMPT)

Press the **[AMPT]** key to activate the reference level function and access the amplitude setting menu.

Reference level: Press the **[AMPT]** key to activate the reference level setting. The reference level represents the power ratio displayed by the reference grid lines on the screen. Default unit: dBc/Hz. The reference level can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Attenuation: Sets the RF front-end attenuator to allow large signals to pass through the mixer with minimal distortion (and small signals with low noise). The input attenuation can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Scale: Sets the logarithmic value per vertical grid on the screen. This function is available only when the scale type is set to logarithmic. The scale can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Reference Position: Sets the reference position to top, middle, or bottom.

Sweep

Press the **[Sweep]** key to access the sweep menu and configure the sweep, control, and trigger functions.

Sweep/Measurement (Single/Continuous): Sets the sweep mode to Single or Continuous.

Default: Continuous. The corresponding status of the selected mode is displayed at the top of the screen.

Continuous Sweep: The icon  on the screen indicates continuous mode. The system automatically sends a trigger initialization signal and directly enters trigger condition judgment after each sweep. This is a global setting and applies to all active traces.

Single Sweep: Press this key to perform a single sweep or measurement. The icon  indicates single-window mode. After pressing the Single key, its backlight turns on.

If the system is in single sweep mode and not measuring, pressing the key starts a sweep when trigger conditions are met.

If the system is in single sweep mode and measuring, pressing the key starts both a sweep and measurement when trigger conditions are met.

This is a global setting and applies to all active traces.

Trace

Press the **[Trace]** key to enter the trace setting menu, which allows control of trace acquisition, display, storage, detection, and trace data operations. Each trace consists of a series of data points containing amplitude information. With each sweep, the signal analyzer refreshes the data for all active traces.

For slower sweeps, a visual indicator appears on the trace while new data is being written: a green caret (^) symbol that moves along the bottom grid of the display at the current trace point.

Trace: Select a trace from up to three available traces.

Trace Type: Select the type for the currently active trace. The system displays the acquired data based on the selected trace type and applies to the corresponding calculation method. Available trace types include refresh and average.

Copy/Swap: Sets the current trace to be copied or swapped with another trace. After copying or swapping, the target trace update state is set to Off.

Copy from trace: Specifies the trace to be copied or swapped.

To trace: Specifies the trace to receive the copy or swap.

Copy now: Copies the source trace to the destination trace.

Swap now: Swaps the source trace with the destination trace.

Marker

Press the **[Marker]** key to access the marker panel menu to select the marker type and number. Up

to six markers can be displayed on the screen simultaneously, but only one marker or a pair of markers can be controlled at a time.

Select Marker: Choose one of the ten available markers. Marker 1 is selected by default. After selecting a marker, the user can configure parameters such as marker type, the trace to be marked, and the reading mode. The active marker will be placed on the trace selected in Marked Trace. The current reading of the active marker at the marked position will be displayed both in the parameter area and in the upper-right corner of the screen.

Marker Mode

1. Normal: Used to measure X-axis (frequency or time) and Y-axis (amplitude) values at a specific point on the trace. When Normal mode is selected, a cursor marked with its number (e.g., "1") will appear on the trace.

Note:

- If no cursor is active, one will automatically be placed at the center frequency of the trace.
- The current reading of the active cursor is displayed in the upper-right corner of the screen.
- The resolution of the X-axis (time or frequency) is determined by the sweep bandwidth.

Reducing sweep bandwidth improves reading resolution.

2. Difference Value Δ : Used to measure the difference in X (frequency or time) and Y (amplitude) values between a reference point and another point on the trace. When Delta mode is selected, a pair of cursors appears:
 - The reference cursor, marked with "x".
 - The delta cursor, marked with " Δ ".
3. OFF: Disables the selected cursor. All on-screen cursor information and related functions will be hidden.

Marked Trace: Select the trace marked by the current marker: Trace 1, Trace 2, or Trace 3.

Relative to: Used to measure the difference between two marker points. The two markers can be placed on different traces simultaneously.

Marker (ON/OFF): Disables all markers.

Marker Function: Noise angle, Noise Radian, Noise Jitter, Noise dBc, Residual FM (Weighted Integration), and Average Noise Density.

Marker List (ON/OFF): Enable or disable the marker list.

