SASTUDIO4
USER GUIDE

SA/NX/PX Series User Guide

Real-time Spectrum Analyzer
up to 40 GHz

V4.55.41.0
04/13/2026

HAROGIC

Content

1. Version Management

Updated Description Sheet

Version	Description	Date
V4.55.41	1. Added: TG chapter added 2. Added: MSCAN chapter 3. Added: Fan control description added in Parameter Setting section 4. Modified: Software and Firmware Update chapter	04/13/2026
V3.55.32.0	1. Added: Mapping mode chapter added.	02/03/2026
V3.55.30.1	1. Modified: Updated the License Placement section for the Pulse Detection Option 2. Modified: Updated the License and Digital Demodulation Library Placement section for the Digital Demodulation Option 3. Modified: Updated the Firmware Update for PX Series Instrument on Linux Systems section	11/20/2025
V3.55.30.0	1. Added: Spectrum Color Bar power range adjustment method in Spectrogram chapter 2. Updated: Optimized version management 3. Added: Record File Format Description	11/07/2025
V3.55.29.0	1. Updated: Document version number (no content changes)	10/24/2025
V1.3	1. Added: Auto Reference Level chapter 2. Added: Auto Load Antenna Factor chapter 3. Added: Average Number parameter description in Digital Demodulation Mode 4. Modified: AM/FM Demodulation operation instructions	10/20/2025
V1.2	1. Modified: AM/FM Demodulation chapters based on new functionality 2. Modified: Software Update for PX Series Instrument chapter 3. Added: Firmware update for PX Series Instrument on Linux system chapter 4. Added: Connecting and Operating Multiple Instruments Simultaneously chapter 5. Added: Antenna Factor chapter 6. Added: Y-Axis Scale Zoom chapter 7. Added: Interactive zoom (PX series only) in Graph Zoom Function chapter 8. Added: Center Frequency and Span setting in Quick Parameter Setting chapter	9/8/2025
V1.1	1. Added: Switch X-Axis Scale chapter 2. Added: Peak Tracking chapter 3. Added: Auto parameter setting in Left/Right Peak Search	8/25/2025
V1.0	1. Initial Version	8/8/2025

2. Preface

The software supports three display modes:

- **SA/NX Series instruments**: workstation one column (default), workstation two column, and tablet mode
- **PX Series instruments**: Tablet mode

This document uses the tablet mode in the software as an example to describe the interface layout, operating modes, and operation methods of the spectrum analysis software. Although the supported display modes vary among different instruments, the operation logic is consistent across all modes. The corresponding interface diagrams are shown below.

Figure 1 Tablet mode interface display

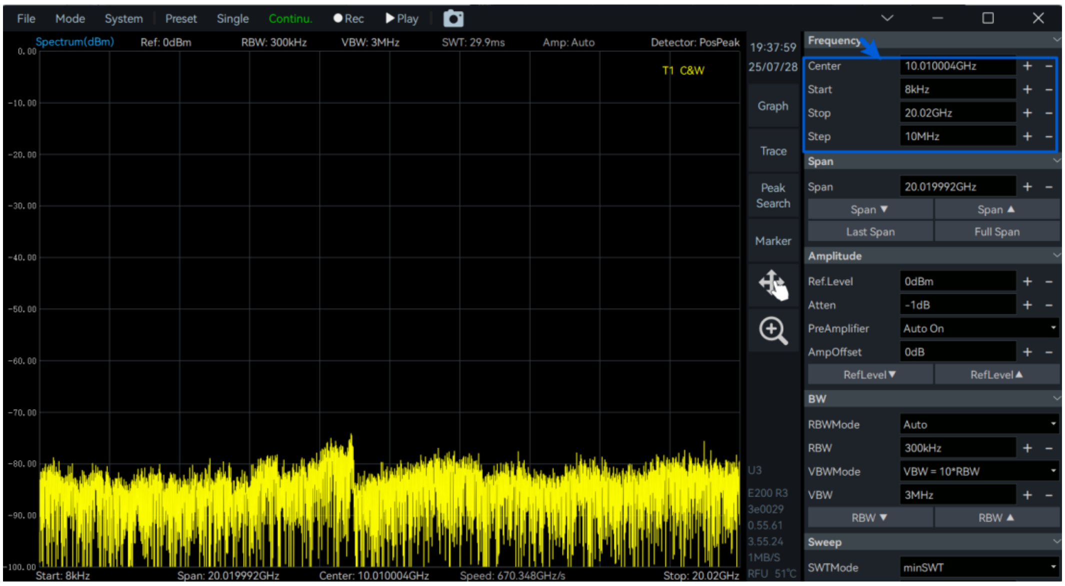

Figure 2 Workstation one column mode interface display

3. Preparation

3.1 Software Compatibility

The spectrum analysis software is compatible with the full range of SA, NX, and PX instruments running version 55.

3.2 Operating Environment Requirements

For the SA/NX series, which are kernel-based instruments, the spectrum analysis software must be installed on a host computer. The recommended operating environment for the host computer is shown in the table below:

Only the basic recommended configurations are listed in the table. For systems below the recommended specifications, please refer to the actual test results.

Table 1 System Operating Environment Requirements

Operating System	Windows 11/10/8/7, requires VS2019 C++ redistributables Ubuntu 22.04/20.04/18.04, Debian 12/11/10, Raspberry Pi OS 64-bit
Architecture	Windows: x64, AArch64 (only on NX devices) Linux: x64, AArch64
Processor	Windows: Intel i3 or above; AArch64 (tested on 8CX Gen2) Linux: Tested on Raspberry Pi 4B, Raspberry Pi 5, RK3399, RK3588, etc.
Memory	4 GB or above
Storage	IQ recording requires sustained storage write speed >400 Mbytes/s
Data Interface	USB 2.0 or USB 3.0 (USB 3.0 recommended) IQ recording bandwidth and duration depend on interface bandwidth
Display Resolution	Not less than 1280 * 768 pixels
Other	Certain antivirus software may cause the system to malfunction

3.3 Default Software Storage Paths

For PXE-90/PXE-200/PXN-400 series instruments have their software installed by default in the desktop userdata directory;

For PXN-45/PXN-60/PXN-90 series instruments have their software installed by default in the "/software" directory.

For SA/NX series instruments, the software is installed in a user-defined directory.

In the software directory, the "data", "images", and "reports" folders store different types of data respectively.

- data folder: Recording files, Configuration files, and Spectrogram CSV data files
- images folder: Chart images
- reports folder: CSV files containing chart data and the corresponding configuration files

Except for quick record/playback files and quick screenshots, all other recording files or images can be stored in a user-defined path (PX series instruments require an external storage device, while SA/NX series instruments can define the storage path directly).

3.4 Software Acquisition

Please refer to the Software and Firmware Update section for instructions on obtaining and installing the latest version of the software.

Note: By default, Windows x64, Linux x86_64 and Linux aarch64 versions of the software are provided. If a Windows x86 version is required, please contact official technical support for assistance.

4. Working Modes Overview

Software offers working modes, including Standard Spectrum Analysis (SWP), IQ Streaming (IQS), Power Detection Analysis (DET), Real-time Spectrum Analysis (RTA), Phase Noise Measure, Basic Digital Demodulation (option), MSCAN mode and Mapping mode. The measurement functions available in each working mode will be explained in the following sections.

4.1 Standard Spectrum Analysis

In the standard spectrum analysis mode, the instrument performs frequency hopping according to the configuration to achieve frequency scanning. This mode is suitable for applications focused on frequency trace measurement and analysis. The measurement and analysis functions provided in the standard spectrum analysis mode include:

- Spectrum Panoramic Sweep
- Local Spectrum Zoom Display
- Spectrogram
- Spectrum Recording and Playback
- SEM
- Peak and Signal Tracking
- IM3
- Channel Power
- OBW
- ACPR
- Amplitude Correction
- Peak Table

4.2 Receiver/IQ Streaming Mode

In the IQ streaming mode, the instrument acquires time-domain data within the analysis bandwidth according to the specified trigger signal and returns it to the user. This mode is suitable for applications such as time-domain signal recording and basic demodulation analysis. The functions provided in the IQ streaming mode include:

- IQ Time Domain Waveform
- Spectrogram
- Power-Time Waveform
- Multi-Channel DDC
- Pulse Signal Detection (option)
- Spectrum Analysis
- AM/FM Demodulation
- Audio Analysis
- IQ Data Recording and Playback

4.3 Power Detection Mode

In the detector analysis mode, the instrument performs continuous detection analysis on the time-domain signal within the analysis bandwidth. This mode is suitable for observing the relationship between time and power within a certain bandwidth, such as pulse parameter measurements. The functions provided in the detector analysis mode include:

- Power-Time waveform and zoom
- Pulse Signal Detection (option)
- DET Data Recording and Playback

4.4 Real-Time Spectrum Analysis Mode

In the real-time spectrum analysis mode, the instrument performs real-time spectrum analysis on the time-domain signal within the analysis bandwidth and returns the spectrum results to the user. This mode is suitable for applications that focus on instantaneous and transient signals, such as interference troubleshooting and the identification of characteristic signals in complex electromagnetic environments. The functions provided in the real-time spectrum analysis mode include:

- Real-time Spectrum Probability Density Graph and Spectrogram
- Real-Time Spectrum Data Recording and Playback

4.5 Harmonic Analysis Mode

In the harmonic analysis mode, the instrument performs harmonic analysis on the signal based on its fundamental frequency and displays the frequency, amplitude, and the relative difference from the fundamental for each harmonic. This mode is suitable for analyzing harmonic distortion in signals and helps identify and evaluate their nonlinear characteristics. The functions provided in the harmonic analysis mode include:

- Harmonic Spectrum Diagram
- Harmonic Measurement Table

4.6 Phase Noise Measurement Mode

In the phase noise measurement mode, the instrument uses automated measurement techniques to provide high-precision phase noise plots and detailed data tables, enabling users to thoroughly analyze the phase stability of a signal and the noise density at different frequency offsets. The functions provided in the phase noise measurement mode include:

- SSB Phase Noise Spectrum Diagram
- Phase Noise Measurement Table

4.7 Digital Demodulation Mode (Option 71)

In the digital demodulation mode, the instrument supports demodulation of various modulated signals and evaluates their modulation quality from multiple perspectives. This function is suitable for a wide range of applications, particularly for in-depth analysis and quality assessment of known modulated signals. The functions provided in the digital demodulation mode include:

- Constellation and Eye Diagram
- Bit Table and Demodulation
- Modulated Signal Spectrum Analysis
- ASK/FSK/PSK/QAM Demodulation

4.8 MSCAN Mode

In MSCAN mode, the instrument allows users to customize measurement parameters for each frequency band and combine them into a configuration list. Once the list is configured, the device continuously acquires and displays spectrum data according to the defined settings. This feature is suitable for rapid preview and analysis of multi-band signals.

- Multi-Band Spectrum Preview
- Spectrum Analysis
- IQ Time-Domain Waveform
- Configuration List

4.9 Mapping Mode

In Mapping mode, the instrument combines spectrum measurement data with synchronously acquired GPS geographic coordinate information to generate a visual heat map displaying signal strength, peak power, occupied bandwidth, and interference distribution. This mode is suitable for radio monitoring, signal surveys, interference analysis, and network optimization. The functions provided by Mapping mode include:

- Georeferenced Map Import
- GPS Integration
- Heatmap Generation
- Signal Analysis and Auto Measurement
- Spectrum Display
- Measurement Results Table
- Task Import/Export

4.10 Application Software UI Layout

The application software UI consists of the following sections:

- Menu
- Graph Set Area
- Graph Display Area
- Main Setting Area
- Instrument State
- Parameter Quick Set

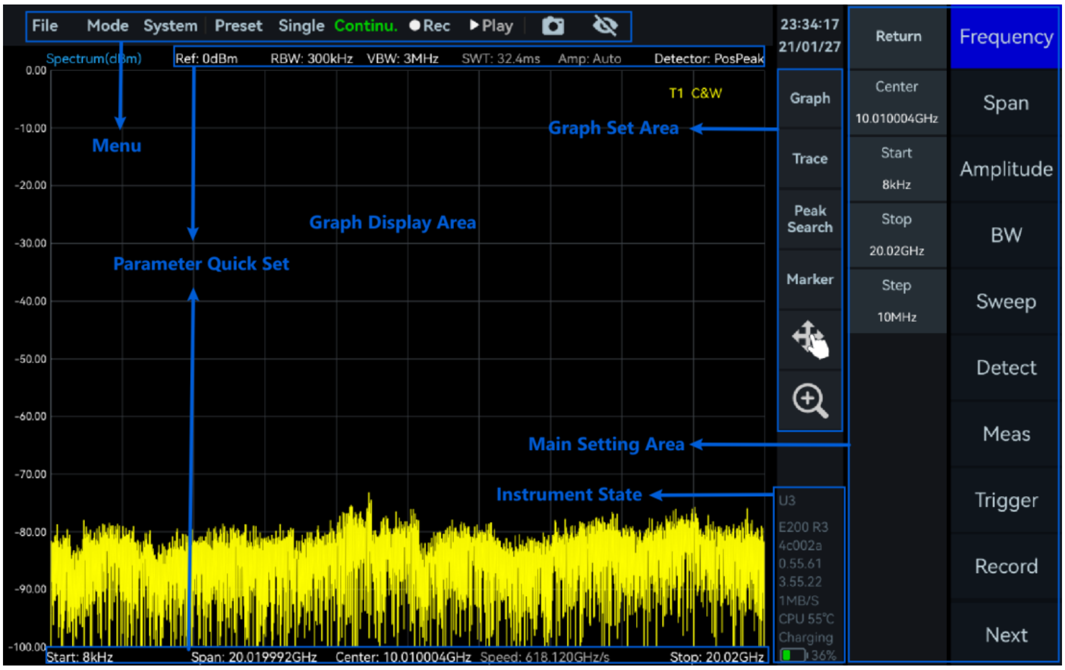

Figure 3 Software Interface Layout

4.10.1 Menu

- Save and Load Configuration
- Set Startup State
- Working Mode Switch
- Measurement Mode Selection
- Single or Continuous Preview
- Recording and Playback
- Quick Screenshot
- GNSS and Instrument Information View
- Fan Control (SA/NX only)
- Display Mode Switch (SA/NX only)

4.10.2 Graph Set Area

- Graph Settings
- Trace Settings
- Marker Settings
- Display Measurement Results

4.10.3 Main Settings Area

- Measurement and Analysis Settings
- Trigger Settings
- Data Recording and Playback
- System Settings

4.10.4 Instrument State

- GNSS Antenna Connections Status
- Instrument Model
- Last Six Digits of Instrument UID
- API/FPGA/MCU Version
- Software GUI Version
- Bus Data Throughput
- Instrument Real-Time Temperature
- Instrument Power Level (PX only)

5. Common Operation

5.1 Save and Recall Instrument Configuration

1. Save the current configuration
1). Click "File" -> "Save State" in the menu bar;
2). In the "Save Configuration File" pop-up window, set the save path and file name, click "Confirm" to save the configuration file.
2. Open pre-stored configurations
1). Click "File" -> "Recall State" in the menu bar;
2). Select the configuration file in the "Please select file" pop-up window, click "Confirm" to open the pre-stored configuration.

5.2 Save the Pictures

1. Click "File" -> "Save Image" on the menu bar;
2. In the "Save Image" pop-up window, set the path to save the picture and the picture name, and click "Confirm" to save the screenshot.
3. Users can also take screenshots by clicking the shortcut button " " in the menu bar, the pictures are saved in the "/images" folder by default, and the storage path cannot be changed.

5.3 Deleting files and images

PXE-90/PXE-200/PXN-400 Series Instruments: In the corresponding storage folder under the software directory, drag and drop the target file to the "Trash Can", then click "Yes" in the confirmation dialog to delete it. (The deletion method for record files and configuration files is the same as for screenshots).

PXN-45/PXN-60/PXN-90 Series Instruments: In the corresponding storage folder under the software directory, select the target file, then click "Edit" -> "Move to Trash" in the top menu bar. Finally, click "Yes" in the confirmation dialog to complete the deletion.

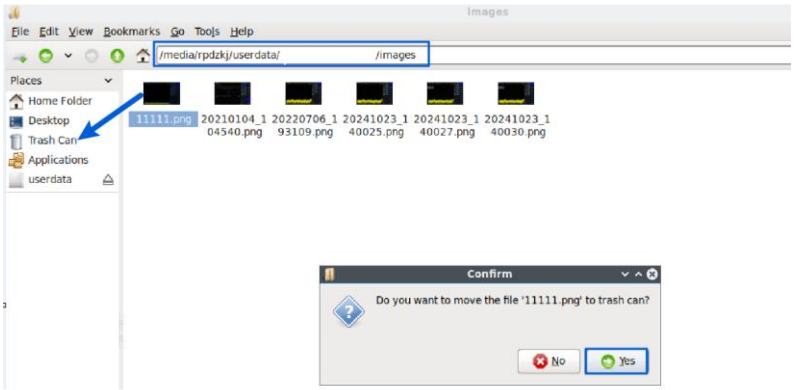

Figure 4 PXE-90/PXE-200/PXN-400 Series Instruments Delete Picture

5.4 Setting the Startup State

The instrument supports user-defined startup states, the relevant startup state description is detailed in Table below.

Table 2 Upper computer software power on state

No.	Power On State	
1	**Default**	Default configuration.
2	**User Preset**	Load a user-saved profile as the startup configuration.
3	**Last State**	Restore settings from the last session at startup.

If you want to set the startup state, follow these steps.

1. Click "File" -> "Power On State" in the menu bar;
2. "Default" and "Last State" can be ticked directly, the software will take this option as the initial state when it starts next time;
3. Select "User Preset", select the user's pre-saved configuration file in the "Please select file" pop-up window that appears, and the software will open with the specified configuration at the next startup.

5.5 Switching Operating Modes

Click "Mode" in the menu bar to switch between Standard Spectrum Analysis, Receiver/IQ Streaming, Power Detection, Real-Time Spectrum Analysis, Digital Demodulation (Option), Harmonic Analysis, Phase Noise Measurement, MSCAN mode and Mapping mode.

5.6 Professional and Concise Settings

Click "System" -> "Setting Mode" in the menu bar to switch between "Basic" and "Professional" modes. Compared to the Basic mode, the Professional mode provides more parameter options in the main settings area, allowing users to flexibly select the appropriate setting mode based on actual needs.

5.7 Theme Settings

Click "System" -> "Theme" in the menu bar to switch between "Dark" and "Light" themes.

5.8 Parameter Settings

Click "System" -> "Preference" in the menu bar, and you can set the following functions in the pop-up setting window:

Table 3 Parameter Setting Parameter Description

Parameter	Description
Haptics (PX only)	When enabled, the instrument provides haptic feedback via vibration during touchscreen operations.
Screen Lock	When enabled, a lock icon "" appears on the right side of the screen. Tap the icon "" to lock the screen and prevent accidental operations, tap again to unlock.
Digital Det	When enabled, reduces the refresh rate of certain displayed parameters (including marker) to aid observation and recording.
Auto-Dim (PX only)	When enabled, the instrument automatically lowers screen brightness if there is no operation for one minute.
Brightness (PX only)	Adjusts the screen brightness for PX series instruments.
Volume (PX only)	Adjusts the volume for PX series instruments.

Data/Time (PX only)	When GNSS is not locked, the user can manually set the PX series system time. Once GNSS is locked, system time can be synchronized either by a one-time "Auto UTC Time" or continuously via "Sync UTC Time".
Fan Control	Standard: lower temperature threshold, more responsive. Quiet: higher threshold, smoother speed ramp.

5.9 GNSS Usage

This section provides detailed instructions on how to obtain real-time positioning data using either the built-in or external GNSS module. Here, the built-in module refers to the GNSS module independently developed by the company, while the external module refers to a GNSS module produced by other manufacturers that supports serial communication. In addition, it explains how to use the 1PPS trigger of the built-in GNSS module and the 10MHz reference clock of the high-precision built-in GNSS module.

Table 4 Description of GNSS parameters

No.	Parameter	Description
1	GPS Type	Select internal or external GNSS module.
2	Baud Rate	Serial port baud rate for the external GNSS module. Required only when using an external GNSS module.
3	Antenna	Select Internal Antenna or External Antenna (Currently only external antenna is supported). Required only when using the internal GNSS module.
4	XPPS Out	On: Outputs the XPPS pulse signal Off: Forces the GNSS module's XPPS output function to be disabled
5	XPPS	Adjust the output pulse frequency of the GNSS module, in Hz. Default value: 1Hz, which outputs a 1PPS signal. If set to 0.5Hz, a pulse is output every 2 seconds, i.e., a 0.5PPS signal.
6	Format	Provides two formats: Local Time and UTC Time.
7	SatNum	Number of satellites currently positioned.
8	SNR(Max)	Maximum signal-to-noise ratio of positioned satellites.
9	SNR(Min)	Minimum signal-to-noise ratio of positioned satellites.
10	SNR(Avg)	Average signal-to-noise ratio of positioned satellites.
11	Reference Frequency Offset	Display the frequency offset relative to the 100MHz reference clock.

5.9.1 Using the Built-in GNSS module

1. Click "System" -> "GNSS Info", and set "GPS Type" to "Internal GPS" and "Antenna" to "External" in the GNSS Info box;
2. Wait 1 to 3 minutes for the GNSS to lock, you can judge whether the GNSS is locked or not according to the GNSS lock logo in the status bar information, after locking the GNSS lock logo is green, if it is grey, then it is not locked. see table 4 for the explanation of the parameters in the GNSS information pop-up window.

Figure 5 Locked GNSS external antenna

5.9.2 1PPS Trigger Using Internal GNSS Module

Only IQS mode, DET mode and RTA mode can use 1PPS trigger of GNSS module. This section will take IQS mode as an example and explain in detail how to configure the 1PPS trigger function of the GNSS module.

1. Refer to the section on Using the Built-in GNSS module to ensure that the GNSS is locked;
2. Click "Mode" -> "IQStreaming" to switch to IQS mode;
3. Click "Next" -> "Trigger" in the main setup area, and set "TriggerSource" to "GNSS-1PPS" in the "Trigger" submenu to use the GNSS module 1PPS trigger.

Figure 6 Triggered using GNSS 1 PPS

5.9.3 Using the 10 MHz Reference Clock from the Built-in GNSS Module

Note: Available only high quality GNSS modules.

1. Please refer to the section on Using the Built-in GNSS module to ensure that GNSS is locked;
2. Set "DOCXO" to "LockMode" in the GNSS Info box, wait for 5-10 minutes, if "DOCXO Locked" appears in the GNSS Info box, OCXO is locked successfully;
3. Set "RefCLKSource" to "Internal_Premium" and "RefCLKFreq" to "10MHz" under the System submenu in the main setup area. At this time, the reference clock source is OCXO.

