SA Series

NX Series

USER MANUAL

# SA/NX Series

# Spectrum Analyzer User Guide

Real-Time Spectrum Analyzer

Up to 40 GHz


HAROGIC

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# 1. Version Update Instruction

Version Update Instruction Table

| Version Number | Content | Time |
|---|---|---|
| **V1.0** | Added instructions for digital demodulation and pulse option measurement | 2025-3-27 |
| **V1.1** | 1. Added description of phase noise testing function<br>2. Description of pulse signal detection version, replacement of screenshots in pulse mode<br>3. Modified trigger function introduction (based on the latest SAS4) | 2025-4-3 |
| **V1.2** | 1. Added pulse signal testing in DET mode<br>2. Modified some details in the document | 2025-4-8 |
| **V1.3** | 1. Added operating environment requirements and probability density map chapter<br>2. Added instructions for modifying the IP address of single and multiple NX series instruments<br>3. Removed instructions for using SWP mode pulse detection and digital demodulation dongle | 2025-4-9 |

# 2. Operating Environment Requirements

The following are only recommendations for the upper computer configuration. For configurations lower than this recommendation, please refer to the actual measurement results.

## 2.1 Windows System

| | |
|---|---|
| **Operating System** | Windows 11/10/8/7 |
| **Architecture** | x86, x64 (AArch64 is only supported by NX devices) |
| **Processor** | Intel i3 and above, AArch64 has only been tested with Snapdragon 8CX Gen2 |
| **Memory** | 4 GB or more |
| **Hard Drive** | For IQ signal recording, ensure that the continuous write bandwidth of the hard drive system is greater than 400 MBytes/s |
| **Data Interface** | USB2.0 or USB3.0 (USB3.0 is recommended)<br>The IQ signal recording bandwidth and duration are limited by the data interface bandwidth. |
| **Display resolution** | Higher than 1280 × 800 pixels |
| **Other** | Some antivirus software may cause the system to malfunction |

## 2.2 Linux system

| | |
|---|---|
| **Operating System** | Ubuntu 24.04/22.04/20.04/18.04<br>Debian 12/11/10<br>Raspberry Pi OS 64bit |
| **Architecture** | x64、AArch64 (Raspberry Pi 4B, RK3399, RK3588) |
| **Memory** | 4 GB or more |
| **Hard Drive** | For IQ signal recording, ensure that the continuous write bandwidth of the hard disk system is greater than 400 Mbytes/s |
| **Data Interface** | USB2.0 or USB3.0 (recommended)<br>The IQ signal recording bandwidth and duration are limited by the data interface bandwidth. |
| **Display resolution** | Higher than 1280 × 800 pixels |
| **Other** | Some antivirus software may cause the system to malfunction |

# 3. Quick start guide (SA series)

This chapter serves as a quick start guide for the SA Series instruments. The main content includes safety guidelines, instrument connection, driver installation, and operation of SAStudio4 software.

## 3.1 Safety Guidelines

### 3.1.1 Power Adapter Selection

It is strongly recommended to use the original power adapter provided by the manufacturer. If under certain circumstances, you cannot use the original power adapter, please refer to the specific product datasheet and select a power adapter with appropriate specifications.

If powering the instrument directly from a DC power source, please strictly adhere to the product manual specifications: the input voltage must meet the 5 V/2 A power supply standard (acceptable range: 4.75 V-5.25 V). Simultaneously, ensure that the peak-to-peak ripple voltage does not exceed 200 mVp. These parameter requirements are crucial to guarantee normal operation of the device and prevent hardware damage.

### 3.1.2 RF Input

Please refer to the product datasheet of your specific instrument model for the maximum damage input power (Continuous Wave, CW) and maximum DC voltage. Always strictly comply with the indicator requirements in the manual during operation. Never exceed these maximum values to avoid irreversible damage to the instrument.

## 3.2 Using SA Series Instruments

### 3.2.1 Connecting the Device

1、 **Power Connection:** Connect the instrument's power port to the power adapter using the Type-C data cable. Plug the power adapter into a power outlet (wall socket).

2、 **Data Connection:** Connect the instrument's data port to a computer or embedded device's USB interface using the Type-C data cable. **For optimized performance, it is strongly recommended to use USB 3.0.**

**Important Note:** It requires for 3 seconds for SA Series instruments operating normally after power-on.

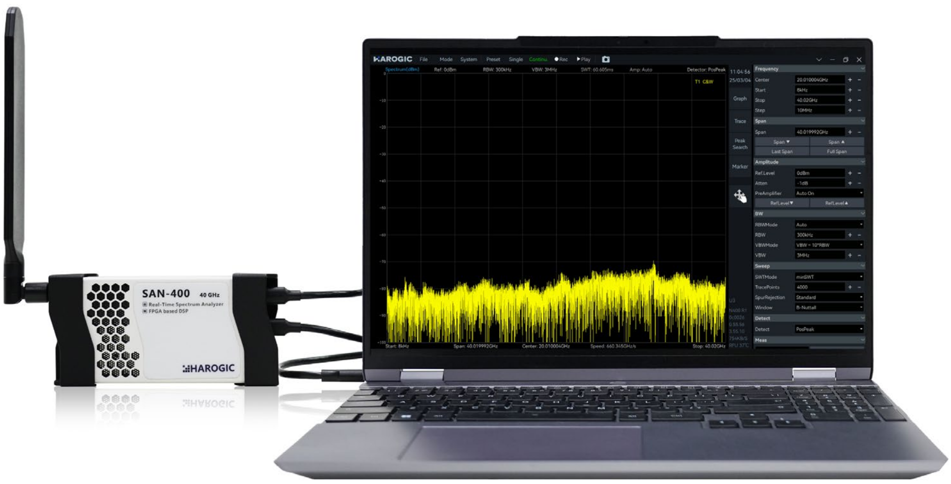
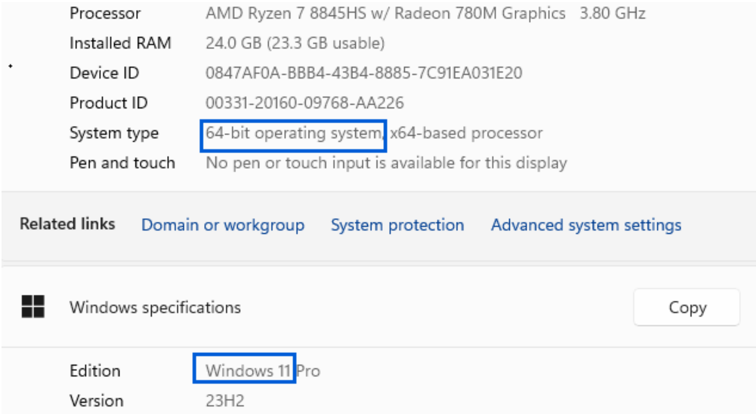



Figure 1 SA series connection diagram

### 3.2.2 Driver Installation (Windows)

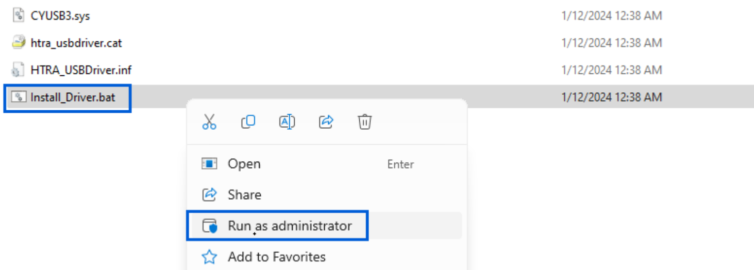
The following part presents the instructions for driver installation using Windows 10 x64 as an example. **Note:** Windows 11 is compatible with Windows 10 drivers.

1. **System Information Check:** On the computer desktop, right-click "This PC" (or "My Computer") and click "Properties". Review the computer's system information to confirm the system type (32-bit or 64-bit) and edition.

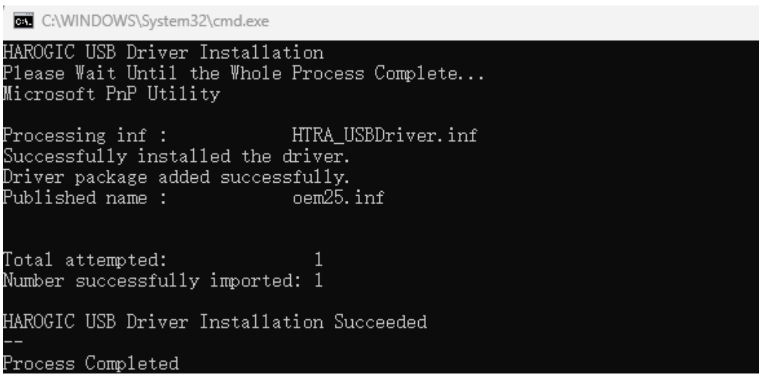



2. **Open Driver Folder:** Open the "Windows\HTRA_Driver\Win10_x64" folder from the USB flash.

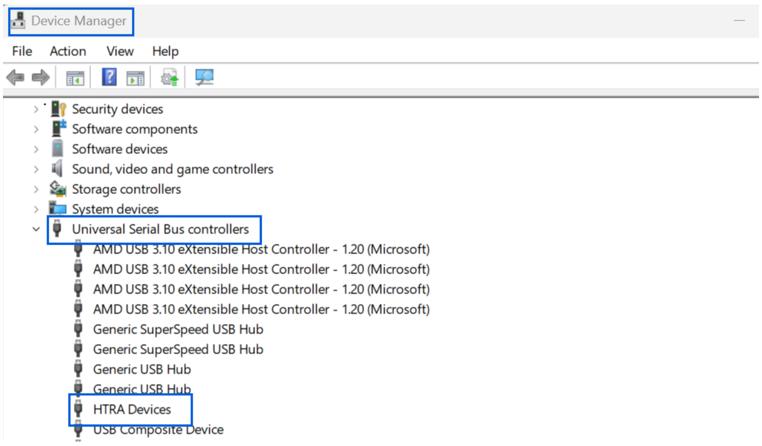

3. **Run Driver Installer:** Right-click the "Install_Driver.bat" file and select "Run as administrator" from the pop-up menu to initiate driver installation.




4. **Installation Completion:** The driver installation is complete when the following message appears in the terminal window.



5. **Verify Driver Installation:** Connect the SA series instrument to the computer. Find the device manager and expand the "Universal Serial Bus controllers" category. You can see the "HTRA Device" driver listed in the dropdown menu after driver is installed successfully.

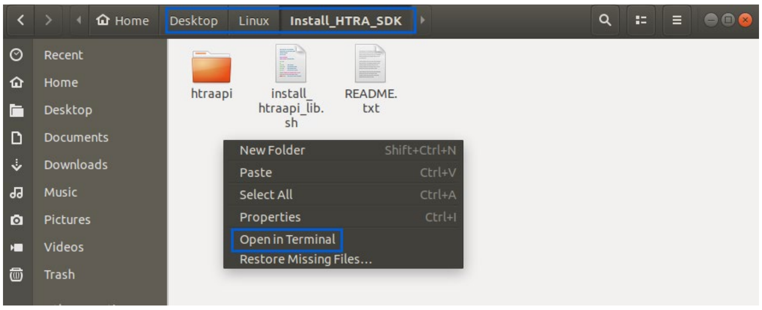



### 3.2.3 Driver Installation (Linux)

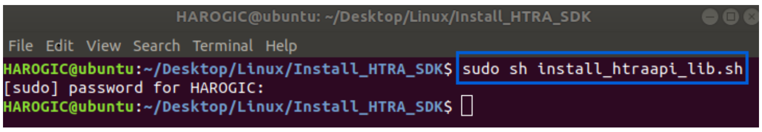
The following instructions use Ubuntu 18.04 virtual machine as an example for driver installation. The steps for other Linux systems are fundamentally similar.

1. **Copy Linux Folder:** Copy the "Linux" folder from the USB flash to your Linux system.


2. **Open Terminal in SDK Folder:** Navigate to the "Install_HTRA_SDK" folder within the "Linux" folder. Right-click in an empty area of the folder and select "Open in Terminal" to open a terminal window.

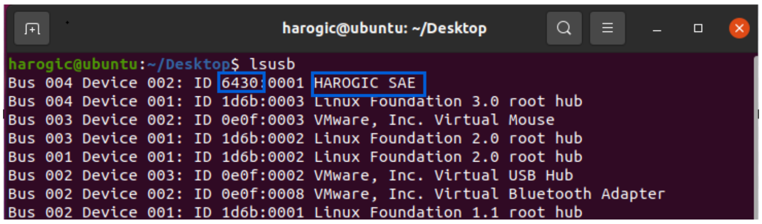



3. **Run Installation Script:** In the terminal, type "sudo sh install_htraapi_lib.sh" and press Enter. Follow the system prompts to enter your user password when requested and press Enter again to confirm.




4. **Verify Driver Installation:** Connect the instrument to the host computer (if the host computer is a virtual machine, upon successful connection, you can check the hardware device icon at the bottom right corner of the virtual machine window. Hovering the mouse over this icon should display the HTRA logo, confirming that the device is connected to the virtual machine. Simultaneously, ensure that the USB compatibility setting is set to USB 3.1 to guarantee proper device operation). In the terminal, type "lsusb" and press Enter to view the list of USB devices connected to the system. If "ID:6430", "ID:3675", "ID:04b5", or "ID 367f" appears in the list, the

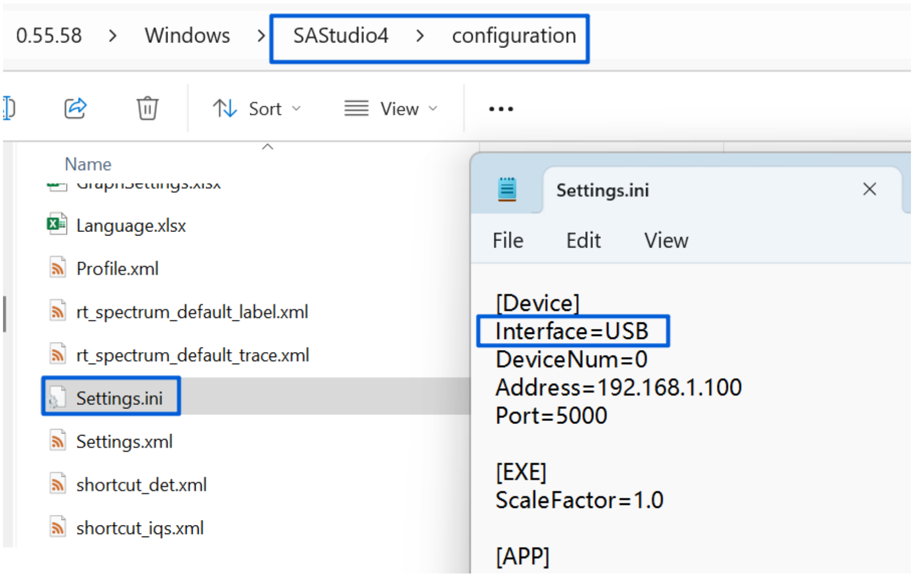
driver installation is successful.



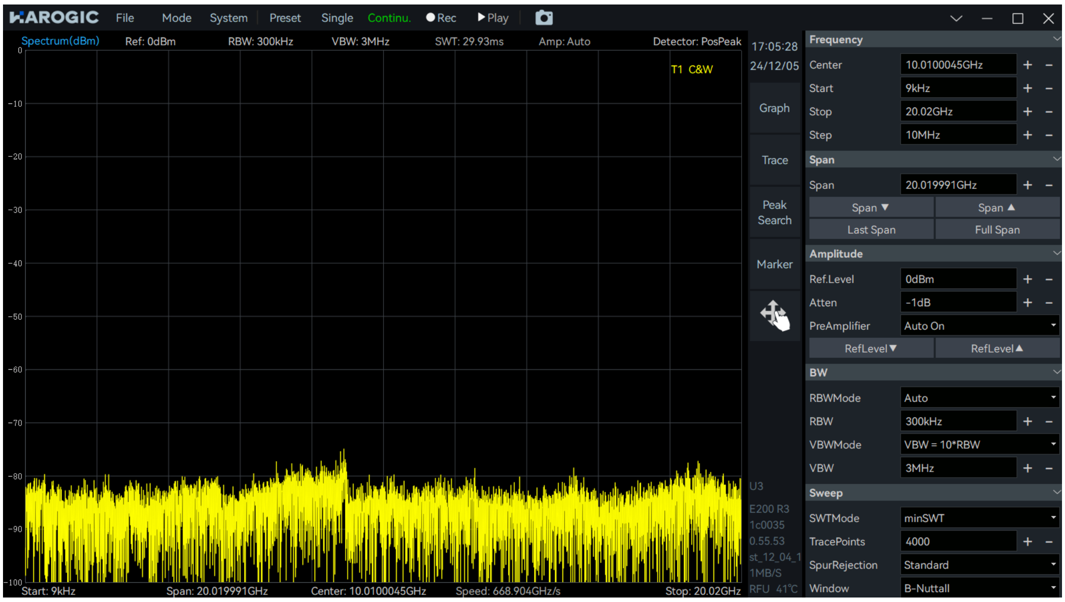

## 3.3 Run SAStudio4

Assuming the device is properly connected and the driver is successfully installed.

1. **Copy SAStudio4 Folder:** Copy the "Windows\SAStudio4" folder from the provided USB drive to your computer desktop or another desired directory.
2. **Configure Interface Setting:** Navigate to the "\SAStudio4\configuration" folder and double-click to open the "Settings.ini" file. Verify that the "Interface" parameter is set to "USB". If not, manually change it to "USB" and save the file.




3. **Run SAStudio4 Executable:** Navigate to the "\SAStudio4\bin" folder and double-click "SAStudio4.exe" to run the software.
4. **SAStudio4 Operation:** SAStudio4 now is running normally, as shown in the following image.



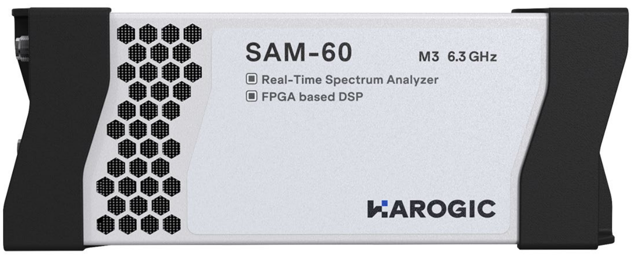

**Notes:**

1. The default SAStudio4 provided on the USB drive is the Windows x64 version, which supports Windows 7, Windows 8, Windows 10, and Windows 11. If you require Windows x86 (only valid for NX series), Linux x64, or Linux aarch64 please visit the HAROGIC official website (https://www.harogic.com/support/download-center/) to download.

2. If the software displays a message indicating a missing calibration file, please copy the "CalFile" folder from the instrument's corresponding USB flash to the "SAStudio4/Bin/CalFile" directory. If the issue persists, please contact HAROGIC official technical support for support.

## 3.4 External Interface Description

### 3.4.1 SAN Series and SAM Series



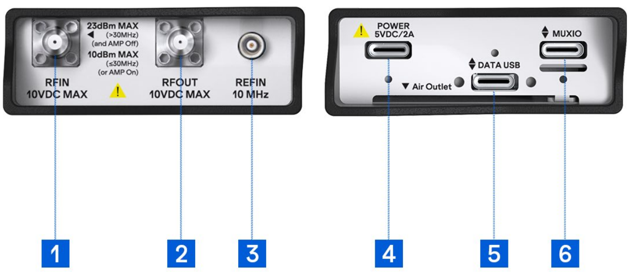



**Table 1 SAN Series and SAM Series Interface Description**

| Pin | Interface Name | Description |
|---|---|---|
| 1 | RF Input | SMA (Female, F), Input Impedance 50 Ω |
| 2 | RF Output | SMA (Female, F), Output Impedance 50 Ω |
| 3 | Reference Clock Input | MCX (Female, F), Amplitude ≥ 1.5 Vpp, Input Impedance 330 Ω |
| 4 | Power Port | Instrument Charging Port, Type-C 5 V 2 A |
| 5 | Data Port | Type-C, USB 3.0 Recommended (USB 2.0 compatible, but bandwidth limited) |
| 6 | Multi-function MUXIO | For a detailed description, please refer to Table 2. |

**Table 2 Description of Multi-function MUXIO PIN Interface of Port 6 (Illustration direction from left to right)**

| Pin | Name | Direction | Level Standard | Meaning |
|---|---|---|---|---|
| A1 | GND | / | / | Ground |
| A2 | NC | / | / | / |
| A3 | EXT_TRG-IO1_F | I | 3.3 V | External trigger input |
| A4 | VEXT | O | / | Power output, 5 V |
| A5 | GND | / | / | Ground |
| A6 | USART6_TX_F | O | 3.3 V | Serial Port Output |
| A7 | USART6_RX_F | I | 3.3 V | Serial Port Input |
| A8 | NC | / | / | / |
| A9 | VEXT | O | / | Power output, 5 V |
| A10 | EXT_TRG-IO2_F | / | / | External Trigger Output |
| A11 | USART6_IT_F | / | / | Reserved |
| A12 | GND | / | / | Ground |

### 3.4.2 SAE Series and SAN-400 R2

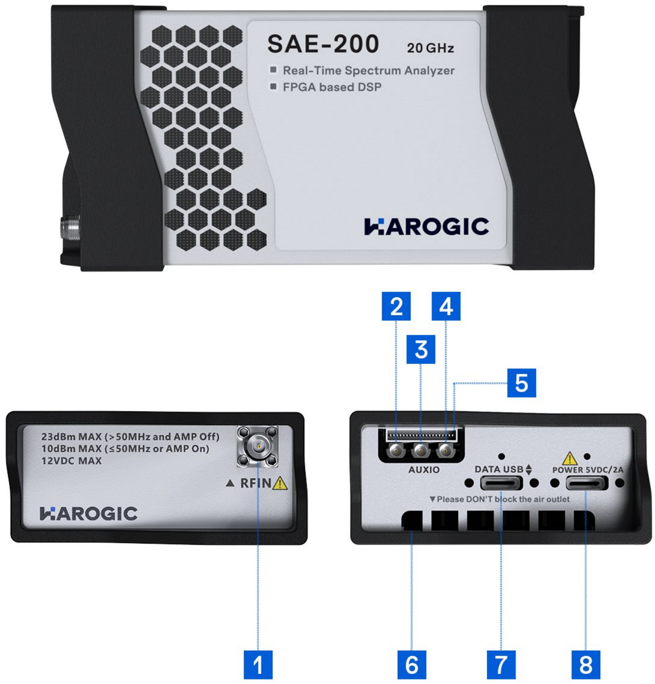



**Table3 SAE Series and SAN-400 M2 Interface**

| Pin | Interface Name | Description |
|---|---|---|
| **1** | RF Signal Input | 2.92 mm (F), input impedance 50 Ω |
| **2** | Analog Intermediate Frequency Output | MMCX (F), maximum output power -25 dBm, output impedance 50 Ω |
| **3** | Reserved Interface | / |
| **4** | Reference Clock Input | MMCX (F), amplitude ≥1.5 Vpp, input impedance 330 Ω |
| **5** | Multifunctional MUXIO | See Table 4 for a detailed description. |
| **6** | Heat dissipation vent | / |
| **7** | Data Port | Type-C, it is recommended to use USB 3.0 (USB 2.0 is available, but the bandwidth is limited) |
| **8** | Power Port | Instrument charging port, Type-C 5 V 2 A |

**Table4 Description of Multifunctional MUXIO PIN Interface of Port 5 (Illustration direction from left to right)**

| Pin | Name | Direction | Level Standard | Meaning |
|---|---|---|---|---|
| **1** | EXT_TRG_IO1 | I | 3.3 V | Trigger input |
| **2** | EXT_TRG_IO2 | / | / | Reserved |

| | | | | |
|---|---|---|---|---|
| **3** | EXT_TRG_IO3 | O | 3.3 V | Trigger output |
| **4** | GND | / | / | Ground |
| **5** | LFADC_INA | I | Analog signal | Low Frequency ADC Input |
| **6** | 3V3D | O | / | Power output, 5 V output |
| **7** | USART9_RX | I | 3.3 V | Serial Port Input |
| **8** | GND | / | / | Ground |
| **9** | USART_TX | O | 3.3 V | Serial Port Output |
| **10** | NC | / | / | / |
| **11** | NC | / | / | / |
| **12** | NC | / | / | / |
| **13** | GND | / | / | Ground |
| **14** | REFCLK_OUT | O | / | Reference clock output, can output 10 MHz standard clock signal |

# 4. Quick Start Guide (NX Series)

This chapter serves as a quick start guide for the NX series instruments. Key topics include: Safety Instructions, Instrument Connection, Network Configuration, and Running the SAStudio4 Software.