When the marker list is enabled, all active markers are displayed in a list format in the lower split window. The displayed information includes marker number, marker mode, marked trace number, X-axis scale type, X-axis reading, and amplitude. The marker list allows for viewing measured values at multiple measurement points.

Peak

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

Next Peak: Finds the peak with the second-highest amplitude that meets the search criteria and marks it with the marker. If no such peak exists, the marker remains at its current position.

Next Peak on the Left: Finds the closest qualifying peak to the left of the current peak and marks it with the marker.

Next Peak on the Right: Finds the closest qualifying peak to the right of the current peak and marks it with the marker.

Trigger

Trigger Type: Trigger types include: Free Run Trigger, External Trigger, IF Power Trigger, and Frequency Mask Template (FMT) Trigger.

1. **Free Run Trigger:** The trigger condition is always satisfied, meaning trigger signals are generated continuously. No trigger condition needs to be set. A new frame sweep starts automatically after the completion of each frame sweep.

2. **Video Trigger:** This mode is unavailable in the gray state.

Trigger Level: When the video trigger is selected, the trigger level line and its value are displayed on the screen. The trigger level can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

3. **External Trigger:** An external signal (TTL signal) is input through the **[TRIG1]** connector on the rear panel. A trigger signal is generated when the signal meets the set trigger edge condition.

Trigger Edge (Rising / Falling): Sets the trigger edge for the external trigger to either the rising or falling edge of the pulse. A trigger signal is generated when the signal meets the set trigger edge condition.

Trigger Delay Switch: Enables or disables the trigger delay function. When enabled, the trigger delay time can be set.

Trigger Delay: Sets the waiting time between the generation of a trigger signal that meets the

conditions and the start of the instrument sweep. The trigger delay can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

4. **External Trigger 2:** Same as External Trigger, but input is via the **【TRIG2】** connector on the rear panel.
5. **Periodic Trigger:** When periodic trigger is selected, the analyzer uses the internal periodic timer signal as the trigger.

Trigger Period: Sets the trigger period.

Offset: Sets the offset.

Sync Source: Selects the synchronization signal input from External 1 or External 2 port.

Trigger Delay: Sets the trigger delay time.

Measurement (Meas)

Press the **【Mode/Meas】** key to access the measurement menu. There are four measurement modes available: Spectrum Monitor, Point Frequency Measurement, Logarithmic Plot, and IQ Waveform.

Measurement Setting (Meas Setup)

Press the **【Meas Setup】** key to access the measurement parameter menu.

Average/Hold Count: Sets the averaging count for the trace. The average count can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu. Increasing the averaging count reduces the impact of noise and other random signals, helping to highlight stable signal characteristics. A higher average count results in a smoother, more consistent trace.

Average Mode: Switches between Exponential and Repeat average modes. This mode determines how the signal analyzer performs averaging after the specified number of average sweeps is reached.

Exponential: After the specified number of average sweeps is completed, exponential weighting is applied to each channel trace data point, which is then combined with the previous average value for further averaging. In Exponential Average mode, new data is given higher weight than old data, which is beneficial for tracking slowly varying signals. The average result is displayed after each sweep.

Repeat: After the specified number of average sweeps is reached, all previous data is cleared, and a new sweep starts.

Smoothness: Sets the flatness and the amount of smoothing applied after measurement. The

smoothing function is much faster than filtering; however, it may introduce errors if the noise varies rapidly with frequency or if discrete signals are present.

Changing this parameter forces the recalculation of the smoothed trace based on the original trace, which in turn forces the recalculation of all results. A full restart is not required.

Reduction:

Noise Reduction: Enabling noise reduction suppresses the noise floor or extraneous noise in the measurement system, thereby improving the measurement accuracy of the true phase noise performance of the signal under test (e.g., oscillators, clock sources, etc.). It can be turned on or off by clicking the toggle switch.

Reference Trace: Select a trace as the reference. In subsequent measurements, the measurement results containing the signal under test are compared with this trace in real time. Portions that match the reference trace are identified as the instrument's own noise.

Threshold: Serves as the sensitivity threshold for noise reduction, in dB. When measuring the current trace, a comparison is made with the reference trace. When the difference exceeds the threshold, the energy at that frequency point is determined to originate mainly from the real external signal under test and is therefore retained. When the difference is less than or equal to the set threshold, the analyzer judges the energy at that frequency point to be highly similar to the reference trace, most likely instrument noise, and performs reduction to subtract it from the final result.