Figure 7 10MHz reference clock using high quality GNSS modules

5.9.4 Using External GNSS module

1. Connect the external GNSS module to the PC USB port of the PX series or SA/NX series instrument using a USB-to-serial cable;
2. In the software, click "System" -> "GNSS Info";
3. In the popup window, set "GPS Type" to "External GPS";
4. Click the "Refresh" button in the "COM Device" column and select the newly recognized "ttyUSBX" or "COMX" device;
5. Set the "Baud Rate" to the actual output of the GNSS module (e.g. "9600") and click the "Connect" button below;
6. The instrument will parse and display the received GNSS positioning information, see Table 4 for an explanation of the parameters in the GNSS information pop-up window.

Figure 8 Connecting an external GNSS module

5.10 GPIO Output Level Control

After connecting the instrument to the corresponding EIO expansion board, click "System" -> "GPIO" in the menu bar to control the output levels of different GPIO interfaces. "On" indicates a high level, and "Off" indicates a low level. The interface definitions of the EIO expansion board are shown in the table below.

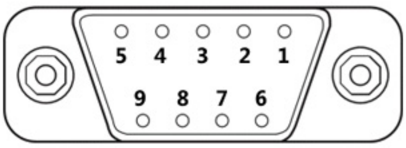

Figure 9 EIO Expansion Board Interface Diagram

Table 5 EIO Expansion Board Interface Pin Description

Pin	Description
1	GPIO0
2	GPIO2
3	GPIO4
4	GPIO6
5	GND
6	GPIO1
7	GPIO3
8	GPIO5
9	GPIO7

5.11 Viewing Instrument Information

Click "System" -> "About" in the menu bar, the UID number and firmware version of the current instrument will be displayed in the pop-up window.

5.12 Preset

Click the "Preset" button in the menu bar to restore the current software configuration to the default initial state of the instrument.

5.13 Single or Continuous Preview

Single preview: click "Single", Continuous preview: click "Continu.".

5.14 Quick Record and Playback

- **Recording**: Click "Rec" to start recording data, and click "Stop" to stop recording.
- **Playback**: Click "Play" in the menu bar to play back the last recorded data, and click "Pause" to pause the playback. Click the "Continu." button in the menu bar to resume normal data acquisition and display.

5.15 Hide Panel

Click the hide icon "" in the menu bar to hide the main settings menu and expand the display area. This function is only available in Tablet Mode.

5.16 Y-Axis Scale Zoom

Click "Graph" -> "Scale/Div" in the chart settings area to modify the dB value per division, thereby adjusting the vertical display range of the trace.

For PX series instruments, the Y-axis scale can also be adjusted in the following way:

Click the interactive mode button "" in the chart setting area, then use touch gestures on the touchscreen:

- Spread two fingers vertically: Decrease the dB value per division;
- Pinch two fingers vertically: Increase the dB value per division.

5.17 Offset

The display offset of the trace can be adjusted in any of the following ways:

1. Click "Graph" -> "Offset" in the chart setting area, and enter the offset value in the offset setting interface, where a positive value indicates that the trace is offset downward and a negative value indicates that the trace is offset upward.
2. Click "" in the chart settings panel to enable manual adjustment. Once enabled, press and drag the trace up or down to quickly adjust its display position.
   You can later restore the default position via "Graph" -> "Reset Scale".

5.18 Switch X-Axis scale

Click the chart display area "Graph" -> "XScale" to display the X-axis of the spectrum either in "Lin" (Linear) or "Log" (Logarithmic) mode.

5.19 Display Line

Click "Graph" -> "Line" to enable a configurable visual reference line. Set the "LinePos" value to adjust its position on the y-axis.

5.20 Setting Chart Units

Click "Graph" -> "Units" to set the display units of the graph, including dBm, dBmV, dBmA, W, V, A, dBuV, dBuA and dBpW.

5.21 Spectrogram

Only the standard spectrum analysis, IQ streaming, and Real-Time spectrum analysis modes support the spectrogram display function. A description of each control in the spectrogram settings interface is provided in the table below:

Table 6 Description of Spectrogram Controls

Graph Setting Area	
Scan Depth	The time length cached on the y-axis of the spectrogram Cache limit: 8000 lines of pixels
Time Density	The refresh rate of the spectrogram When set to 100, scrolls 100 lines of pixels per second
Color	Sets the color gradient for the spectrogram

1. Click "Graph" -> "Spectrogram" to create a spectrogram corresponding to the spectrum;
2. Click the Spectrogram, switch to the corresponding chart setting area of the spectrogram, and then click "Graph" to enter the spectrogram setting interface;
3. "Export Image" can export the current spectrogram in PNG format to the "/images" folder, "DataExport" can export the current cached data not exceeding the scan depth to the "/data" folder in CSV format, and the exported data is sorted in reverse chronological order.

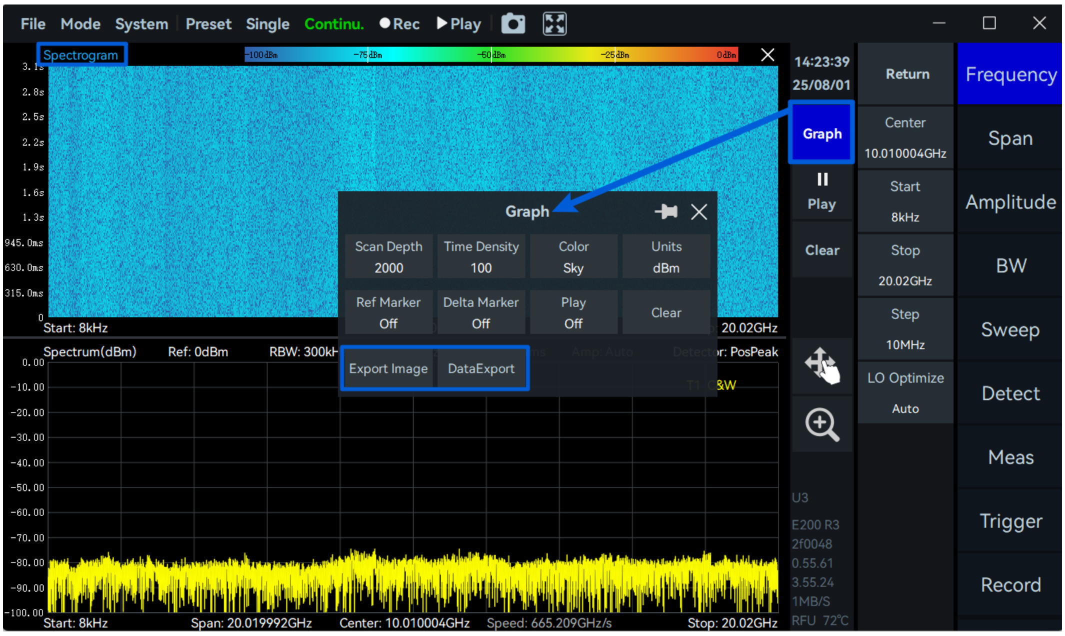

Figure 10 Enable Spectrogram

4. The Power range corresponding to the Spectrogram's Color Bar can be set by adjusting the "Offset" and "Scale/Div" parameters. The specific calculation rules are as follows:

- Color Bar Upper Limit = "Ref.Level" + "Offset"
- Color Bar Lower Limit = "Ref.Level" + "Offset" - 10 * "Scale/Div"

5.22 Export Data

The PNG image or CSV data of the current chart can be exported in any of the following ways: Export as follows:

1. Click "Graph" -> "DataExport" in the setting area of the chart where the data is to be exported;
2. Click the right mouse button in the chart display area, open the shortcut menu, select "DataExport".

- The "Image" option allows you to export the current chart as a PNG image file, which is saved to the "/images" folder by default;
- The "Data" can export chart data to CSV file, default save to "/reports" folder.

5.23 Record and Playback

Please refer to table 6 for key parameters in record and playback function. The record file format description is provided in Appendix 1 through Appendix 5.

Table 7 Record and playback parameter description

Record	
RecordMode	FixedPoints: Allows presetting the number of recording points, recording duration, and file size limit. The actual recording duration cannot exceed the set "file size limit". Adaptive: Requires manually controlling the recording duration of the file. (Note: In manual mode, the software will automatically stop recording if the file size exceeds the "file size limit")
RecordTime	Set the recording duration, only effective when the record mode is "FixedPoints"
FileSizeLimit	The storage size limit for a single recording file
Diskcapacity	The remaining and total disk capacity
Play Back	
Last frame	Rewind by one frame
Next frame	Fast forward by one frame.
Back	Rewind by multiple frames.
Forward	Fast forward by multiple frames.

1. Data Recording

1). Click "Record"-> "RecordMode" in the main setting area and select the desired record mode;

2). Click "REC File Path" to set the storage location of the log files, the default path is "/data" folder, users can also customize the storage path;

3). In "Fixed" mode, click "Record" to automatically record data of a preset size. In "Manual" mode, you can manually control the recording duration by clicking "Record" and "Stop". Automatically stops recording when the file size exceeds the file size limit.

2. Data Playback

1). Click "Play Back" -> "Open File" in the main setting area, and select the record file to be played back in the pop-up window.

2). Click "Playback" to start playback, click "Pause" to stop playback, click "Stop" to exit the playback interface to resume data acquisition, and enable Turn on "Auto Loop" to loop back the record file.

5.24 Graph Zoom Function

The chart zoom function can be used to view detailed information in a local region of a spectrum or time-domain plot. The instrument provides two zoom methods: Zoom scaling and magnifier zoom, allowing users to flexibly choose according to their needs.

5.24.1 Zoom Function

1. Spectrum Zoom (Only in SWP mode)
1). Click "Graph" ->"Zoom";
2). Click to select "Spec zoom", click "Graph", set the frequency range to be zoomed in the pop-up submenu, or directly drag the zoom box and its edges in the spectrum graph to adjust the position and zoom area.

Figure 11 Spectrum zoom in SWP mode

2. Time Domain Zoom (Only in IQvT, PvT, and DET Modes)
1). IQvT and PvT

In IQS mode, click "IQvT" or "PvT" in the main setting area, select the corresponding channel, open "Analyze" and "Zoom". Open "Analyze" and "Zoom", adjust the zoom area by holding down the zoom area and sliding the zoom frame, or holding down the zoom border and dragging it left and right.

2). DET mode
a) Click on "Graph" and open "Zoom" in the pop-up submenu;
b) Slide the zoom frame by holding down the zoom area, drag the zoom border left and right, select the zoom graph "PvT Zoom", and click "Graph" to set the "TimeCenter" and "TimeRange". You can adjust the zoom area.

5.24.2 Magnifying Glass Function

1. Click on the magnifying glass button "" to frame the area of interest;
2. A thumbnail view will be displayed in the upper right corner of the main interface, showing the complete trace and the position of the zoomed-in area in the global picture;
3. You can quickly switch the position of the zoomed-in area by dragging the red box in the thumbnail, or you can re-select a new area to zoom in;
4. Click the Zoom button again to exit the zoomed-in view and restore the original trace display.

Figure 12 Magnifying Glass Zoom in SWP Working Mode

5.24.3 Interactive Zoom(PX series only)

Click the interactive mode button "" in the chart setting area, then use touch gestures on the touchscreen:

- Swipe left or right with one finger: Adjust the center frequency;
- Spread two fingers horizontally: Decrease the span;
- Pinch two fingers horizontally: Increase the span.

5.25 Trace settings

Click on "Trace" in the chart settings area and see the following table for a description of the parameters in the additional menu:

Table 8 Trace Control Parameter Description

Trace	
Enabled	On: Turn on the traces of the corresponding labels, the upper limit is 4.
Type	ClearWrite, MaxHold, MinHold and Average
Avg	Setting the average number of times the average type of trace is averaged

StateReset	Clears the current trace data and restarts the display according to the set trace type.
Edit Lable	Modify trace name for user to edit and manage multiple traces.
Max/Avg/C&W	Simultaneously enable three traces for MaxHold, Average and ClearWrite
Max/Avg/Min	Simultaneously enable three traces for MaxHold, Average and MinHold
Reset	Resets the trace display method, clears all current trace data, and reverts to the default clear write type

5.26 Maker Function

5.26.1 Create Markers

1. Create a Marker

Double-click on the chart display area, or click on "PeakSearch" in the chart settings area to quickly bring up the reference marker.

2. Create multiple Markers

Click the "Marker" submenu in the Chart Settings area, select the marker you want to create, and then click "Enable" to enable the selected marker.

5.26.2 Create Marker Pairs

Marker pairs can be created in any of the following ways (reference marker and difference marker as a group, current limit 5 groups):

1. In the "Marker" submenu, select the marker pairs you want to create (e.g., "M1R" and "M1D") and click on "Enable";
2. Right-click on the chart display area to open the shortcut menu and select "Create marker pair";
3. Click "Graph" -> "Marker Pair" in the Graph Settings area to quickly enable a pair of reference marker and difference marker, and click continuously to enable multiple pairs of markers.

5.26.3 Close Markers

1. Close a Single Marker

In the "Marker" submenu, select the marker you want to disable and click "Enable" to disable the selected marker.

2. Close all Markers

All currently enabled markers can be cleared in one of the following ways.

1). Click "Graph" in the Chart Settings area and select "Clear All" in the pop-up window;

2). Click the right mouse button in the chart display area, open the shortcut menu, select "Clear all markers".

5.26.4 Change Markers Frequency

1. Manual Enter Frequency Value

Click "Marker" submenu, select an enabled marker (e.g. M1R, M2R), click the "Freq:" area on the top of the pop-up window, and set the marker frequency value.

2. Drag Marker or Click to Jump

1). Drag Marker: press and hold the marker and drag it to the desired position and then release it;

2). Click to Jump: select the marker, then double-click on the target frequency point; the marker will automatically jump to that position.

5.26.5 Marker switching traces

Switching the marker trace can be achieved using either of the following methods:

1. Click "Marker" in the chart device area, select the target trace (e.g. switch from T1 to T2), the marker will automatically jump from T1 to the corresponding frequency position of T2;

2. Right-click on the graph display area to open the context menu and select "Marker trace" to switch the target trace associated with the current marker.

5.26.6 Delta Marker

The delta marker must be used together with a reference marker to indicate the frequency difference, time difference, and amplitude difference relative to the reference marker.

Figure 13 Enable Delta Marker

5.26.7 Noise Density

After creating the marker, turn on "NoiseDensity" in the "Marker" section of the chart settings area to convert the original power values to power density per Hz.

5.26.8 Marker Peak Search

1. Local peak search

Double-click on the chart near a local peak, or select the marker and click "Marker" -> "Local Peak".

2. Global peak search

Click on "Peak Search" in the graph setting area to enable global peak search.

3. Left and right peak search

1). Enable Auto Parameter Setting

After enabling the cursor, click "Marker" -> "Left Peak" / "Right Peak" in the chart setting area. By default, "AutoParam" is enabled, and the software will calculate appropriate peak thresholds and peak offsets based on the noise floor and signal distribution of the current trace, so as to accurately identify valid local peaks.

2). Set Custom Peak Threshold and Peak Offset

After the marker is enabled, click "Marker" -> "Advanced" in the chart setting area, set the "Threshold" and "Excursion" for left and right peak searching. After that, click "Left Peak" or "Right Peak", when a qualified signal is detected, the marker will automatically locate to the signal position.

- Peak Excursion: the minimum amplitude difference (dB) between the peak and the troughs on either side, used to determine if the peak is sufficiently prominent.

5.26.9 Marker to Center

The Marker to Centre function aligns the frequency of the current reference marker to the center of the chart, which can be achieved in any of the following ways:

1. After moving the reference marker to the target frequency point, click "Marker" -> "to Center" in the chart setting area;
2. After moving the reference marker to the target frequency point, click the right mouse button on the chart display area, open the shortcut menu and select "Marker to center".

5.26.10 Marker Switch to Mode

The Marker to Mode function quickly switches to other operating modes and sets the frequency at which the current reference marker is located as the center frequency of the new mode. This function can be realized in any of the following ways:

1. After moving the reference marker to the target frequency point, click "Marker" -> "Switch to" in the chart setting area, and select the target mode;
2. After moving the reference marker to the target frequency point, click the right mouse button in the chart display area, open the shortcut menu, select "Marker to Mode", and select the target mode.

5.26.11 Signal tracking

Signal tracking supported in standard spectrum analysis mode only.

1. Click "Marker" in the chart setting area, in the pop-up submenu, click "More", and then click "Advanced". Set the "Threshold" and "Shake Range" for the tracking signal (when the peak frequency jitters within this range, the frequency value will not be frequently aligned to the center position);

Figure 14 Set the Peak Threshold and Shake Range

2. Click "Signal Track", the reference marker will search for peaks within the span at this time, and align the peak signal to the center frequency, when the frequency of the target signal drifts, the spectrometer will automatically adjust its own center frequency, so that the signal is always located in the center of the chart display area, which is convenient for the user to observe and analyze.

Figure 15 Frequency Tracking

Note: In general, this function only moves the frequency position and does not change the span. However, it is difficult to continue tracking signals with particularly large drift beyond the current span; for signals at the edge of the instrument's scanning range, because of frequency limitations, the span will be further reduced.

5.26.12 Peak tracking

Click "Marker" -> "Peak Tracking" in the chart setting area. After enabling, the cursor will automatically locate and continuously track the maximum peak within the current sweep span. When the signal amplitude or frequency changes, the cursor position will update in real time, allowing the user to continuously observe variations in signal amplitude.

Note: The peak tracking function is only effective within the currently set sweep span. If the signal goes beyond this range, tracking will no longer continue.

5.26.13 Peak table

The Peak Table function is only supported in Standard Spectrum Analysis Mode:

1. Click "Marker" in the chart settings area. In the pop-up submenu, click "More", then "Advanced". Set the threshold for the Peak Table. For detailed setup instructions, see the Signal Tracking section;
2. Click "Peak Table". The instrument will automatically detect and mark peak points that exceed the threshold within the current sweep span (up to 10 peaks). These peaks are listed in the Peak Table below the display area, showing the frequency and power of each peak in descending order of signal power, allowing users to quickly identify the main signals in the spectrum.

Figure 16 Peak Table

5.27 Quick Parameter Setting

5.27.1 Parameter setting

Currently, quick settings are supported for the following commonly used parameters: Reference Level, RBW, VBW, Detector, Start frequency, Stop frequency, Span, Center frequency and other parameters. Users can tap the corresponding parameter on the screen and directly enter a value to modify it.

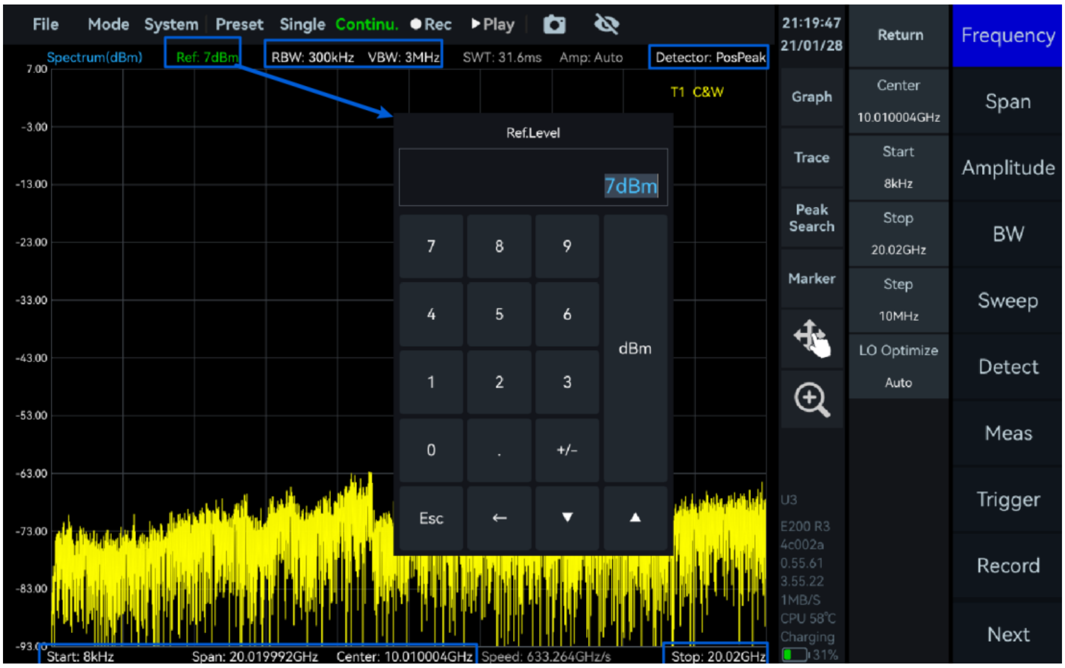

Figure 17 Setting Quick Parameters

In addition to entering values, the center frequency and span can also be quickly modified in the following ways:

- Center Frequency: Click the interactive mode button "" in the chart settings area, then press and drag the trace left or right.
- Span: Click the interactive mode button "" in the chart settings area, then scroll the mouse wheel. (Note: This quick method is supported in GUI version 3.55.28 and above.)

5.27.2 Parameter display

In addition to the quick parameterization, this area also supports the display of some of the key parameters during the measurement:

- SWT: Scan time for a single trace in the current configuration
- Amp: Preamplifier enabled status
- Spurious Suppression Label: Displays the spurious suppression mode in the current configuration (Note: Supported when GUI version is 3.55.26 and above)
  - "S" Indicates Standard Spurious Rejection
  - "E" Indicates Enhanced Spurious Suppression
  - Blank Indicates spurious suppression is not enabled
- Speed: the width of the spectrum swept per unit time in the current configuration (Hz/s)

5.28 Modifying the IQSampleRate

In IQ streaming mode, click "BW" in the main setup area and modify the value of "IQSampleRate" in the submenu to modify the sampling rate of the instrument.

5.29 Amplitude Correction

To ensure the accuracy and repeatability of spectrum measurements, the instrument provides an amplitude correction function, which supports the user to compensate by manually inputting external gain/loss and importing the frequency response correction table. Currently, the amplitude correction function is only supported in spectrum analysis mode.

5.29.1 Correction Rules

- Between the start frequency and the first compensation point in the current span, compensation is performed according to the offset value of the first frequency point;
- Between multiple compensation points, compensation is performed by linear interpolation based on the frequency data in the correction table;
- Between the last compensation point and the termination frequency, according to the offset value of the last frequency point.