## 4.1 Safety Instructions

### 4.1.1 Power Adapter Selection

It is recommended to use the original power adapter supplied with the instrument. If you cannot use the originally shipped power adapter for any reason, please refer to the product manual for your specific instrument model to select a power adapter with the appropriate specifications.

If powering directly via a DC source, strictly adhere to the specifications in the product manual: the input voltage must meet the 12 V/2 A standard (allowable range 9 V-12 V), and ensure the peak-to-peak ripple voltage does not exceed 200 mVpp. Adhering to this parameter requirement ensures normal device operation and prevents hardware damage.

Refer to the product manual for your specific instrument model regarding the Maximum Destructive Input Power (Continuous Wave - CW) and Maximum DC Voltage. During operation, strictly adhere to the specification requirements in the manual and never exceed the maximum values to avoid irreversible damage to the instrument.

## 4.2 Using the NX Series Device

### 4.2.1 Connecting the Device

1、 Connect the instrument's power port to the power adapter using the Type-C data cable; plug the power adapter into a power outlet.

2、 Connect the instrument's LAN port to the network port of a computer or embedded device using a network cable (user-supplied). For optimal transmission performance, it is strongly recommended to use Gigabit Ethernet ports for both the host computer and the NX series instrument: use LAN2 (LAN1: 100 Mbps, LAN2: 1 Gbps).

Note: The NX series instrument automatically starts up when powered on. It requires approximately 40 seconds to complete the startup process and become ready for normal use. Please wait patiently. To turn off the device, press and hold the device power button for more than 5 seconds.

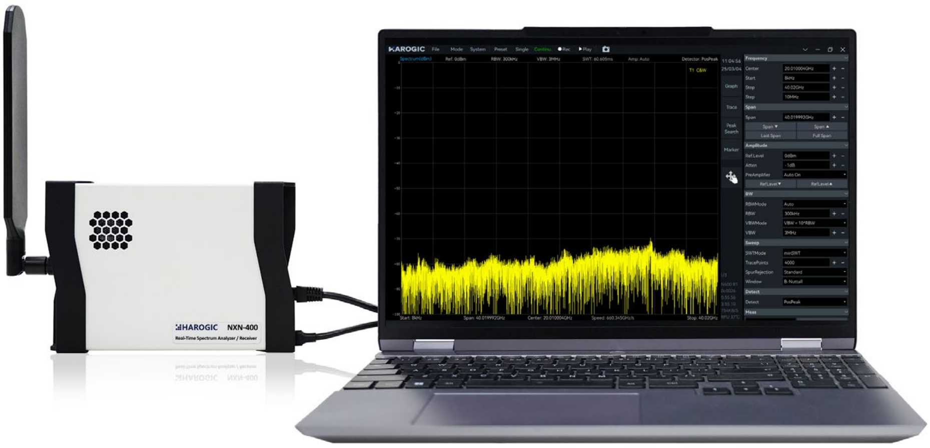


Diagram 2 NX series connection diagram

### 4.2.2 Configuring the Network

The NX device has a default IP address of 192.168.1.100 and a subnet mask of 255.255.255.0. Bridge mode is enabled by default, allowing access via the IP address 192.168.1.100 when connected to either LAN1 or LAN2.

The default network configuration for the NX series instrument is as follows:

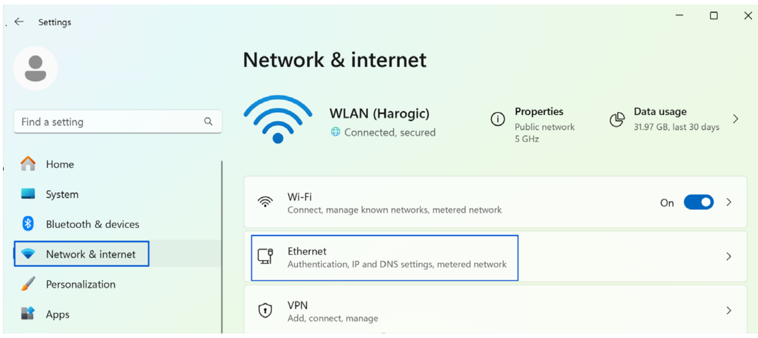
- IPv4 Address: 192.168.1.100 (non-modifiable), 192.168.3.100 (modifiable)
- Subnet Mask: 255.255.255.0
- Bridge Mode: Enabled

Interface Description:

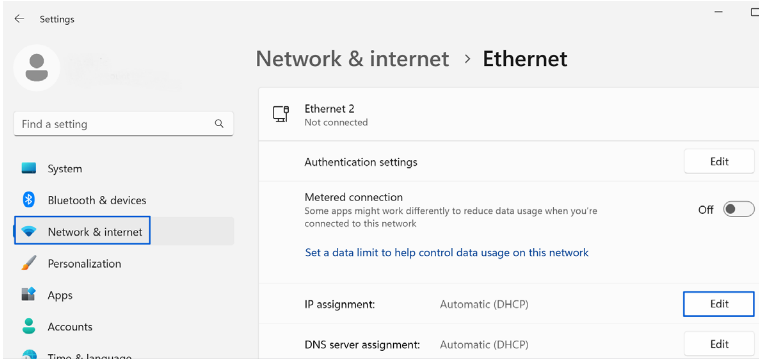
- The physical ports LAN1 (Fast Ethernet / 100 Mbps) and LAN2 (Gigabit Ethernet / 1 Gbps) are bridged into a logical interface.
- After connecting either physical port to the network, the device can be accessed via the 192.168.1.100 or 192.168.3.100 addresses.

The IP address of the host computer must be in the same network segment as the NX instrument to be used normally. The following will introduce how to configure the IP address of the host computer.

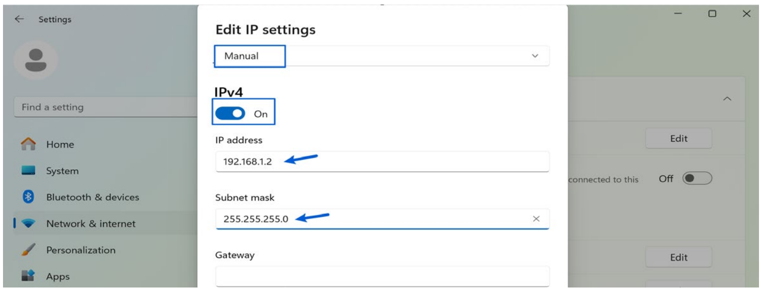
1. Open "Settings" → Select "Network & Internet" → Select "Ethernet";



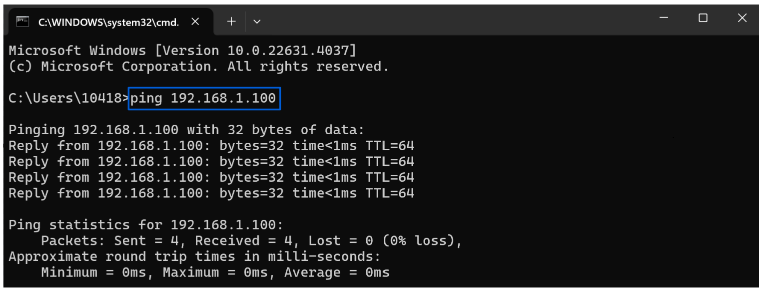
2. Under Ethernet settings, find the IP assignment section and click “Edit”;




3. Select "Manual" IP settings, enable the IPv4 option, and set the IP address and subnet mask. For example, set the computer's IP address to 192.168.1.2 and the subnet mask to 255.255.255.0;



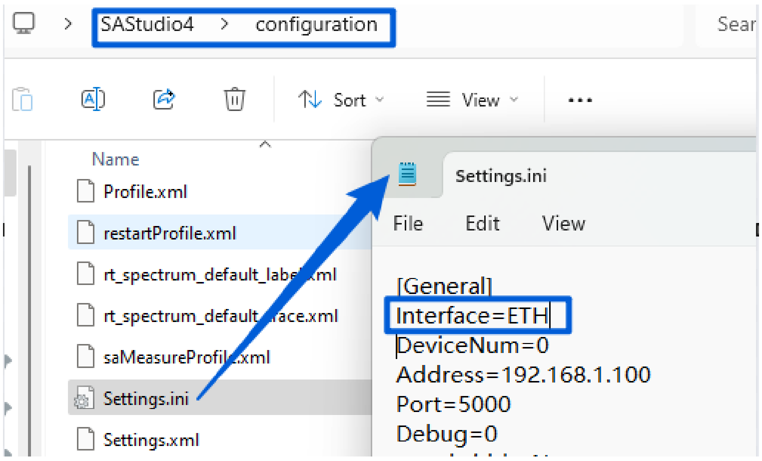

4. In the search box on the computer's taskbar or Start menu, type "cmd" and click on "Command Prompt" in the search results. Then, type ping 192.168.1.100 and press Enter. If the network connection is successful and you receive replies, it indicates that the network connection between the device and the target IP address has been established, and the network configuration is complete.



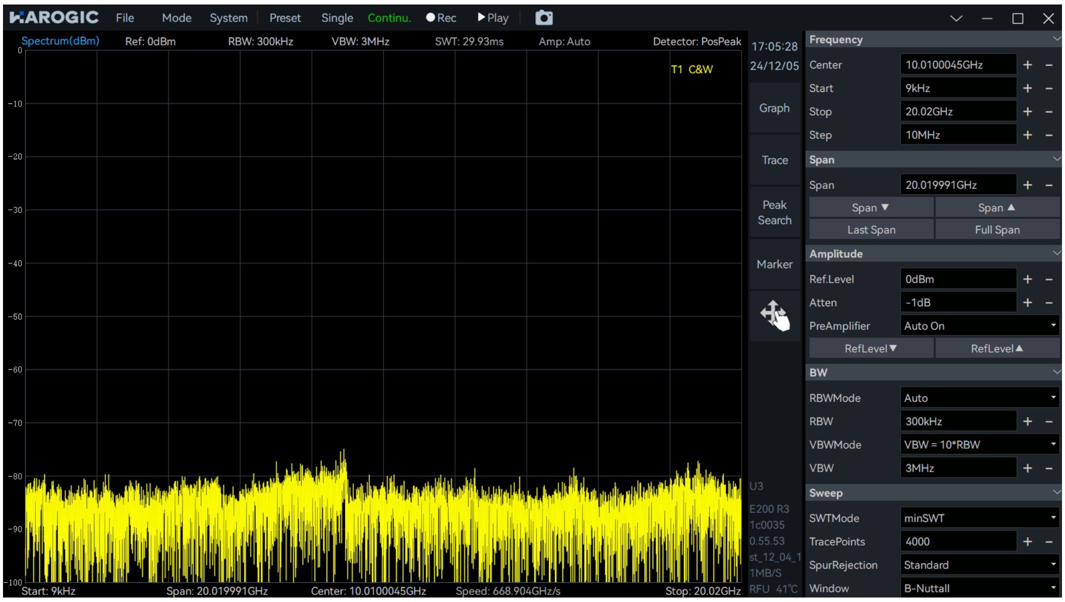

## 4.3 Running SAStudio4

Assume the instrument is connected correctly as described above, and the network is successfully configured.

1. Copy the \Windows\SAStudio4\ folder from the provided USB drive to your computer's desktop or another directory.
2. Navigate to the \SAStudio4\configuration\ folder, double-click to open the Settings.ini file, and confirm that Interface is set to ETH. If not, manually change it to ETH and save the file.




3. Navigate to the \SAStudio4\bin\ folder and double-click SAStudio4.exe to run the application.
4. SAStudio4 should run normally, as shown in the figure below.




Notes:

1. The provided USB drive contains the Windows x64 version of SAStudio4 by default, supporting Win7, Win8, Win10, and Win11. If you require Windows x86, or Linux aarch64 versions, please contact HAROGIC official technical support to obtain.

2. If the software indicates missing calibration files upon opening, copy the CalFile folder from the instrument's corresponding USB drive into the SAStudio4/Bin/CalFile directory. If the problem persists, please contact HAROGIC official technical support for assistance.

## 4.4 External Interface Description

### 4.4.1 NXN and NXM Series

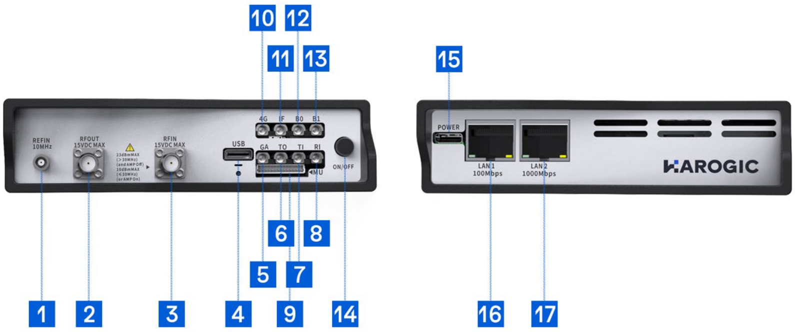




**Table 5 NXN Series and NXM Series Interface Description5**

| Pin | Interface Name | Description |
|---|---|---|
| **1** | Reference Clock Input | MCX(F), Amplitude ≥1.5 Vpp, Input impedance 330 Ω |
| **2** | RF Output | SMA (F), output impedance 50 Ω |
| **3** | RF Input | SMA (F), input impedance 50 Ω |
| **4** | USB | Type-C, USB 2.0 |
| **5** | GNSS antenna input | MMCX (F) |
| **6** | Trigger output | MMCX (F), 3.3 V CMOS |
| **7** | Trigger input | MMCX (F),3.3 V CMOS, input impedance is high impedance |
| **8** | Reference Clock Output | When the internal DOCXO is selected, a high-quality 10 MHz clock signal can be output. |
| **11 12 13** | Reserved Interface | / |
| **9** | Multifunctional MUXIO | / |
| **10** | 4G Antenna Input | MMCX (F) |
| **14** | Instrument Switch | Turns the instrument on/off. The instrument starts automatically when it is powered on for the first time, without the need to |

| | | |
|---|---|---|
| | | manually press the switch. During the power-on process, the instrument can be turned off or restarted via the switch. |
| **15** | Power Port | Type-C PD 12 V 2 A/9 V 2 A |
| **16** | LAN1 | Fast Ethernet Port (100 Mbps) |
| **17** | LAN2 | Fast Ethernet Port (1000 Mbps) |

**Table 6 Description of Multifunctional MUXIO PIN Interface of Port 9 (Illustration direction from right to left)6**

| Pin | Name | Direction | Level Standard | Meaning |
|---|---|---|---|---|
| **1** | GPIO0 | / | / | Reserved |
| **2** | TRG IO2 | / | / | Reserved |
| **3** | GPIO1 | / | / | Reserved |
| **4** | GND | / | / | Ground |
| **5** | GPIO2 | / | / | Reserved |
| **6** | 3V3/5VIN | O | / | Power output, 5 V output |
| **7** | GPIO3 | / | / | Reserved |
| **8** | GND | / | / | Ground |
| **9** | USART_TX_FP | / | / | Reserved |
| **10** | NC | / | / | / |
| **11** | NC | / | / | / |
| **12** | NC | / | / | / |
| **13** | GND | / | / | Ground |
| **14** | REFCLK_OUT_FP | O | / | Reference Clock Output, Outputs 10 MHz std. clock |

### 4.4.2 NXE and NXN-400 Series

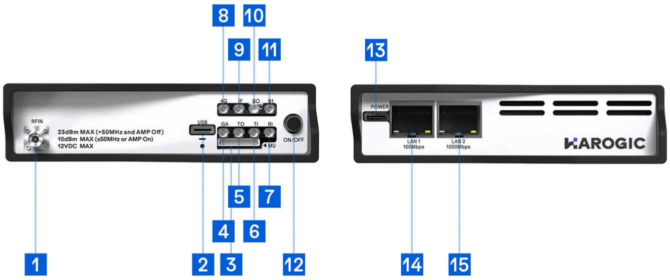




**Table 7 NXE and NXN-400 Series Interface Description**

| Pin | Interface Name | Description |
|---|---|---|
| 1 | RF Input | 2.92mm (F), Input Impedance 50 Ω |
| 2 | USB | Type-C, USB 2.0 |
| 3 | Multifunction MUXIO | |
| 4 | GNSS Antenna Input | MMCX (F) |
| 5 | Trigger Output | MMCX (F), 3.3V CMOS |
| 6 | Trigger Input | MMCX (F), 3.3V CMOS, Input Impedance: High-Z |
| 7 | Reference Clock Input | MMCX (F), Amplitude ≥ 1.5 Vpp, Input Impedance 330 Ω |
| 8 | 4G Antenna Input | MMCX (F) |
| 9 | Analog IF Output | MMCX (F), Max Output Power -25 dBm, Output Impedance 50 Ω |
| 10 11 | Reserved Interface | |
| 12 | Instrument Power Switch | Turns the instrument On/Off. The instrument starts automatically on initial power-up without needing a manual press. During power-up, the switch can be used to turn off or restart the instrument. |
| 13 | Power Port | Type-C PD3.0 12V 2A / 9V 2A |
| 14 | LAN1 | Fast Ethernet Port (100 Mbps) |
| 15 | LAN2 | Fast Ethernet Port (1000 Mbps) |

Table 8 Pin 3 Multi-function MUXIO Pin out Description (Pins ordered right-to-left in diagram)

| Pin | Name | Direction | Level Standard | Meaning |
|---|---|---|---|---|
| **1** | GPIO0 | / | / | Reserved |
| **2** | TRG IO2 | / | / | Reserved |
| **3** | GPIO1 | / | / | Reserved |
| **4** | GND | / | / | Ground |
| **5** | GPIO2 | / | / | Reserved |
| **6** | 3V3/5VIN | O | / | Power Output, 3.3V Output |
| **7** | GPIO3 | / | / | Reserved |
| **8** | GND | / | / | Ground |
| **9** | USART_TX_FP | / | / | Reserved |
| **10** | SYNC_RXRFLO | I | 3.3V | RF LO Synchronization Input |
| **11** | SYNC_ADCCLK | I | 3.3V | ADC Clock Synchronization Input |
| **12** | SYNC_RXIFLO | I | 3.3V | IF LO Synchronization Input |
| **13** | GND | / | / | Ground |
| **14** | REFCLK_OUT_FP | O | / | Reference Clock Output, Outputs 10 MHz std. clock |

# 5. SAStudio4 Operation Overview

This chapter mainly explains the UI layout, working modes, and common features of SAStudio4 software.

## 5.1 Introduction to Working Modes

SA/NX series spectrum analyzers offer working modes, including Standard Spectrum Analysis (SWP), IQ Streaming (IQS), Power Detection Analysis (DET), Real-time Spectrum Analysis (RTA), Phase Noise Measure and Basic Digital Demodulation.