The threshold should be adjusted according to actual measurement requirements. An excessively high threshold may cause real signals or low-amplitude signals to be misidentified as noise and erroneously removed, resulting in loss of useful information. An excessively low threshold leads to overly sensitive analysis that cannot effectively identify and remove noise, leaving residual instrument noise and degrading measurement accuracy.

Advanced

AM Suppression: Enable/disable the AM (amplitude modulation) noise suppression function.

By enabling this function, the measurement system distinguishes and suppresses amplitude noise (AM noise) in the signal, thereby accurately extracting the pure phase noise.

Overdrive: Improves the signal-to-noise ratio of the signal received by the instrument, optimizing its own noise floor so that weak signals originally buried in the instrument noise floor can be measured clearly.

Overdrive Mechanical Attenuation: Controls whether the mechanical attenuator at the analyzer input is inserted into the signal path. The mechanical attenuator is a physical, high-precision

attenuation component inside the instrument used to reduce excessive input signals to a level that can be safely processed by subsequent circuits such as the mixer. When the Overdrive Mechanical Attenuation switch is enabled or in a specific state, it may bypass this mechanical attenuator, providing a signal path with lower attenuation and lower noise, thus enabling overdrive operation.

Allow 0 dB Attenuation: Enables or disables setting the input attenuation to 0 dB. When Allow 0 dB Attenuation is off, the analyzer typically enforces a minimum attenuation value (such as 10 dB) to ensure measurement accuracy and device safety. When this switch is on, the input attenuation can be reduced to 0 dB. This represents the maximum overdrive condition, where no additional attenuation is applied to the input signal, allowing the signal to enter the mixer at maximum power for highest sensitivity.

Note

Enabling Overdrive Mechanical Attenuation, especially Allow 0 dB Attenuation, removes protection for the instrument's front-end circuitry. Excessively high input power can cause permanent damage to critical components such as the mixer. Therefore, this function should be used with caution only when the signal under test is confirmed to be very weak and well below the instrument's maximum safe input level. For general measurements or when signal power is unknown, keep these switches off.

Measurement Preset: Resets all measurement and configuration parameters of the current measurement mode to their factory default settings.

IQ Waveform

Frequency (FREQ)

Press the **[FREQ]** key to enter the frequency function menu, which contains controls for setting the instrument frequency and channel parameters.

Carrier Frequency: Activates the center frequency, configure a specific frequency at the center of the screen's horizontal axis. The center frequency can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Amplitude (AMPT)

Press the **[AMPT]** key to activate the reference level function and access the amplitude setting menu.

Reference Level: Press the **[AMPT]** key to activate the reference level setting. The reference level represents the power ratio displayed by the reference grid lines on the screen. Default unit: dBc/Hz. The reference level can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Attenuation: Sets the RF front-end attenuator to allow large signals to pass through the mixer with minimal distortion (and small signals with low noise). The input attenuation can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Scale: Sets the logarithmic value per vertical grid on the screen. This function is available only when the scale type is set to logarithmic. The scale can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.

Auto Scale: Automatically adjusts the scale and reference level of the currently selected trace, ensuring it is displayed at an appropriate size for easy viewing.

Reference Position: Sets the Y-axis position for the reference level, which can be set to top, middle, or bottom.

Bandwidth (BW)

Press the **[BW]** key to activate the resolution bandwidth function. The Digital IF BW function controls the filter bandwidth and filter type. Two filter types are available: Gaussian and Flattop. The response curve of the Gaussian filter is parabolic on a logarithmic scale, while the shape of the Flattop filter approximates that of a rectangular filter.

Digital IF Bandwidth: Sets the effective bandwidth for the instrument digital IF signal sampling.

Filter Type: Sets the filter type to Gaussian or Flattop.

Sweep

Press the **[Sweep]** key to access the sweep menu and configure the sweep, control, and trigger functions.

Pause: Pauses sweep measurement.

Trigger

Trigger Type: Trigger types include: Free Run Trigger, External Trigger, IF Power Trigger, and Frequency Mask Template (FMT) Trigger.