5.29.2 Amplitude Correction Example

Take the 1 GHz to 3 GHz band to compensate for -20 dB, the 3 GHz to 5 GHz band to perform -20 dB to +10 dB interpolation compensation, and the 5 GHz to 7 GHz band to compensate for 10 dB as an example, the operation steps are as follows:

1. Click "Frequency" and set "Start Frequency" to "1 GHz" and "Stop Frequency" to "7 GHz";
2. Click "System" -> "Amplitude Correction" in the menu bar;
3. Enable the amplitude correction function in the pop-up window, and then click "Add" to add one frequency correction item at a time;
4. Set Frequency 1 to "3 GHz" and Offset 1 to "-20 dB", click "Add" again and set Frequency 2 to "5 GHz" and Offset 2 to "10 dB";
5. Click "Apply" in the bottom right corner of the pop-up window to apply the amplitude correction function;

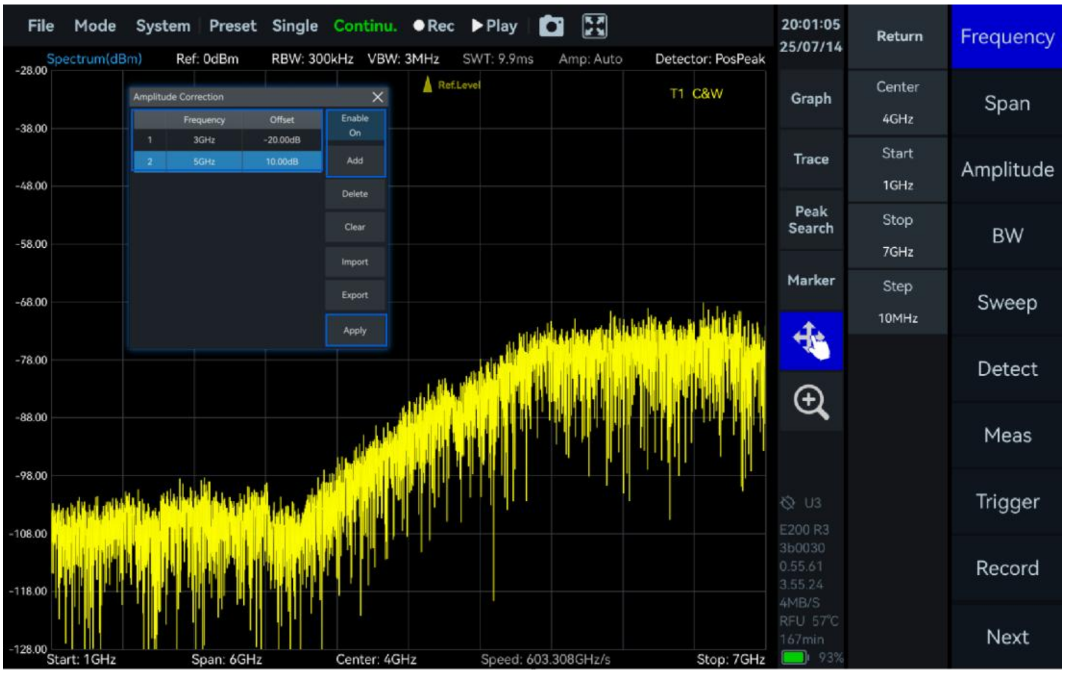

Figure 18 Amplitude correction application

6. Users can export the current correction configuration to an Excel table file via "Export" in the pop-up window, and the default export is to the "/data" folder;
7. The user can also customize the amplitude correction table according to the format of the exported configuration and import it using the "Import" button.

5.30 Display modes (only in SA/NX series)

The upper computer software of SA/NX supports three display modes: workstation single-column (default), workstation dual-column, and flat-panel mode; PX series instruments only support flat-panel mode. Users can choose the appropriate display mode according to their own needs.

Table 9 Display Mode Lookup Table

Display Mode	Description
Workstation One Col	Single-column parameter display, providing more spectrum display space for focused spectrum observation.
Workstation Two Col	Two-column parameter display, allowing more convenient parameter settings and simultaneous viewing/comparison of multiple parameters.
Tablet	Suitable for tablets and other mobile devices, featuring a clean interface and easy touch operation.

5.31 Fan Control (only in SA series)

SA series instruments support users to set the instrument fan status, click "System" -> "Fan Control" in the menu bar to set the fan status, see the following table for status details. (Note: Turning off the fan for a long period of time may cause the device to overheat, thus affecting the performance and service life, so please use the function of turning off the fan forcibly with caution).

Table 10 Fan Status Lookup Table

Fan Control	Descriptions
On	Turn on the fan.
Off	Turn off the fan.
Auto	Default mode. The fan is intelligently controlled, and automatically turns on when the device temperature reaches 50 °C, and automatically turns off when it drops to 40 °C. (SAE/SAN-400 series instruments have the fan on by default, not programmable)

6. Using of the SWP mode

This section highlights some of the important parameters and test methods of the standard spectrum analysis model.

6.1 Introduction to the General Parameters of the SWP Mode

The important parameters of the SWP mode are described in Table below.

Table 11 Description of SWP Mode Parameters

Frequency	
LO Optimize	Auto: default low spurious mode; Speed: high sweep speed mode; Spur: low spurious mode; PhaseNoise: low phase noise.
Amplitude	
PreAmplifier	Set the operation of the preamplifier: Auto On: The preamplifier turns on automatically when the reference level is below approximately -30 dBm. Forced Off: The preamplifier remains off regardless of the reference level. Low Gain: The preamplifier operates in low gain mode. Medium Gain: The preamplifier operates in medium gain mode. High Gain: The preamplifier operates in high gain mode.
GainStrategy	LowNoise: Focuses on low noise while keeping the noise floor flat. HighLinearity: Focuses on high linearity while keeping the noise floor flat.
IFGainGrade	0 to X steps, 3 dB gain difference per step Increasing IF Gain Step: Reduces RF gain, raises noise floor, improves linearity, and reduces spurs. Decreasing IF Gain Step: Increases RF gain, lowers noise floor, reduces linearity, and increases spurs.
Atten	Step size 3 dB Atten = -1 dB (default): No attenuation. Atten ≥ 0 dB: Attenuation is enabled.
Amplitude Offset	Adjusts the amplitude range of the signal displayed on the spectrum analyzer without changing the actual signal value. By setting an offset, the displayed result on the device is modified.
Auto Reference	Available only in standard spectrum analysis mode. When enabled, the instrument automatically adjusts the reference level to ensure the signal trace is displayed within an appropriate range, preventing overload or an excessively low display.
IFAGC	IF AGC Control On: Reduces IF gain when saturation occurs to prevent overload. Off: Disables automatic gain control.
AGC Target	When IF gain control is enabled, set the target power for IF AGC: range is 0 to −30 dBFS; the Target represents the dBFS level relative to ADC saturation.

IF Out	IF Output Control: On: Enables IF output. Off: Disables IF output.
Antenna Factor	Used to compensate for the antenna's gain or attenuation, in order to convert the signal received by the antenna into the actual electric field strength.

Sweep

SWTMode	min SWT: minimum sweep time; min SWTx2: approximately 2 times of min SWT; min SWTx4: approximately 4 times of min SWT; min SWTx10: approximately 10 times of min SWT; min SWTx20: approximately 20 times of min SWT; min SWTx50: approximately 50 times of min SWT; min SWTxN: approximately N times of min SWT, N = SweepTimeMultiple; Manual: approximately equal to the target SweepTime.
PointsStrategy	SweepSpeed: priority is given to the fastest sweep speed; PointsAccuracy: priority is given to ensuring that the number of trace points is close to the target.
SpurRejection	Bypass, Standard and Enhanced.
FFTExecution	Auto: automatically selects the CPU or FPGA for FFT calculation based on the settings (using CPU for RBW below 30 kHz and FPGA for RBW above 30 kHz), CPU preferred, FPGA preferred, CPU Low Occ, CPU Mid Occ, CPU High Occ, FPGA only.
Window	FlatTop Window: higher amplitude accuracy. B-Nuttal Window: greater frequency selectivity. LowSideLobe Window: higher accuracy in measuring low-frequency signals. Rectangular Window: highest frequency resolution. Kaiser Window: β = 7.6.

System

RefCLKSource	When using an external reference clock source, set the reference clock frequency to 10MHz. Internal: Use the internal reference clock. External: Use the external reference clock; if unavailable, automatically switches to the internal clock. External_Forced: An external reference clock must be connected. If not, the system will not switch to the internal clock, and an unlocked clock may result in unstable received signals
RefCLKOut	All-New PXN and SAN series: When enabled, outputs a 100 MHz reference clock. Others: When enabled, outputs a 10 MHz reference clock.

6.2 Channel Power

As an example, a BPSK signal with a carrier frequency of 1 GHz, a power of -20 dBm and a symbol rate of 1 MHz is tested.

6.2.1 Parameters description

Only some of the important parameters are described here: the important parameters in the channel power measurement section are shown in Table below.

Table 12 Description of Channel Power Measurement Parameters

Channel Power	
Meas BW	The bandwidth of the channel to be measured; channel power is the integrated power within this bandwidth.
SpanPower	The measurement bandwidth to the current span and calculates the channel power within this range.

6.2.2 Procedure

1. Set "Center" to 1 GHz and "Ref.Level" to 0 dBm, click "Meas" menu and select "ChannelPower";
2. The software will automatically configure the default parameters, and the test results are shown below. The upper left corner of the measurement box shows the channel power value. In the lower "ChannelPower" column, you can also view the Meas BW, ChannelPower and Power Density values;
3. You can adjust the channel center frequency (press and hold the measurement area and slide to select), measurement bandwidth (press and hold the measurement border and drag left and right or adjust the Meas BW setting), and also modify the parameters such as "Center", "Span", "Ref.Level" and "RBW" in the main setting area to suit different signals.

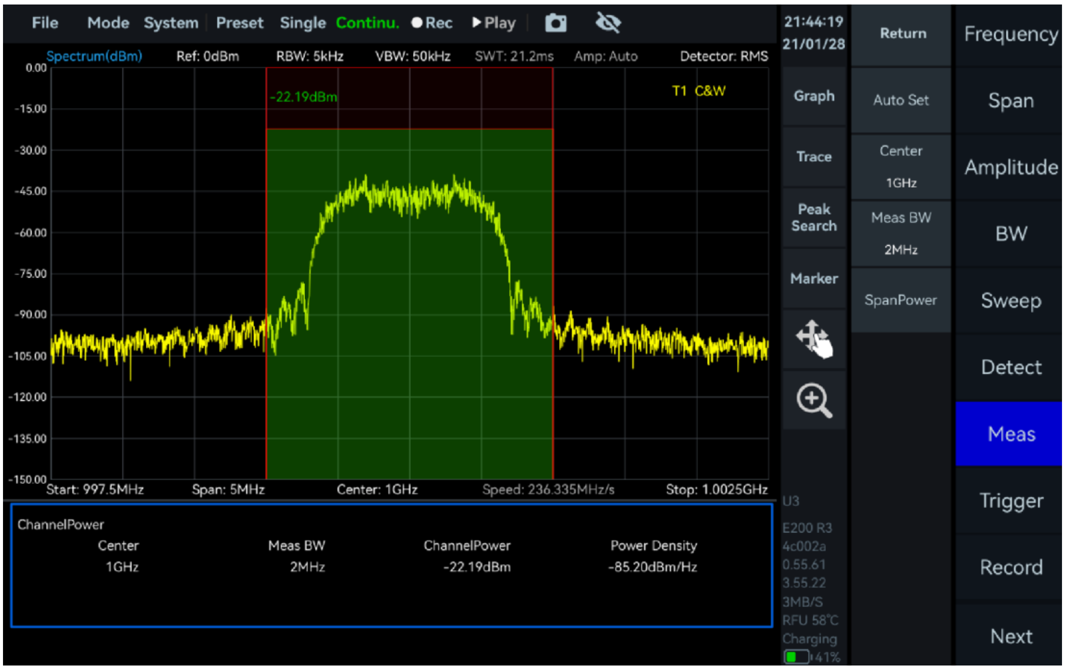

Figure 19 Measurement of ChannelPower

6.3 Occupied Bandwidth

As an example, a BPSK signal with a carrier frequency of 1 GHz, a power of -20 dBm and a symbol rate of 1 MHz is tested.

6.3.1 Parameters description

Only some of the important parameters are described here: some of the important parameters of the occupied bandwidth measurement are shown in Table below.

Table 13 Description of OBW Parameters

OBW	
Method	XdB, Percentage
XdB/%	Set specific XdB values/percentages

6.3.2 Procedure

1. Set "Center " to 1 GHz and "Ref.Level" to 0 dBm, click "Meas" menu and select "OBW" in the submenu;
2. Click on "BW" and set "RBW" to 50 kHz;
3. The software will automatically configure the measurement parameters, and the measurement results are shown in the figure. You can see the occupied bandwidth value in the lower "OBW" column;
4. You can also modify the parameters such as "Center ", "Span", "Ref.Level" and "RBW", etc. in the main setup area to suit the measurement of different signals.

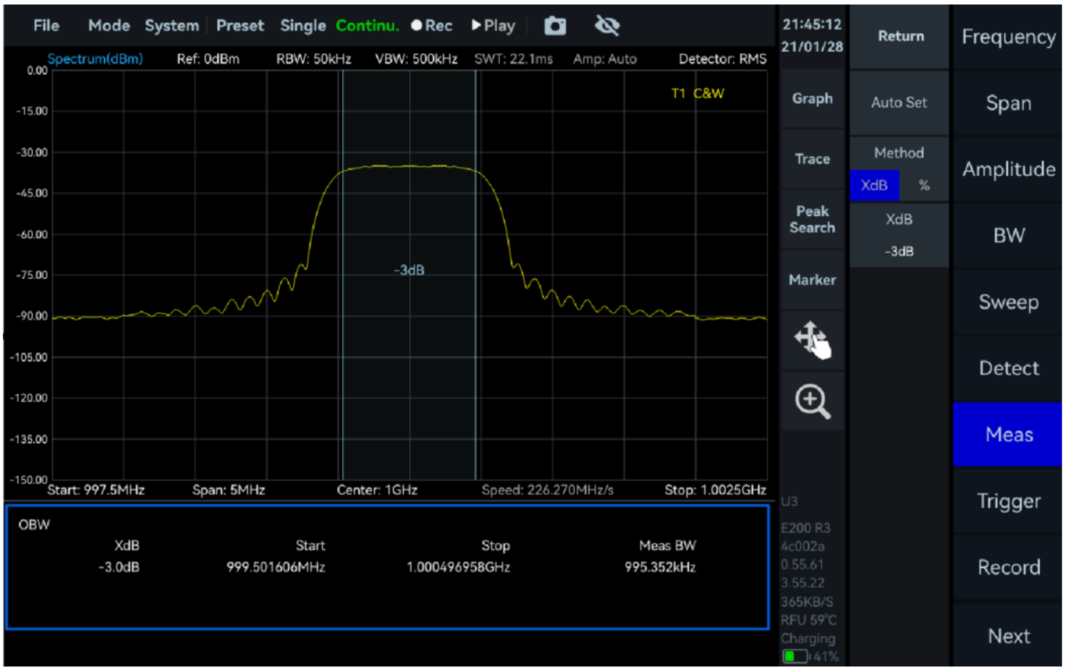

Figure 20 Measurement of OBW

6.4 Adjacent Channel Power Ratio (ACPR)

As an example, a BPSK signal with a carrier frequency of 1 GHz, a power of -20 dBm and a symbol rate of 1 MHz is tested.

6.4.1 Parameters description

Only some of the important parameters are described here: some of the important parameters of the adjacent channel power ratio measurement are shown in Table below.

Table 14 Description of ACPR Measurement Parameters

ACPR	
Space	Setting the frequency interval between the main channel and the adjacent channel.
Count	Set the number of adjacent pairs, upper limit 2 pairs.

6.4.2 Procedure

1. Set "Center" to 1 GHz and "Ref.Level" to 0 dBm, click "Meas" menu and select "ACPR" in the submenu;
2. The software will automatically configure the default parameters and the test results are shown below. The top green channel bandwidth is the power value of each channel. You can also check the Adj Center, Adj Power and Adj Ratio in the "ACPR" column at the bottom;
3. You can set the center frequency of the main channel, the bandwidth of each channel, the adjacent channel spacing and the number of adjacent channel pairs, and you can also modify the parameters such as "Center", "Span", "Ref.Level" and "RBW", etc. in the main setting area to suit the measurement of different signals.

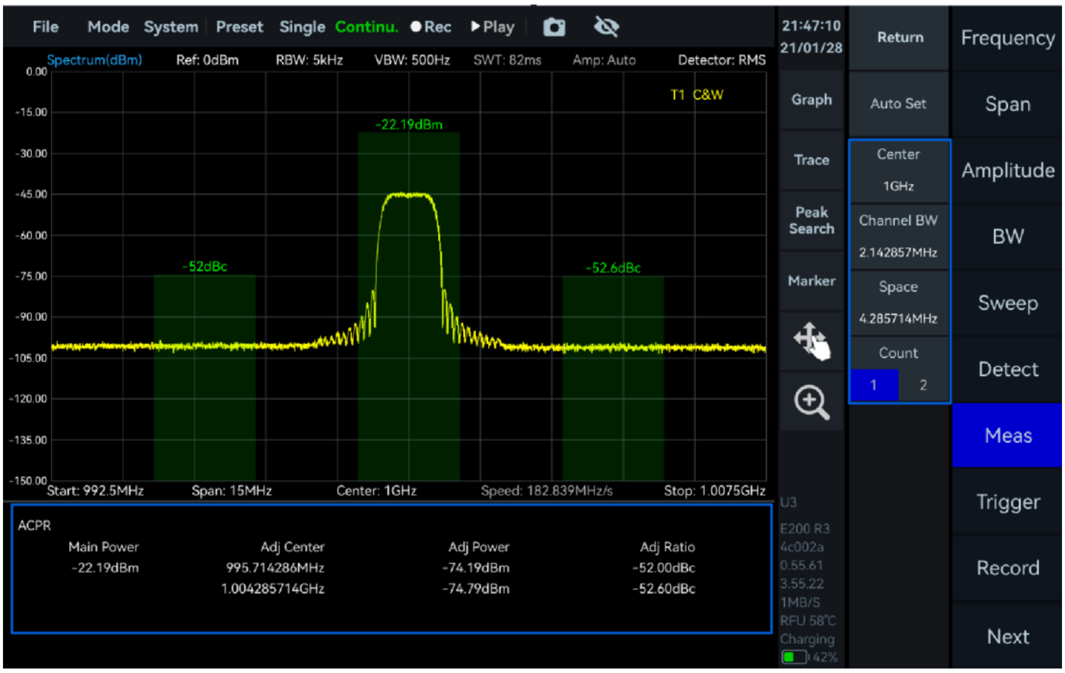

Figure 21 Measurement of ACPR

6.5 IP3/IM3

Example of testing IP3/IM3 at the 1 GHz frequency point.

6.5.1 Parameters description

Only some of the important parameters are described here: Some of the important parameters for IP3/IM3 measurements are shown in Table below.

Table 15 Description of IP3/IM3 Measurement Parameters

IP3/IM3	
LowTone Frequency/Power	Frequency/Power of the input low-frequency signal.
HighTone Frequency/Power	Frequency/Power of the input high-frequency signal.
LowIM3P Frequency/Power	Frequency/Power of the intermodulation-generated low-side signal.
HighIM3P Frequency/Power	Frequency/Power of the intermodulation-generated high-side signal.
TonePowerDiff	High and low frequency power difference of the input signal.

6.5.2 Procedure

1. Combine the signals with a center frequency of 999 MHz and an amplitude of 0 dBm and a center frequency of 1.001 GHz and an amplitude of 0 dBm into a single signal by means of two signal sources and combiners, and input them into the instrument;
2. Set the "Center" of the instrument to 1 GHz and the "Ref.Level" to 0 dBm, click the "Meas" menu and select "IM3";
3. Adjust the signal power so that the third-order intermodulation interference signal appears approximately 6 dB below the reference level in the spectrum;
4. The software will automatically configure the default parameters and the test results are shown below. The IP3 test results can be viewed in the "IM3" column below.

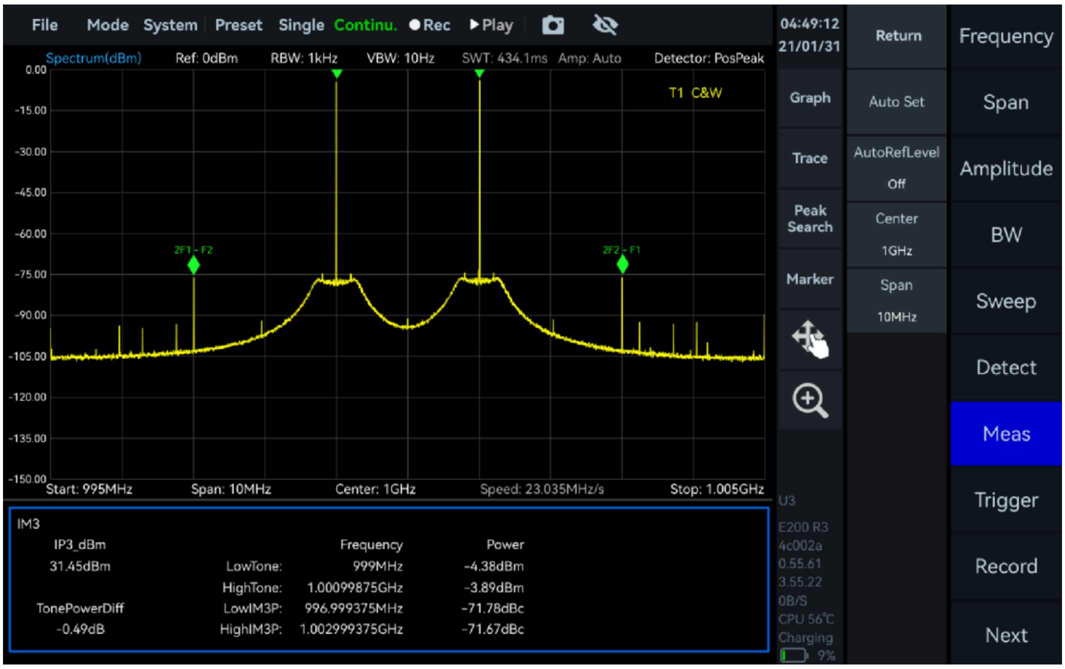

Figure 22 Measurement of IP3/IM3

6.6 SEM

The Spectrum Emission Mask (SEM) is a measurement function used to evaluate whether a wireless signal has excessive emissions or spurious signals outside its operating frequency band.

As an example, this function can be used to assess whether an IEEE 802.11ac signal with a frequency of 1 GHz and a power level of -20 dBm complies with the standard.