### 5.1.1 Standard Spectrum Analysis Mode (SWP)

In SWP mode, the instrument performs frequency hopping to realize frequency sweep. This mode is suitable for frequency trace-based measurement and analysis applications. The measurement and analysis functions provided in SWP mode include:

- Spectrum panoramic sweep
- Local spectrum zoom display
- Waterfall graph
- Spectrum record and playback
- Signal tracking
- IP3/IM3
- Channel Power
- OBW
- ACPR
- Peak table

### 5.1.2 IQ Streaming Mode (IQS)

In IQS analysis mode, the instrument keeps the LO configuration unchanged to obtain IQ time domain data. IQS mode is suitable for time-domain signal recording, basic demodulation analysis, and other applications. The functions provided in IQS mode include:

- IQ time domain waveform
- Waterfall graph
- Power-time waveform
- Multi-channel DDC
- Spectrum analysis of IQ data
- AM/FM demodulation
- Audio analysis
- IQ record and playback

### 5.1.3 Detection Analysis Mode (DET)

In DET analysis mode, the instrument keeps the LO configuration unchanged to obtain IQ time domain data. DET mode is suitable for observing the relationship between time and power within a certain bandwidth. The functions provided in DET mode include:

- Power-time waveform
- Record and playback

### 5.1.4 Real-Time Spectrum Analysis Mode (RTA)

In RTA analysis mode, the instrument keeps the LO configuration unchanged to obtain IQ time domain data. RTA mode is suitable for applications that focus on transient and burst signals. The functions provided in RTA mode include:

- Real-time spectrum probability density graph and waterfall graph
- Record and playback

### 5.1.5 Phase Noise Measurement Mode (PNM)

In phase noise measurement mode, the instrument provides high-precision phase noise spectra and detailed data tables through automated measurement technology. These measurement results help users to deeply analyze the phase stability, noise distribution, and noise density at different frequency offsets of the signal. The functions provided by the phase noise measurement mode include:

- Single-sideband phase noise spectrum
- Phase noise measure table

### 5.1.6 Digital Demodulation Mode (Option71)

In digital demodulation mode, the instrument demodulates the modulated signal and analyzes the modulation quality from various perspectives. The demodulation functionality is suitable for multiple applications, especially in environments where known modulated signals need to be analyzed, quality-assessed, and data extracted. The functions provided in digital demodulation mode include:

- Constellation and eye diagram
- Bit table and demodulation
- Modulated signal spectrum analysis
- ASK/FSK/PSK/MSK/QAM

## 5.2 Interface Layout

The SAStudio4 UI consists of the following sections:

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

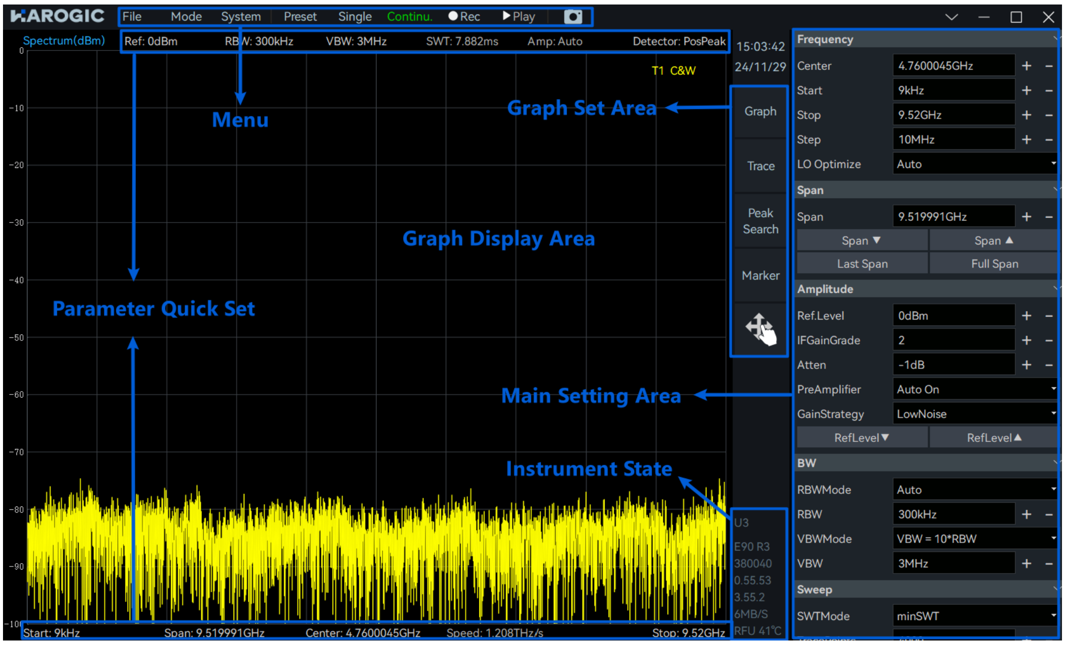



Figure 3 SAStudio4 Interface Layout

### 5.2.1 Menu

- Save and load configuration
- Set startup state
- Working mode switch
- System setting
- Single/Continue preview
- Record and playback

- Quick screenshot
- GNSS, Instrument Information View

### 5.2.2 Graph Settings Area

- Graph settings
- Trace settings
- Marker settings
- Display Measurement Results

### 5.2.3 Main Settings Area

- Measurement and analysis settings
- Trigger settings
- Data record and playback
- System settings

### 5.2.4 Instrument state

- Instrument model
- Software and firmware versions
- Current instrument temperature
- Bus data throughput
- GNSS antenna connection status
- Last six digits of instrument UID

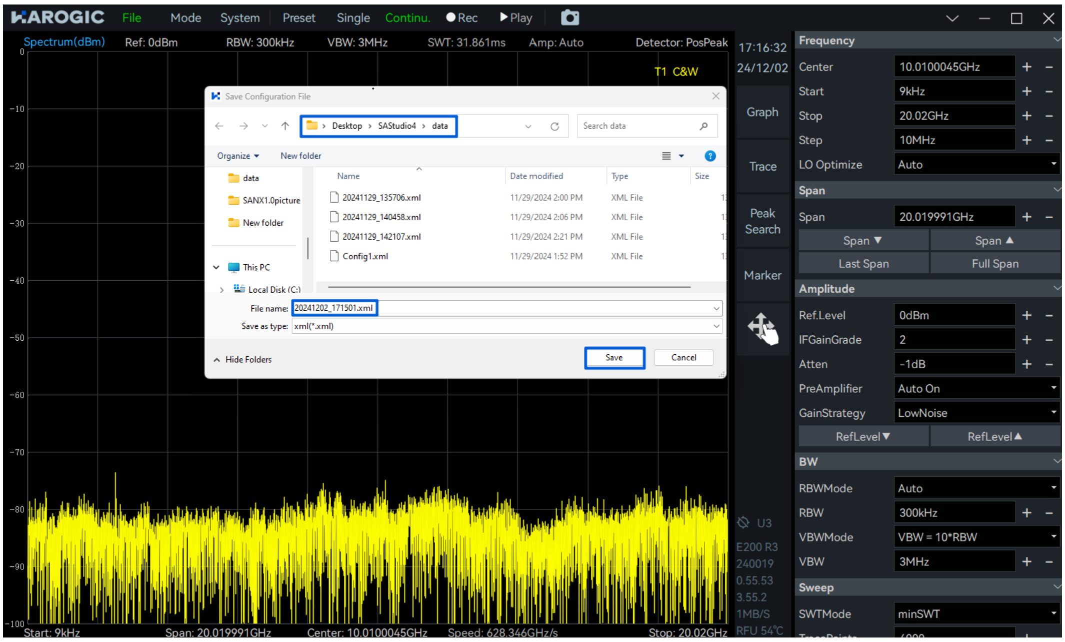
## 5.3 SAStudio4 Common Functions Introduction

### 5.3.1 Saving Store or load configuration

1. Store measurement configuration

1) Meau-File-Save State;

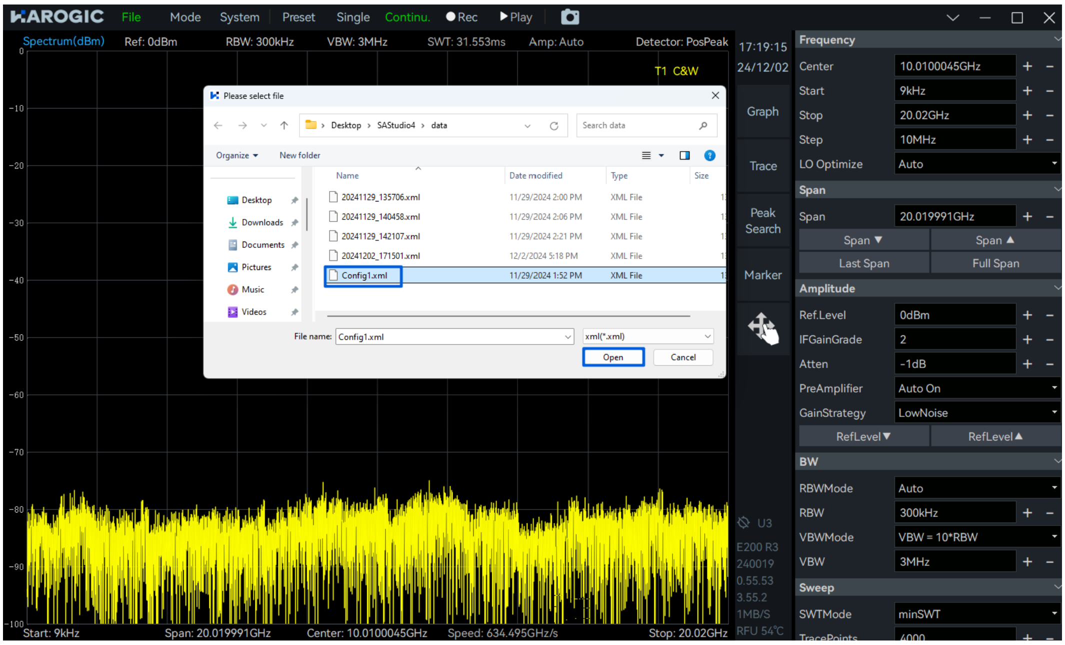
2) In the Save Configuration File dialog, set the save path and file name, then click Confirm to save the configuration file.




2. Load configuration

1) Menu-File-Recall state;

2) In the "Please Select file" dialog, choose the configuration file and click "Confirm" to open the previously saved configuration.



### 5.3.2 Setting Startup State

SA/NX series spectrum analyzers allow users to set the instrument's startup state. Supported states are detailed in Table 9.

**Table 9 SAStudio4 Software Startup States**

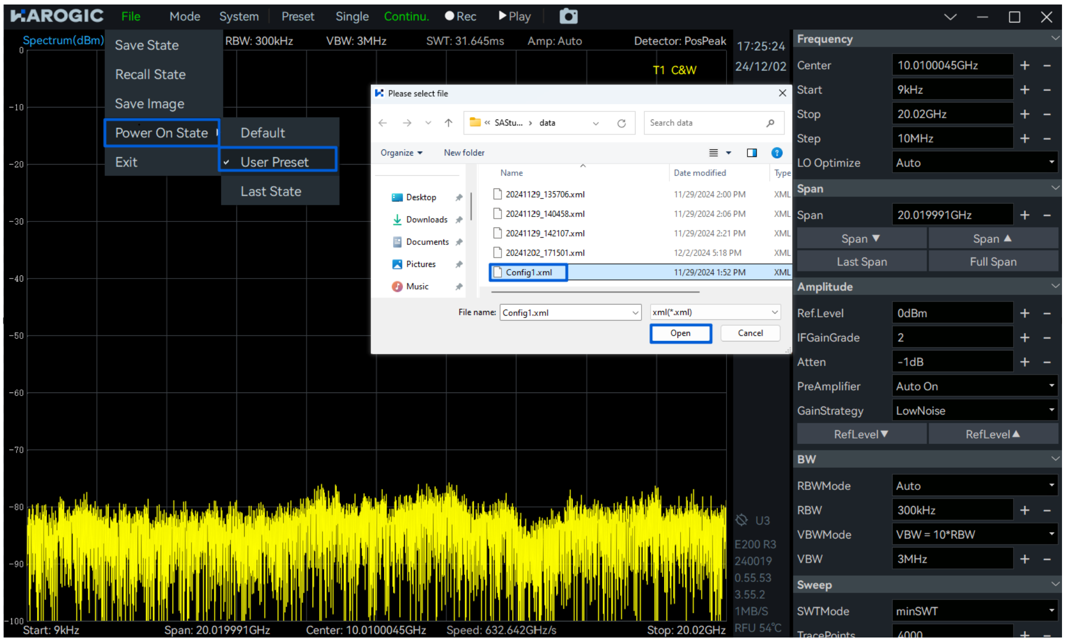
| No. | Startup State | Description |
|---|---|---|
| 1 | Default | Default configuration |
| 2 | User Preset | Use a user-saved configuration file as the startup state configuration |
| 3 | Last State | Use the parameter configuration when last software exit as the startup state configuration |

To configure the startup state, follow these steps:

1. Click "File" in menu bar, and select "Power On State" to set the software startup state;

2. For "Default" and "Last State", simply click the corresponding option. The software will use the state as the initial startup state when it is launched for the next time.

3. To select "User Preset," click on the "Please Select File" dialog that appears, choose the user-saved configuration file, and then click "Confirm." The software will start with the user-specified configuration next time.

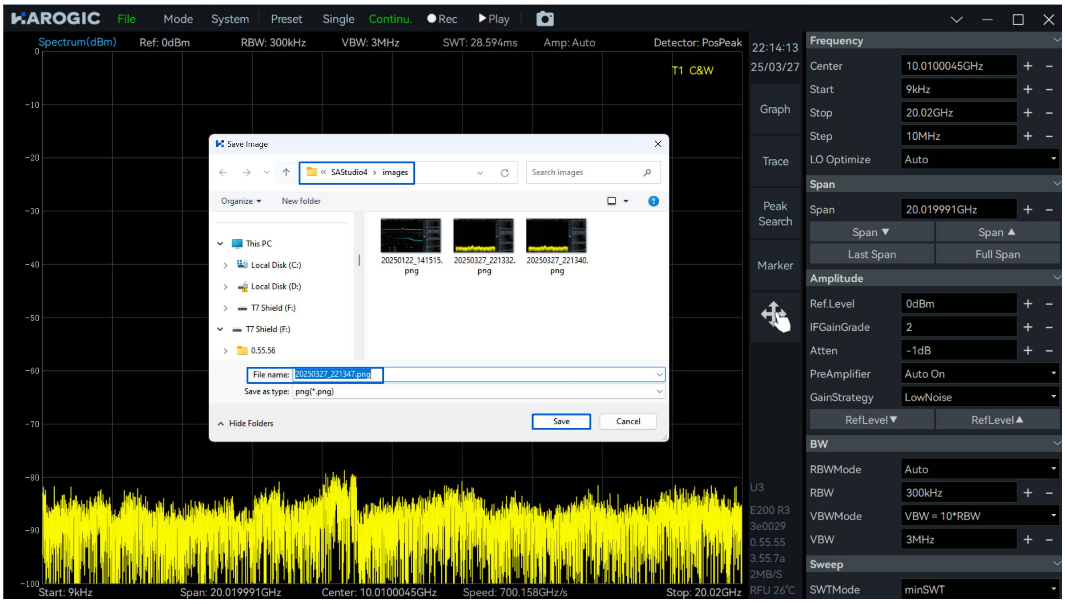



## 5.3.3 Switching Working Modes

Click "Mode" in the menu bar to switch SAStudio4's working mode to Standard Spectrum Analysis (SWP), IQ Streaming (IQS), Detection Analysis (DET), Real-Time Spectrum Analysis (RTA), Phase Noise Measurement (PNM), or Digital Demodulation.


## 5.3.4 Saving Screenshots

1. Click “File” in the menu bar, and select “Save Image”;
2. In the “Save Image” dialog, set the image save path and file name, then click “Confirm” to save the screenshot (when no external storage is connected, the image will be saved locally by default; when external is connected, you can choose to save directly to external disk). Alternatively, you can use the shortcut key in the menu bar "" for quick screenshot.




### 5.3.5 Switching Display Modes

The SA/NX host software interface supports three display modes: Workstation Single Column (default), Workstation Double Column, and Tablet Mode. Users can choose the mode according to their needs.

**Table 10 Display Mode Descriptions**

| Display Mode | Description |
|---|---|
| **Workstation Single Column** | Parameters displayed in a single column, larger spectrum display area, focuses on spectrum observation. |
| **Workstation Double Column** | Parameters displayed in two columns, more convenient parameter setting, allows viewing and comparing multiple parameters simultaneously. |
| **Tablet** | Suitable for tablets and mobile devices, simplified interface, convenient for touch operation. |


## 5.3.6 Fan Control

SA/NX series spectrum analyzers allow users to configure the instrument's fan status. Click "System" in the menu bar, select "Fan Control", and configure as needed. See Table 11 for supported fan states. (Note: Turning off the fan for extended periods may cause the device to overheat, potentially impacting performance and lifespan. Use the forced-off function cautiously.)

**Table 11 Fan Status Descriptions**

| Fan Status Name | Description |
|---|---|
| **On** | Fan is turned on. |
| **Off** | Fan is turned off. |
| **Auto** | Default mode. Intelligent fan control: automatically turns on at 50°C and off at 40°C. (SAE/SAN-400 series devices have the fan on by default and it is not programmatically controllable). |

### 5.3.7 Viewing GNSS Information

**Important Note:** The GNSS module provided with SA/NX series instruments currently does not support viewing GNSS information using the internal antenna. For SA series instruments, GNSS information can be viewed in SAStudio4 after connecting an external GNSS module and antenna. For NX series instruments, connect an external GNSS antenna directly to view the information.

1. Click "System" in the menu bar, select "GNSS Info". The "GNSS Info" dialog will appear. Key parameters are explained in Table 12.

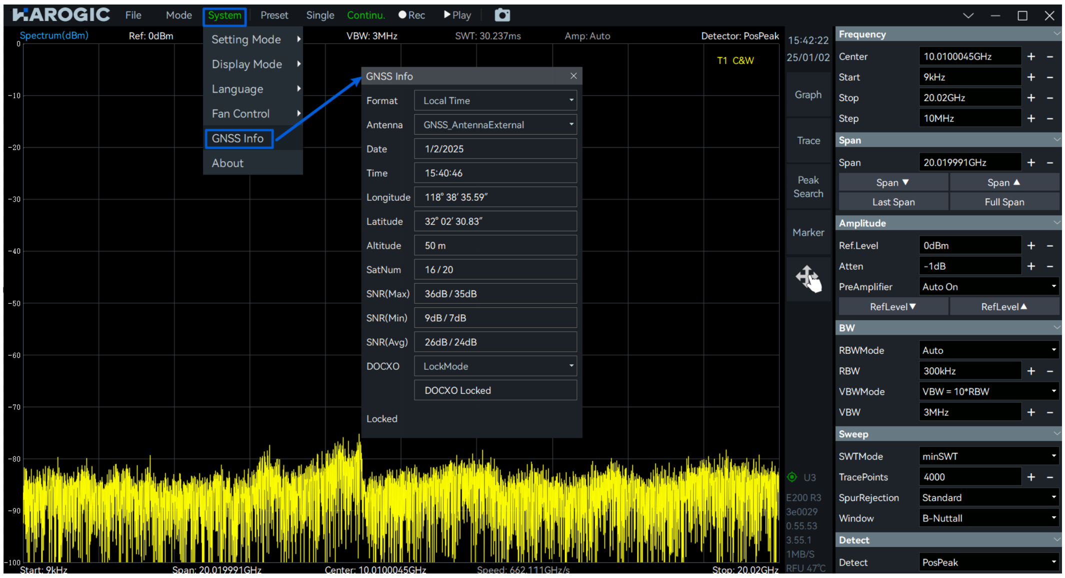
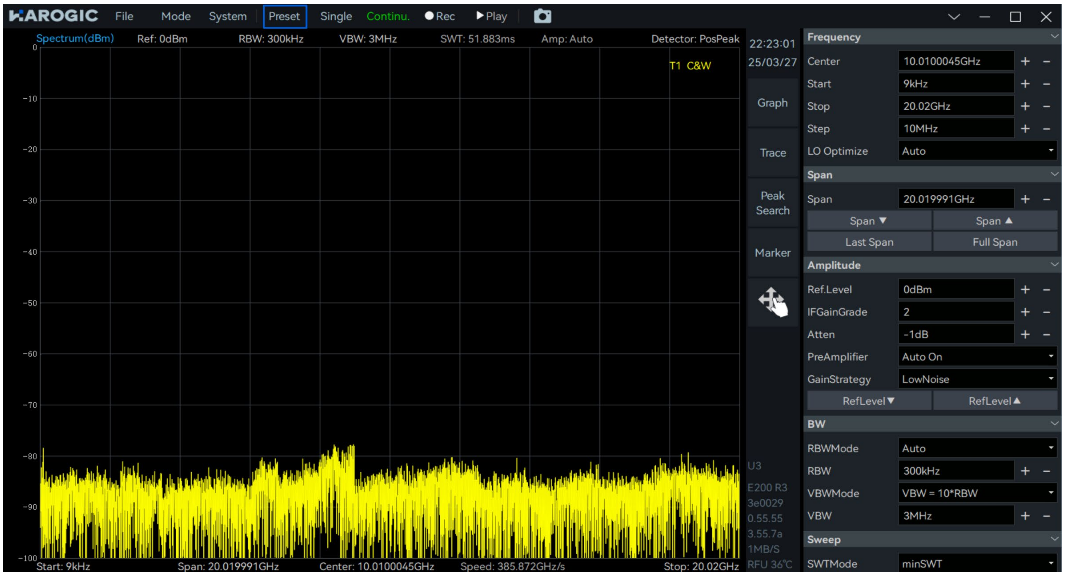



**Table 12 GNSS Parameter Descriptions**

| No. | Parameter | Description |
|---|---|---|
| **1** | Format | "Local Time" and "UTC Time" |
| **2** | Antenna | Select "Internal Antenna" or "External Antenna" (currently only external antenna is supported) |
| **3** | SatNum | Number of locked satellites/Number of visible satellites |
| **4** | SNR(Max) | Maximum signal-to-noise ratio (SNR) of the locked satellites/Maximum SNR of the unlocked satellites |
| **5** | SNR(Min) | Minimum SNR of the locked satellites/Minimum SNR of the unlocked satellites |
| **6** | SNR(Avg) | Average SNR of the locked satellites/ Average SNR of the unlocked satellites |
| **7** | DOCXO | Lock mode of the Oven-Controlled Crystal Oscillator (OCXO). |
| **8** | DOCXO Locked | Indicates if the OCXO is locked. |

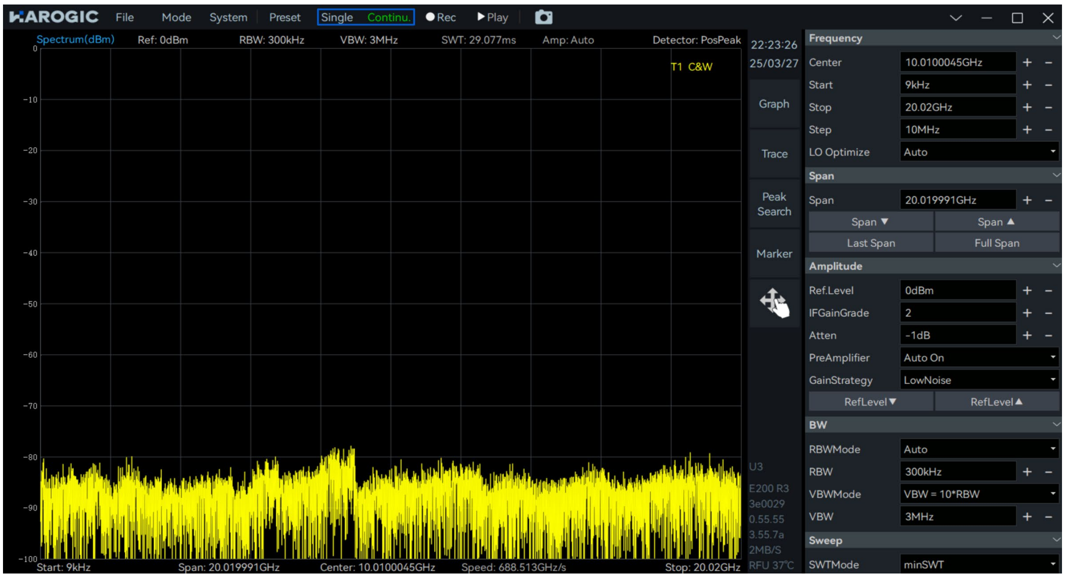
### 5.3.8 Preset

Click on "Preset" to restore the software configuration to the instrument's default state.