1. **Free Run Trigger:** The trigger condition is always satisfied, meaning trigger signals are generated continuously. No trigger condition needs to be set. A new frame sweep starts automatically after the completion of each frame sweep.
2. **Video Trigger:** This mode is unavailable in the gray state.
Trigger Level: When the video trigger is selected, the trigger level line and its value are displayed on the screen. The trigger level can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.
3. **External Trigger:** An external signal (TTL signal) is input through the **[TRIG1]** connector on the rear panel. A trigger signal is generated when the signal meets the set trigger edge condition.
Trigger Edge (Rising / Falling): Sets the trigger edge for the external trigger to either the rising or falling edge of the pulse. A trigger signal is generated when the signal meets the set trigger edge condition.
Trigger Delay Switch: Enables or disables the trigger delay function. When enabled, the trigger delay time can be set.
Trigger Delay: Sets the waiting time between the generation of a trigger signal that meets the conditions and the start of the instrument sweep. The trigger delay can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu.
4. **External Trigger 2:** Same as External Trigger, but input is via the **[TRIG2]** connector on the rear panel.
5. **Periodic Trigger:** When periodic trigger is selected, the analyzer uses the internal periodic timer signal as the trigger.
Trigger Period: Sets the trigger period.
Offset: Sets the offset.
Sync Source: Selects the synchronization signal input from External 1 or External 2 port.
Trigger Delay: Sets the trigger delay time.

Marker

Press the **[Marker]** key to access the marker panel menu to select the marker type and number. A marker is a rhombic icon. Up to six markers can be displayed on the screen simultaneously, but only one marker or a pair of markers can be controlled at a time.

Select Marker: Choose one of the ten available markers. Marker 1 is selected by default. After selecting a marker, the user can configure parameters such as marker type, the trace to be marked, and the reading mode. The active marker will be placed on the trace selected in Marked Trace. The

current reading of the active marker at the marked position will be displayed both in the parameter area and in the upper-right corner of the screen.

Marker Mode

1. Normal: Used to measure X-axis (frequency or time) and Y-axis (amplitude) values at a specific point on the trace. When Normal mode is selected, a cursor marked with its number (e.g., "1") will appear on the trace.

Note:

- If no cursor is active, one will automatically be placed at the center frequency of the trace.
- The current reading of the active cursor is displayed in the upper-right corner of the screen.
- The resolution of the X-axis (time or frequency) is determined by the sweep bandwidth.

Reducing the sweep bandwidth improves the reading resolution.

2. Difference Value Δ : Used to measure the difference in X (frequency or time) and Y (amplitude) values between a reference point and another point on the trace. When Delta mode is selected, a pair of cursors appears:
 - The reference cursor, marked with "x".
 - The delta cursor, marked with " Δ ".
3. OFF: Disables the selected cursor. All on-screen cursor information and related functions will be hidden.

Marker Frequency/Time: The frequency point of the marker on the trace. The frequency can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu. When the marker mode is set to differential, the label changes to "Marker Δ Frequency". When the marker is set to power time marker, the marker indicates time.

Relative to: Used to measure the difference between two marker points. The two markers can be placed on different traces simultaneously.

Marker (ON/OFF): Disables all markers.

Marker Function

1. Mark Noise: Performs noise marking at the selected cursor and displays the normalized noise power density at that point.

If the currently selected cursor is disabled in the Marker menu, pressing Mark Noise will automatically enable it in Normal mode. The system measures the average noise level at the cursor's frequency and normalizes it to a 1 Hz bandwidth. Compensation is applied based on the

selected detection method and trace type. For higher accuracy, it is recommended to use RMS Average or Sampling mode during noise measurements.

2. In-band Power: In non-zero span mode, calculate the total signal power within the specified bandwidth.

In zero span mode, calculate the average power within the defined bandwidth.

3. In-band Density: In non-zero span mode, in-band density is defined as the total power within the measured bandwidth divided by the measurement bandwidth.

In zero span mode, in-band density is calculated as the measured in-band power divided by B_n , where B_n refers to the noise bandwidth of the RBW filter.

Peak

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

Next Peak: Finds the peak with the second-highest amplitude that meets the search criteria and marks it with the marker. If no such peak exists, the marker remains at its current position.

Minimum Peak: Finds the minimum amplitude on the trace and marks it with the cursor.