6.6.1 Parameters description

Only some of the important parameters are described here: some of the important parameters for SEM measurements are shown in Table below.

Table 16 Description of SEM Measurement Parameters

SEM		
Auto Set	Linkage with peak reference type, automatically using the signal peak as the current relative reference when enabled.	
Ref Set Type	Manual: When enabled, user-defined relative reference level. Peak: When enabled, the peak of the current signal is used as the relative reference level.	
Manual Ref	Sets the relative reference level value. This function only works when "Manual" is selected as the reference type The set manual reference value will be used as the reference for calculating the start/stop threshold in the offset table.	
Offset Table	StarFreq/StopFreq	Set the upper offset band to indicate the offset distance relative to the center frequency. The system automatically generates upper and lower offset bands symmetrical to the center frequency, and up to 16 offset bands can be configured.
	LimitStart/LimitStop	Setting the power limit of the signal in the corresponding upper and lower offset bands
	Mode	Absolute: Measurement in absolute amplitude, based on the actual power value, independent of the reference value. Relative: Measurement relative to a set "Manual" value, based on the reference value to calculate the power limit in the offset band.
	Priority	Required: must meet the requirements of the template, if not, it will be regarded as a failure. Suggested: recommended to meet the requirements of the template, if not, then prompt a warning.
	Save Table	Save the current measurement template Default path: "/data".
	Load Table	Load user pre-stored measurement templates
	Load Preset	Select the appropriate template from the predefined templates provided with the device Template type: 802.11a/g, 802.11b, 802.11n (20MHz, 40MHz), 802.11ac (20MHz, 40MHz, 80MHz, 160MHz) AM NRSC, FM FCC 73.317, FM NRSC Hybrid, AM NRSC 5K Hybrid, AM NRSC 8K Hybrid, Bluetooth
Export Result	Export the measurement table below the trace as a table Default path: "/reports".	

6.6.2 Procedure

1. Set the "Center" to 1 GHz and the "Ref.Level" to -20 dBm;
2. Click "Meas" and select "SEM" in the additional menu;
3. Click "Offset Table", select the "Load Preset" button in the pop-up window, and select the "802.11ac (20MHz)" template in the template list;
4. Click "BW", adjust "RBW" to "5 kHz" and "VBW Mode" to "VBW = 0.01 RBW";
5. Click "Sweep", set "SWTMode" in the additional menu to "minSWT×20", and set "Detector" to "Average";
6. The measurement results are shown in the figure below, the spectrum map will show whether this spectrum meets the requirements of the template, and the maximum margin on each offset band is shown in the table below the measurement results.

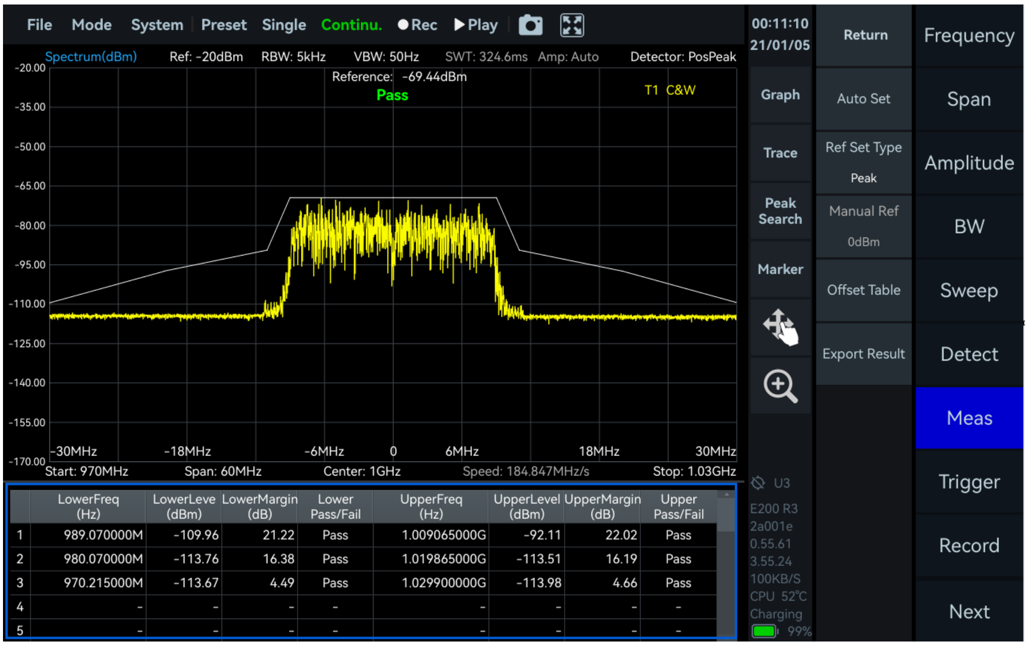

Figure 23 Measurement of SEM

6.7 Auto Reference Level

The Auto Reference Level function is used to automatically adjust the reference level of the instrument to ensure that the signal trace is within the appropriate display range to avoid the signal being out of range or displayed too low.

The following is an example of adjusting the power adjustment of a 1 GHz single tone signal:

1. Input a signal with a frequency of 1 GHz and a power of -35 dBm into the instrument;
2. Set the "Start Frequency" to 90 MHz and the "Stop Frequency" to 3 GHz;
3. Click "Amplitude" in the menu bar to enable the function of "Auto Reference Level";
4. The system will automatically adjust the reference level from 0 dBm to -30 dBm;
5. Modify the input signal power to 5 dBm, the reference level will be adjusted from -30 dBm to +10 dBm.

Note: The lower limit of the automatic reference level threshold is -70 dBm, the adjustment step is 10 dB/grade, the input signal should not exceed the corresponding loss power of each frequency band.

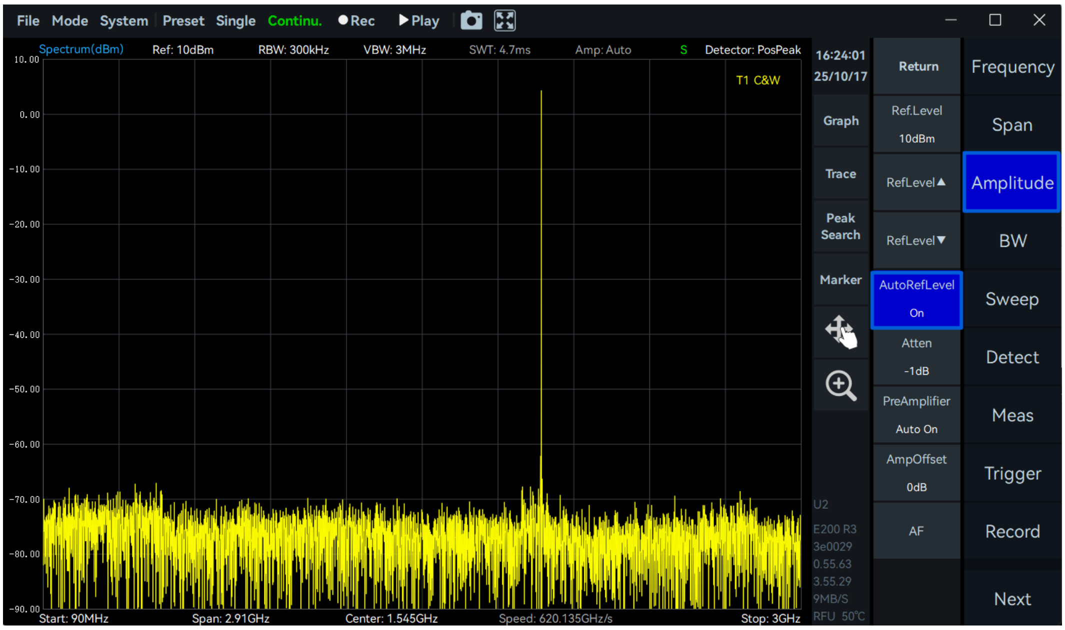

Figure 24 Enable Automatic Reference Level

6.8 Antenna Factor

In software versions 3.55.28 and above of the GUI, the Antenna Factor function has been added. It is used to compensate for the antenna's gain or attenuation and to convert the signal received by the antenna into the actual electric field strength.

6.8.1 Parameters description

Only some key parameters are explained here: the main parameters of the antenna factor are shown in Table below.

Table 17 Description of Antenna factor Parameter

Antenna Factor	
Enable	On: Activates the Antenna factor function.
Import	Allows users to customize the Antenna Factor configuration according to the exported file format and import it into the system.
Export	Exports the current Antenna Factor configuration as an Excel file, with the default export path set to the "/data" folder
Apply	After setting or updating the Antenna Factor configuration, click the Apply button to make the configuration take effect
Load	When paired with the HDA-100 active directional antenna, no configuration is required and the antenna factor is loaded at a button

6.8.2 Compensation Rules

- From the start frequency to the first compensation point within the current sweep span, compensation is applied using the factor of the first compensation point;
- Between multiple compensation points, compensation of the antenna factor is performed using linear interpolation based on the frequency point data in the correction table;
- From the last compensation point to the stop frequency, compensation is applied using the factor of the last compensation point.

6.8.3 Antenna Factor Configuration Example

For example, to configure compensation as follows: 17.5 dB for the 30 MHz to 50 MHz band, linear interpolation from 17.5 dB to 27.3 dB for the 50 MHz to 1 GHz band, and 27.3 dB for the 1 GHz to 2 GHz band, proceed with the following steps:

1. Click "Frequency", set "Start" to 30 MHz and "Stop" to 2 GHz;
2. Click "Amplitude" -> "Antenna Factor" in the menu bar;
3. In the pop-up window, enable "Enable", then click "Add". Each click allows you to add one frequency correction entry;
4. Set "Frequency 1" to "50 MHz" and "Factor 1" to "17.5 dB". Click "Add" again, then set "Frequency 2" to "1 GHz" and "Factor 2" to "27.3 dB";
5. Click "Apply" in the bottom-right corner of the pop-up window to apply the antenna factor compensation;
6. Users can also click "Export" to export the current configuration as an Excel file, which is saved by default in the "/data" folder;
7. If using antenna factor data provided by the manufacturer, you need to generate a correction table in the same format as the exported file so it can be recognized by the software, and then import it using the "Import" button.

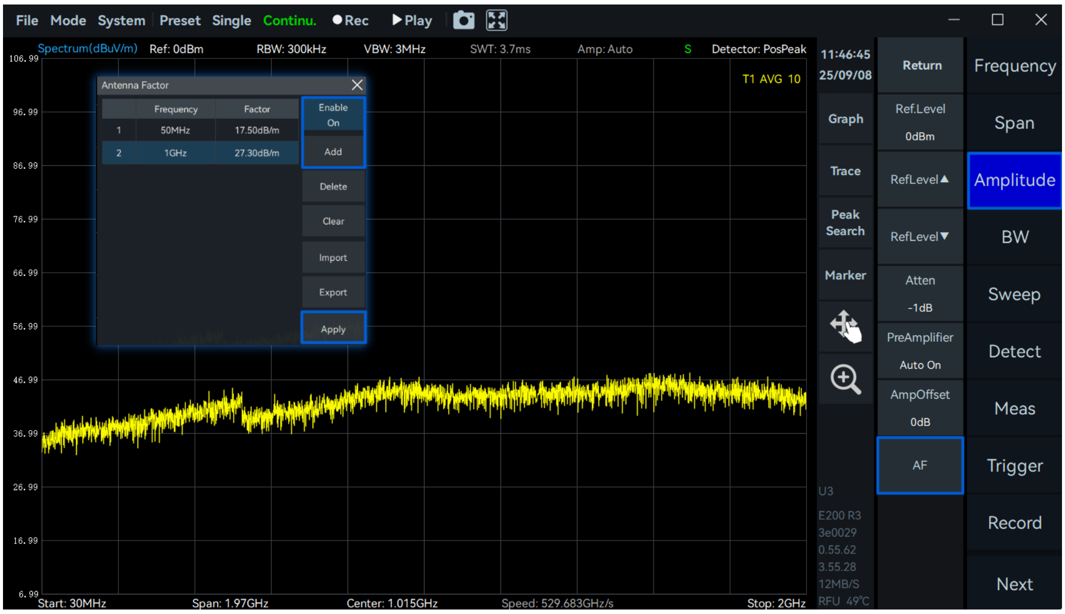

Figure 25 Antenna Factor Configuration Example

6.8.4 Auto Load Antenna Factor

When paired with HDA-100 active directional antenna, there is no need to manually configure it, the system can automatically load the antenna factor, thus enhancing work efficiency. The specific steps are shown below:

1. Correctly connect the instrument and HAD-100 active directional antenna, and start the software;
2. Set the "Start Frequency" to 500 MHz and the "End Frequency" to 10 GHz;
3. Click "Amplitude" -> "Antenna Factor" in the menu bar;
4. Enable "Enable" in the pop-up window, and then click "Load", the system will load the antenna factor automatically.

Figure 26 With HDA-100: automatic loading of antenna factors

7. Using of the IQS mode

This chapter describes in detail some of the important parameters of the IQ streaming mode, and focuses on describing how to carry out further analyses of the time-domain IQ data acquired by the system, such as spectral analysis, time-domain analysis, power-time analysis, digital down-conversion, demodulation, etc.

7.1 Introduction to the General Parameters of The IQS mode

Table 18 Description of IQS Mode Parameters

Frequency	
LO Optimize	Please refer to the parameter with the same name in the Introduction to the General Parameters of SWP Mode.
BW	
IQSampleRate	ADC sampling rate, 110 MSPS to 130 MSPS can be set.
AnalysisBw	Display the equivalent sampling rate after extraction: Span * 0.8.
Span▲/▼	Support increasing or decreasing the analysis bandwidth in powers of two.
DataFormat	8-bit: Lower precision. When there is no signal, many zeros are likely to be captured. 16-bit: Default configuration. 32-bit: Higher precision.
Amplitude	
PreAmplifier **GainStrategy** **IFGainGrade** **Atten** **AmpOffset** **IFAGC** **IFAGCTarget** **IFOut**	Please refer to the parameter with the same name in the Introduction to the General Parameters of SWP Mode.
Current IF Gain	Unit: dB. Returns the current IF AGC gain, where positive values indicate amplification and negative values indicate attenuation.
Record	
RecordMode **RecordTime** **FileSizeLimit** **Diskcapacotu**	Please refer to the parameter with the same name in the Recording and Playback.

Playback	
Last frame Next frame Back Forward	Please refer to the parameter with the same name in the Recording and Playback.
System	
RefCLKSource RefCLKOut	Please refer to the parameter with the same name in the Introduction to the General Parameters of SWP Mode.

7.2 IQ Streaming Working Mode Overview

The initial interface of the IQ Stream Mode consists of a Max Power vs. Time thumbnail, a spectrum plot, and a time-domain plot. Click "Next" in the main settings area, then click "Trigger". In the submenu, modify the "Preview Time" parameter to adjust the preview time range of the IQ stream in the Max Power vs. Time thumbnail.

The display ranges of the spectrum plot and the IQ time-domain plot are determined by the red selection boxes, "Spectrum-P" and "IQvT-P", in the Max Power vs. Time thumbnail. By adjusting the position and range of these selection boxes, you can observe IQ time-domain signals from different time segments, or perform spectrum analysis on IQ time-domain signals captured over different time periods.

7.3 Spectrum Analysis

7.3.1 Parameters description

Only some of the important parameters are described here: the important parameters in the spectrum analysis section are shown in Table 18.

Table 19 Description of Spectrum Analysis Parameters

Spectrum analysis	
Window	Please refer to the parameter with the same name in the Introduction to the General Parameters of SWP Mode.
Intercept	Spectrum interception: e.g. Intercept = 0.8, displays 80% of the FFT spectrum analysis results in order to intercept the transition band spectral components

7.3.2 Procedure

1. Click "FFT" in the main settings area and enable "Analyze". Drag the red selection box "Spectrum-P" in the Max Power vs. Time thumbnail, or adjust the values of "TimeStart" and "TimeLength" to perform spectrum analysis on IQ signals collected over different time segments. Adjust the values of "Center" in the "Frequency" submenu and "Span" in the "BW" submenu to change the center frequency and analysis bandwidth of the spectrum;
2. Use "FFTsize" to set the number of points for spectrum analysis, "Window" to select different window functions, "TraceDetector" to set different trace detectors, and "Intercept" to crop the displayed spectrum. When Intercept = 0.8, the transition band can be cropped.

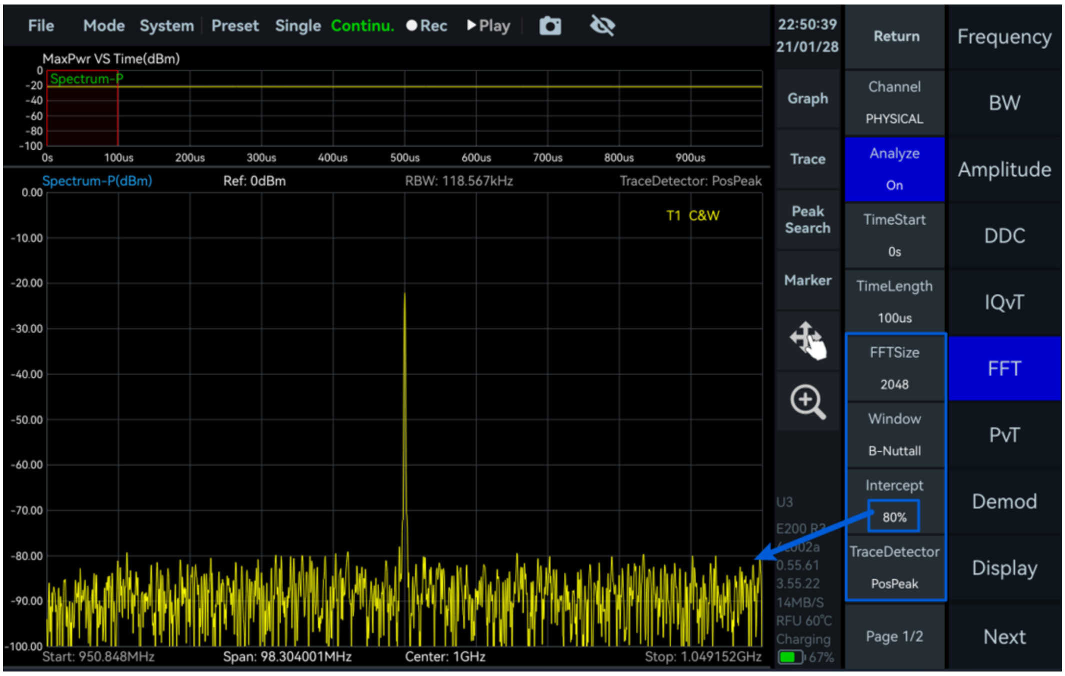

Figure 27 Spectrum analysis of IQ data

7.4 IQvT

7.4.1 Procedure

Click "IQvT" in the main settings area and enable "Analyze". Drag the red selection box "IQvT-P" in the Max Power vs. Time thumbnail, or adjust the values of "TimeStart" and "TimeLength". Then click "Auto Range" under "Graph" to perform time-domain analysis on IQ signals from different time segments.

Figure 28 IQ Time-Domain Plot and Zoom

7.5 PvT

7.5.1 Procedure

Click "PvT" in the main settings area and enable "Analyze". Drag the red selection box "PvT-P" in the Max Power vs. Time thumbnail, or adjust the values of "TimeStart" and "TimeLength" to perform power-vs.-time analysis on IQ signals from different time segments.

Figure 29 IQ Power-Time Plot and Zoom

7.6 AM Demodulation

As an example, demodulate an AM signal with a carrier frequency of 1 GHz, a power of -20 dBm, a modulation rate of 50 kHz and a modulation depth of 50%.

7.6.1 Parameters description

Only some of the important parameters are described here: the important parameters of the AM demodulation section are shown in Table below.

Table 20 Description of AM Demodulation Parameters

AudioFilter	
n	Number of Filter Taps: The larger the number of taps, the steeper the filter’s transition band and the smaller the passband ripple.
Fc	Cutoff Frequency: 0<Fc<0.5. For example, if set to 0.25, a low-pass filter is applied to half of the bandwidth.
As	Stopband Attenuation: The higher the stopband attenuation, the stronger the suppression in the stopband. Attenuation is specified in dB.
mu	Fractional Sample Offset: It is recommended to use the default value.

7.6.2 Procedure

1. Set "Center" to 1 GHz. Click the "Trigger" in the main settings area and set the "PreviewTime" to 3 ms;
2. Click "Demod" in the main settings area and set the "Type" in the additional menu to AM;
3. In the Max Power vs. Time thumbnail, drag the edge of the "Spectrum-P" selection box or increase the "TimeLength" in the "FFT" additional menu in the main settings area to expand the analysis range;
4. Click "BW" in the main setting area, and click "Span▼", to decrease the analysis bandwidth. In this example, set the analysis bandwidth to 768kHz;
5. Click the magnifying glass button "" in the chart setting area, and select the area of interest in the "AM Waveform-P(%)" chart to perform the initial zoom. For PX series tablet instruments, users can further adjust the zoom box size using gestures:

- Spreading or pinching two fingers horizontally allows for zooming in/out in the horizontal direction
- Spreading or pinching two fingers vertically allows for zooming in/out in the vertical direction

6. In the current configuration, the AM demodulation interface is shown in the figure below. The displayed content includes the spectrum of the modulated signal, the demodulated time-domain waveform, the audio spectrum, as well as parameters such as AM modulation depth, carrier power, modulation rate, SINAD, signal-to-noise ratio, and total harmonic distortion, allowing users to intuitively assess signal quality.

Figure 30 AM Demodulation

7.6.3 Audio analysis

Can be used to test the demodulation sensitivity of an instrument.

1. Refer to AM demodulation chapter Demodulation of AM signals;
2. Click "Demod" in the main settings area, open "AudioAnalysis" in the submenu, and enable audio analysis. Check whether the audio analysis frequency matches the modulation rate. You can also measure the signal's SINAD and Total Harmonic Distortion.

Figure 31 Audio analysis of AM demodulation

7.7 FM Demodulation

As an example, demodulate an FM signal with a carrier frequency of 1 GHz, a power of -20 dBm, a modulation frequency of 5 kHz and a frequency offset of 75 kHz.

7.7.1 Parameters description

Please refer to the AM demodulation parameter description chapter. When listening to FM broadcast signals, the FM demodulated signals can be low-pass filtered to reduce some of the high-frequency noise and make the listening sound purer.