### 5.3.9 Single and Continuous Preview

Single Preview: Click "Single", Continuous Preview: Click "Continue".

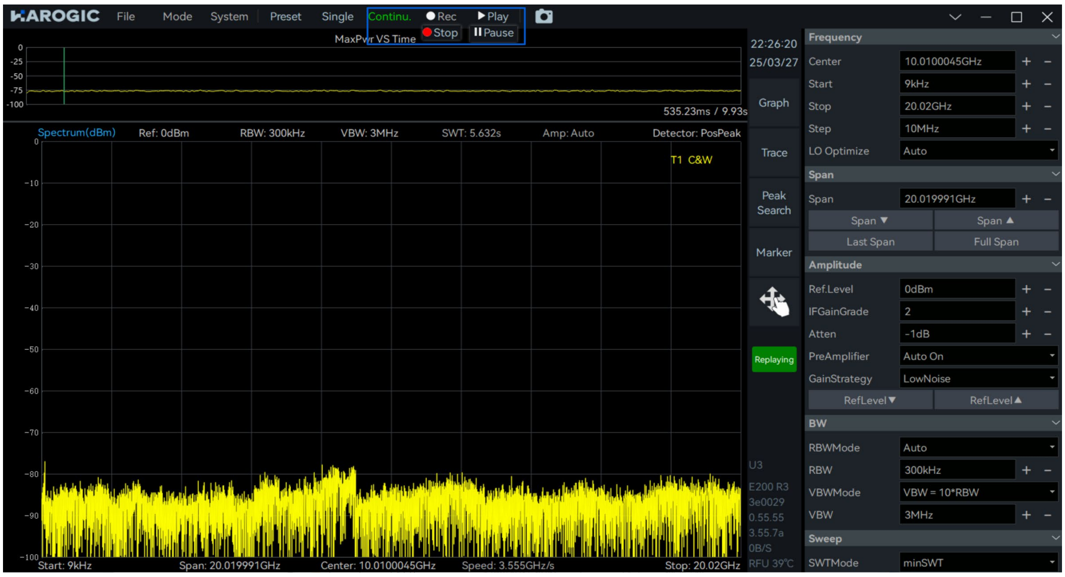


### 5.3.10 Quick Record and Playback

Record: Click "Rec" in the menu bar to start recording data; click "Stop" to stop recording.

Playback: Click "Play" in the menu bar to play back the most recent recording; click "Pause" to pause playback.

Click "Continu." in the menu bar to resume data acquisition.




## 5.3.11 Professional and Basic Settings

Click "System" in the menu bar, then click "Setting Mode" in the dropdown menu to select "Basic" or "Professional" mode. Compared to Basic mode, Professional mode offers more parameter options, suitable for users requiring higher customization and fine-tuning. Select the setting method according to your needs. See the table below for extended parameters; refer to the general parameter introduction for each mode for specific parameter meanings.

**Table 13 Professional Mode Extended Function Parameters**

| Mode | Extended Parameters |
|---|---|
| **Standard Spectrum Analysis** | LO Optimization, IF Gain Stage, Gain Strategy, Trace Points Strategy, Trace Detection Mode, Trace Detector, FFT Execution |
| **Receiver/IQ Stream** | LO Optimization, IF Gain Stage, Gain Strategy, Trace Detector, Trace Detection Ratio, Calibration |
| **Detection Analysis** | LO Optimization, IF Gain Stage, Gain Strategy |
| **Real-Time Spectrum Analysis** | LO Optimization, IF Gain Stage, Gain Strategy, Trace Detection Mode, Trace Detector, Trace Detection Ratio |


## 5.3.12 Viewing Current Instrument Information

Click "System" in the menu bar, select "About" from the dropdown menu. Current instrument information will be displayed in the "About" dialog.


## 5.3.13 Marker Functions

Marker functions are primarily set under the "Marker" submenu in the Graph Settings Area. SAStudio4 also provides quick usage methods for using markers, detailed below.

1. Create Marker

1) Create a single marker: Double-click in the Graph Display Area or click the "Peak Search" button in the Graph Settings Area to quickly activate the reference marker.

2) Create multiple markers: Click the "Marker" submenu in the Graph Settings Area, select the desired marker, and click "Enabled" to activate it.


2. Create Marker Pair

Click "Graph" in the Graph Settings Area, select "Marker Pair" in the pop-up to quickly enable a pair of reference and delta markers. Click repeatedly to enable multiple pairs.


3. Close Marker

1) Close a single marker

Click the "Marker" submenu in the Graph Settings Area, select the marker to close, and click "Enabled" to disable it.

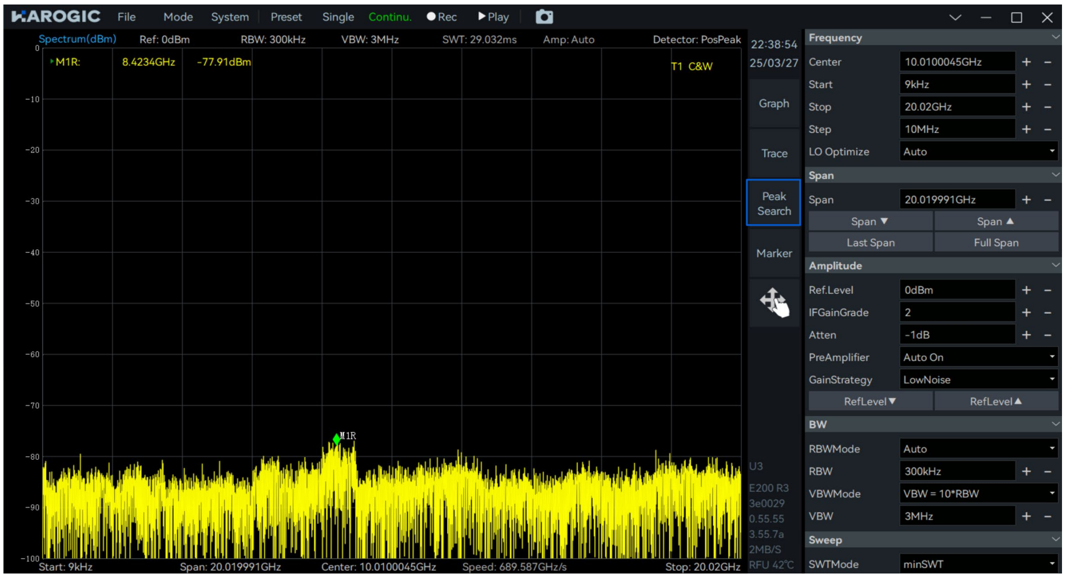

2) Close all markers: Click "Graph" in the Graph Settings Area, select "Clear All" in the pop-up to close all markers.


4. Marker Peak Search

1) Local Peak Search

Double-click near a local peak in the graph, or select the marker and click "Marker" → "Local Peak".


2) Global Peak Search: Click "Peak Search".




5. Delta Marker: Delta markers are typically used with reference markers to show the difference in frequency, time, or amplitude relative to the reference marker.


6. Noise Density

After creating a marker, enable "Noise Density" in the "Marker" submenu of the Graph Settings Area to convert the power value to power density per Hertz (e.g., dBm/Hz).


7. Marker to Center

Move the reference marker to the target frequency, then click "to Center" in the "Marker" submenu of the Graph Settings Area to align the marker's frequency to the center frequency.


8. Marker to Mode

Move the reference marker to the target frequency, then click the "Switch To" button under the "Marker" options in the Graph Settings Area to quickly switch to another working mode, setting the current marker frequency as the new mode's center frequency. (Note: SWP mode only supports one-way switching to other modes; other modes can be switched between mutually).


### 5.3.14 Waterfall Graph (Spectrogram)

Only SWP, IQS, and RTA modes support the waterfall plot function.

1. Click "Graph", open "Spectrogram" to create a waterfall plot corresponding to the spectrum.


2. Click the waterfall plot to switch to its Graph Settings Area, then click "Graph" again to access waterfall settings. Key controls are described in Table 14:


**Table 14 Waterfall Graph Control Descriptions**

| Graph Setting Area Control | Description |
|---|---|
| **Scan Depth** | Controls the time duration buffered on the y-axis. |
| **Time Density** | Controls the refresh speed of the waterfall plot. |
| **ColorGradation** | Sets the color scale (gradient) for the plot. |

### 5.3.15 Zoom View

1. Spectrum Zoom View (SWP mode only)

1) Click "Graph", open "Zoom" from the submenu.

2) Click to select the spectrum zoom plot, then click "Graph" and set the desired frequency range to zoom into via the pop-up submenu.


2. Time Domain Zoom View (IQvT, PvT, and DET modes only)

1) IQvT and PvT

IQvT and PvT: In IQS mode, under the "IQvT" or "PvT" submenu in the Main Settings Area, select the channel, enable "Analyze" and "Zoom". Adjust the zoom area by: clicking and dragging within the zoom area, dragging the edges of the zoom box, or scrolling the mouse wheel while hovering inside the zoom box.


2) DET Mode

Click "Graph", open "Zoom" from the submenu.

Adjust the zoom area by: clicking and dragging within the zoom area, dragging the edges of the zoom box, scrolling the mouse wheel inside the zoom box, or selecting the "PvT Zoom" plot, clicking "Graph", and setting "TimeCenter" and "TimeRange".

### 5.3.16 Record & Playback

Key parameters for the Record & Playback function are described in Table 15.

**Table15 Record & Playback Parameter Descriptions**

| | |
|---|---|
| **Recording** | |
| **RecordMode** | Default save path: ..\SAStudio4\data folder.<br>* Fixed: Pre-set recording points, duration, and single file size limit (Actual size cannot exceed disk space).<br>* Manual: Manually control recording points (Recording stops automatically if file size limit is exceeded). |
| **RecordTime** | Sets recording duration (only effective in "Fixed" mode). |
| **FileSizeLimit** | Storage size limit for a single recording file. |
| **Disk** | Remaining disk space and total disk capacity. |
| **Playback** | |
| **Last frame** | Go back one frame. |
| **Next frame** | Go forward one frame. |
| **Back** | Go back multiple frames. |
| **Forward** | Go forward multiple frames. |

1. Data Recording

Select the recording mode via the "RecordMode" option in the "Record" dropdown menu of the Main Settings Area.

Set the file storage path via "REC File Path" (default is ..\SAStudio4\data).

In Fixed mode, click "Record on" to automatically record the preset amount of data. In Manual mode, use "Record on" and "Record off" to manually control the recording duration; recording stops automatically if the user-defined file size limit is reached.

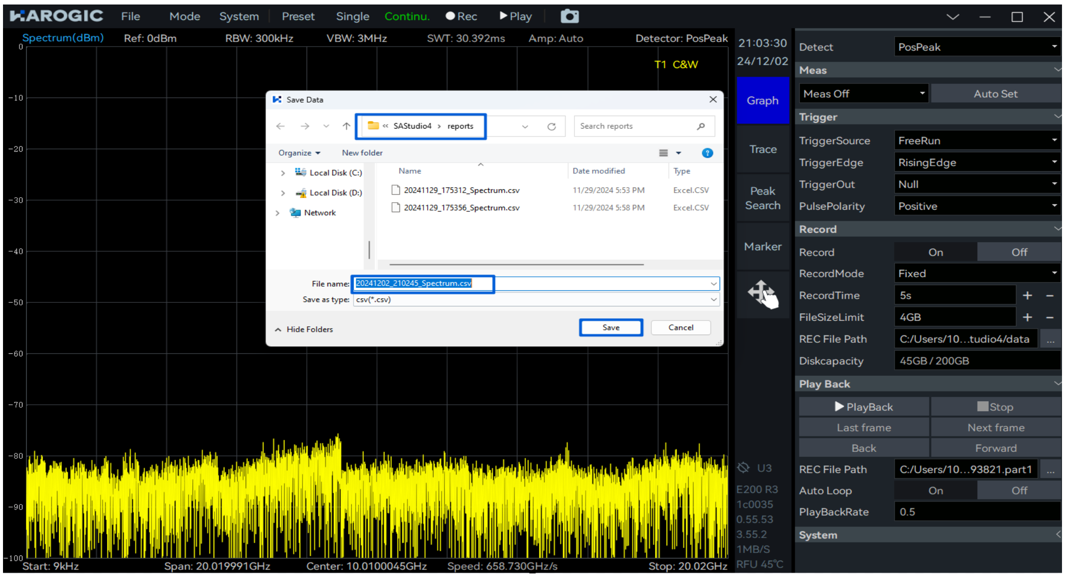
2. Data Playback

- Click "REC File Path" under "Play Back" in the Main Settings Area, select the recording file in the dialog, and click "Open".
- Click "Play Back" to start playback, "Pause" to pause, and "Stop" to exit playback and resume data acquisition.
- Adjust the playback speed using the "PlaybackRate" value.
- Enable "Auto Loop" to loop the playback of the recording file.

### 5.3.17 Exporting Data

1. In the Graph Settings Area for the chart you want to export data from (e.g., exporting spectrum chart data in the example below), click the "Graph" menu, and select "Data Export" from the submenu. Choose the desired data type: "Image" exports the current chart as a PNG image file, "Data" exports the chart data as a CSV file.

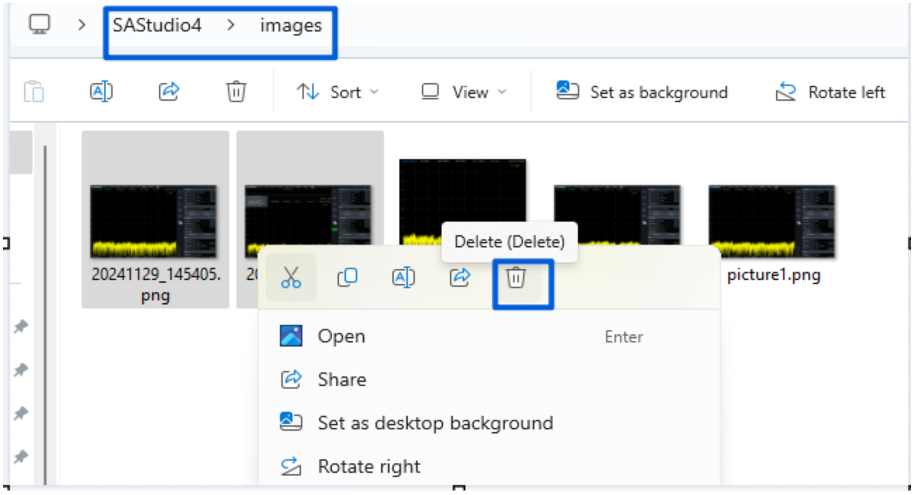

2. In the "Save" dialog, set the save path and filename, then click "Save" (images default to ..\SAStudio4\images, CSV files default to ..\SAStudio4\reports).




3. By default, SA/NX series instruments store data in subfolders under ..\SAStudio4\: images (chart images), data (recording files and configuration files), reports (chart data CSV files and corresponding configuration files).

### 5.3.18 Deleting Files and Images

If saved to the default path, navigate to ..\SAStudio4\images to delete corresponding screenshots (deleting recording files and configuration files follows the same procedure in their respective folders).

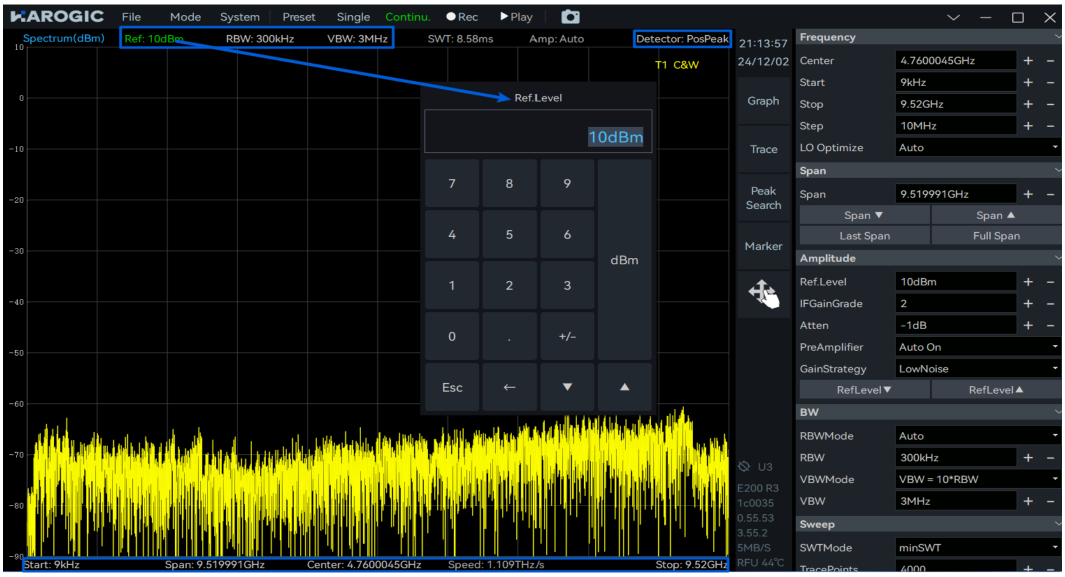



## 5.3.19 Modifying Sample Rate

In IQS mode, modify the "IQSampleRate" value under the "BW" module in the Main Settings Area to change the instrument's sample rate. (Note: Changing the sample rate affects the instrument's analysis bandwidth and data processing capability. Set the sample rate reasonably based on the actual application scenario and requirements).


## 5.3.20 Quick Parameter Settings

Currently supported quick-set parameters include common spectrum analysis parameters such as: Reference Level, RBW (Resolution Bandwidth), VBW (Video Bandwidth), Detector, Start Frequency, Stop Frequency, Span, and Center Frequency.


HAROGIC
File
Mode
System
Preset
Single
Continu.
Rec
Play
Spectrum(dBm)
Ref: 10dBm
RBW: 300kHz
VBW: 3MHz
SWT: 8.58ms
Amp: Auto
Detector: PosPeak
21:13:57
24/12/02
T1 C&W
Ref.Level
10dBm
7
8
9
4
5
6
1
2
3
0
.
+/-
dBm
Esc
Graph
Trace
Peak Search
Marker
Frequency
Center
4.7600045GHz
Start
9kHz
Stop
9.52GHz
Step
10MHz
LO Optimize
Auto
Span
Span
9.519991GHz
Span ▼
Span ▲
Last Span
Full Span
Amplitude
Ref.Level
10dBm
IFGainGrade
2
Atten
-1dB
PreAmplifier
Auto On
GainStrategy
LowNoise
RefLevel ▼
RefLevel ▲
BW
RBWMode
Auto
RBW
300kHz
VBWMode
VBW = 10*RBW
VBW
3MHz
Sweep
SWTMode
minSWT
Start: 9kHz
Span: 9.519991GHz
Center: 4.7600045GHz
Speed: 1.109THz/s
Stop: 9.52GHz

# 6. SWP Mode

This chapter will provide you with important parameters and measurement methods for SWP mode.

## 6.1 SWP Mode General Parameter Introduction

Important parameters for the SWP mode are listed in Table 7.

**Table16 SWP Mode Parameter Descriptions**

| | |
|---|---|
| **Frequency** | |
| **LO Optimization** | Auto: Default Low Spurious mode;<br>Scan Speed: High Scan Speed mode;<br>Spurious: Low Spurious mode;<br>Phase Noise: Low Phase Noise mode. |
| **Amplitude** | |
| **Pre-ampplifier** | Set Preamplifier action:<br>Auto Enable: Preamp selectively enabled when Reference Level is below -30 dBm<br>Force Off: Preamp always remains off regardless of Reference Level |
| **Gain Strategy** | Low Noise: Prioritizes low noise and maintains a flat noise floor<br>High Linearity: Prioritizes high linearity and maintains a flat noise floor |
| **IF Gain Stage** | 0-X steps (Specific range depends on model). Each step is approx. 3dB gain difference.<br>Increase IF Gain: RF gain decreases, noise floor increases, linearity improves, spurious decreases.<br>Decrease IF Gain: RF gain increases, noise floor decreases, linearity degrades, spurious increases. |
| **Attenuation** | 0-33 dB (Max attenuation varies by frequency band), 1 dB step.<br>Atten = -1 dB (Auto/Default): Attenuation Off.<br>Atten ≥ 0 dB: Attenuation On. (Note: Relationship between Ref Level and Attenuation may apply, refer to specific device behavior.) |
| **Sweep** | |
| **Sweep Time Mode** | min SWT: minimum sweep time;<br>min SWTx2: approximately 2 times of min SWT;<br>min SWTx4: approximately 4 times of min SWT;<br>min SWTx10: approximately 10 times of min SWT;<br>min SWTx20: approximately 20 times of min SWT;<br>min SWTx50: approximately 50 times of min SWT;<br>min SWTxN: approximately N times of min SWT, N=SweepTimeMultiple;<br>Manual: approximately equal to the target sweep time. |

| | |
|---|---|
| **Trace point strategy** | Prioritize Speed: Prioritizes fastest scan speed, approximating the target trace points.<br>Prioritize Points: Prioritizes achieving the target trace points, potentially slowing the scan. |
| **Spurious suppression** | Bypass: No spurious optimization. Standard: Standard spurious optimization.<br>Enhanced: Enhanced spurious optimization. |
| **FFT Execution** | 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 type** | Flat Top: Higher amplitude accuracy.<br>Blackman-Nuttall (B-Nuttal): Higher frequency selectivity.<br>Low Sidelobe: Higher measurement accuracy for signals close to stronger signals. |

## 6.2 Channel Power

A BPSK signal with a carrier frequency of 1 GHz, power of -20 dBm and symbol rate of 1 MHz is as input to spectrum analyzer.