Measurement (Meas)

Press the **[Mode/Meas]** key to access the measurement menu. There are four measurement modes available: Spectrum Monitor, Point Frequency Measurement, Logarithmic Plot, and IQ Waveform.

Measurement Setting (Meas Setup)

Press the **[Meas Setup]** key to access the measurement parameter menu.

Average/Hold Count: Sets the averaging count for the trace. The average count can be adjusted using the numeric keypad, rotary knob, arrow keys, or touch panel menu. Increasing the averaging count reduces the impact of noise and other random signals, helping to highlight stable signal characteristics. A higher average count results in a smoother, more consistent trace.

Average Mode: Switches between Exponential and Repeat average modes. This mode determines how the signal analyzer performs averaging after the specified number of average sweeps is reached.

Exponential: After the specified number of average sweeps is completed, exponential weighting is applied to each channel trace data point, which is then combined with the previous average value

for further averaging. In Exponential Average mode, new data is given higher weight than old data, which is beneficial for tracking slowly varying signals. The average result is displayed after each sweep.

Repeat: After the specified number of average sweeps is reached, all previous data is cleared, and a new sweep starts.

Average Type

1. Log Power Averaging: Log Power Averaging takes the average of the logarithmic amplitude values (in dB) of the signal envelope measured within one signal bin. The average detection type changes to video detection.

For random noise: $\text{Log Average} = \text{Power Average} - 2.5 \text{ dB} = \text{Voltage Average} - 1.45 \text{ dB}$

This method lowers the displayed noise level (not the true noise level), making it suitable for observing low-power narrowband signals, especially those near the noise floor.

2. Power Averaging: Power Averaging takes the average of the signal power (the square of the amplitude). The average detection type changes to RMS (Power) Detection. Power averaging represents the true power for noise and is most suitable for measuring the real-time power of complex signals.

3. Voltage Averaging: Voltage Averaging takes the average of the voltage values of the signal envelope measured within one signal bin. The average detection type changes to voltage detection.

Voltage averaging uses a linear display and is suitable for observing the rise and fall characteristics of AM or pulse-modulated signals (e.g., radar, TDMA transmitters).

Measurement Time: Sets the duration of the measurement.

Measurement Preset: Resets all measurement and configuration parameters of the current measurement mode to their factory default settings.

Single

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

Default Setting

Press the **[Default]** key to quickly restore the system to a clean, ready-to-measure state.

Press **[Default] > Factory Setting**. The system will then reset according to the following steps:

1. Reset the phase noise analysis mode of the signal analyzer.
2. Open the frequency menu.
3. Reset the specified parameter to their default values.
4. Execute the processor test without affecting the calibration data.
5. Clear input and output cache and all trace data.

System Setting

Press the **[System]** key to enter the setup menu. This menu provides access to system information, basic settings, and network settings of the signal analyzer.

System Information: Access the system information panel menu to view basic and optional information.

1. **Basic Information:** Includes product name, manufacturer, product model, serial number, software version, intermediate frequency (IF) hardware version, radio frequency (RF) hardware version, IF logic version, RF logic version, and other relevant details.
2. **Option Information:** Displays the version number and status of installed options.

Setting: Access the Setup panel to configure basic network settings.

1. **Basic Setting**

Language: Simplified Chinese, English, German.

Time Format: Select 12-hour or 24-hour format.

Date/Time: Tap this area to open the system time setting window. Slide up or down to adjust the date and time, then tap ✓ to confirm the settings.

Picture Format: Select the screenshot file format. Available options include BMP, JPEG, and PNG.

Power-on Parameter: Choose the system parameter settings to load upon startup. Available options include Default, Previous, and Preset.

Backlight: Adjust the screen backlight by moving the slider.

Sound: Adjust the sound volume using the slider.

HDMI: Enable or disable the HDMI interface by checking or unchecking the box. A checked ☐ indicates that the interface is enabled.

Screenshot Inverse Color: Enable or disable color inversion for screenshots.

Preset File: When the power-on parameter is set to Preset, this configuration file will be used to initialize the instrument settings at startup.

Power Off: When the power switch is set to Power Off, a confirmation window will appear.

2. Network Setting

Adopter: LAN switch. Check the box ☐ to enable LAN.