7.7.2 Procedure

1. Set "Center" to 1GHz. Click the "Trigger" in the main settings area and set the "PreviewTime" to 3ms;
2. Click "Demod" in the main settings area and set the "Type" in the additional menu to FM;
3. In the Max Power vs. Time thumbnail, drag the edge of the "Spectrum-P" selection box or increase the "TimeLength" in the "FFT" additional menu in the main settings area to expand the analysis range;
4. Click "BW" in the main setting area, and click "Span▼", to decrease the analysis bandwidth. In this example, set the analysis bandwidth to 384kHz
5. Click the magnifying glass button "" in the chart setting area, and select the area of interest in the "FM Waveform-P(%)" chart to perform the initial zoom. For PX series tablet instruments, users can further adjust the zoom box size using gestures:

- Spreading or pinching two fingers horizontally allows for zooming in/out in the horizontal direction
- Spreading or pinching two fingers vertically allows for zooming in/out in the vertical direction

6. In the current configuration, the FM demodulation interface is shown in the figure below. The displayed content includes the spectrum of the modulated signal, the demodulated time-domain waveform, the audio spectrum, as well as parameters such as FM modulation frequency offset, carrier power, carrier frequency error, modulation rate, SINAD, signal-to-

noise ratio, and total harmonic distortion, allowing users to intuitively assess signal quality.

Figure 32 FM Demodulation

7.7.3 Audio analysis

After demodulating the FM signal, please refer to the Audio analysis section for audio analysis of the demodulated signal.

7.8 DDC Digital Down Conversion

Perform digital down conversion and resampling on the IQ data stream to generate sub-IQ streams for further spectrum analysis. The following example demonstrates DDC on a single-tone signal at 1 GHz with a power of -20 dBm.

7.8.1 Parameters description

Only some of the important parameters are described here: some of the important parameters of the DDC digital down conversion are shown in Table below.

Table 21 Description of DDC Digital Down Conversion Parameters

State	
OffsetFreq	Frequency shift of complex mixing, for >0, the spectrum is shifted to the right; for <0, the spectrum is shifted to the left.
Decimate	Setting the DDC extraction multiplier, i.e., the resampling rate.

7.8.2 Procedure

1. Set "Center" to 1 GHz and "Ref. Level" to 0 dBm. Adjust the range of "IQvT-P" in the Max Power vs. Time thumbnail. Select the IQ time-domain plot, click "Graph", and choose "Auto Range" in the Graph submenu;
2. Click "DDC" in the main settings area. In the additional submenu, click "State On" to enable Channel 1. Set DDC1 channel parameters as follows: "Center" = 1.003 GHz, "OffsetFreq" = -3 MHz, "Step" = 1 MHz, and "Decimate" = 3;
3. Click "FFT" in the main settings area. In the additional submenu, select "DDC1" and enable "Analyze". Drag the red selection box "Spectrum-D1" in the Max Power vs. Time thumbnail,

or adjust "TimeStart" and "TimeLength" to perform spectrum analysis on the IQ sub-stream generated by DDC over different time segments;

4. Click "IQvT" in the main settings area. In the additional submenu, select "DDC1" and enable "Analyze". Drag the red selection box "IQvT-D1" in the Max Power vs. Time thumbnail, or adjust "TimeStart" and "TimeLength" to perform spectrum analysis on the IQ sub-stream generated by DDC over different time segments;

Figure 33 View the time-domain diagram of the IQ subflow under DDC

5. In the main settings area, click "PvT", select "DDC1", and enable "Analyze". Then drag the red "PvT-D1" box in the Max Power vs. Time thumbnail, or adjust "TimeStart" and "TimeLength" to analyze the IQ sub-stream from DDC over different time segments.

Figure 34 View the power-time graph of the IQ subflow under DDC

8. Using of the DET Mode

This chapter describes in detail some of the parameters of the detector analysis mode and the measurement of pulse signals in this mode.

8.1 Introduction to the General Parameters of DET Mode

Only some of the important parameters are described here: some of the important parameters of the detector analysis mode are shown in Table 21.

Table 22 Description of DET Mode Parameters

Frequency	
LO Optimize	Please refer to the parameter with the same name in the Introduction to the General Parameters of SWP Mode.
Amplitude	
PreAmplifier **GainStrategy** **IFGainGrade** **Atten** **AmpOffset** **IFAGC** **IFAGCTarget**	Please refer to the parameter with the same name in the Introduction to the General Parameters of SWP Mode.
IFAGCGain	Unit: dB. Returns the current IF AGC gain; positive values indicate gain, and negative values indicate attenuation.
System	
RefCLKSource **RefCLKOut**	Please refer to the parameter with the same name in the Introduction to the General Parameters of SWP Mode.

8.2 Pulse Signal Measurement

For example, a pulse modulated signal with a carrier frequency of 1 GHz, a power of -10 dBm, a pulse period of 80 us and a pulse width of 40 us is tested.

8.2.1 Procedure

1. Set "Center" to 1 GHz. Click "Single" in the menu bar to enable single-shot preview mode;
2. Click "Graph" in the chart settings area, then click "Zoom" to enable zoom. Adjust the zoom region by dragging the selected area or by dragging the edges of the zoom box left or right;
3. Select the zoomed plot, click "Graph" in the chart settings area, and choose "Marker Pair" to create two pairs of markers. Move M1R to the rising edge of a pulse, M1D to the falling edge of the same pulse, M2R to the rising edge of the pulse, and M2D to the rising edge of the next pulse. At this point, the values displayed for M1D and M2D in the upper-left corner of the zoomed plot correspond to the pulse width and pulse period, respectively. The duty cycle can be calculated using the following formula:

$$\text{DutyCycle} = \frac{\text{PulseWidth(M1D)}}{\text{PulsePeriod(M2D)}}$$

Figure 35 Pulse Signal Period and Width Measurement

8.3 Pulse Signal Detection (Option 72)

If you purchase the Pulse Detection Option at a later date, please refer to the Pulse Detection Option section to apply for a license in order to use the function properly.

8.3.1 Parameters description

Only some of the important parameters are described here: The important parameters of the pulse signal detection section are shown in Table below.

Table 23 Description of Pulse Signal Detection Parameters

Pulse Det	
Threshold	Pulse detection threshold, greater than the threshold value of the pulse signal will be determined as a valid pulse.
Pulse Count	Upper limit of pulse signal detection at current preview time.

8.3.2 Procedure

An example is the detection of a pulsed signal at 1 GHz, -20 dBm, with a pulse width of 40 us and a pulse period of 80 us.

1. Set "Center" to 1 GHz and "Ref. Level" to 0 dBm;
2. Click "BW" in the main settings area and adjust the "BW" value in the additional menu to set different analysis bandwidths. In this example, set "AnalysisBW" to 61.44 MHz;
3. Click "Trigger" in the main settings area and set "PreviewTime" to 500 μs;
4. Click "Pulse Det" in the main settings area to enable pulse detection. Drag the "Trigger.Level" in the power vs. time plot to set the pulse detection threshold, and adjust "Pulse Count" to set the maximum number of pulses detected within the current preview time;
5. Click "Single" in the menu bar. The pulse detection results under the current configuration are shown in the figure below. From the figure, you can obtain parameters for each detected pulse signal, including Top Level (dBm), Base Level (dBm), Rise Time, Rise Edge, Fall Time, Fall Edge, Width, PRI, and Duty Cycle. Additionally, statistical parameters of the detected

pulses are available, such as Max, Min, and Mean PRI and PW, as well as PRI deviation (%) and PW deviation (%).

Figure 36 Result of Pulse Detection

9. Using of the RTA mode

This chapter provides a detailed introduction to certain parameters of the real-time spectrum analysis mode, the disabling of the probability density plot, and the measurement of Wi-Fi signals in this mode.

9.1 Introduction to the General Parameters of RTA Mode

Only some of the important parameters are described here: some of the important parameters of the real-time spectrum analysis mode are shown in Table below.

Table 24 Description of RTA Mode Parameters

Frequency	
LO Optimize	Please refer to the parameter with the same name in the Introduction to the General Parameters of SWP Mode.
Amplitude	
PreAmplifier **GainStrategy** **IFGainGrade** **Atten** **AmpOffset** **IFAGC** **IFAGCTarget**	Please refer to the parameter with the same name in the Introduction to the General Parameters of SWP Mode.
IFAGCGain	Unit: dB. Returns the current IF AGC gain; positive values indicate gain, and negative values indicate attenuation.
Sweep	
SWTMode **Window**	Please refer to the parameter with the same name in the Introduction to the General Parameters of SWP Mode.
System	
RefCLKSource **RefCLKOut**	Please refer to the parameter with the same name in the Introduction to the General Parameters of SWP Mode.

9.2 Probability Density Plot

9.2.1 Parameters description

Graph	
BitMap	On: Enable probability density plot display Off: Disable probability density plot display
Color	Sky, Sea(Default), Jet, Cold, Hot, Gray
Afterglow	Increase: Extend the persistence of signal traces, suitable for capturing burst signals. Decrease: Speed up the refresh rate, suitable for tracking continuous signals.

9.2.2 Close Probability Density Plot

Click "Graph" in the chart settings area, and in the pop-up window disable "BitMap" to turn off the probability density plot.

Figure 37 Close Probability Density Plot

9.3 WIFI Signal Measurement

1. Connect the antenna to the RF input port "RFIN";
2. Set the "Center" frequency to 2.44 GHz, and increase the "Afterglow" value under the "Graph" submenu in the chart settings area to more clearly observe the Wi-Fi signal.

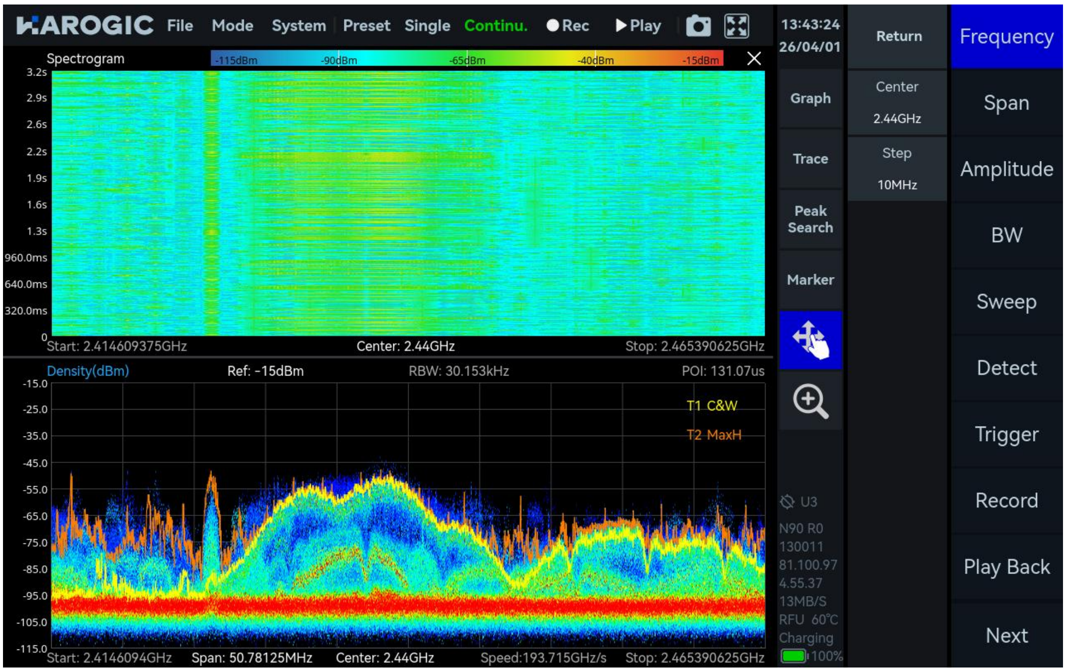

Figure 38 Probability Density Plot of WIFI Signal

10. Digital Demodulation (Option 71)

If you purchase the Pulse Detection option at a later date, please refer to the Digital Demodulation option section to apply for a license and a demodulation library in order to use the function properly.

10.1 Parameters description

Only some of the important parameters are described here: some of the important parameters are shown in Table below.

Table 25 Description of Digital Demodulation Parameters

Digital Demod	
SymbolRate	The number of symbols per second transmitted by the signal, which should be filled in according to the symbol rate of the modulated signal to ensure correct demodulation at the receiving end
ModType	2ASK, 2FSK, 4FSK, GMSK, BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM
FilterAlpha	The roll-off rate of the filter used to limit the signal bandwidth in the transition band needs to be consistent with the roll-off coefficient at the transmitter to ensure efficient processing and correct demodulation of the signal by the demodulator
Average number	Increasing the number of averages reduces jitter in parameters such as EVMs

10.2 Function Overview

The initial interface of the digital demodulation mode consists of the modulated signal spectrogram, the demodulated constellation diagram, the eye diagram, and the demodulation parameters, including: error vector magnitude (EVM), magnitude error, phase error, frequency error, signal-to-noise ratio (SNR/MER), and a partially decoded bit sequence. The modulation quality of the signal is analyzed in depth, providing several error indicators to effectively assess the integrity and reliability of the signal in transmission.

10.3 Procedure

As an example, demodulation of a 64QAM signal at 1 GHz, -20 dBm, SymbolRate 1 MHz, FilterAlpha 0.35.

1. Click "Mode" -> "Digital Demod";
2. Set the "Center" to 1 GHz and the "Ref.Level" to 0 dBm;
3. Click "Demod" in the main setting area, set "ModType" to QAM64, "SymbolRate" to 1 MSPS, "FilterType" to 0.35, and "Average Count" to 10 in the additional menu, then click "Single" in the menu bar. MSPS, "FilterType" is set to 0.35, "Average Count" is set to 10, click "Single" in the menu bar, the demodulation result under the current configuration is shown in the figure below. The demodulation result under the current configuration is shown in the figure below.

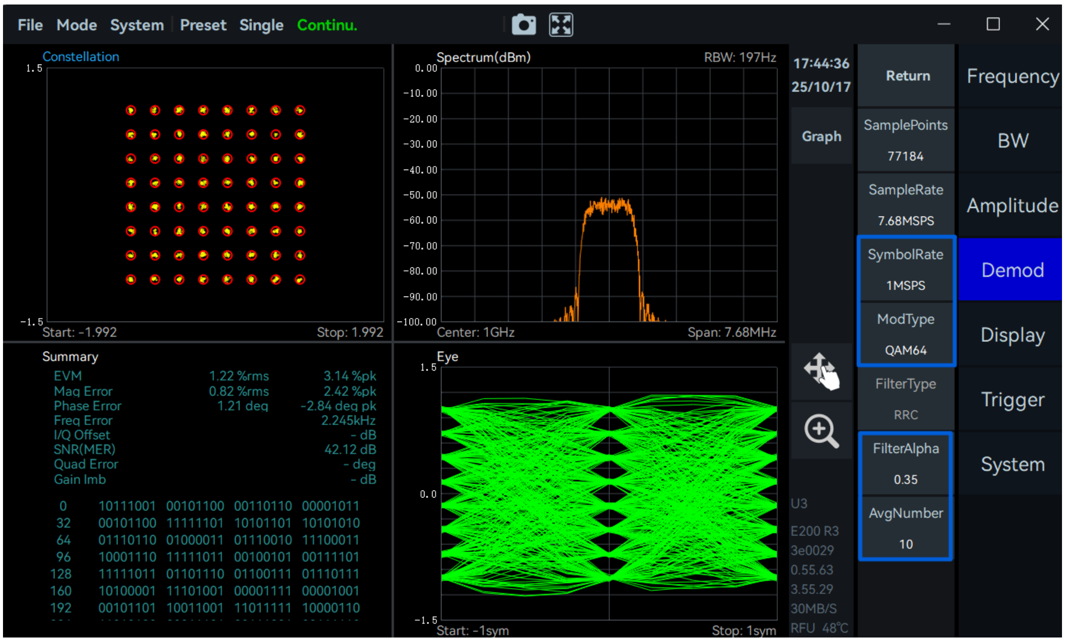

Figure 39 64QAM Demodulation

11. Harmonic Analysis Mode

11.1 Version Requirements

1. Refer to the Viewing Instrument Information section to view the soft and firmware version;
2. Ensure the version meets the following requirements:

- GUI Version: 4.3.55.24 or above
- API Version: 0.55.0 or above
- FPGA Version: 0.55.0 or above
- MCU Version: 0.55.0 or above

3. If the GUI version does not meet the above requirements, please refer to the section on Software and Firmware Update to obtain the appropriate version of the host computer software.

11.2 Enable Harmonic Analysis Function

After updating the software and firmware to the required version, restart the host software, and click "Mode" -> "Harmonics" in the menu bar to use the harmonic analysis function normally.

11.3 Parameters description

Only some of the important parameters are described here: the important parameters of the harmonic analysis section are shown in Table below.

Table 26 Description of Harmonic Analysis Parameters

Frequency	
Center	The center frequency of the fundamental signal.
Span	
Span	The measurement bandwidth for each harmonic. Range: 10 Hz to 100 MHz.
Amplitude	
Offset	Adjust the position of the spectrum plot along the amplitude axis.
Meas	
Harm Count	Set the number of harmonics to measure and plot, up to 10.
Meas Type	Peak: Measure the peak power of the fundamental and each harmonic. ChannelPower: Measure the channel power of the fundamental and harmonics within their respective sweep bandwidths.
Trace Type	ClearWrite: Update the spectrum plot in real time, suitable for observing instantaneous signal changes. MaxHold: Hold the peak value of the displayed signal, suitable for capturing instantaneous peaks.
PK Tracking	On: Enable peak tracking of the fundamental signal, aligning its peak to the center frequency.
THD	Used to evaluate the distortion level of the signal.

11.4 Procedure

An example is the measurement of the third harmonic of a 1 GHz, -20 dBm signal.

1. Click "Frequency" in the main settings area and set "Center" to 1 GHz;
2. Click "Amplitude" and set "Ref. Level" to -10 dBm;
3. Click "Meas", set "Harm Count" to 3, and enable "PK Tracking". Keep other parameters at their default values;
4. Click "Span" and set the "Span" to 10 MHz;
5. Click "BW" and adjust "RBW" and "VBW" values to stabilize the trace. In this example, set RBW to 1 kHz and VBW to 100 Hz;
6. The test results are shown in the figure below. The THD is displayed in the top-right corner of the spectrum plot. In the harmonic measurement table below, the frequencies, amplitudes, and differences from the fundamental of the second and third harmonics are listed.

Figure 40 Measurement of Third Harmonic

12. Phase Noise Measurement Mode

12.1 Version Requirements

1. Refer to the Viewing Instrument Information section to view the soft and firmware version;
2. Ensure the version meets the following requirements:

- GUI Version: 4.3.55.12 or above
- API Version: 0.55.58 or above
- FPGA Version: 0.55.17 or above
- MCU Version: 0.55.49 or above

3. If the soft and firmware version does not meet the above requirements, please refer to the section on Software and Firmware Update to update.

12.2 Enable Phase Noise Measurement Function

After updating the software and firmware to the required version, restart the host software, and click "Mode" -> "Phase Noise" in the menu bar to use the phase noise measurement function normally.

12.3 Parameters description

Only some of the important parameters are described here: The important parameters for the phase noise measurement are shown in Table below.

Table 27 Description of Phase Noise Measurement Parameters

Frequency	
Center	Set the center frequency of the fundamental.
Start Offset	Set the frequency offset start point: Range: 1 Hz to 9 MHz.
Stop Offset	Set the frequency offset stop point: Range: 10 Hz to 10 MHz.
Threshold	Set the threshold above which carriers will be identified.
Meas	
RBW/Offset	RBW Radio: (RBW of each frequency segment or start frequency of each frequency segment), range: 0.01 to 0.3.
Detect	Frame Detection Rate: The default configuration is recommended. If the test signal exhibits significant low-frequency jitter near the carrier, increase the frame detection rate in the near region to obtain more stable measurement results.
Trace	
Average	Set the number of averaging times for the trace.
Smooth	On: Enable trace smoothing. Off: Disable trace smoothing.
Window Length	Set the window length of the smoothing algorithm, range: 0 to 10%.

12.4 Procedure

12.4.1 Phase Noise Measurement with Known Carrier Information

As an example, the phase noise of a 1 GHz, 0 dBm signal is measured over an offset range of 100 Hz to 10 MHz.

1. Click "Frequency" in the main settings area. In the additional menu, set "Center" to 1 GHz, "Start Offset" to 100 Hz, and "Stop Offset" to 10 MHz. It is recommended to keep the other parameters at their default settings;
2. If the test signal exhibits strong jitter near the carrier, click "Meas" in the main settings area. Then, in the additional menu, select "Detect". In the pop-up window, appropriately increase the frame detection rate for the corresponding frequency band to obtain more convergent measurement results;

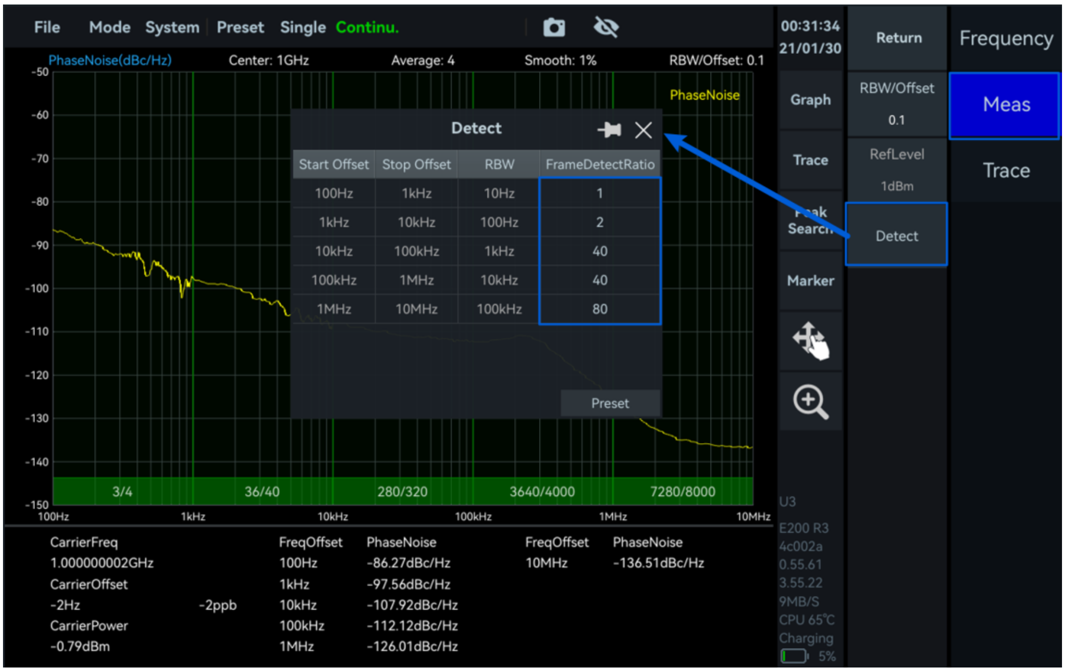

Figure 41 Pulse Signal Detection Settings

3. If significant spurious components appear in the single-sideband phase noise spectrum, click "Trace" in the main settings area. Then, in the additional menu, select "Window Length" and gradually increase its parameter value to reduce the impact of spurious signals on the measurement results;
4. The instrument will automatically perform phase noise measurements within the specified frequency offset range. The measurement results are shown below. In the phase noise measurement table at the bottom of the interface, information about the carrier as well as the phase noise values (dBc/Hz) at characteristic offset points can be obtained.