### 6.2.1 Parameter Description

Key parameters for Channel Power measurement are described in Table 17

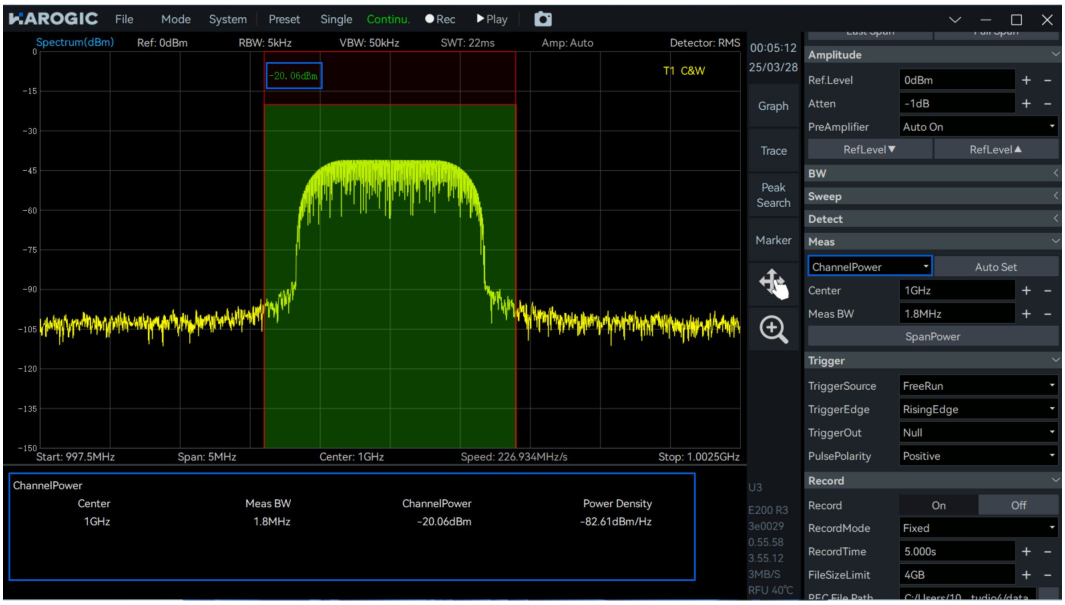
**Table17 Channel Power Measurement Parameter Descriptions**

| **Channel Power** | |
|---|---|
| **Meas BW** | the bandwidth of the channel to be measured; channel power is the integrated power within this bandwidth |
| **Span Power** | the measurement bandwidth to the current span and calculates the channel power within this range |

### 6.2.2 Operating Steps

1. Set the center frequency as 1 GHz and reference level as 0 dBm. Click the "Meas" menu and select "ChannelPower" from the dropdown menu;

2. Parameters are automatically configured to default parameters. The results are shown in the figure below. The top left corner of the measurement box displays the channel power value. The "Channel Power" section below also shows the measurement bandwidth, channel power, and power spectral density values;




3. You can also manually adjust the channel center frequency (drag to select the measurement area) and the measurement bandwidth (drag the measurement border left or right or adjust the Meas BW settings).

## 6.3 Occupied Bandwidth

A BPSK signal with a carrier frequency of 1 GHz, power of -20 dBm and symbol rate of 1 MHz is as input to spectrum analyzer.

### 6.3.1 Parameter description

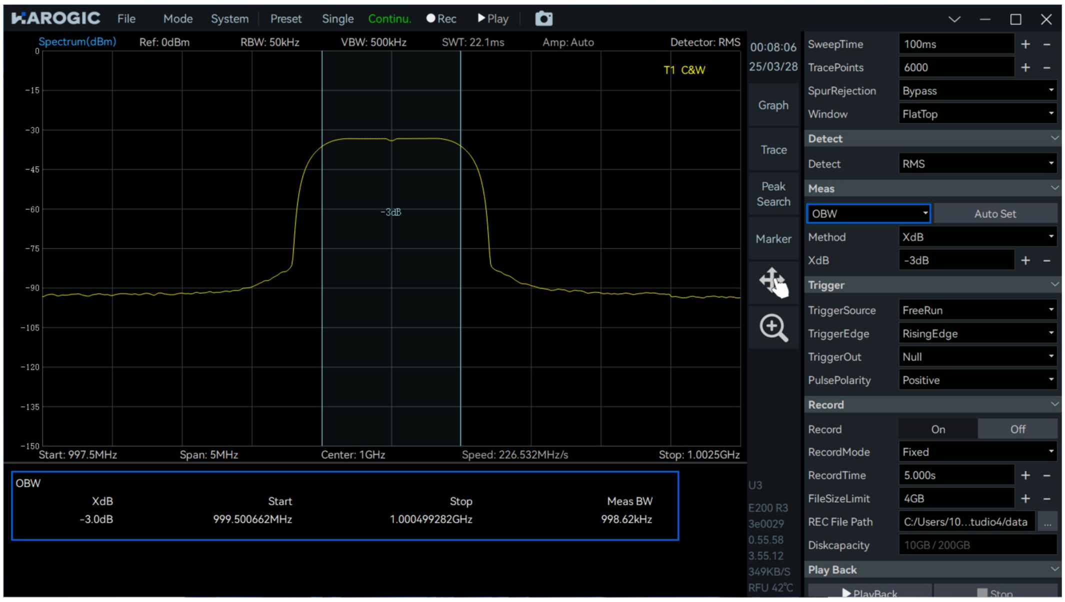
This section provides an explanation of some important parameters: Important parameters for occupied bandwidth measurement are listed in Table 18.

**Table 18 Occupied bandwidth measurement parameter description**

| Parameters | |
|---|---|
| **Method** | XdB、Percentage |
| **XdB/Percent** | the specific XdB value or percentage |

### 6.3.2 Instruction step

1. Set the center frequency as 1 GHz and the reference level as 0 dBm. Select "OBW" from the dropdown menu;
2. Parameters are automatically configured to default parameters. The results are shown in the figure below. The occupied bandwidth value can be viewed in the "OBW" section below.




## 6.4 Adjacent Channel Power Ratio (ACPR)

A BPSK signal with a carrier frequency of 1 GHz, power of -20 dBm and symbol rate of 1 MHz is as input to spectrum analyzer.

### 6.4.1 Parameter description

This section provides an explanation of some important parameters: Important parameters for adjacent channel power ratio (ACPR) measurement are listed in Table 19.

**Table 19 ACPR measurement parameter description**

| **ACPR** | |
|---|---|
| **Space** | the frequency interval between the main channel and adjacent channels |
| **Count** | the number of adjacent channel pairs |
| **Main Power** | The power of the main channel |
| **Adj Center** | Center frequency of the adjacent channel |
| **Adj Power** | Measured power of the adjacent channel |
| **Adj Ratio** | Measured adjacent channel power ratio |

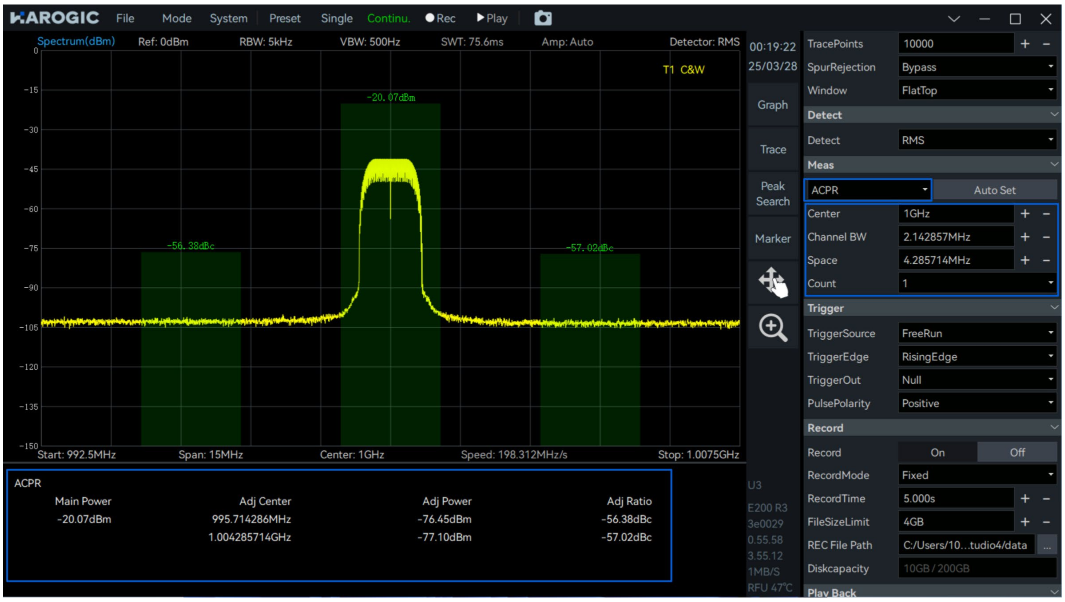
### 6.4.2 Instruction step

1、Set the center frequency as 1 GHz and the reference level as 0 dBm. Select "ACPR" from the dropdown menu.

2.、Parameters are automatically configured to default parameters. The results are shown in the figure below.

The power values of each channel are displayed at the top of the green channel bandwidth. The "ACPR" section below also shows the adjacent channel center frequency, adjacent channel power, and adjacent channel power ratio.

3、You can also manually set the center frequency of the main channel, the bandwidth of each channel, the spacing of adjacent channels, and the number of adjacent channel pairs.




## 6.5 IP3/IM3

Center frequency point of 1 GHz is utilized for IP3/IM3 measurement.

### 6.5.1 Parameter description

This section provides an explanation of some important parameters: Important parameters for IP3/IM3 measurement are listed in Table 20.

**Table 20 IP3/IM3 measurement parameter description**

| **IP3/IM3** | |
|---|---|
| **LowToneFreq** | Frequency of the input low-frequency signal |
| **LowTonePower** | Power of the input low-frequency signal |
| **HighToneFreq** | Frequency of the input high-frequency signal |
| **HighTonePower** | Power of the input high-frequency signal |
| **LowIM3PFreq** | Low-side intermodulation frequency |
| **LowIM3P** | Low-side intermodulation power |
| **HighIM3PFreq** | High-side intermodulation frequency |
| **HighIM3P** | High-side intermodulation power |
| **TonePowerDiff** | Power difference between the high and low frequency signals |

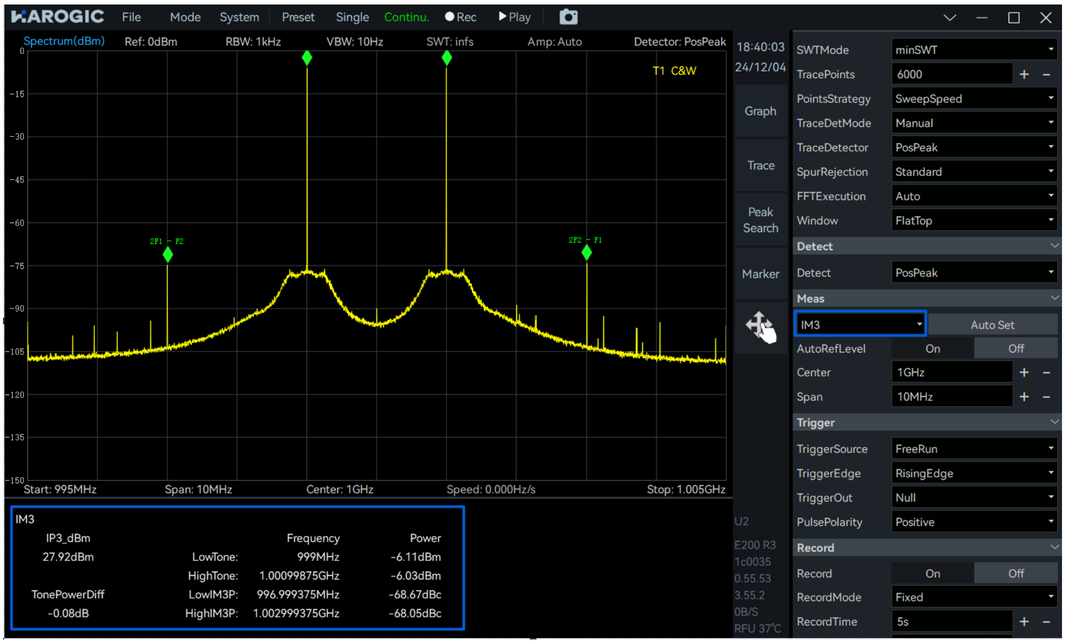
### 6.5.2 Instruction step

1. Two signals with one signal having a center frequency of 999 MHz and amplitude of 0 dBm, and the other having a center frequency of 1.001 GHz and amplitude of 0 dBm is combined using a combiner. Then it is as the input signal to the spectrum analyzer;

2. Set the spectrum analyzer's center frequency as 1 GHz and the reference level as 0 dBm. Click the "Meas" menu and select "IM3" from the dropdown menu;

3. Adjust the signal power so that the signal power displayed in the spectrum graph is approximately 6 dB below the reference level;

4. Parameters are automatically configured to default parameters. The results are shown in the figure below. The "IM3" section at the bottom displays the IP3 test results.




## 6.6 Frequency Tracking

1. Click the "Marker" in the chart settings area. In the pop-up submenu, click "More", then click "Advanced". Set the peak threshold and jitter range for the tracking signal (When the signal being tracked jitters within the specified range, the position of the center frequency will not change due to the signal jitter).


2. Click "Signal Track". The reference marker will search for peaks within the current sweep span and align the peak signal to the center frequency position. When the target signal frequency drifts, the spectrum analyzer will automatically adjust its center frequency so that the signal always remains in the center of the display area,

facilitating user observation and analysis.


Note: Generally, this function only moves the frequency position and does not change the span. However, for signals with a particularly large drift that exceed the current span, tracking becomes difficult. For signals at the edge of the instrument's sweep range, the span will be further reduced due to frequency limitations.

## 6.7 Peak Table

1. Click the "Marker" in the graph settings area. In the pop-up submenu, click "More", then click "Advanced". Set the threshold value for the peak table. For detailed settings, refer to the section Frequency Tracking.
2. Click "Peak Table". The spectrum analyzer will automatically detect and mark the peak points exceeding the threshold within the current sweep span (up to 10 peaks) and display frequency and power information of each peak in descending order of peak signal power in the peak table at the bottom of the display area, enabling users to quickly view the main signals in the spectrum.

# 7. IQS Mode

This chapter provides a detailed introduction for important parameters of the IQS mode, including time-domain IQ data and spectrum analysis, power vs. time analysis, digital down-conversion, demodulation, etc.

## 7.1 IQS Parameters Overview

The key parameter descriptions for IQS mode are shown in Table 21.

**Table 21 IQS parameters overview**

| | |
|---|---|
| **Frequency** | |
| **LO optimize** | Please refer to SWP working mode for reference |
| **BW** | |
| **Sample rate** | ADC sample rate: 110MSa/s ~ 130MSa/s |
| **Analysis bandwidth** | Equivalent sampling rate after decimation: ADC sampling rate / decimation factor |
| **Data Format** | SA series:<br>8bit: Lower precision, prone to acquiring many 0s when there is no signal, supports continuous stream acquisition with 1x decimation and above.<br>16bit: Default configuration, supports continuous stream acquisition with 2x decimation and above.<br>32bit: Higher precision, supports continuous stream acquisition with 4x decimation and above.<br><br>NX series<br>8bit: Lower precision, prone to acquiring many 0s when there is no signal, supports continuous stream acquisition with 8x decimation and above.<br>16bit: Default configuration, supports continuous stream acquisition with 16x decimation and above.<br>32bit: Higher precision, supports continuous stream acquisition with 32x decimation and above. |
| **Amplitude** | |
| **Preamplifier** | Please refer to SWP working mode for reference |
| **Gain strategy** | |
| **IF gain grade** | |
| **Attenuation** | |
| **Record** | |
| **RecordMode** | Please refer to Record and Playback in SWP working mode for reference |
| **RecordTime** | |
| **FileSizeLimit** | |
| **Disk** | |
| **Playback** | |

| | |
|---|---|
| **Last frame** | Please refer to [Record and Playback](#) in SWP working mode for reference |
| **Next frame** | |
| **Back** | |
| **Forward** | |

## 7.2 IQS Working Mode Overview

The UI of the IQS mode is shown in the figure below, consisting of a maximum power vs time thumbnail, spectrum graph, and time-domain graph. Click "Next" in the main settings area, then click "Trigger". Modify the "PreviewTime" value in the submenu to change the preview time of the IQ stream in the maximum power vs time thumbnail.

The spectrum graph and IQ time-domain graph are determined by the red selected boxes "Spectrum-P" and "IQvT-P" in the maximum power vs time thumbnail, respectively. By changing the selection range, you can observe the IQ time-domain signals at different time intervals, and you can also perform spectrum analysis on the IQ time-domain signals at different times.


## 7.3 Spectrum Analysis

### 7.3.1 Parameter description

This section provides an explanation of some important parameters for spectrum analysis listed in table 22.

**Table 22 Parameter description for spectrum analysis**

| **Spectrum analysis** | |
|---|---|
| **Window** | Please refer to [SWP working mode](#) for reference |
| **Spectrum Intercept** | Spectrum interception: If Intercept = 0.8, 80% of the FFT spectrum analysis results are displayed in order to intercept the transition band spectrum components. |

### 7.3.2 Operation instructions

1. Click "FFT" in the main settings area to enable "Analyze", Drag the red box "Spectrum-P" in the maximum power vs time thumbnail, or adjust the values of "TimeStart" and "TimeLength" to perform spectrum analysis at

different time intervals. Adjust the values in the "Center" submenu of "Frequency" and the "Span" submenu of "BW" to change the center frequency and analysis bandwidth;

2. Use "FFTsize" to set the number of points for spectrum analysis, "Window" to set different window functions, "TraceDetector" to set different trace detectors, and "Intercept" to intercept and display the spectrum. When Intercept = 0.8, it can intercept the transition band.


## 7.4 IQvT

### 7.4.1 Operation instructions

Click "IQvT" in the main settings area to enable "Analyze", drag the red selection box "IQvT-P" in the maximum power vs time thumbnail, or adjust the values of "TimeStart" and "TimeLength". This allows you to perform time-domain analysis at different time intervals.


## 7.5 PvT

### 7.5.1 Operation instructions

Click "PvT" in the main settings area to enable "Analyze". Drag the "PvT-P" red contraction checkbox in the thumbnail of the maximum power time, or adjust the values of "TimeStart" and "TimeLength" to perform power time analysis of IQ signals in different time periods.


## 7.6 AM Demodulation

The AM signal with a carrier frequency of 1 GHz, power of -20 dBm, modulation rate of 3 kHz and modulation depth of 70% is employed as an example.

### 7.6.1 Parameter description

This section provides an explanation of some important parameters for AM demodulation, listed in table 23.

**Table 23 AM demodulation parameter description**

| Filter submenu | |
|---|---|
| **n** | Number of filter taps. The larger the number taps, the steeper the transition band of the filter and the smaller the passband ripple |
| **Fc** | Cutoff frequency, 0 < Fc < 0.5. For example, if Fc is 0.25, then low-pass filtering is performed on half of the bandwidth. |
| **As** | Stopband attenuation. The larger the stopband attenuation, the stronger the suppression effect on the stopband, dB. |
| **mu** | Fractional sample offset, recommended to use the default value. |

### 7.6.2 Operation instruction

1. Set the "Center Frequency" as 1.0001 GHz, adjust the range of the "IQvT-P" in the maximum power vs time thumbnail, select the IQ time domain graph, click "Graph", and choose "Auto Range" in the Graph submenu.
2. Click "Demod" in the main settings area, set "Type" to AM in the submenu, select the AM demodulated time-domain graph, and click "Auto Range" under the "Graph" control.
3. Click "BW" in the main settings area, increase the "Span" in the submenu to adjust the analysis bandwidth. In this example, set the analysis bandwidth to 15.36 MHz.


### 7.6.3 Audio analysis

This function is used to test the demodulation sensitivity of the instrument.

1. Refer to the AM demodulation section to demodulate the AM signal.
2. Click "Demod" in the main settings area, open "AudioAnalysis" in the submenu, enable audio analysis, and check if the frequency of the audio analysis matches the modulation rate. You can also test the signal-to-noise ratio and total harmonic distortion.


## 7.7 FM Demodulation

The FM signal with a carrier frequency of 1 GHz, power of -20 dBm, modulation frequency of 5 kHz, and frequency deviation of 75 kHz is employed as an example.

### 7.7.1 Parameter description

Please refer to AM demodulation for reference.

### 7.7.2 Operation instruction

1. Set the "Center Frequency" as 1 GHz, adjust the range of the "IQvT-P" in the maximum power vs time thumbnail, select the IQ time domain graph, click "Graph", and choose "Auto Range" in the Graph submenu.
2. Click "Demod" in the main settings area, set "Type" to FM in the submenu, select the FM demodulated time-domain graph, and click "Auto Range" under the "Graph" control.
3. Click "BW" in the main settings area, increase the "Span" in the submenu to adjust the analysis bandwidth. In this example, set the analysis bandwidth to 6.144 MHz.

When listening to FM broadcast signal, open "AudioFilter" (the default configuration is enough), which can low-pass filter the signal after FM demodulation, reduce part of the high-frequency noise, and make the listening sound more pure.


## 7.7.3 Audio analysis

After demodulating the FM signal, please refer to audio analysis section to analyze the demodulated signal. The analysis results are shown below:


## 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. Taking the DDC of a single-tone signal with a frequency of 1 GHz and power of -20 dBm as an example.

### 7.8.1 Parameter description

This section provides an explanation of some important parameters for digital down-conversion (DDC), listed in Table 24.