DHCP: Check the box ☐ to enable DHCP. If unchecked, manual IP configuration is required.

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 the 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 the 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 the 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. Interface Settings

Web Login Username: Set the username for browser login. Access the instrument via the web address `http://IP:9000`, where IP is the IPv4 address set in the network settings (e.g., <http://192.168.20.117>).

Web Login Password: Set the password for browser login. After successful login, users can control the instrument, execute SCPI commands, and configure network settings through the browser.

Once the web login username and password are set, the device can be remotely controlled via a web browser on a PC or mobile device. The web interface replicates the touch screen and mouse-click functions of the physical instrument, allowing intuitive operation as follows.

(1) Access Local Area Network

The computer and the signal analyzer must be on the same local area network and able to communicate with each other (e.g., via a successful ping).

Users can view the signal analyzer's local IP address in the **Utility** menu. Once identified, access the instrument by entering `http://IP:port` in a web browser (e.g., `http://192.168.20.117:9000`).

Example:

Computer IP: 192.168.20.3

Signal analyzer IP: 192.168.20.117

PC browser using 192.168.20.117 to access the signal analyzer to check the basic information and control parameters of the instrument, such as network setting, password and SCPI, as shown in Figure 3-19 below.

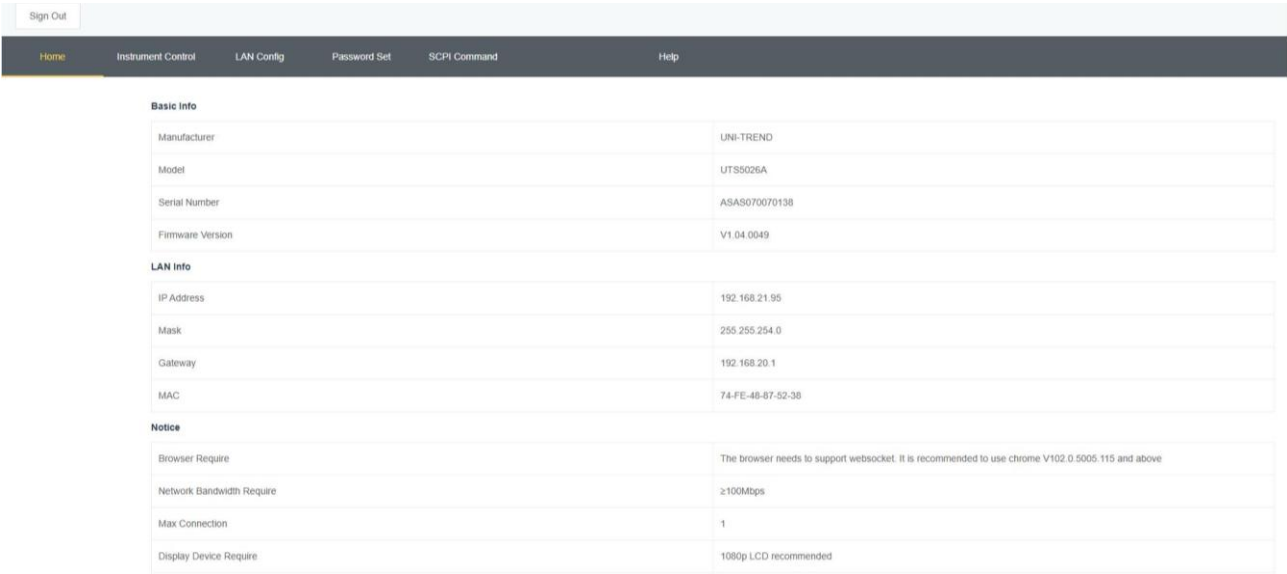


Figure 3-19 Web Basic Information

Log-in is required to access instrument control, network settings, password settings, and SCPI command control. The login username and password are the same as the Web Login Username and Web Login Password specified under Interface Settings. After logging in, users can view and control the signal analyzer, as shown in Figure 3-20 below.