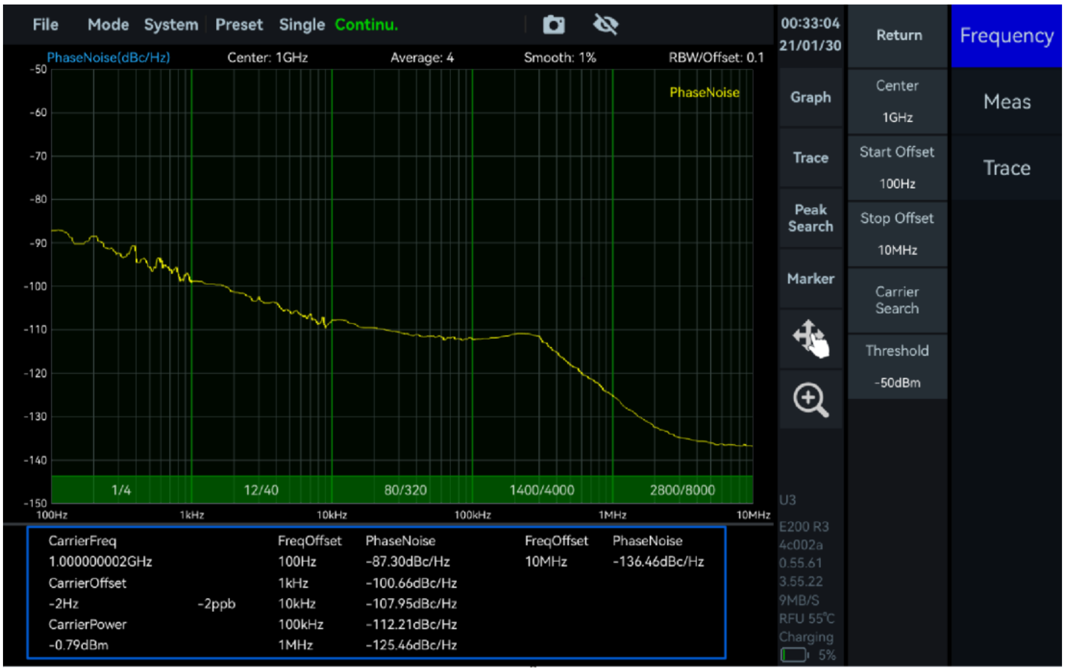

Figure 42 Result of Phase Noise Measurement

12.4.2 Phase Noise Measurement with Unknown Carrier Information

When the signal carrier parameters are unknown, it is recommended to follow the procedure below for phase noise measurement

1. Click "Carrier". The instrument will automatically perform a full-band scan to search for and locate peak signals that exceed the carrier threshold, which will be used as the test carrier;
2. After locating the carrier signal, refer to the Phase Noise Measurement with Known Carrier Information to set the start and stop frequency offsets, and perform the phase noise measurement.

13. Mapping Mode

This chapter provides a detailed introduction to several key parameters of Map Mode and explains how to use this mode to perform automated measurements for generating signal distribution heat maps.

13.1 Version Requirements

Refer to the Viewing Instrument Information section to check the software and firmware versions, and ensure that the GUI version is 4.3.55.32 or later.

13.2 Parameters description

Only some key parameters are described here: the main settings of the mapping mode are shown in Table 28, and the controls in the mapping chart settings area are shown in Table 29.

Table 28 Mapping Mode Main Settings Area Parameter Description

Map	
Point Spacing	Set the distance between two recording points, in meters. This takes effect only in "Manual" mode.
Point Size	Adjust the display radius of a single data point on the map. The larger the value, the larger the area occupied by the data point on the map.
Point Border	When enabled, a black outline border will be added to data points to enhance visual contrast and visibility against complex map backgrounds.
Point Opacity	Adjust the transparency of data point colors. The smaller the value, the lower the transparency.

Table 29 Introduction to Map Chart Settings Area Controls

Map	
Manual	In the map interface, click the mouse or tap the touchscreen to capture measurement data at the current location and plot the data point on the map in real time.
Auto	This function is available when the built-in/external GPS is locked. The software automatically collects and plots data according to the distance specified by the "point spacing" setting.
Select	In the map interface, select or deselect existing measurement points. When a data point is selected, a pop-up window will display detailed measurement parameters (including frequency, integration bandwidth, power, peak value, occupied bandwidth, time, longitude, latitude, and altitude). Click the "Direction" button, a direction indicator line will be automatically generated next to the data point. Click and hold the data point to rotate it, and the direction line will rotate accordingly. The corresponding panel will update and display the current indicated angle in real time.
Clear Points	Clear all measurement data points plotted on the map.
	Click "", zoom in on the current map display scale.
	Click "", zoom out on the current map display scale.

	Click "", enter distance measurement mode. Click sequentially on the map to display the actual distance between two consecutive points. Click the icon again to exit measurement mode. Click the "x" next to the measurement line to clear the current measurement trace,

13.3 Procedure

This section describes how to use a spectrum analyzer equipped with a built-in GNSS and an external antenna to generate signal distribution heat maps through automated measurements.

1. Click "Mode" -> "Mapping" on the menu bar to enable the Map function;
2. Refer to the Using the Bulit-in GNSS Module section to complete the GNSS module connection;
3. Connect the antenna to the RF input port of the spectrum analyzer;
4. Click "Map" in the main settings area, and set the "point spacing", as well as the size, border, and transparency of measurement points in the submenu;
5. Click "Frequency" in the main settings area to set the "center frequency" to 2.13 GHz. Click "Span" to set the "sweep bandwidth" to 200 MHz. Click "Meas" and set the "center frequency" to 2.13 GHz and the "integration bandwidth" to 40 MHz;
6. Drag and zoom the map in the interface to the current location. Click the "Auto" button in the chart settings area to start measurement. Then move the device, and the instrument will automatically collect and plot measurement points on the map according to the preset "point spacing";
7. Click "Select" in the chart settings area, and select an existing measurement point on the map. A floating information panel will display detailed parameters of the point, including frequency, integration bandwidth, power, peak value, occupied bandwidth, time, latitude, longitude, and altitude;
8. Enable "Direction" in the measurement details panel. A direction indicator line will be automatically generated next to the data point. Click and hold the data point to rotate it, and the direction line will rotate accordingly. The corresponding panel will update and display the current indicated angle in real time;
9. The channel power measurement result is displayed in the upper-right corner of the interface, and the measurement point information table is shown in the lower-right corner. Double-click the corresponding chart or table area to enlarge it, and double-click again to restore it.

14. MSCAN Mode

14.1 Description of MSCAN Mode Functions

MSCAN mode is an analysis mode based on a user-defined frequency band list for multi-segment sequential sweeping. It is particularly suitable for fast preview and analysis of multi-band signals. The interface of this mode includes the following key elements:

1. Preview Diagram

The preview diagram shows the composite spectrum of all configured frequency bands in the list. The red box highlights the spectrum corresponding to the selected frequency band in the list, allowing users to quickly locate and analyze the detailed signal characteristics of a specific band.

2. Configuration List

The table lists the configuration items for different frequency bands. Users can customize the measurement parameters for each band. Adjustable parameters include center frequency, span, reference level, dwell time, decimation factor, FFT size, number of detections, detector type, IFAGC, XPPS Trigger, IQ output, and window type. After the list configuration is completed, the device continuously acquires and displays spectrum data according to the defined settings.

3. Spectrum and IQvT View

Displays the spectrum and IQ time-domain view corresponding to the selected frequency band in the list configuration.

14.2 Introduction to the General Parameters of MSCAN mode

Table 30 Description of Preview Diagram Parameters

Preview Diagram	
#x Center	Display the center frequency corresponding to the selected frequency band in the sweep list.
SweepTime	Display the total time required for all frequency bands in the sweep list.

Table 31 Description of Configuration List Parameters

Configuration List	
#	Index of each frequency band in the sweep list, range: [1, 128]
Center (Hz)	Set the center frequency for each frequency band
Span (Hz)	Set the analysis bandwidth for each band, where bandwidth = 101.526/ decimation factor
Ref (dBm)	Set the reference level for each band, range: [-100, 27]
DwellTime (s)	Set the dwell time of the device for each band
Decimate	Increase the decimation factor reduces the span, range: 2^n, n =1 to 12
FFTSize	Set the number of FFT points for each band, range: 2^n, n = 5 to 12
DetectCount	Number of sweeps performed by the device for each band

Detector	Select the detector type for each band. Options: Sample, Positive Peak, Average, Negative Peak, Max Power, Raw Frame Detector, and RMS.
IFAGC	On: Adjusts the gain of signals within the band to keep the signal level within an appropriate range
XPPStrigger	On: The enabled band uses 1PPS trigger Off: Use Bus Trigger
IQPlayBack	On: Displays the IQ time-domain data of the enabled band in the IQ time-domain view
Window	Select the window type for each band. Options: B-Nuttall, Flat-Top, LowSideLobe, Rectangle and Kaiser.
Insert	Insert a new configuration band below the selected frequency band.
Delete	Delete the selected item.
Import	Import pre-saved configurations.
Export	Export the configuration list to the "/data" folder.

14.3 Procedure

14.3.1 Configuration Requirements

Configure the list according to the data in the table below to acquire spectrum data for different frequency bands under different configurations.

Index	Configuration
1	Center: 500 MHz; Span: 50 MHz; FFTSize: 2048; Detector: PosPeak; Window: FlatTop
2	Center: 2.4 GHz; Span: 25 MHz; FFTSize: 1024; Detector: RMS; IQPlayBack: On; Window: Kaiser

14.3.2 Operating Steps

The following example uses a newly configured SAN series instrument with a 50 MHz analysis bandwidth option to perform the above configuration and observe the spectrum display.

1. Click "Mode" -> "MSCAN" in the menu bar, and delete the default configuration;
2. Double-click the parameter field corresponding to Band 1 and modify the settings as follows: Set "Center (Hz)" to 500 MHz, "Ref (dBm)" to 0 dBm, "Decimate" to 1, "FFTSize" to 2048, "Window" to FlatTop;
3. Double-click the parameter field corresponding to Band 2 and modify the settings as follows: Set "Center (Hz)" to 2.4 GHz, "Ref (dBm)" to -20 dBm, "Decimate" to 2, "FFTSize" to 1024, enable "IQPlayBack", and set "Window" to Kaiser;
4. At this point, the preview displays a combined spectrum of the two bands. The selected band in the list is highlighted with a red box in the preview. The corresponding spectrum analysis and IQ time-domain waveform (if IQ output is enabled for that band) are displayed simultaneously;
5. Click the "Export" button to export the current configuration list data, or click "Import" to load a saved configuration.

Figure 43 Configuration List in MSCAN mode

15. Signal/Tracking Generator Function (Option 02)

The built-in signal/tracking generator option can output single-tone signals, frequency sweep signals, and power sweep signals, and supports tracking generator functionality. This option is only available for all-new PXN series.

15.1 Introduction to the General Parameters of the Signal Generator

Table 32 Description of AUXS Mode Parameters

RF Out	On: Enables the signal source output Off: Disables the signal source output
Mode	Fixed Frequency mode, frequency sweep, power sweep, TG
FixedPoint	
Center	Set the frequency for single-tone and power sweep signals
Level	Set power for single-tone and frequency sweep signals
FreqSweep	
Start	Set the start frequency of the frequency sweep signal
Stop	Set the stop frequency of the frequency sweep signal
Step	Set the frequency step of the frequency sweep signal
Dwell Time	Set the dwell time of the frequency sweep signal
PowerSweep	
Center	Set the output signal center frequency
Start	Set the start power of the power sweep signal
Stop	Set the stop power of the power sweep signal
Step	Set the power step of the power sweep signal
DwellTime	Set the dwell time for sweep signals, effective in "PowerSweep" and "FrequencySweep" modes
TG	
Output Power	Track the amplitude of the tracking generator output signal.
Save Reference	Save the current measurement trace as a reference baseline.
Show Reference	Recall the saved reference trace for comparison and analysis
Normalize	Perform normalization based on the reference trace to eliminate system path loss, displaying only the frequency response characteristics of the device under test (DUT).

15.2 Instructions for Using the ASG Function

The signal is output through the instrument's RFOUT port, which can either provide an input signal to other devices or be connected via cable to the instrument's own RF input port. The following example demonstrates a self-transmit-and-receive setup.

15.2.1 Output a Single-Tone Signal

1. Click "AUXS" -> "RF On" in the main settings area to enable the signal source option;
2. In the "AUXS" submenu, set "Center" to 1 GHz and "Level" to -20 dBm to output a single-tone signal at 1 GHz with a power level of -20 dBm.

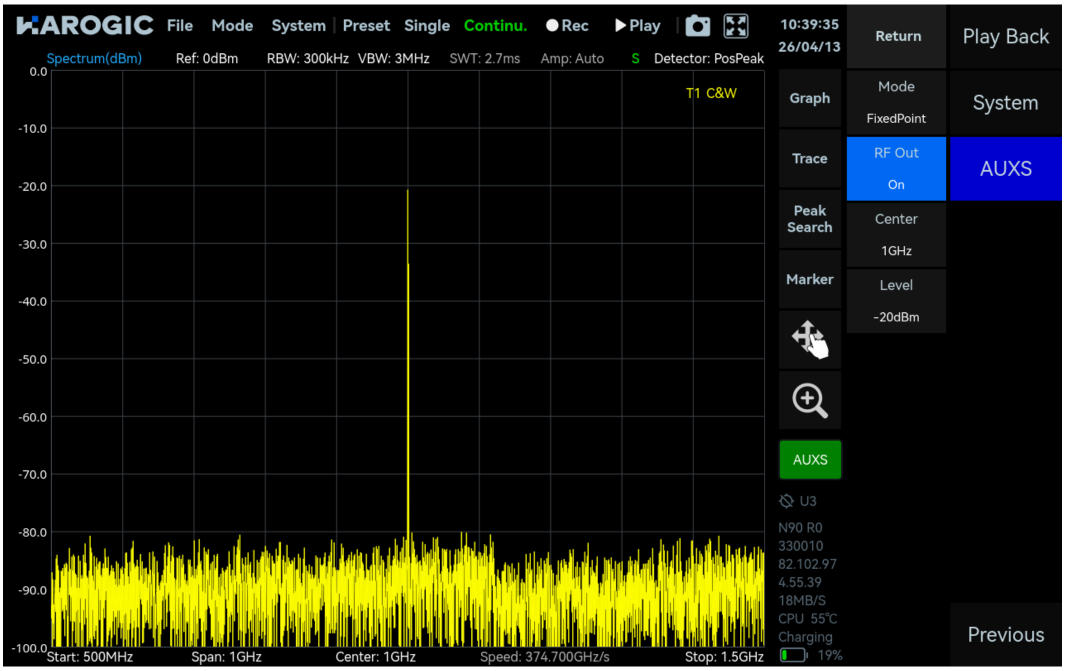

Figure 44 AUXS Single-Tone Signal Output

15.2.2 Output a Frequency Sweep Signal

1. Click "AUXS" in the main setting area, set the "Mode" to Frequency Sweep, and enable "RF Output";
2. In the sweep signal parameter settings area, set Output Power to -20 dBm, Start Frequency to 3 GHz, Stop Frequency to 3.5 GHz, Frequency Step to 40 MHz, and Dwell Time to 8 ms;
3. The built-in signal generator outputs a frequency sweep signal with a start frequency of 3 GHz, a stop frequency of 3.5 GHz, a frequency step of 40 MHz, a dwell time of 8 ms, and an amplitude of -20 dBm.

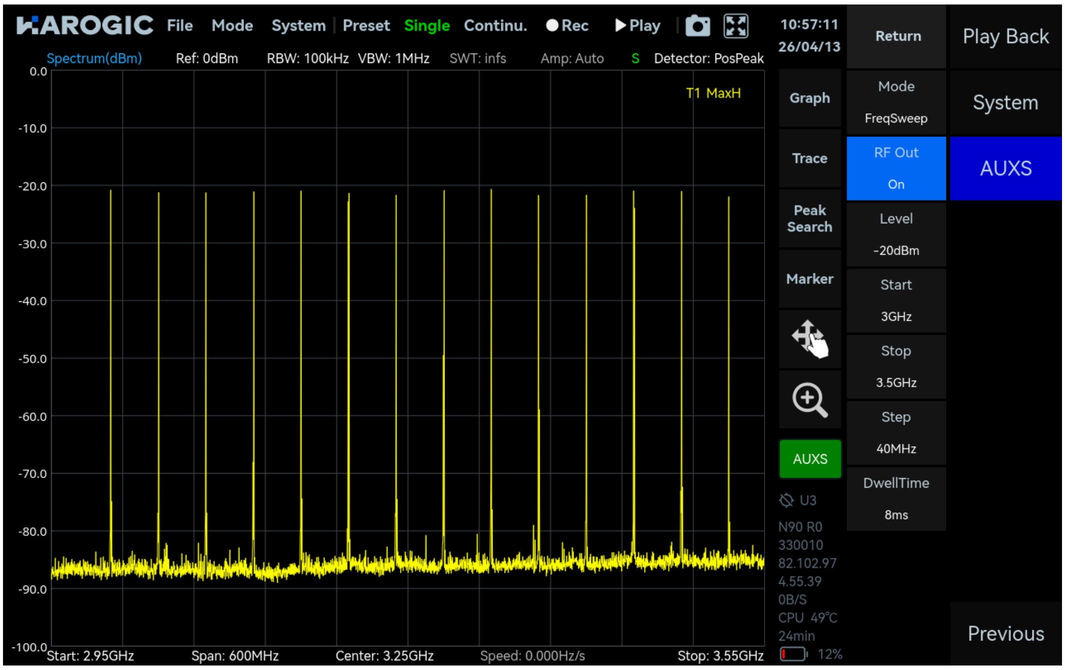

Figure 45 AUXS Frequency Sweep Signal Output

15.2.3 Output a Power Sweep Sigal

1. Click "AUXS" in the main settings area, set the "Mode" to Power Sweep, and enable "RF Output";
2. In the power sweep signal parameter settings area, set “Center Frequency” to 1 GHz, “Start Power” to -40 dBm, “Stop Power” to -10 dBm, “Power Step” to 1 dBm, and “Dwell Time” to 100 ms;
3. The built-in signal generator outputs a power sweep signal with a frequency of 1 GHz, a start power of -40 dBm, a stop power of -10 dBm, a power step of 1 dBm, and a dwell time of 100 ms.

15.2.4 Tracking Generator (TG)

The tracking generator (TG) is a core function of a spectrum analyzer used for measuring the frequency response of devices under test (DUT). When the TG function is enabled, the RF output port of the spectrum analyzer generates a signal that is strictly synchronized with the current sweep frequency.

1. Set the instrument’s “Center Frequency” and “Span” according to the operating frequency band of the device under test (DUT);
2. Click “AUXS” → “RF On” in the main settings area, select “TG” as the mode to enable the tracking generator, and set an appropriate “Output Power” according to the DUT characteristics;
3. Use a high-quality RF coaxial cable to directly connect the spectrum analyzer’s TG output port to the RF input port;
4. After the trace on the screen becomes stable, press the “Through Calibration” button to save the measurement curve that includes system cable loss, and enable the normalization function to eliminate system errors from the cable and instrument (after normalization, the trace typically appears as a near 0 dB flat line);

5. Disconnect the through connection and insert the DUT between the TG output port and the RF input port. The trace displayed on the screen now represents the true frequency response of the DUT.

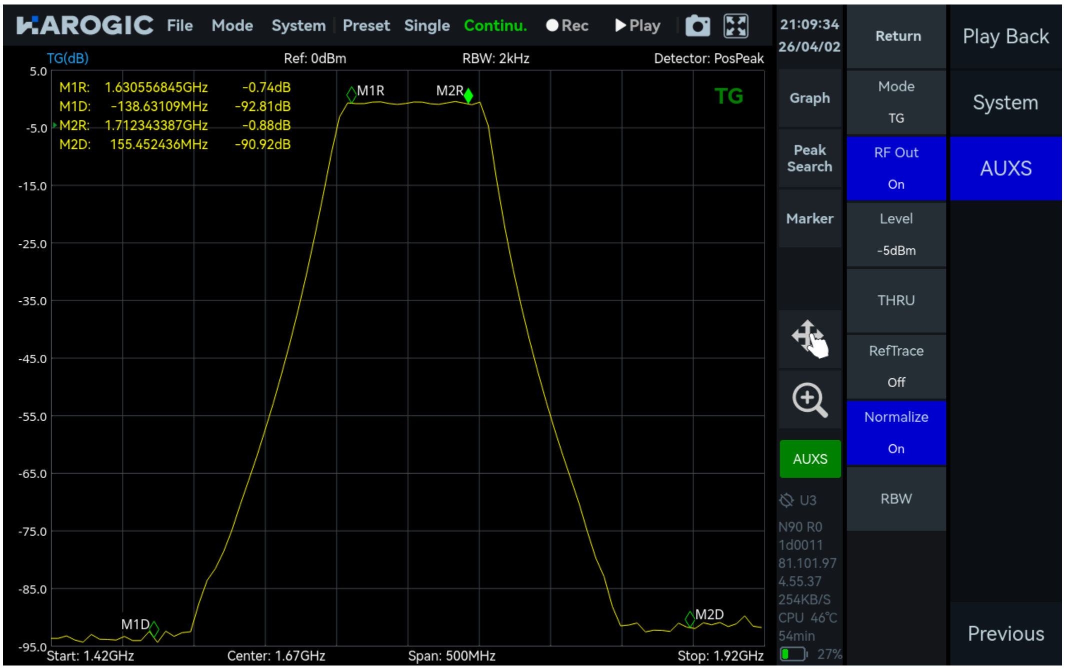

Figure 46 Frequency response curve of a band-pass filter

16. Additional Functions

This chapter briefly describes the IF outputs of the instrument, as well as the trigger function, the input of an external reference clock, and the remote control of the device.