**Table 24 DDC parameter description**

| **Sampling submenu** | |
|---|---|
| **OffsetFreq** | Frequency offset of complex mixing<br>>0: Spectrum shifts to the right<br><0: Spectrum shifts to the left |
| **Decimate** | decimation factor for the DDC, i.e., the resampling rate |

### 7.8.2 Operation instruction

1. Set "Center" as 1 GHz and "Ref.Level" to 0 dBm. Adjust the range of "IQvT-P" in the maximum power time thumbnail, select the IQ time-domain graph, click "Graph", and choose "Auto Range" from the Graph submenu.
2. Click "DDC" in the main settings area, enable "Channel1", and set the "Center" of the DDC1 channel to 1.003 GHz, "OffsetFreq" to -3 MHz, "Step" to 1 MHz, and "Decimate" to 3.


3. Click "FFT" in the main settings area, select "DDC1 Channel" from the dropdown menu, enable "Analyze", drag the red selection box "Spectrum-D1" in the maximum power time thumbnail, or adjust the "TimeStart" and "TimeLength" values to perform spectrum analysis on the sub-IQ streams generated by the DDC at different time intervals.

4. Click "IQvT" in the main settings area, select "DDC1 Channel" from the dropdown menu, enable "Analyze", drag the red selection box "IQvT-D1" in the maximum power time thumbnail, or adjust the "TimeStart" and "TimeLength" values to perform time-domain analysis on the sub-IQ streams generated by the DDC at different time intervals.

5. Click "PvT" in the main settings area, select "DDC1" from the dropdown menu, enable "Analyze", drag the red selection box "PvT-D1" in the maximum power time thumbnail, or adjust the "TimeStart" and "TimeLength" values to perform power vs. time analysis on the sub-IQ streams generated by the DDC at different time intervals.


HAROGIC
File
Mode
System
Preset
Single
Continu.
Rec
Play
MaxPwr VS Time(dBm)
Spectrum-P
IQvT-P
PvT-D1
Spectrum-P(dBm)
RBW: 13.498kHz
TraceDetector: PosPeak
T1 C&W
Start: 938.56MHz
Center: 1GHz
Stop: 1.06144GHz
PvT-D1(dBm)
AnalysisBW: 40.96MHz
Start: 710.8μs
Stop: 857.2μs
IQvT-P(mV)
SampleRate: 122.88MHz
Center: 1GHz
Ref.Level: 0dBm
Ch-I
Ch-Q
Start: 263.6μs
Stop: 470.1μs
01:37:53
25/03/28
Graph
Trace
Peak Search
Marker
IQvT
Channel
PHYSICAL
Analyze
On
Off
TimeStart
263.558us
TimeLength
206.498us
Zoom
FFT
89.283us
146.41us
FFTSize
2048
Window
B-Nuttall
Intercept
100%
PvT
DDC1
710.827us
Demod
Display
Layout
Auto
Graph
A
B
C
D

# 8. DET Working Mode

This chapter provides a detailed introduction to some parameters of the DET mode and the measurement of pulse signals in this mode.

## 8.1 DET Parameter Description

This section provides an explanation of some important parameters for the DET mode, listed in Table 25.

**Table 25 DET working mode description**

| | |
|---|---|
| **Frequency** | |
| **LO optimize** | Please refer to SWP working mode for reference |
| **Amplitude** | |
| **Preamplifier** | Please refer to SWP working mode for reference |
| **Gain strategy** | |
| **IF gain grade** | |
| **Attenuation** | |

## 8.2 Pulse Signal Measurement

A pulse modulation signal with a carrier frequency as 1 GHz, power of -10 dBm, pulse period of 80 µs, and pulse width of 40 µs as an example.

### 8.2.1 Operation instruction

1. Set the "Center" as 1 GHz and click the "Single" in the menu bar to enable the single preview mode;
2. Click "Graph" in the chart settings area, then click "Zoom" to enable zooming. Adjust the zoom area by dragging the selected zoom area or dragging the zoom border left or right.
3. Select the zoomed-in graph, click "Graph" in the chart settings area, and choose "Marker Pair" to create two pairs of markers. Move the M1R marker to the pulse rising edge, M1D marker to the same pulse falling edge, M2R marker to the pulse rising edge, and M2D marker to the next pulse rising edge. The results displayed by the M1D and M2D markers in the top left corner of the zoomed-in graph will be the pulse width and pulse period of the pulse signal, respectively. The duty radio can be calculated using the following formula.

$$\text{Duty radio} = \frac{\text{Pulse width}}{\text{Pulse period}}$$

## 8.3 Pulse Signal Detection (Option, opt72)

This chapter introduces the basic operation methods of pulse signal detection, and how customers who purchase the pulse detection option can obtain and place the license.

### 8.3.1 Apply for a License

If you purchased the instrument with the pulse detection option included, the HAROGIC official technical support team will provide you with a pulse detection license. Please follow steps 3-4 to place the license to enable the pulse detection function. If you purchase the pulse detection option later, please complete steps 1-4 in sequence to obtain and place the license to ensure normal use of the function.

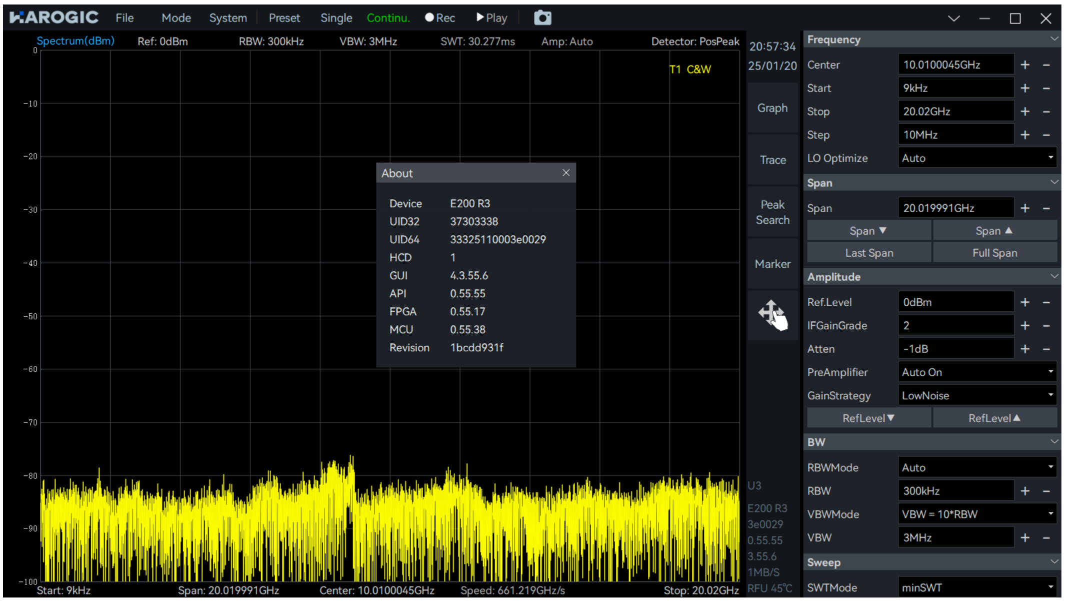
1. Click "System" in the menu bar, select "About" in the drop-down menu, and view the version information in the pop-up window.

2. Ensure that the version meets the following requirements:

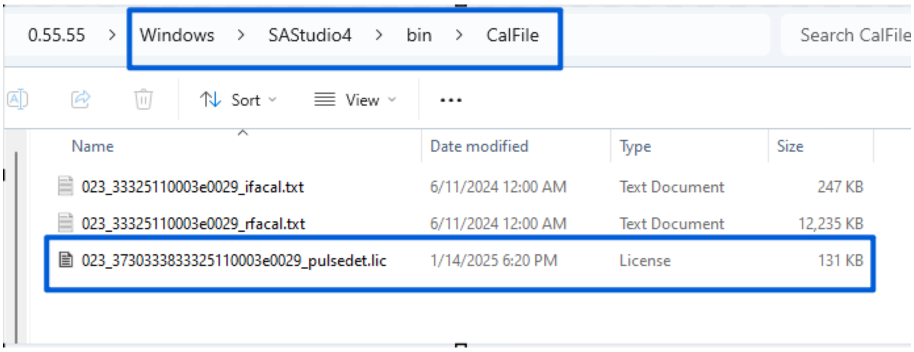
- GUI Version: 4.3.55. 6 or later
- API Version: 0.55. 55 or later
- FPGA Version: 0.55. 15 or later
- MCU Version: 0.55. 32 or later

3. If the software/firmware version does not meet the above requirements, please refer to the Soft firmware update section to update the software/firmware to the required version.

4. After updating the software/firmware to the required version, send a screenshot of the entire interface to HAROGIC official technical support to apply for a pulse detection license for the corresponding device. An example of the required interface is shown below:

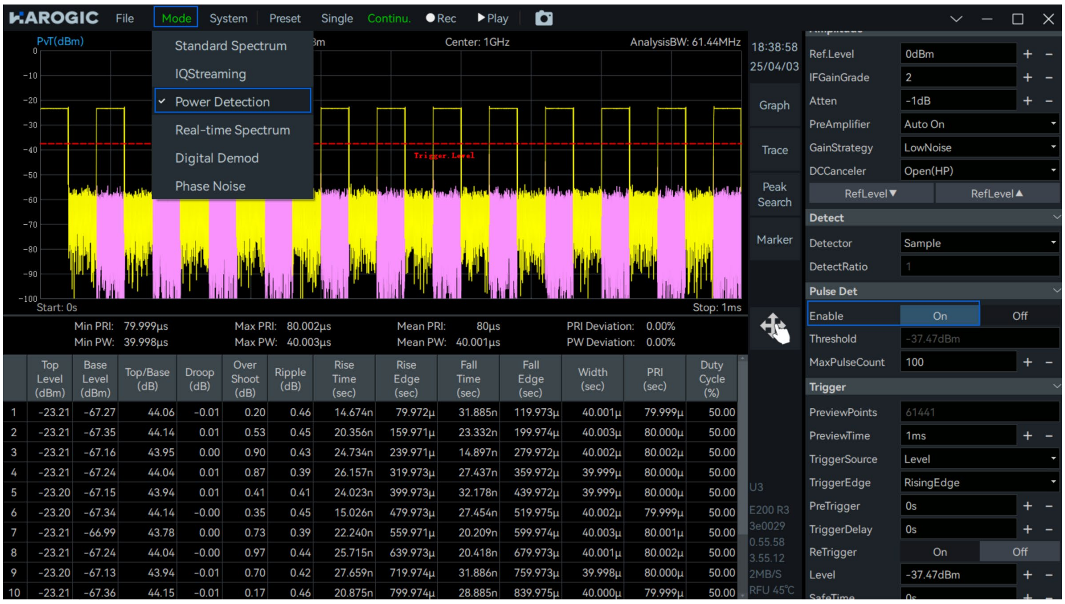



5. Copy the obtained pulse detection license to the "../SAStudio4/bin/CalFile" folder.




6. Restart the SAStudio4 software, click "Mode" in the menu bar, and select "Power Detection" to enter the detection analysis mode.

Enable "Pulse Det" in the main settings area to use the pulse signal detection function normally.




### 8.3.2 Parameter Description

Here, only some important parameters are explained: Important parameters of the pulse signal detection part are shown in 26.

**Table 26 Pulse Signal Detection Parameter Description18**

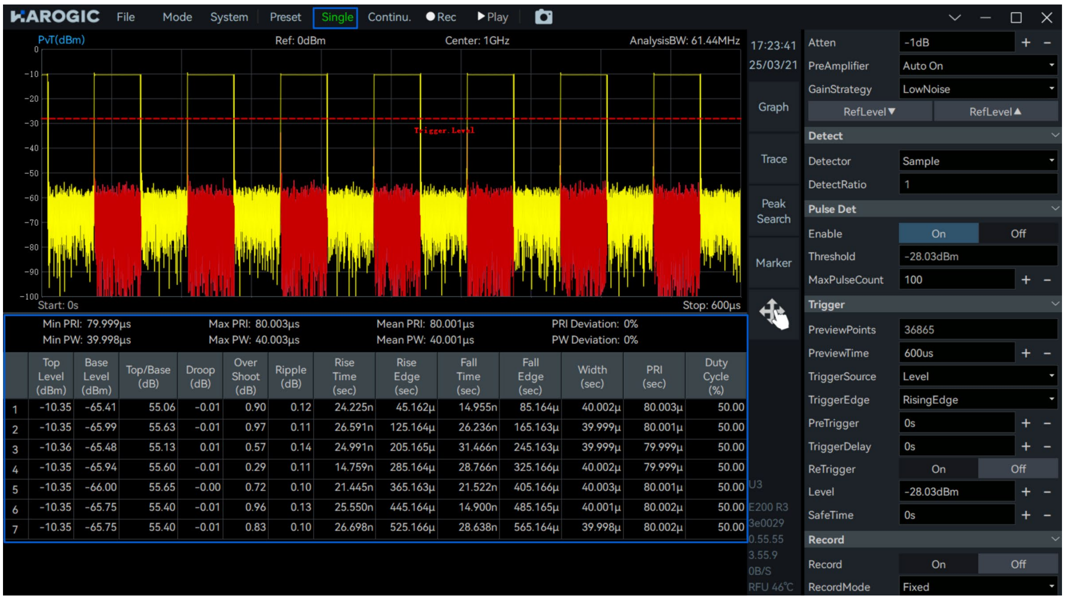
| **Pulse Det** | |
|---|---|
| **Threshold** | Pulse detection threshold; only pulse signals exceeding this threshold will be considered valid pulses. |
| **Maximum Pulse Count** | Upper limit for pulse signal detection under the current preview time. |

### 8.3.3 Operation steps

Take the detection of a pulse signal with 1 GHz, -10 dBm, pulse width of 40 us, and pulse period of 80 us as an example.

1. Set “Center” to 1 GHz and ”Ref.Level” to 0 dBm;
2. Adjust the value of ”Span” in the “BW” submenu of the main settings area to set different analysis bandwidths. In this example, set ”AnalysisBW” to 61.44 MHz;
3. Set “PreviewTime” in the ”Trigger” submenu of the main settings area to 600 us;
4. Enable “Pulse Det” in the main settings area for pulse detection. Drag the value of ‘Trigger.Level’ in the power-time graph to set the pulse detection threshold, and adjust the value of ‘MaxPulseCount’ to set the upper limit for pulse signal detection under the current preview time.


5. Click "Single" in the menu bar. The pulse detection result under the current configuration is shown in the figure below. From the figure, you can obtain parameters such as peak level (dBm), reference level (dBm), rise time, rising edge, fall time, falling edge, pulse width, period, and duty cycle of each detected pulse signal. As well as the statistical parameters of the detected pulse signal, such as: maximum, minimum, average pulse period and pulse width, period deviation percentage, and pulse width deviation percentage.




6. If the user encounters measurement freezes or stops during pulse detection, the following methods can be used to avoid this phenomenon: reduce the analysis bandwidth or extend the pulse period.

# 9. RTA Mode

This chapter provides a detailed introduction to some parameters of the RTA mode and the measurement of WIFI signals in this mode.

## 9.1 RTA Parameter Description

This section provides an explanation of some important parameters: Important parameters for RTA mode are listed in Table 26.

**Table 26 RTA mode parameter description**

| | |
|---|---|
| **Frequency** | |
| **LO optimize** | Please refer to SWP working mode for reference |
| **Amplitude** | |
| **Preamplifier**<br>**Gain strategy**<br>**IF gain settings**<br>**Attenuation** | Please refer to SWP working mode for reference |
| **Sweep** | |
| **Sweep Time Mode**<br>**Window** | Please refer to SWP working mode for reference |

## 9.2 Probability Density Graph

### 9.2.1 Parameter Description

| | |
|---|---|
| **Graph** | |
| **Probability Graph** | On: Enable probability density map display<br>Off: Disable probability density map display |
| **Color Scale** | Sky Color, Deep Sea Color (default), Jet Color, Cold Color, Hot Color, Grayscale Color |
| **Afterglow** | Increase: Extend the display time of signal afterimages, suitable for capturing sudden signals<br>Decrease: Increase the refresh rate, suitable for tracking continuous signals |

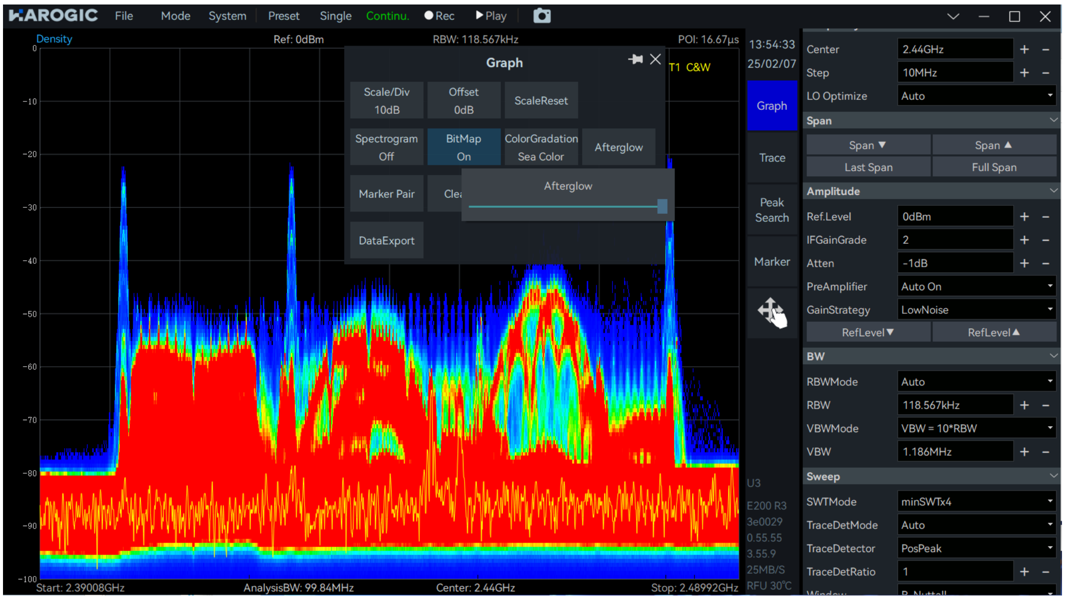
### 9.2.2 Close the probability density map

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


## 9.3 WIFI Signal Measurement

1、 Connect the antenna to the RF input port "RFIN";

2、 Set the "Center" as 2.44 GHz. Increase the "Afterglow" value in the "Graph" submenu of the chart settings area to observe the WIFI signal more clearly.

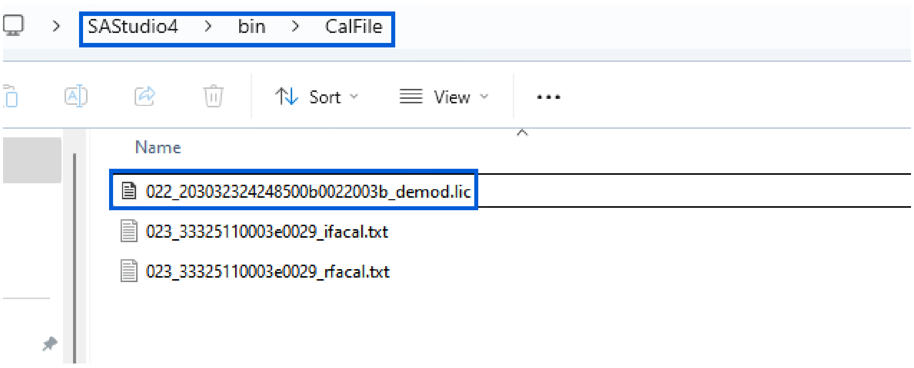


# 10. Digital Demodulation (Option71)

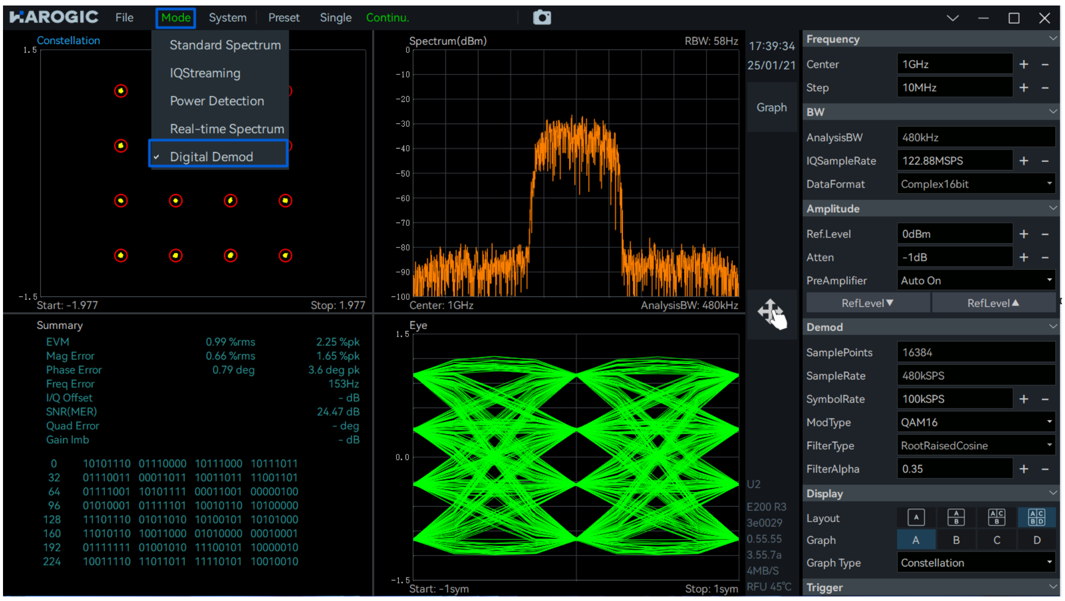
This chapter introduces the basic operation methods of digital demodulation and how to enable the digital demodulation function by updating the license or other means.

## 10.1 Apply for a License

1. After purchasing the digital demodulation feature, apply for the digital demodulation license and library for the corresponding device according to the Pulse Signal Detection License Application section. The version requirements must be consistent with those of the Pulse Signal Detection option;
2. Copy the DigitalSigDemod.dll demodulation library file to the ../SAStudio4/bin folder;
3. Copy the digital demodulation license to the ../SAStudio4/bin/CalFile folder;




4. According to the software version requirements, update the firmware to the corresponding version, restart the SAStudio4 software, click Mode in the menu bar, and select Digital Demod in the drop-down menu to enter the digital demodulation mode.