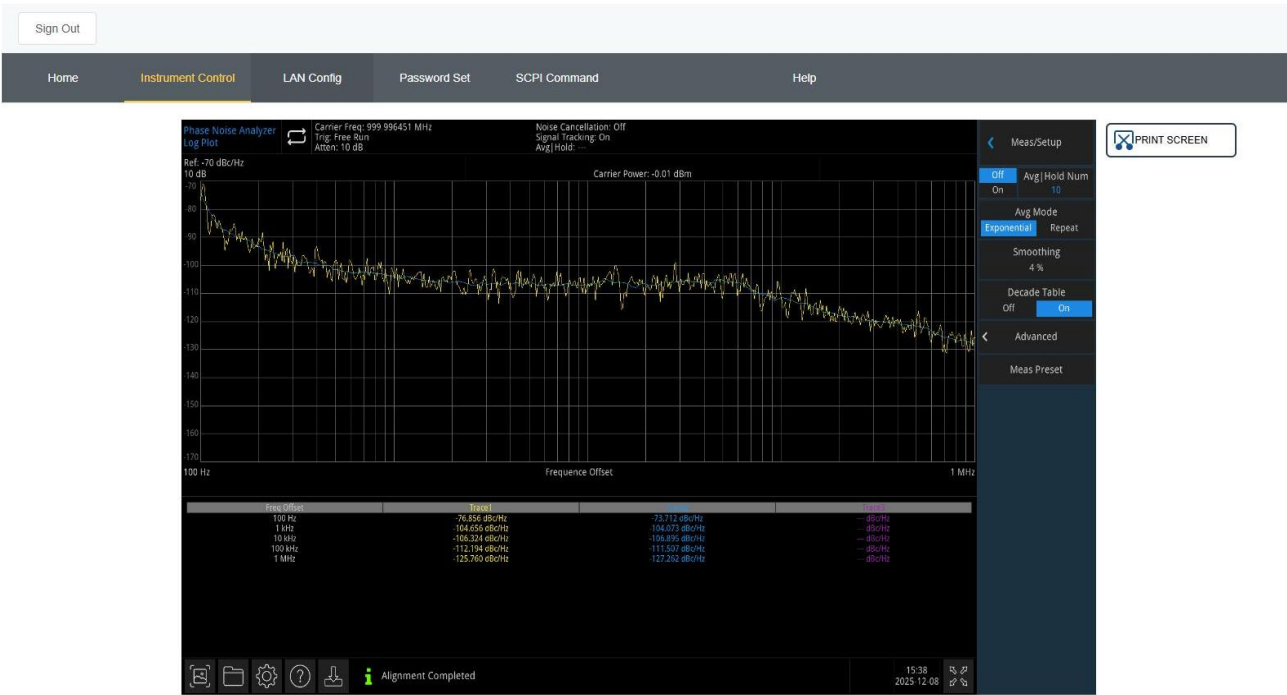


Figure 3-20 Web Control

All operations available on the instrument’s physical touch screen, such as selecting menu

panels, tapping function keys, entering numbers and characters, dragging markers, and printing the screen can also be performed via the web interface.

(2) Access Outer Network

- Connect an Ethernet cable to the signal analyzer and ensure the network has Internet access.
- Enable the FRP proxy service on the server.
- Configure the FRP proxy IP address and port on the signal analyzer.
- Access the signal analyzer via a browser using the proxy address http://IP:web_port.

The web interface is identical to the local access interface described above.

Note: This signal analyzer uses FRP for intranet penetration to enable external network access. The supported FRP version is 0.34.0. The instrument is equipped with an FRP 0.34.0 client, which must be used in conjunction with an FRP server. To establish a connection, the FRP server must be running and configured to listen on port 7000.

Specifically, the server's configuration file should include: bind_port = 7000.

4. Network Setting

Modify the network and FRP agent network information of the signal analyzer, as shown in Figure 3-21 below.

The screenshot shows the 'LAN Config' section of the web interface. At the top, there is a 'Sign Out' button. Below it is a navigation bar with tabs: 'Home', 'Instrument Control', 'LAN Config' (selected), 'Password Set', 'SCPI Command', and 'Help'. The 'LAN Info' section has a 'Type' dropdown menu set to 'DHCP'. Below this is a table with two columns: 'Item' and 'Value'. The table contains three rows: 'IP' with value '192.168.21.95', 'Mask' with value '255.255.254.0', and 'Gateway' with value '192.168.20.1'. Below the table are two buttons: 'Modify LAN Config' and 'Confirm'. The 'Frp Proxy Info' section is below that, also with a table of 'Item' and 'Value'. It contains four rows: 'Frp IP' with value '121.37.220.55', 'Web Port' with value '9000', 'Pic Port' with value '9002', and 'Ctrl Port' with value '9001'.