16.1 Description of Trigger Functions

16.1.1 SWP Frequency Sweep Mode

Trigger

TriggerSource	FreeRun, Ext.PerHop, Ext. PerSweep, Ext.PerProfile, InXpps.PerHop, InXpps.PerSweep, InXpps.PerProfile
TriggerEdge	RisingEdge, FallingEdge, DoubleEdge
TriggerOut	None. PerHop: outputs a trigger for each completed frame of analysis. PerSweep: outputs a trigger for each trace scan completed. PerProfile: outputs a trigger for each switching configuration.
PulsePolarity	Positive, Negative

16.1.2 Fixed Frequency Point Mode for IQS, DET and RTA

Trigger

TriggerSource	External, Bus, Level, Timer, DevSyncByExt, DevSyncBy1PPS, GNSS1PPS
TriggerEdge	RisingEdge, FallingEdge, DoubleEdge
TriggerDelay	Set the time to delay acquisition after triggering
PreTrigger	Set the time to collect in advance before triggering
ReTrigger	The instrument responds multiple times after capturing a trigger

ReTrigger-On

Count	After a single trigger response, additional responses may be required.
Period	The time interval between multiple responses to a single trigger corresponds to the trigger period under the timer trigger mode.

TriggerSource-Level

Level	Set the level trigger threshold. A signal exceeding the threshold indicates that the trigger condition is met.
SafeTime	Set the debounce safety time for the level trigger.

TriggerSource-Timer

Period	Trigger period under the timer trigger mode
Sync	Not synchronized with the external trigger Synchronized with the external trigger's rising edge Synchronized with the external trigger's falling edge Single-shot synchronization with the external trigger's rising edge Single-shot synchronization with the external trigger's falling edge Synchronization with the GNSS-1PPS rising edge

	Synchronization with the GNSS-1PPS falling edge Single-shot synchronization with the GNSS-1PPS rising edge Single-shot synchronization with the GNSS-1PPS falling edge

16.2 IF Output Application Guide

The frequency of the analog IF output signal is between 312.5 MHz ± 50 MHz. The center frequency of the analog IF output of each instrument can be viewed in the IF calibration file in the "/bin/CalFile" folder in the software installation directory.

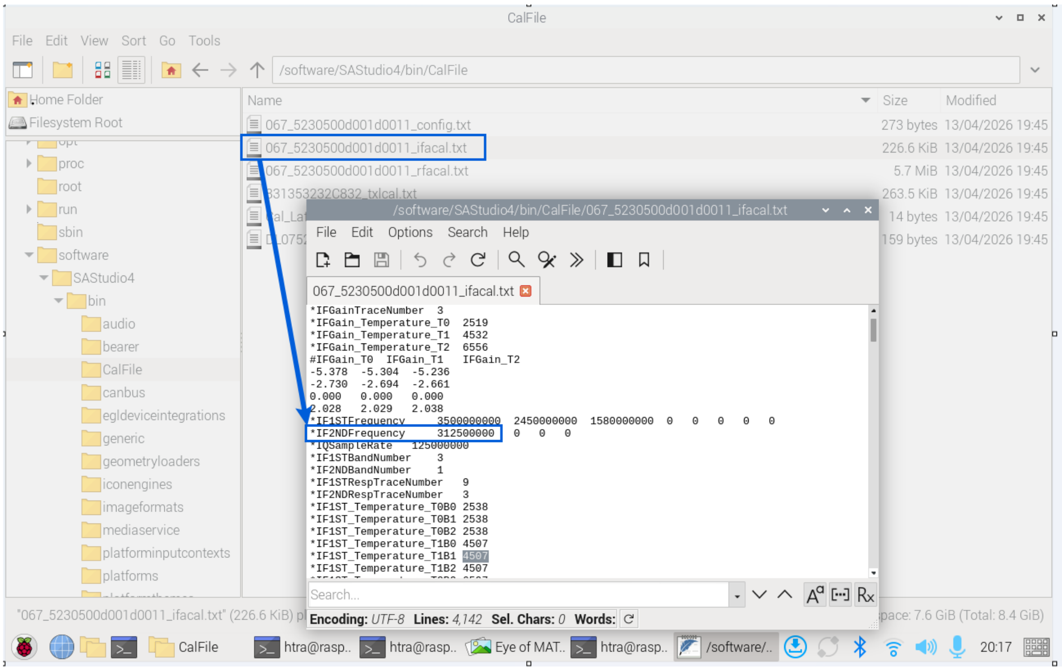

Figure 47 Check the IF Output Center Frequency on PXN Series Instruments

16.3 External Reference Clock Input

1. Refer to the interface description in the *Quick Start Guide* to input the external reference clock;
2. In the main settings area, click "Next" -> "System", set the reference clock frequency "RefCLKFreq" to 10 MHz, and select "External" as the reference clock source "RefCLKSource". If the reference clock source displays "External", the switch is successful. If it reverts to "Internal" and an error message pops up, the switch has failed. In this case, click "Preset" to switch back to the internal clock.

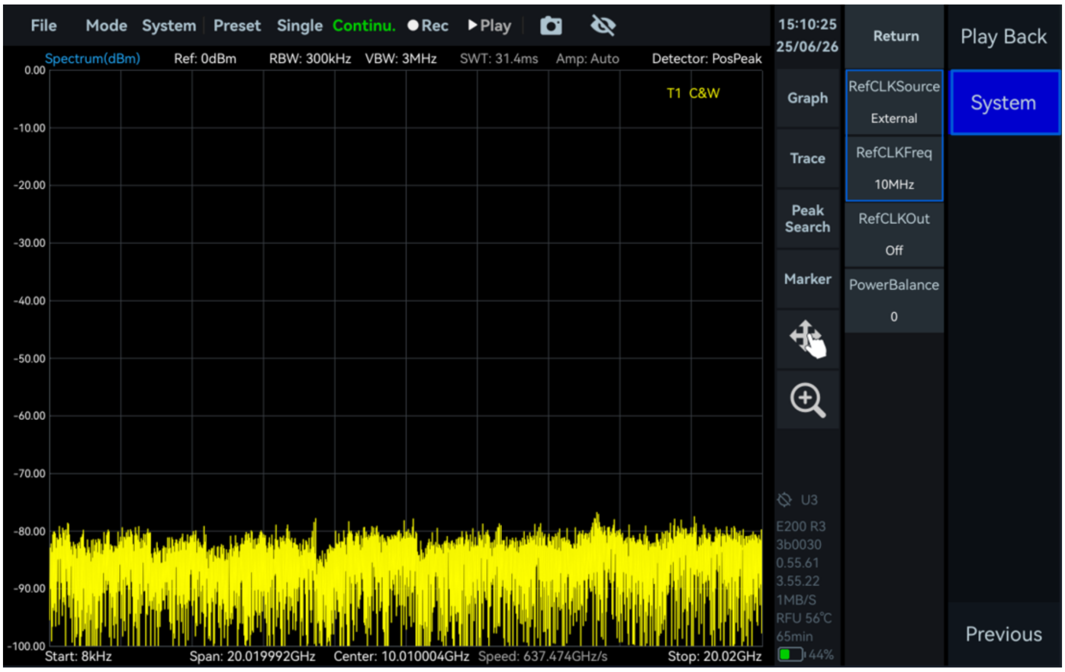

Figure 48 Use an external 10 MHz reference clock

16.4 Connecting and Operating Multiple Instruments Simultaneously

A single window of the software can only control one instrument. To operate multiple instruments simultaneously, you can open multiple windows within the same software, with each window corresponding to a different instrument number.

This section takes the simultaneous operation of two SA series instruments as an example. The specific steps are as follows:

1. Correctly connect the two instruments to the host computer;
2. Copy the calibration files corresponding to the two instruments into the "/bin/CalFile" folder in the software directory;
3. Double-click the executable program in the "bin" folder to open the software and enable the instrument with device number 0;
4. Go to the "configuration" folder in the software directory, open the "Setting.ini" text file, and change "DeviceNum=0" to "DeviceNum=1";
5. Double-click the software executable program again, and enable the instrument with device number 1 in the new window.

Note: If only one instrument is connected for use later, reset "DeviceNum" in the "configuration/Setting.ini" file to 0, otherwise the software may not recognize the instrument correctly.

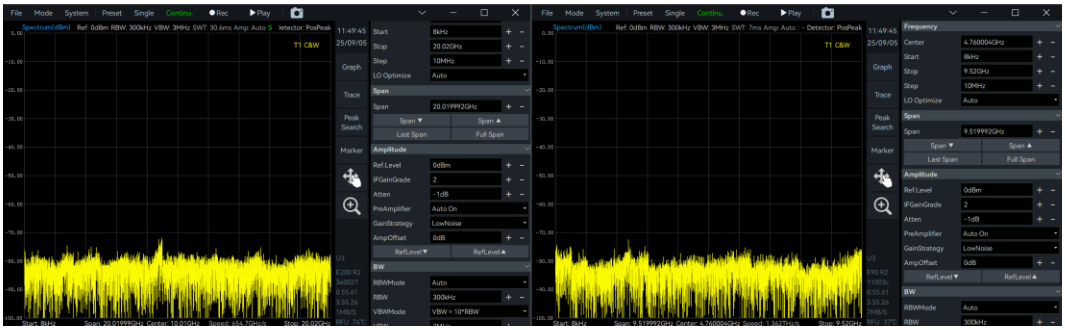

Figure 49 Operating two Instruments Simultaneously

17. Application for Options

17.1 Pulse Detection Option

17.1.1 Application for License

1. Refer to the Viewing Instrument Information section to view the soft and firmware version;
2. Ensure the version meets the following requirements:

- GUI Version: 4.3.55.6 or above
- API Version: 0.55.55 or above
- FPGA Version: 0.55.15 or above
- MCU Version: 0.55.32 or above

3. If the soft and firmware version does not meet the above requirements, please refer to the section on Software and Firmware Update to update.
4. Click "System" -> "About", take a screenshot of the entire software interface, and send it to the official technical support team to apply for the corresponding device license.

17.1.2 License Placement

1 . Place the Pulse detection license for SA/NX Series instruments

1) Copy the obtained Pulse Detection license to the "/bin/CalFile" folder of the software;
2) Restart the software. In the menu bar, click "Mode" -> "Power Detection", then enable "Pulse Det" in the main settings area to use the pulse signal detection function.

2 . Place the Pulse detection license for PX Series instruments

1) Extract the obtained "Option" folder and copy it to a USB flash drive;
2) Click "File" -> "Exit" to quit the software operation interface;
3) Insert the USB flash drive into the instrument's USB port. When the "Removable medium is inserted" prompt box pops up, click "OK";
4) Enter the "Option" folder, click the "Optional" icon. When the terminal prompts "The option has been successfully installed!!!", it indicates that the pulse license has been successfully placed;

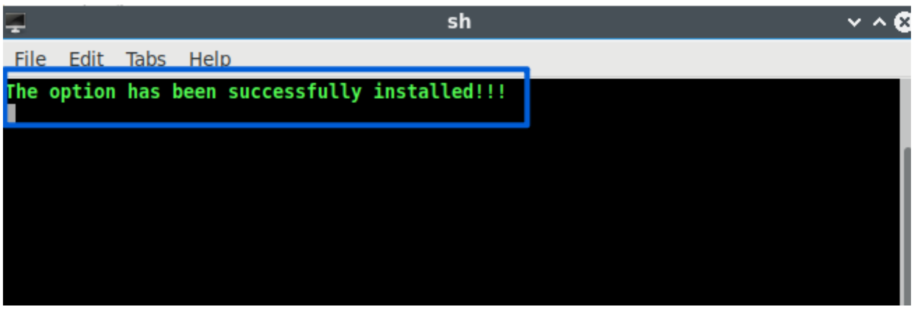

Figure 50 Install the Pulse Detection Option License

5) Close the popup window and restart the software. In the menu bar, click "Mode" -> "Pulse Detection", then enable "Pulse Det" in the main settings area to use the pulse signal detection function.

17.2 Digital Demodulation Option

17.2.1 Application for License and Digital Demodulation Library

Refer to the license application for Pulse Signal Detection to apply for the corresponding license and digital demodulation library.

17.2.2 License and Digital Demodulation Library Placement

1. Place the Digital demodulation license and Library for SA/NX Series instruments

1) Copy the "DigitalSigDemod.dll" demodulation library file into the "/bin" folder under the software directory;
2) Copy the digital demodulation license into the "/bin/CalFile" folder under the software directory;
3) Restart the software. In the menu bar, click "Mode" -> "Digital Demod" to enable and use the digital demodulation function.

2. Place the Digital demodulation license and Library for PX Series instruments

1) Refer to the Place the Pulse detection license for PX Series Instruments section, and click "Optional" icon to install the corresponding license and demodulation library;
2) Close the popup window and start the software. In the menu bar, click "Mode" -> "Digital Demod" to use the digital demodulation function.

17.2.3 AUXS Option

For later purchases of the ASG option, the device must be returned for an upgrade.

18. Software and Firmware Update

This section describes how to update the instrument's software, FPGA, MCU, and Bus versions.

18.1 Version Requirements

1. Refer to the viewing instrument information section to check the software and firmware versions;
2. For all instruments, ensure that the GUI version is 4.4.55.36 or above;
3. If the software indicates that the update cannot be performed, please contact official technical support.

18.2 Parameter Description

Note: Displays the current and target versions of the software, FPGA, MCU, and Bus;

Update Content: Provides detailed information about the changes in the target version;

Update Notification: Sets whether to automatically pop up an update notification window when a new version is detected;

Update Method: The update methods are described in the table below.

Table 33 Update Method Description

Update Method	Description
Online	Download and install the latest software and firmware directly from the server.
Default	Update using the locally stored default update files.
Local	Manually select local update files to perform the update.

18.3 Online Update

1. Click "System" -> "Update" to enter the update interface;
2. Check the "Update Notification" checkbox and ensure the device is connected to the internet. When the software starts or is running, if a new version is detected. The "Update" window will pop up automatically. You can also open this window by clicking "System" -> "Update";
3. Set the "Update Method" to Online. The system will then start downloading the update package, and the "Update" button will be temporarily disabled. After the package is successfully downloaded and parsed, detailed release notes will be displayed in the window, and the "Update" button will become enabled;
4. Carefully compare the information between the current version and the target version, and review the new features and fix list. Once confirmed, click the "Update" button in the lower-right corner;

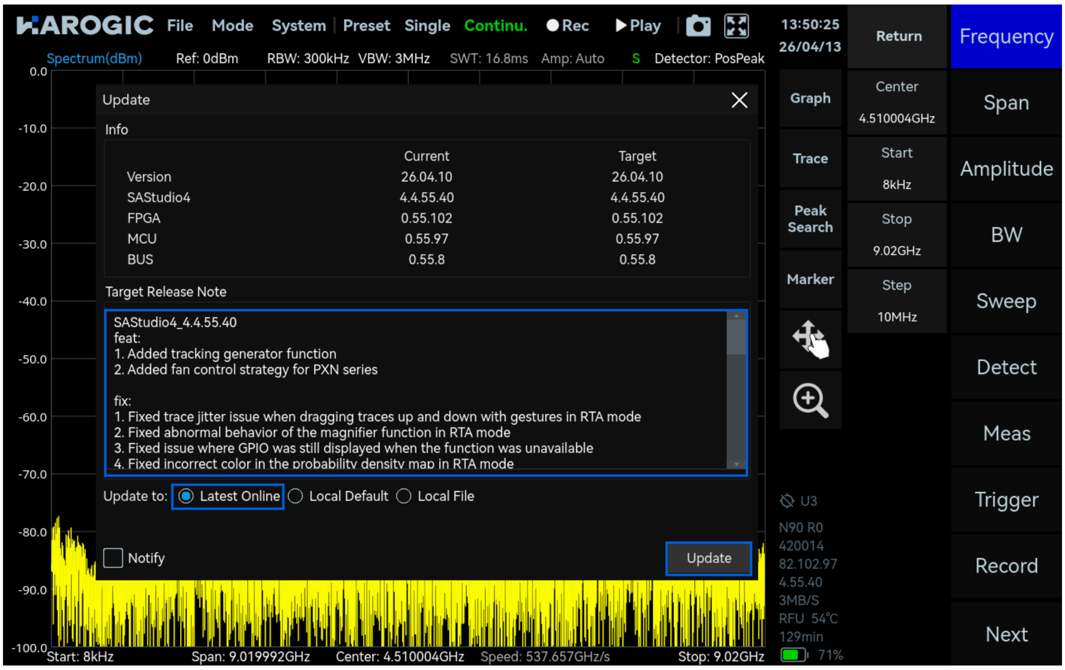

Figure 51 Update Software and Firmware Online

5. After clicking, the software will automatically exit and enter the upgrade process. Please keep the update window open until the progress bar completes and the software automatically restarts and returns to the main interface;
6. Close the update information window, then click “System” → “About” in the menu bar to view the current firmware version of the instrument.

18.4 Offline Update

Download the latest software version from the company’s official website using the links below:

- SA/NX Series Instruments: https://www.harogic.com/software-for-harogic-sa-nx-series-spectrum-analyzer/
- PX Series Instruments: https://www.harogic.com/software-for-haroglc-px-series-spectrum-analyzer/

Taking the PX series instrument software and firmware update as an example, the offline update steps are as follows:

1. Copy the downloaded PX series software installation package from the official website to a USB drive. Insert the USB drive into the instrument, and click **"OK"** in the pop-up **"Removable medium is inserted"** window;
2. Click "System" -> "Update" to open the update window;
3. Select "Local", click "Open" to choose the target software installation package, then click the "update" button at the bottom right;

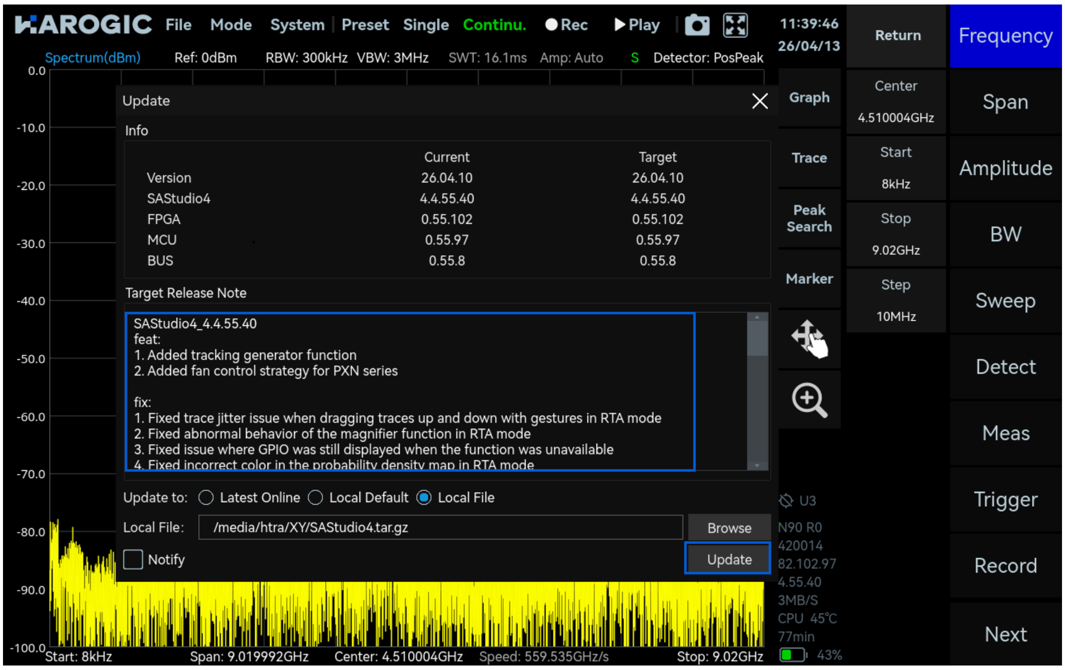

Figure 52 Offline Software and Firmware Update

4. The software will then automatically exit and enter the upgrade process. Please keep the update window open until the progress bar is complete and the software automatically restarts and returns to the main interface.

Appendix

Appendix 1: Record File Format Description

1.1 File Naming Format

The file name consists of the last four digits of the device ID, the date and time (year, month, day, hour, minute, and second) at the start of recording, the part index, and the file suffix.
For example: 0028_yyyymmdd_hhmmss_partx. suffix.
Regardless of the total recording duration, all sub-files generated during the same recording session share the same date-time stamp in their names, which corresponds to the time when the recording started.

1.2 Conversion of Structures into Byte Arrays

The structures SWP_Profile_TypeDef, SWP_TraceInfo_TypeDef, IQS_Profile_TypeDef, IQS_StreamInfo_TypeDef, DET_Profile_TypeDef, DET_StreamInfo_TypeDef, RTA_Profile_TypeDef and RTA_FrameInfo_TypeDef are converted into byte arrays using the third-party tool msgpack. Therefore, these structures must also be decoded using msgpack during data reading.

Appendix 2: Standard Spectrum Analysis Mode

The SWP record file uses a custom ".spectrum" format. The format description is shown in the following table.

Table 1 Description of the Spectrum Format

Byte Index	Description
0 to (71 + 10M)	This section stores the file information and packet index. (1 MB = 1024 * 1024 bytes)
(72 + 10M) to (73+10M+length)	This section stores the SWP_Profile_TypeDef, SWP_Profile_TypeDef (default configuration), and SWP_TraceInfo_TypeDef structures, where length represents the total number of bytes occupied by these three structures.
(74 + 10M + structure length) to (end of file)	This section stores the byte length of each data packet and the SWP data packets sequentially. Each SWP data packet mainly contains the frequency and power arrays, HopIndex, FrameIndex, and the MeasAuxInfo_TypeDef structure.