## 10.2 Parameter Description

Only some important parameters are described here: Some important parameters are shown in Table 28.

**Table19 Digital Demodulation Parameter Description**

| Digital | |
|---|---|
| **Symbol Rate** | The number of symbols transmitted per second. It needs to be filled in according to the symbol rate of the modulated signal to ensure that the receiving end can correctly demodulate it. |
| **Mode** | AM, FM, PM, CW, LSB, USB, 2ASK, 2FSK, 4FSK, BPSK, QPSK, 16QAM, 64QAM |
| **Filter Roll-off Factor** | The roll-off rate of the filter used to limit the signal bandwidth in the transition band. It needs to be consistent with the roll-off factor of the transmitting end to ensure effective processing and correct demodulation of the signal by the demodulator. |

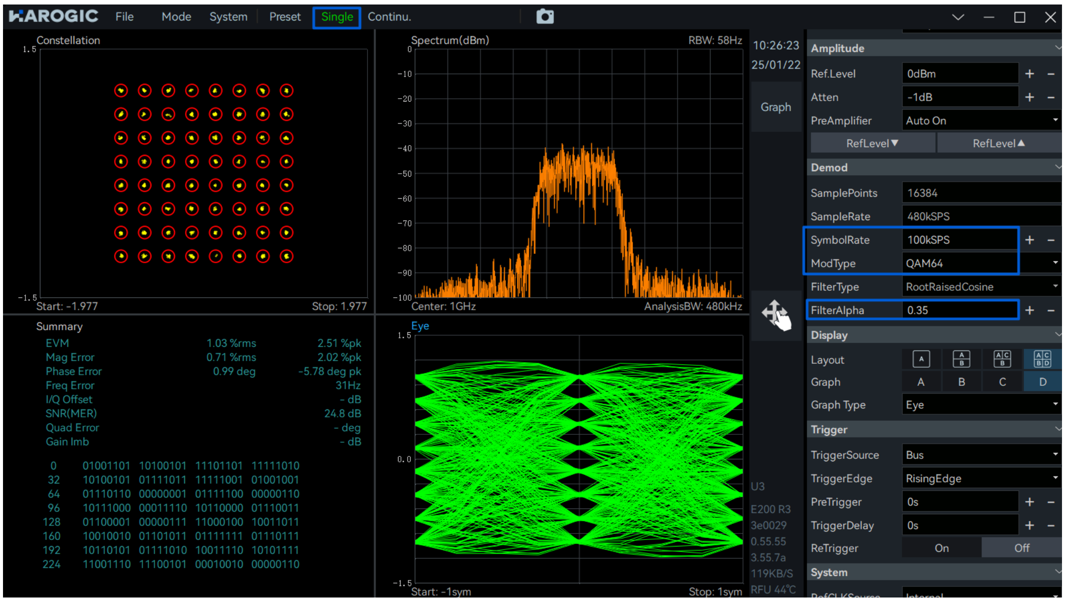
## 10.3 Function Introduction

The initial interface of the digital demodulation mode is shown in the figure below, which consists of a spectrum diagram of the modulated signal, a constellation diagram after demodulation, an eye diagram, and demodulation parameters. It deeply analyzes the modulation quality of the signal, provides multiple error indicators, and effectively evaluates the integrity and reliability of the signal during transmission.

## 10.4 Operation steps

Take demodulating a 1 GHz, -20 dBm, symbol rate of 100 kHz, and filter roll-off factor of 0.35 64QAM signal as an example.

1. Set Center to 1 GHz and RefLevel to 0 dBm;
2. Set ModType to QAM64, SymbolRate to 100 KSPS, and FilterType to 0.35 in the Demod submenu of the main settings area, and click ”Single” in the menu bar. The demodulation result under the current configuration is shown in the figure below. The constellation points in the constellation diagram are clear and tightly distributed, and the theoretical and actual demodulation point positions basically coincide, indicating that the modulation quality of the signal is high and the overall performance of the communication system is good; the eye diagram is clear and has a large opening, indicating that the inter-symbol interference is small, and the receiving end can reliably distinguish symbols; at the same time, the error vector magnitude (EVM), amplitude error, phase error, frequency error, signal-to-noise ratio (SNR/MER), and part of the decoded bit sequence can also be obtained.



# 11. Phase Noise Measurement Mode

## 11.1 Version Requirements

1. Click "System" in the menu bar, select "About" from the drop-down menu, and check the version information in the pop-up window.

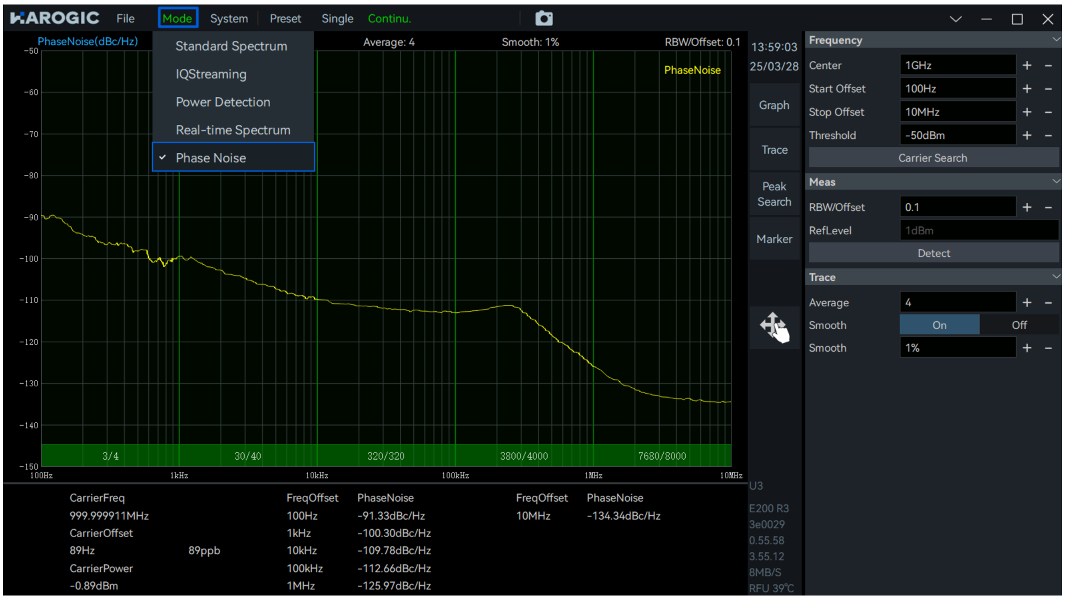

2. Ensure the software and firmware versions meet the following minimum requirements:

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

3. If the software/firmware versions do not meet these requirements, please refer to the Software/Firmware Update section to update them to the required versions.

## 11.2 Enable the Phase Noise Measurement Function

After updating the software and firmware to the required versions, restart the SAStudio4 software. Click "Mode" in the menu bar and select "Phase Noise" to activate the phase noise measurement function.




## 11.3 Parameter Descriptions

This section describes key parameters for phase noise measurement, as detailed in Table 29.

**Table 20 Phase Noise Measurement Mode Parameter Descriptions**

| | |
|---|---|
| **Frequency** | |
| **Start Offset Frequency** | Sets the starting point of the frequency offset. Range: 1 Hz to 10 MHz. |
| **Stop Offset Frequency** | Sets the ending point of the frequency offset. Range: 10 Hz to 10 MHz. |
| **Carrier Detect Threshold** | Sets the threshold level for carrier identification. Only carriers exceeding this threshold will be detected. |
| **Search Carrier** | Performs a full span search to locate signals exceeding the Carrier Detect Threshold. |
| **Meas** | |
| **RBW/Offset** | Ratio of Resolution Bandwidth (RBW) to the start frequency for each offset segment (RBW / Segment Start Frequency). Range: 0.01 to 0.3 |
| **Detector Settings** | Frame Detection Rate: Recommended to use default settings. If the signal under test (SUT) exhibits significant low-frequency jitter close to the carrier, increasing the frame detection rate for the close-in offset range(s) can yield more stable results. |
| **Trace** | |
| **Averaging** | Sets the number of trace averages to perform. |
| **Smoothing** | On: Enables trace smoothing.<br>Off: Disables trace smoothing. |
| **Window Length** | Sets the window length for the smoothing algorithm, as a percentage of the offset span. Range: 0 to 10%. |

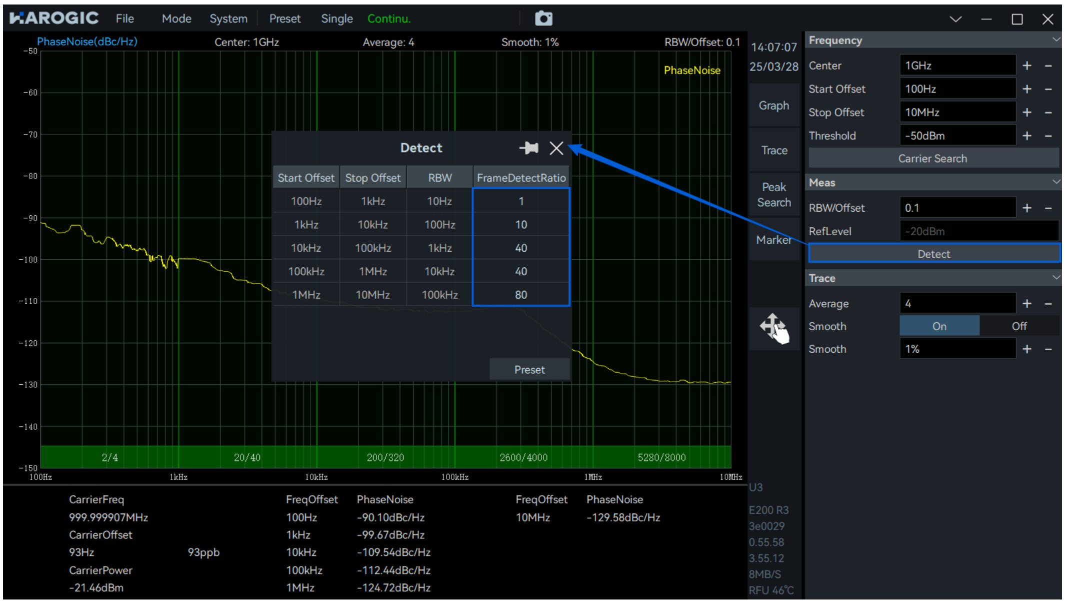
## 11.4 Operating Steps

### 11.4.1 Phase Noise Measurement with Known Carrier Information

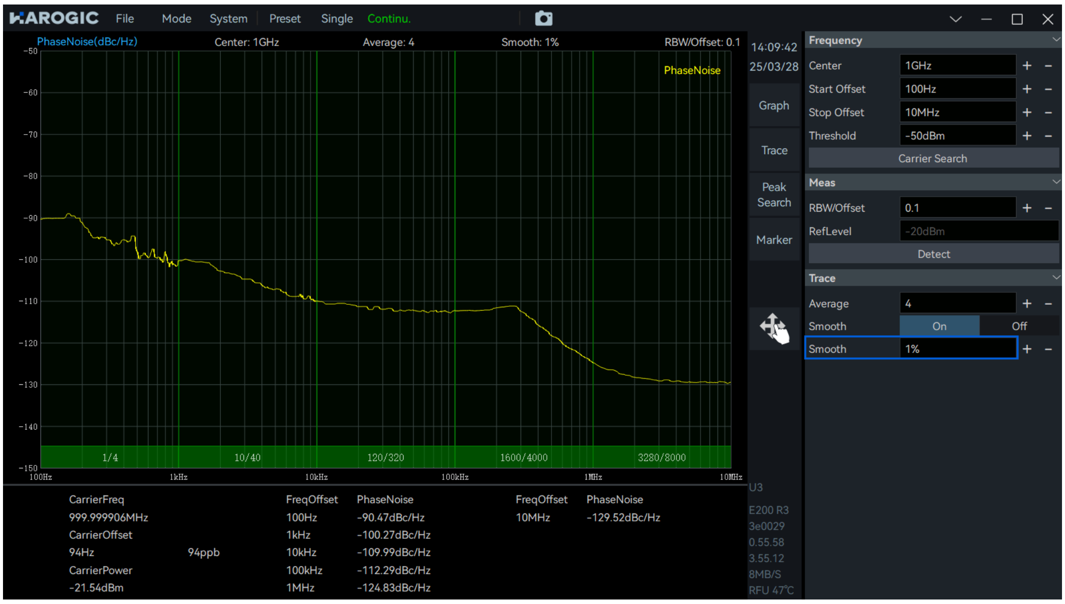
Measuring the phase noise of a 1 GHz, -20 dBm signal over a frequency offset range of 100 Hz to 10 MHz.

1. Set the Center Frequency to 1 GHz, Start Offset Frequency to 100 Hz, and Stop Offset Frequency to 10 MHz. It is recommended to use default settings for other parameters.

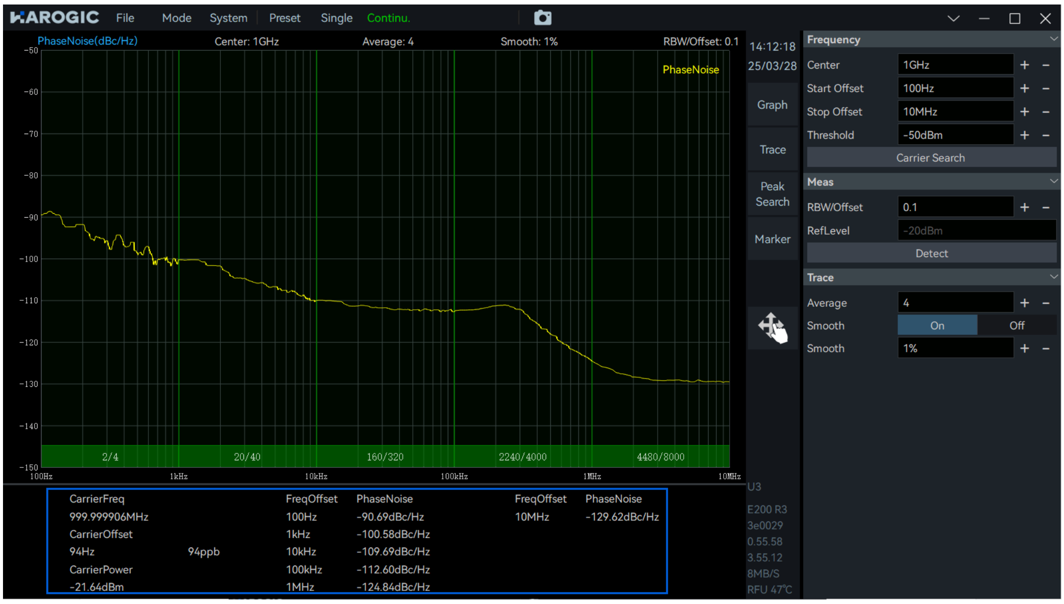
2. If the signal under test (SUT) exhibits strong close-in jitter, click Detector Settings in the main settings area. In the pop-up window, increase the Frame Detection Rate for the relevant frequency offset range(s) to obtain more stable (converged) measurement results.




3. If significant spurious signals (spurs) are present in the Single Sideband (SSB) phase noise plot, gradually increase the **Window Length** parameter in the main settings area to reduce their impact on the measurement results.




4. The instrument will automatically perform the phase noise measurement over the specified offset frequency range. The results are displayed. The phase noise measurement table, usually located at the bottom of the interface, provides carrier information and phase noise values (in dBc/Hz) at specific offset frequencies.

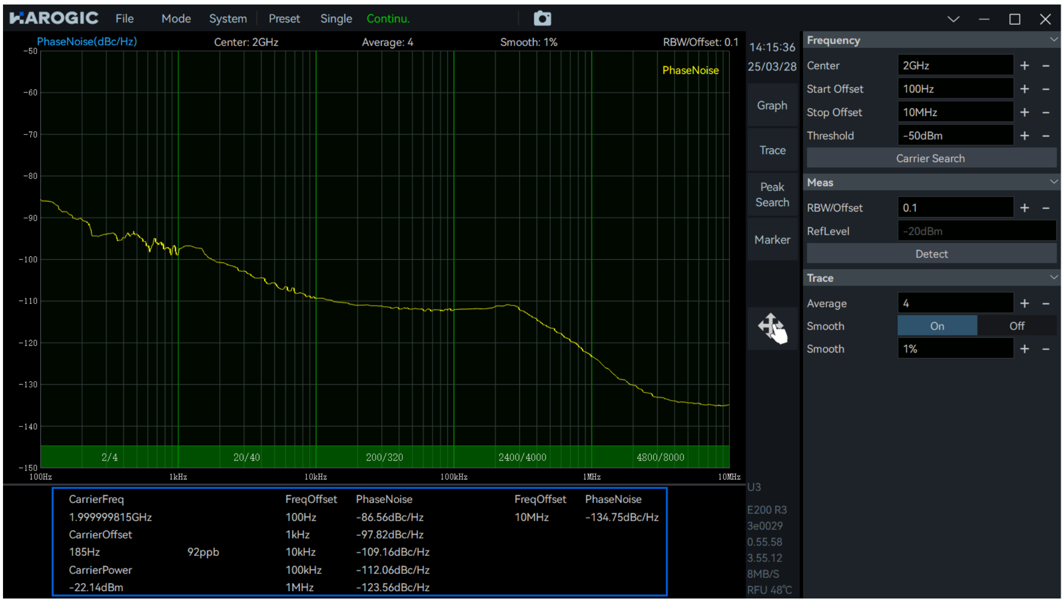



## 11.4.2 Phase Noise Measurement with Unknown Carrier Information

When the carrier parameters of the signal are unknown, it is recommended to follow these steps for phase noise measurement. (Example assumption: the unknown carrier signal is 2 GHz, 0 dBm).

1. Click Search Carrier. The instrument will automatically perform a full span sweep to search for and identify the peak signal exceeding the Carrier Detect Threshold, designating it as the carrier under test.


2. Once the carrier signal is located, refer to section 11.4.1 Phase Noise Measurement with Known Carrier Information to set the Start Offset Frequency and Stop Offset Frequency, and proceed with the phase noise measurement.



KAROGIC
File
Mode
System
Preset
Single
Continu.
PhaseNoise(dBc/Hz)
Center: 2GHz
Average: 4
Smooth: 1%
RBW/Offset: 0.1
14:15:36
25/03/28
PhaseNoise
Graph
Trace
Peak Search
Marker
Frequency
Center 2GHz
Start Offset 100Hz
Stop Offset 10MHz
Threshold -50dBm
Carrier Search
Meas
RBW/Offset 0.1
RefLevel -20dBm
Detect
Trace
Average 4
Smooth On Off
Smooth 1%
2/4
20/40
200/320
2400/4000
4800/8000
100Hz
1kHz
10kHz
100kHz
1MHz
10MHz
CarrierFreq
1.999999815GHz
CarrierOffset
185Hz 92ppb
CarrierPower
-22.14dBm
FreqOffset PhaseNoise
100Hz -86.56dBc/Hz
1kHz -97.82dBc/Hz
10kHz -109.16dBc/Hz
100kHz -112.06dBc/Hz
1MHz -123.56dBc/Hz
FreqOffset PhaseNoise
10MHz -134.75dBc/Hz

# 12. ASG Function Usage

The ASG is an optional function for analog signal sources that can output single-tone signals, frequency sweep signals, and power sweep signals. Devices that support the ASG option are listed in Table 30.