Item	Value
IP	192.168.21.95
Mask	255.255.254.0
Gateway	192.168.20.1

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

Figure 3-21 Web Network Setting

(1) Password Setting

Modify the web login password of the signal analyzer, as shown in Figure 3-22 below. The original password can be viewed by navigating to Physical Instruments > System > Setting > Interface Setting.

Item	Value
Old Password	
New Password	
Confirm New Password	

Figure 3-22 Web Password Setting

(2) SCPI

Execute an SCPI command, as shown in Figure 3-23 below.

Enter the command in the SCPI Command input field, then click the Send Command button.

The result of the command execution will be displayed in the Report.

SCPI Command

Figure 3-23 SCPI Control

Restore Default Settings: Access the restore default menu to reset the settings.

1. Restore System Settings: Resets the system settings of the signal analyzer to their default values.

2. Clear Data: Deletes all stored data on the signal analyzer.
3. Restore All Settings: Resets all settings to factory defaults and clears all user data.

File Management (Save)

Press the **[Save]** key to access the save interface. The instrument supports saving the following file types: State, Trace + State, Measurement Data, and Frequency Mask.

State: Press State to access the state save menu. Instrument states can be saved to internal memory.

1. Press **[Export]** key to save the current state using either the default file name or a user-defined file name.
2. After selecting a state file, press **[Import]** key to load the state file.

Trace + State: Press **[Trace]** and **[State]** key to access the trace and state save menus.

Instrument states and traces can be saved to a specified file.

Trace: Up to 12 traces are available.

1. Press **[Export]** key to save the current state and trace using either the default file name or a user-defined file name.
2. After selecting a Trace+State file, press **[Import]** key to load the file.

Measurement Data: Press the measurement data menu to access the measurement data save menu. The selected measurement data type, such as trace, measurement result, peak table, or marker list can be saved to a specified file. The instrument saves the data in CSV format (comma-separated values) for analysis using Excel software.

Trace: Up to 12 traces are available.

Data Type: Trace, Peak List, Marker List, Waterfall, Waterfall PVT, and Density Spectrum.

1. Press **[Export]** to save the measurement data of the currently selected type using either the default file name or a user-defined file name.
2. After selecting a file, press **[Import]** to load the measurement data.

Frequency Mask: Press the frequency mask menu to access the frequency mask save menu. The selected frequency mask can be saved to a specified file.

Frequency Mask Type: Upper Mask, Lower Mask.

1. Press **[Export]** to save the current frequency mask using either the default file name or a user-defined file name.

2. After selecting a file, press **[Import]** to load the frequency mask file.

Export: Saves the currently selected file.

Import: Loads data from the currently selected file. Note: This key is hidden when no file is selected.

Touch Lock

Press the **[Touch/Lock]** key to enable or disable the touch screen.

When the indicator light is green, the touch function is locked.

When the indicator light is off, the touch function is enabled.

Press the **[Esc]** key to exit screen lock.

Mode

Press the **[Mode]** key to access the mode menu. Available operating modes include IQ Analysis, EMI, Analog Demodulation, Vector Signal Analysis, Spectrum Monitor Analysis, Vector Network Analysis, and Phase Noise Analysis.

Some options require additional activation. Please refer to the relevant user manual on the official website.

Note

1. This key is designed for the UTS3000A series. For the UTS5000A and UTS7000A series, **[Mode]** and **[Meas]** are combined into a single key. Press [Mode/Meas] to open the Mode Selection window. Available operation modes are the same as above.
2. For each mode, specific measurements can be selected.

Appendix

Maintenance and Cleaning

(1) General Maintenance

Keep the instrument away from the direct sunlight.

Caution

Keep sprays, liquids and solvents away from the instrument or probe to avoid damaging the instrument or probe.

(2) Cleaning

Check the instrument and probe frequently according to the operating condition. Follow these steps to clean the external surface of the instrument:

- 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. Before cleaning, disconnect the power supply. Wipe the instrument with a slightly damp (not dripping) soft cloth. Do not use abrasive materials or chemical cleaning agents 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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