Table 2 Detailed Description of the Spectrum Format

	Byte Index	Byte Count	Data Type	Field Name	Endianness
File Header Information	0	2	uint16_t	File ID	Big Endian
	2	1	uint8_t	0x8c	Big Endian
	3	1	uint8_t	0x22	Big Endian
	4	1	uint8_t	0x52	Big Endian
	5	1	uint8_t	0x9b	Big Endian
	6	1	uint8_t	0x00 Protocol Version	Big Endian
	7	1	uint8_t	0x01 Protocol Version	Big Endian
	8	4	uint32_t	api Version Information	Big Endian
	9-63	56		Reserved	
	64	8	quint64	Number of Data Packets in Current File	Big Endian
	72	10M = 10*1024*1024	QList	Packet Index	Big Endian
Configuration Information msgpack Byte Array	72+10M	2	uint16_t	Configuration Information + Default Configuration Information + Trace Information Length (length)	Big Endian
	74+10M		double	StartFreq_Hz	
			double	StopFreq_Hz	
			double	CenterFreq_Hz	
			double	Span_Hz	
			double	RefLevel_dBm	

	Byte Index	Byte Count	Data Type	Field Name	Endianness
			double	RBW_Hz	
			double	VBW_Hz	
			double	SweepTime	
			double	TraceBinSize_Hz	
			int	FreqAssignment	
			int	Window	
			int	RBWMode	
			int	VBWMode	
			int	SweepTimeMode	
			int	Detector	
			int	TraceFormat	
			int	TraceDetectMode	
			int	TraceDetector	
			uint32_t	TracePoints	
			int	TracePointsStrategy	
			int	TraceAlign	
			int	FFTExecutionStrategy	
			int	RxPort	
			int	SpurRejection	
			int	ReferenceClockSource	
			double	ReferenceClockFrequency	
			uint8_t	EnableReferenceClockOut	
			int	SystemClockSource	
			double	ExternalSystemClockFrequency	
			int	TriggerSource	
			int	TriggerEdge	
			int	TriggerOutMode	
			int	TriggerOutPulsePolarity	
			uint32_t	PowerBalance	
			int	GainStrategy	
			int	Preamplifier	

	Byte Index	Byte Count	Data Type	Field Name	Endianness
			uint8_t	AnalogIFBWGrade	
			uint8_t	IFGainGrade	
			uint8_t	EnableDebugMode	
			uint8_t	CalibrationSettings	
			int8_t	Atten	
			int	TraceType	
			int	LOOptimization	
Default Configuration Information msgpack Byte Array	Parameters Same as Configuration Information				
Trace Information msgpack Byte Array			int	FullsweepTracePoints	
			int	PartialsweepTracePoints	
			int	TotalHops	
			uint32_t	UserStartIndex	
			uint32_t	UserStopIndex	
			double	TraceBinBW_Hz	
			double	StartFreq_Hz	
			double	AnalysisBW_Hz	
			int	TraceDetectRatio	
			int	DecimateFactor	
			float	FrameTimeMultiple	
			double	FrameTime	
			double	EstimateMinSweepTime	
			int	DataFormat	
			uint64_t	SamplePoints	
			uint32_t	GainParameter	
			int	DSPPlatform	
Data Packet	74+10M+length	4	int	Data Packet Length	Big Endian
		8*N	double*N	Frequency Array (N = PartialsweepTrace Points)	Platform Dependent
		4*N	float*N	Power Array (N = PartialsweepTrace Points)	Platform Dependent
		4	int	HopIndex	Big Endian

	Byte Index	Byte Count	Data Type	Field Name	Endianness
		4	int	FrameIndex	Big Endian
		4	uint32_t	MaxIndex	Big Endian
		4	float	MaxPower_dBm	Big Endian
		2	int16_t	Temperature	Big Endian
		2	uint16_t	RFState	Big Endian
		2	uint16_t	BBState	Big Endian
		2	uint16_t	GainPattern	Big Endian
		4	uint32_t	ConvertPattern	Big Endian
		8	double	SysTimeStamp	Big Endian
		8	double	AbsoluteTimeStamp	Big Endian
		4	float	Latitude	Big Endian
		4	float	Longitude	Big Endian
Next Data Packet The total number of packets can be found in the File Header		4	int	Data Packet Length	Big Endian
				...	

Appendix 3: Receiver/IQ Stream Mode

The IQ record file uses the standard ".wav" format. The format description is shown in the following table.

Table 3 Description of the WAV Format

Chunk	Description
RIFF chunk	
RIFF chunk size	
File Format Type: "WAVE"	
fmt chunk	
fmt chunk size	
fmt chunk data	
prof chunk	Format Chunk Identifier: "prof"
prof chunk size	Chunk Length
prof chunk data	This chunk stores the IQS_Profile_TypeDef, IQS_StreamInfo_TypeDef, DeviceInfo_TypeDef, and other related information.
trig chunk	Format Chunk Identifier: "trig"
trig chunk size	Chunk Length
trig chunk data	This chunk stores the IQS_TriggerInfo_TypeDef, DeviceState_TypeDef, IQS_ScaleToV, MaxPower_dBm, and MaxIndex for each IQ data packet, sequentially arranged. Each entry corresponds one-to-one with the packets in the data chunk.
data chunk	Format Chunk Identifier: "data"
data chunk size	Chunk Length
data chunk data	This chunk stores the IQ data packets in sequential order.

Table 4 Detailed Description of the iq.wav Format

	Chunk	Byte Index	Byte Index within Chunk	Byte Count	Data Type	Field Name	Filed Description	Endianness
RIFF File Header Information	RIFF	0		4		Document Identifier	"RIFF"	
		4		4	uint32_t	Data Length	Chunk Length	Litter Endian
		8		4		File Format Type	"WAVE"	
fmt Chunk Description	fmt	12		4		Format Chunk Identifier	"fmt"	
		16		4	uint32_t	Chunk Length	16	Litter Endian
		20		2	uint16_t	Audio Format Code	1	Litter Endian
		22		2	uint16_t		2	Litter Endian
		24		4	uint32_t	Sampling Frequency		Litter Endian
		28		4	uint32_t	Byte Rate		Litter Endian
		32		2	uint16_t	Block Align		Litter Endian
		34		2	uint16_t	Bits per Sample		Litter Endian
File Header Information	prof	36		4		Format Chunk Identifier	"prof"	
		40		4	uint32_t	Chunk Length		Litter Endian
		44	0	2	uint16_t	File ID		Big Endian
		46	2	1	uint8_t	0x8c		Big Endian
		47	3	1	uint8_t	0x22		Big Endian
		48	4	1	uint8_t	0x52		Big Endian
		49	5	1	uint8_t	0x9b		Big Endian
		50	6	1	uint8_t	0x00 Protocol Version		Big Endian
		51	7	1	uint8_t	0x02 Protocol Version		Big Endian
		52	8	4	uint32_t	api Version Information		Big Endian
		53-107	56			Reserved		
IQS_Profile Information msgpack Byte Array		108	64	2	uint16_t	IQS_Profile + IQS_StreamInfo Structure Byte Length		Big Endian
		110	66		double	CenterFreq_Hz		
					double	RefLevel_dBm		
					uint32_t	DecimateFactor		
					int	RxPort		
					uint32_t	BusTimeout_ms		

	Chunk	Byte Index	Byte Index within Chunk	Byte Count	Data Type	Field Name	Filed Description	Endianness
					int	TriggerSource		
					int	TriggerEdge		
					int	TriggerMode		
					uint64_t	TriggerLength		
					int	TriggerOutMode		
					int	TriggerOutPulsePolarity		
					double	TriggerLevel_dBm		
					double	TriggerLevel_SafeTime		
					double	TriggerDelay		
					double	PreTriggerTime		
					int	TriggerTimerSync		
					double	TriggerTimer_Period		
					uint8_t	EnableReTrigger		
					double	ReTrigger_Period		
					uint16_t	ReTrigger_Count		
					int	DataFormat		
					int	GainStrategy		
					int	Preamplifier		
					uint8_t	AnalogIFBWGrade		
					uint8_t	IFGainGrade		
					uint8_t	EnableDebugMode		
					int	ReferenceClockSource		
					double	ReferenceClockFrequency		
					uint8_t	EnableReferenceClockOut		
					int	SystemClockSource		
					double	ExternalSystemClockFrequency		
					double	NativeIQSampleRate_SPS		
					uint8_t	EnableIFAGC		
					int8_t	Atten		
					int	DCCancelerMode		

	Chunk	Byte Index	Byte Index within Chunk	Byte Count	Data Type	Field Name	Filed Description	Endianness
					int	QDCMode		
					float	QDCIGain		
					float	QDCQGain		
					float	QDCPhaseComp		
					int8_t	DCCIOffset		
					int8_t	DCCQOffset		
					int	LOOptimization		
IQS_ StreamInfo Structure Information msgpack Byte Array					double	Bandwidth		
					double	IQSampleRate		
					uint64_t	PacketCount		
					uint64_t	StreamSamples		
					uint64_t	StreamDataSize		
					uint32_t	PacketSamples		
					uint32_t	PacketDataSize		
					uint32_t	GainParameter		
DeviceInfo Structure Information				2	uint16_t	DeviceInfo Structure Byte Length		Big Endian
				8	uint64_t	DeviceUID		Big Endian
				2	uint16_t	Model		Big Endian
				2	uint16_t	HardwareVersion		Big Endian
				4	uint32_t	MFWVersion		Big Endian
				4	uint32_t	FFWVersion		Big Endian
Reserved								
IQS_ TriggerInfo Structure Information	trig	400		4		Chunk Identifier	"trig"	
		404		4	uint32_t	Chunk Length		Litter Endian
		408		2	uint16_t	IQS_TriggerInfo Structure Byte Length		Big Endian
				8	uint64_t	SysTimerCountOfFirstDataPoint		Big Endian
				2	uint16_t	InPacketTriggeredDataSize		Big Endian
				2	uint16_t	InPacketTriggerEdges		Big Endian
				4*25	uint32_t	StartDataIndexOfTriggerEdges[25]		Platform Dependent
				8*25	uint64_t	SysTimerCountOfEdges[25]		Platform Dependent

	Chunk	Byte Index	Byte Index within Chunk	Byte Count	Data Type	Field Name	Filed Description	Endianness
				25	int8_t	EdgeType[25]		Platform Dependent
DeviceState Structure Information				2	uint16_t	DeviceState Structure Byte Length		Big Endian
				2	int16_t	Temperature		Big Endian
				2	uint16_t	RFState		Big Endian
				2	uint16_t	BBState		Big Endian
				8	double	AbsoluteTimeStamp		Big Endian
				4	float	Latitude		Big Endian
				4	float	Longitude		Big Endian
				2	uint16_t	GainPattern		Big Endian
				8	int64_t	RFCFreq		Big Endian
				4	uint32_t	ConvertPattern		Big Endian
				4	uint32_t	NCOFTW		Big Endian
				4	uint32_t	SampleRate		Big Endian
				2	uint16_t	CPU_BCFlag		Big Endian
				2	uint16_t	IFOverflow		Big Endian
				2	uint16_t	DecimateFactor		Big Endian
				2	uint16_t	OptionState		Big Endian
Return Information				4	float	IQS_ScaleToV		Big Endian
				4	float	MaxPower_dBm		Big Endian
				4	uint32_t	MaxIndex		Big Endian
Reserved								
Data Packet	Data	25*1024*1024+400		4		Chunk Identifier	"data"	
		25*1024*1024+404		4	uint32_t	Chunk Length		Litter Endian
		25*1024*1024+408		64968		IQ Data Packet		Platform Dependent
				64968		IQ Data Packet		Platform Dependent
						...		Platform Dependent
						The Nth IQ Data Packet, where N = (Chunk Length / 64968)		Platform Dependent

Appendix 4: Power Detection Mode

The DET record file uses the standard ".wav" format, but it is not playable by third-party software. The format description is shown in the following table.

Table 5 Description of the WAV Format

Chunk	Description
RIFF chunk	
RIFF chunk size	
File Format Type: "WAVE"	
fmt chunk	
fmt chunk size	
fmt chunk data	
prof chunk	Format Chunk Identifier: "prof"
prof chunk size	Chunk Length
prof chunk data	This chunk stores the IQS_Profile_TypeDef, IQS_StreamInfo_TypeDef, DeviceInfo_TypeDef, and other related information.
trig chunk	Format Chunk Identifier: "trig"
trig chunk size	Chunk Length
trig chunk data	This chunk stores the IQS_TriggerInfo_TypeDef, DeviceState_TypeDef, IQS_ScaleToV, MaxPower_dBm, and MaxIndex for each IQ data packet, arranged sequentially. Each entry corresponds one-to-one with the packets in the data chunk.
data chunk	Format Chunk Identifier: "data"
data chunk size	Chunk Length
data chunk data	This chunk stores the IQ data packets in sequential order.

Table 6 Detailed Description of the iq.wav Format

	Chunk	Byte Index	Byte Index within Chunk	Byte Count	Data Type	Field Name	Filed Description	Endianness
RIFF File Header Information	RIFF	0		4		Document Identifier	"RIFF"	
		4		4	uint32_t	Data Length	Chunk Length	Litter Endian
		8		4		File Format Type	"WAVE"	
fmt Format Chunk Structure Description	fmt	12		4		Format Chunk Identifier	"fmt "	
		16		4	uint32_t	Chunk Length	16	Litter Endian
		20		2	uint16_t	Audio Format Code	1	Litter Endian
		22		2	uint16_t	Number of Channels	2	Litter Endian
		24		4	uint32_t	Sampling Frequency		Litter Endian
		28		4	uint32_t	Byte Rate		Litter Endian
		32		2	uint16_t	Block Align		Litter Endian
		34		2	uint16_t	Bits per Sample		Litter Endian
File Header Information	prof	36		4		Format Chunk Identifier	"prof"	
		40		4	uint32_t	Chunk Length		Litter Endian
		44	0	2	uint16_t	File ID		Big Endian
		46	2	1	uint8_t	0x8c		Big Endian
		47	3	1	uint8_t	0x22		Big Endian
		48	4	1	uint8_t	0x52		Big Endian
		49	5	1	uint8_t	0x9b		Big Endian
		50	6	1	uint8_t	0x00 Protocol Version		Big Endian
		51	7	1	uint8_t	0x04 Protocol Version		Big Endian
		52	8	4	uint32_t	api Version Information		Big Endian
		53-107	56			Reserved		
DET_Profile Structure Information msgpack Byte Array		108	64	2	uint16_t	DET_Profile + DET_StreamInfo Structure Byte Length		Big Endian
		110	66		double	CenterFreq_Hz		
					double	RefLevel_dBm		
					uint32_t	DecimateFactor		
					int	RxPort		
					uint32_t	BusTimeout_ms		
					int	TriggerSource		

	Chun k	Byte Index	Byte Index within Chunk	Byte Count	Data Type	Field Name	Filed Description	Endianness
					int	TriggerEdge		
					int	TriggerMode		
					uint64_t	TriggerLength		
					int	TriggerOutMode		
					int	TriggerOutPulsePolarity		
					double	TriggerLevel_dBm		
					double	TriggerLevel_SafeTime		
					double	TriggerDelay		
					double	PreTriggerTime		
					int	TriggerTimerSync		
					double	TriggerTimer_Period		
					uint8_t	EnableReTrigger		
					double	ReTrigger_Period		
					uint16_t	ReTrigger_Count		
					int	Detector		
					uint16_t	DetectRatio		
					int	GainStrategy		
					int	Preamplifier		
					uint8_t	AnalogIFBWGrade		
					uint8_t	IFGainGrade		
					uint8_t	EnableDebugMode		
					int	ReferenceClockSource		
					double	ReferenceClockFrequency		
					uint8_t	EnableReferenceClockOut		
					int	SystemClockSource		
					double	ExternalSystemClockFrequency		
					int8_t	Atten		
					int	DCCancelerMode		
					int	QDCMode		
					float	QDCIGain		

	Chunk	Byte Index	Byte Index with Chunk	Byte Count	Data Type	Field Name	Filed Description	Endianness
					float	QDCQGain		
					float	QDCPhaseComp		
					int8_t	DCCIOffset		
					int8_t	DCCQOffset		
					int	LOOptimization		
DET_ StreamInfo Structure Information msgpack Byte Array					uint64_t	PacketCount		
					uint64_t	StreamSamples		
					uint64_t	StreamDataSize		
					uint32_t	PacketSamples		
					uint32_t	PacketDataSize		
					double	TimeResolution		
					uint32_t	GainParameter		
Reserved								
IQS_ TriggerInfo Structure Information	trig	400		4		Format Chunk Identifier	"trig"	
		404		4	uint32_t	Chunk Length		Litter Endian
		408		2	uint16_t	IQS_TriggerInfo Structure Byte Length		Big Endian
				8	uint64_t	SysTimerCountOfFirstDataPoint		Big Endian
				2	uint16_t	InPacketTriggeredDataSize		Big Endian
				2	uint16_t	InPacketTriggerEdges		Big Endian
				4*25	uint32_t	StartDataIndexOfTriggerEdges[25]		Platform Dependent
				8*25	uint64_t	SysTimerCountOfEdges[25]		Platform Dependent
				25	int8_t	EdgeType[25]		Platform Dependent
MeasAuxInfo Structure Information				2	uint16_t	MeasAuxInfo Structure Byte Length		Big Endian
				4	uint32_t	MaxIndex		Big Endian
				4	float	MaxPower_dBm		Big Endian
				2	int16_t	Temperature		Big Endian
				2	uint16_t	RFState		Big Endian
				2	uint16_t	BBState		Big Endian
				2	uint16_t	GainPattern		Big Endian
				4	uint32_t	ConvertPattern		Big Endian

	Chunk	Byte Index	Byte Index within Chunk	Byte Count	Data Type	Field Name	Filed Description	Endianness
				8	double	SysTimeStamp		Big Endian
				8	double	AbsoluteTimeStamp		Big Endian
				4	float	Latitude		Big Endian
				4	float	Longitude		Big Endian
				4	float	ScaleToV		Big Endian
Reserved								
Data Packet	Data	25*1024*1024+400		4		Format Chunk Identifier	"data"	
		25*1024*1024+404		4	uint32_t	Chunk Length		Litter Endian
		25*1024*1024+408		64968		DET Data Packet		Platform Dependent
				64968		DET Data Packet		Platform Dependent
						...		Platform Dependent
						The Nth DET Data Packet, where N = (Chunk Length / 64968)		Platform Dependent

Appendix 5: Real-Time Spectrum Analysis Mode

The RTA record file uses a custom ".rtspectrum" format. The format description is shown in the following table.

Table 7 Description of the rtspectrum Format

Chunk	Description
0 to (71+10M)	This section stores the file information and packet index. (1 MB = 1024 × 1024 bytes)
(72+10M) to (73+10M+ length)	This section stores the RTA_Profile_TypeDef and RTA_FrameInfo_TypeDef structures, where length represents the total number of bytes occupied by these structures.
(74+10M+ length) to (end of file)	This section stores the byte length of each data packet and the RTA data packets sequentially. Each RTA data packet mainly contains the SpectrumStream array, RTA_PlotInfo_TypeDef, RTA_TriggerInfo_TypeDef, and MeasAuxInfo_TypeDef structures.

Table 8 Detailed Description of the rtspectrum Format

	Byte Index	Byte Count	Data Type	Field Name	Endianness
File Header Information	0	2	uint16_t	File ID	Big Endian
	2	1	uint8_t	0x8c	Big Endian
	3	1	uint8_t	0x22	Big Endian
	4	1	uint8_t	0x52	Big Endian
	5	1	uint8_t	0x9b	Big Endian
	6	1	uint8_t	0x00 Protocol Version	Big Endian
	7	1	uint8_t	0x03 Protocol Version	Big Endian
	8	4	uint32_t	api Version Information	Big Endian
	9-63	56		Reserved	
	64	8	quint64	Number of Data Packets in Current File	Big Endian
	72	10M=10*1024*1024	QList	Packet Index	Big Endian
Configuration Information msgpack Byte Array	72+10M	2	uint16_t	Configuration Information + Trace Information Length (length)	Big Endian
	74+10M		double	CenterFreq_Hz	
			double	RefLevel_dBm	
			double	RBW_Hz	
			double	VBW_Hz	
			int	RBWMode	
			int	VBWMode	

	Byte Index	Byte Count	Data Type	Field Name	Endianness
			uint32_t	DecimateFactor	
			int	Window	
			int	SweepTimeMode	
			double	SweepTime	
			int	Detector	
			int	TraceDetectMode	
			uint32_t	TraceDetectRatio	
			int	TraceDetector	
			int	RxPort	
			uint32_t	BusTimeout_ms	
			int	TriggerSource	
			int	TriggerEdge	
			int	TriggerMode	
			double	TriggerAcqTime	
			int	TriggerOutMode	
			int	TriggerOutPulsePolarity	
			double	TriggerLevel_dBm	
			double	TriggerLevel_SafeTime	
			double	TriggerDelay	
			double	PreTriggerTime	
			int	TriggerTimerSync	
			double	TriggerTimer_Period	
			uint8_t	EnableReTrigger	
			double	ReTrigger_Period	
			uint16_t	ReTrigger_Count	
			int	GainStrategy	
			int	Preamplifier	
			uint8_t	AnalogIFBWGrade	
			uint8_t	IFGainGrade	
			uint8_t	EnableDebugMode	

	Byte Index	Byte Count	Data Type	Field Name	Endianness
			int	ReferenceClockSource	
			double	ReferenceClockFrequency	
			uint8_t	EnableReferenceClockOut	
			int	SystemClockSource	
			double	ExternalSystemClockFrequency	
			int8_t	Atten	
			int	DCCancelerMode	
			int	QDCMode	
			float	QDCIGain	
			float	QDCQGain	
			float	QDCPhaseComp	
			int8_t	DCCIOffset	
			int8_t	DCCQOffset	
			int	LOOptimization	
Trace Information msgpack Byte Array			double	StartFrequency_Hz	
			double	StopFrequency_Hz	
			double	POI	
			double	TraceTimestampStep	
			double	TimeResolution	
			double	PacketAcqTime	
			uint32_t	PacketCount	
			uint32_t	PacketFrame	
			uint32_t	FFTSize	
			uint32_t	FrameWidth	
			uint32_t	FrameHeight	
			uint32_t	PacketSamplePoints	
			uint32_t	PacketValidPoints	
			uint32_t	MaxDensityValue	
			uint32_t	GainParameter	

	Byte Index	Byte Count	Data Type	Field Name	Endianness
Data Packet	74+10M+ length	4	int	Data Packet Length	Big Endian
		N	uint8_t *N	SpectrumStream Array	Platform Dependent
		4	float	ScaleTodBm	Big Endian
		4	float	OffsetTodBm	Big Endian
		8	uint64_t	SpectrumBitmapIndex	Big Endian
		8	uint64_t	SysTimerCountOfFirstDataPoint	Big Endian
		2	uint16_t	InPacketTriggeredDataSize	Big Endian
		2	uint16_t	InPacketTriggerEdges	Big Endian
		4*25	uint32_t	StartDataIndexOfTriggerEdges [25]	Platform Dependent
		8*25	uint64_t	SysTimerCountOfEdges [25]	Platform Dependent
		25	int8_t	EdgeType [25]	Platform Dependent
		4	uint32_t	MaxIndex	Big Endian
		4	float	MaxPower_dBm	Big Endian
		2	int16_t	Temperature	Big Endian
		2	uint16_t	RFState	Big Endian
		2	uint16_t	BBState	Big Endian
		2	uint16_t	GainPattern	Big Endian
		4	uint32_t	ConvertPattern	Big Endian
		8	double	SysTimeStamp	Big Endian
		8	double	AbsoluteTimeStamp	Big Endian
		4	float	Latitude	Big Endian
		4	float	Longitude	Big Endian
Next Data Packet (The total number of packets can be found in the File Header)		4	int	Data Packet Length	Big Endian
				...	

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