**Table21 Devices Supporting the ASG Option**

| Product Series | Models |
|---|---|
| **SA** | SAM-80、SAM-60、SAN-60 and SAN-45 |
| **NX** | NXM-80、NXM-60、NXN-60 and NXN-45 |

## 12.1 ASG General Parameter Description

**Table30 ASG Mode Parameter Description**

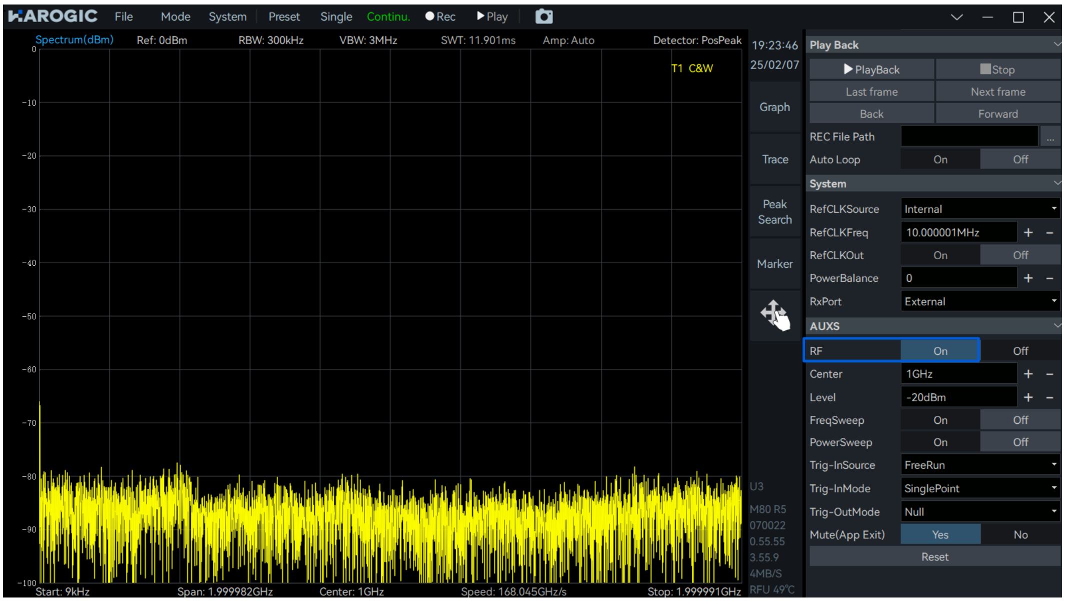
| | |
|---|---|
| **RF** | On: Enables the signal source output<br>Off: Disables the signal source output |
| **Center** | Sets the frequency for single-tone and power sweep signals |
| **Level** | Sets power for single-tone and frequency sweep signals |
| **FreqSweep** | |
| **Start** | Sets the start frequency of the frequency sweep signal |
| **Stop** | Sets the stop frequency of the frequency sweep signal |
| **Step** | Sets the frequency step of the frequency sweep signal |
| **PowerSweep** | |
| **Start** | Sets the start power of the power sweep signal |
| **Stop** | Sets the stop power of the power sweep signal |
| **Step** | Sets the power step of the power sweep signal |
| **DwellTime** | Sets the dwell time for sweep signals, effective in "PowerSweep" and "FrequencySweep" modes |
| **Trig-In source** | the trigger input source for the signal generator: Free Run, External Trigger, Bus Trigger |
| **Trig-In Mode** | the trigger input mode: No Action, Single-Point Trigger (triggers a single frequency or power configuration), Single Sweep Trigger (triggers one sweep cycle), Continuous Sweep Trigger (triggers continuous operation) |
| **Trig-Out Mode** | the trigger output mode: No Output, Output Trigger per Configuration, Single Sweep Output Trigger |
| **Mute(APP Exit)** | Continue outputting the signal after exiting the software<br>Yes: Stops output after exit<br>No: Continues output after exit |

## 12.2 ASG Function Usage Instructions

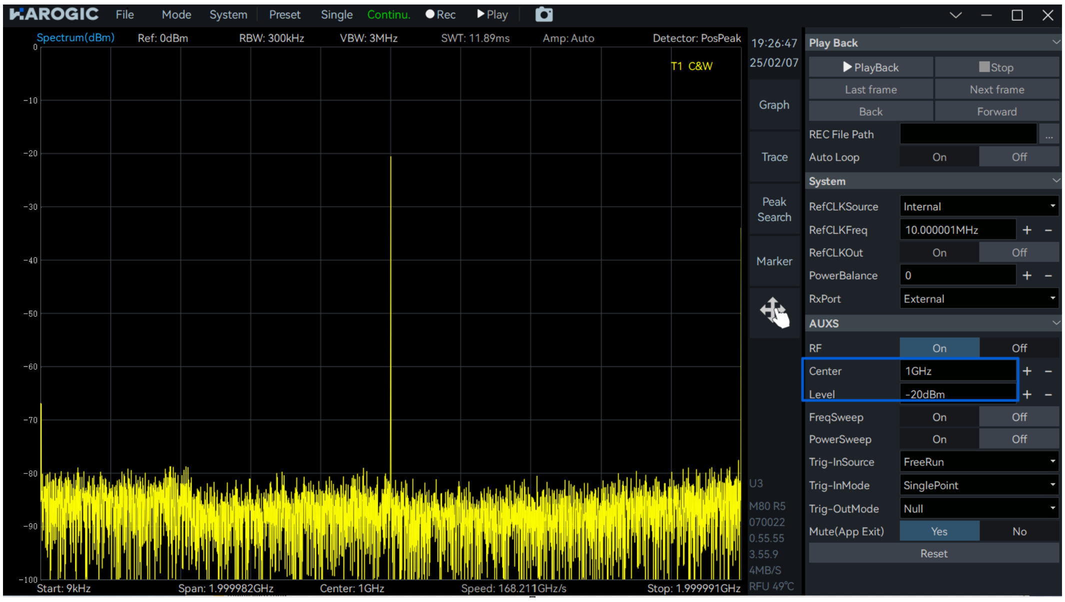
The signal is output through the RFOUT port of the instrument, which can provide an input signal for other devices or be connected via a cable to the instrument' s own RF input port, supplying an RF input signal to itself. The specific connection method is shown in the figure below:


## 12.3 Single-Tone Signal

1. Open SAStudio4, go to the main settings area, and under the "AUXS" submenu, click "RF On" to enable the signal source output.

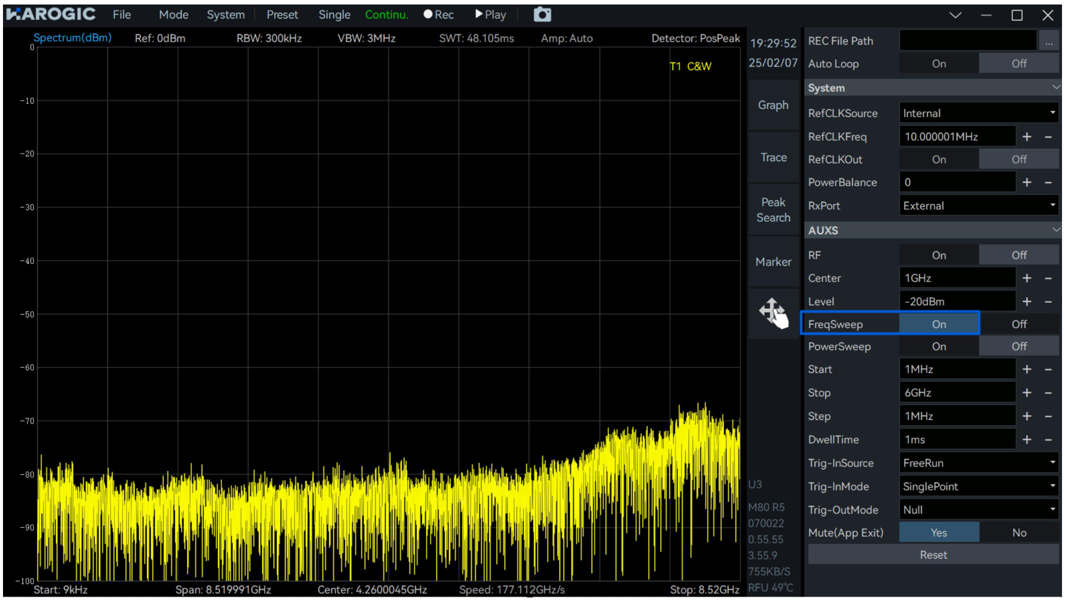



2. In the "AUXS" submenu, set "Center" as 1 GHz and "Level" as -20 dBm. This will output a single-tone signal with a frequency of 1 GHz and a power level of -20 dBm.

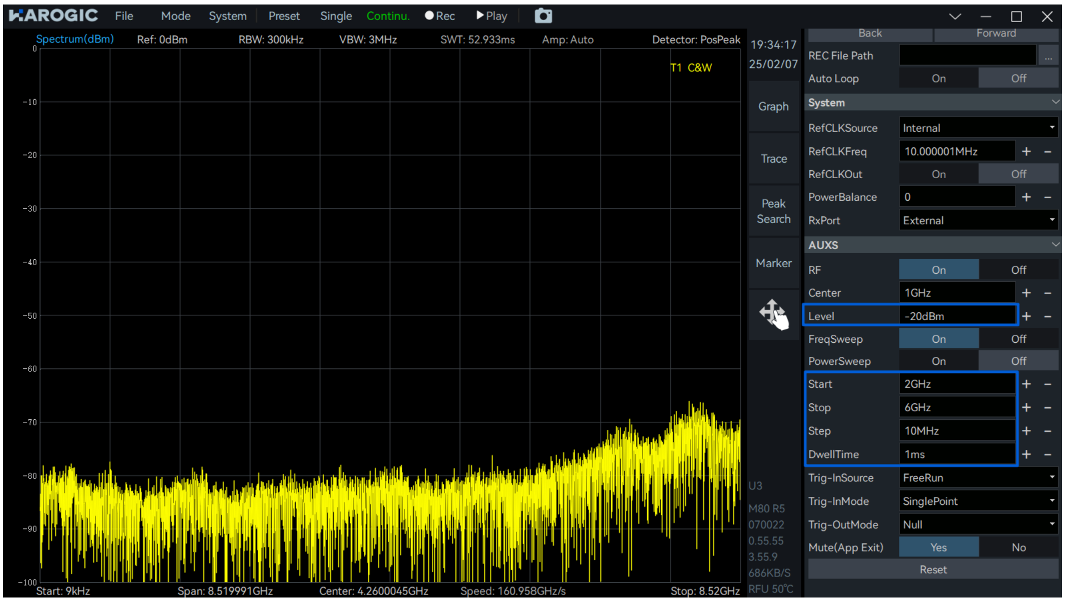



## 12.4 Frequency Sweep Signal

1. Refer to Step 1 in the Single-Tone Signal section to enable the signal source function;
2. In the "AUXS" submenu, enable the "FreqSweep" mode;



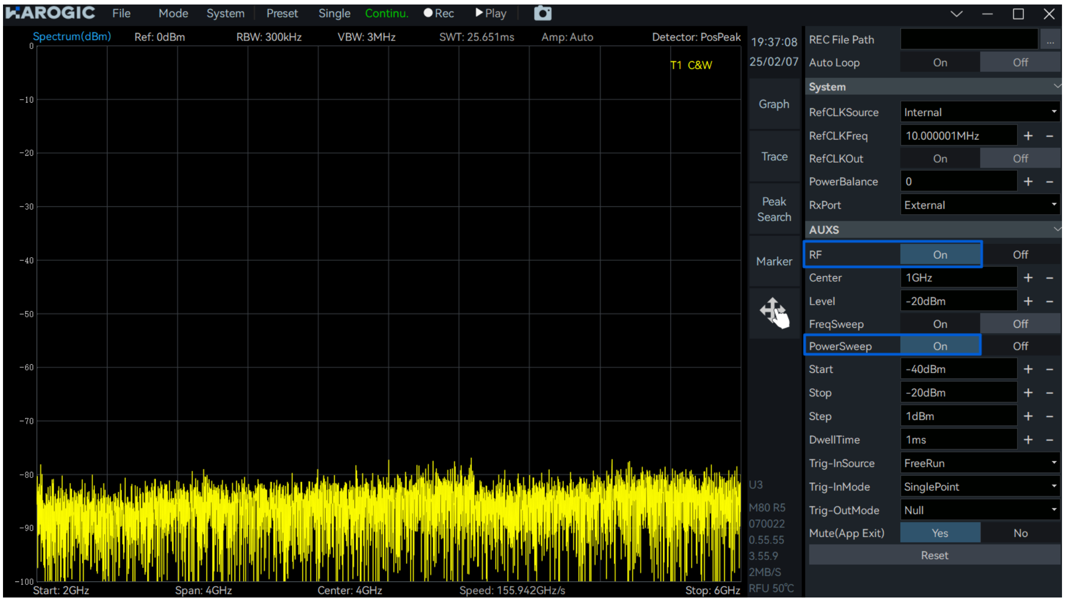

3. In the "AUXS" submenu, set "Start" as 2 GHz, "Stop" to as 6 GHz, "Step" as 10 MHz, "Level" to -20 dBm, and "DwellTime" to 1 ms;



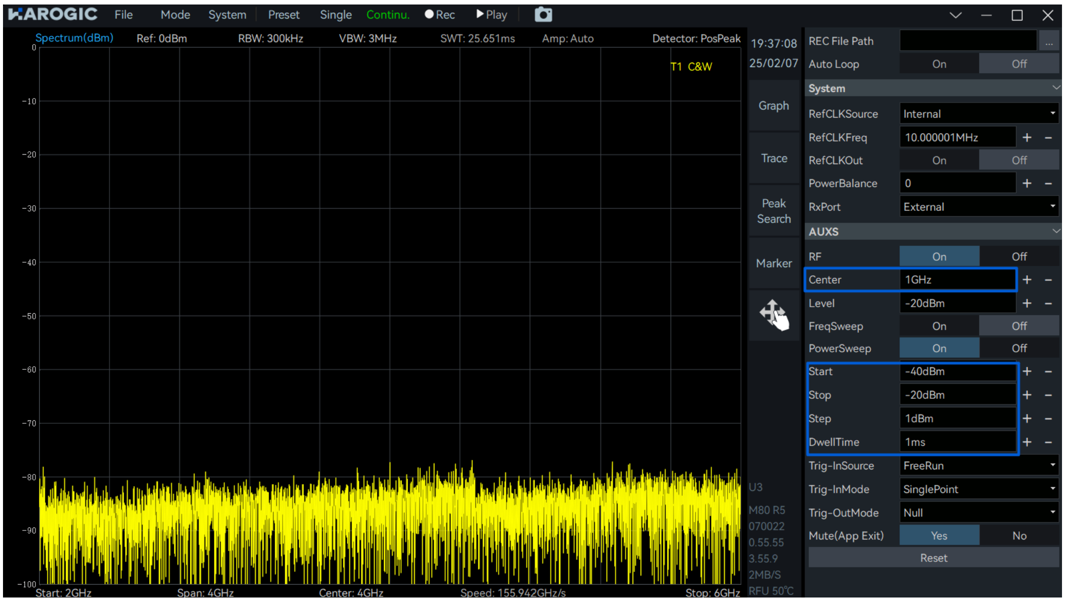

4. The ASG will output a frequency sweep signal with start frequency of 2 GHz, stop frequency of 6 GHz, frequency step of 10 MHz, dwell time of 1 ms, and amplitude of -20 dBm.

## 12.5 Power Sweep Signal

1. Refer to Step 1 in the Single-Tone Signal section to enable the signal source function;
2. In the "AUXS" submenu, enable the "PowerSweep" mode;




3. In the "AUXS" submenu, set "Center" as 1 GHz, "Start" as -40 dBm, "Stop" as -20 dBm, "Step" as 1 dBm, and "DwellTime" to 1 ms.




4. The ASG will output a power sweep signal with a frequency of 1 GHz, a start power of -40 dBm, a stop power of -20 dBm, a power step of 1 dBm, and a dwell time of 1 ms.

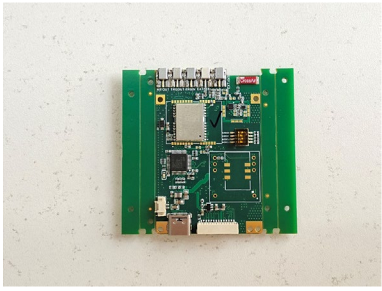
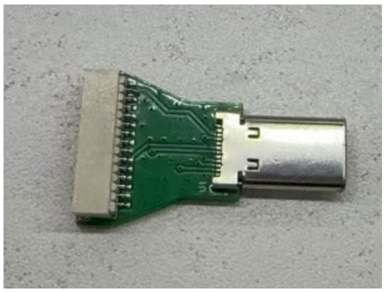
# 13. Usage of Other Functions

This chapter briefly introduces the instrument's intermediate frequency (IF) output and trigger functions. It provides a detailed explanation of the accessories, interfaces, and connection methods required for using the GNSS function with different models. Additionally, it describes how to view GNSS information, use the 1PPS trigger, utilize the 10MHz reference clock of the high-quality GNSS module and remotely control NX devices.

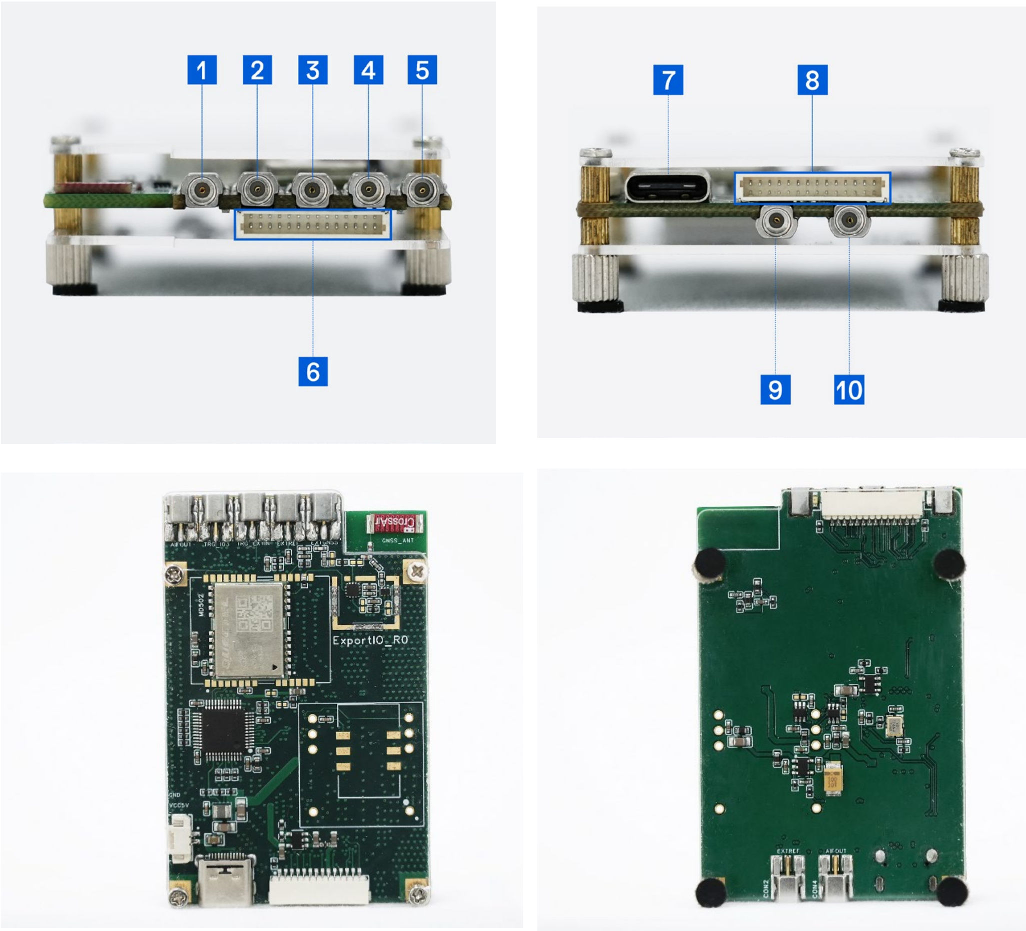
## 13.1 GNSS Application Instructions

### 13.1.1 GNSS Accessories Overview

The following accessories are applicable to SA series devices. NX series instruments have a built-in GNSS module, which only requires an antenna connection to enable GNSS functionality.

| | | |
|---|---|---|
| <br>Standard GNSS Module | <br>High-Precision GNSS Module | <br>High-Quality GNSS Module |
| <br>Ribbon Cable<br>(for connecting an external GNSS module to SA series devices) | <br>MMCX-to-SMA Cable<br>(for connecting the antenna to the GNSS module) | <br>MUXIO Multi-Function to Type-C Adapter<br>(for connecting SAM/SAN devices, except SAN-400, to the ribbon cable) |
| <br>MCX-to-MMCX Cable<br>(for connecting the reference input of SAM/SAN devices to the reference output of the GNSS module) | <br>MMCX Cable<br>(for connecting the reference input of SAE/SAN-400 devices to the reference output of the GNSS module) | |

### 13.1.2 GNSS Interface Description




| | | | |
|---|---|---|---|
| 1 | External GNSS Antenna Interface | 6 | Reserved Interface |
| 2 | External Reference Input Interface | 7 | Auxiliary Power Supply Type-C Interface (only applicable to high-quality GNSS modules) |
| 3 | External Trigger Input Interface | 8 | MUXIO Multi-Function Interface (Trigger Input/Output) |
| 4 | Trigger Output Interface | 9 | Analog Intermediate Frequency (IF) Input Interface (for SAE/SAN-400 devices) |
| 5 | Analog Intermediate Frequency (IF) Output Interface (for SAE/SAN-400 devices) | 10 | 10MHz Reference Clock Output for High-Quality GNSS Modules |

### 13.1.3 GNSS Module Connection Methods

For the interfaces mentioned later, please refer to the External Interface Description section of the SA series devices and the External Interface Description section of the NX series devices according to the device model.

The GNSS module interface numbers correspond to those listed in the GNSS Interface Description section. When using an external GNSS antenna, ensure that the antenna's receiving surface is facing an unobstructed sky.

1. GNSS Module Connection for SA Series Devices

■ SAE/SAN-400 Series Devices

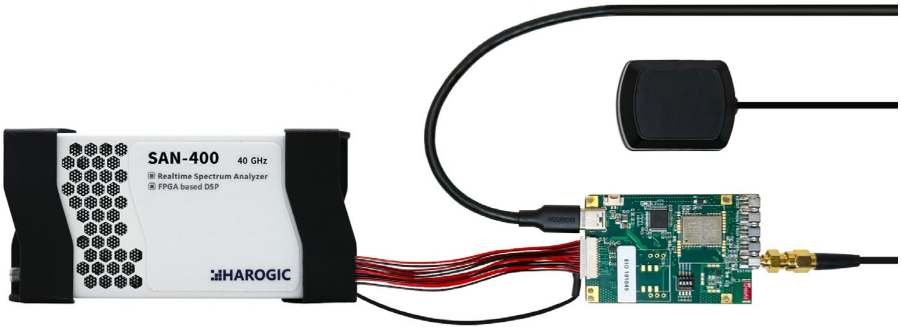



Figure 4: SAE/SAN-400 Module Connection Diagram

1) Connect the ribbon cable: Use a ribbon cable to connect the instrument's MUXIO multi-function interface (port 5) to the GNSS module's MUXIO multi-function interface (port 8). If the GNSS module's indicator light blinks, the connection is successful.

2) Connect the external GNSS antenna: Connect the antenna to the MMCX-to-SMA cable, then connect MMCX end of the antenna cable to the GNSS module's antenna interface (port 1)

3) Connect external power to the GNSS module: Use a Type-C data cable to connect the high-quality GNSS module's power interface (port 7) to a power adapter, then plug the adapter into a power outlet to supply additional power to the GNSS module. (This step is not required for standard or high-precision GNSS modules)

4) Connect the 10MHz reference clock of the GNSS module: Use an MMCX-to-MMCX cable to connect the instrument's reference input (port 4) to the high-quality GNSS module's 10MHz reference clock output (port 10). (This step is not required for standard or high-precision GNSS modules.)

■ SAN and SAM Series Devices


Figure 5: SAN and SAM Series Module Connection Diagram

1) Connect the MUXIO Multi-Function to Type-C Adapter: Plug the MUXIO Multi-Function to Type-C adapter into port 6 of the device.

2) Connect the ribbon cable: Use a ribbon cable to connect the MUXIO multi-function interface on the Type-C adapter to port 8 of the GNSS module. If the GNSS module's indicator light blinks, the connection is successful.

3) Connect the external GNSS antenna: Connect the antenna to an MMCX-to-SMA cable, then attach the MMCX end of the cable to port 1 of the GNSS module.

4) Connect external power to the GNSS module: Use a Type-C data cable to connect port 7 of the high-quality GNSS module to a power adapter, then plug the adapter into a power outlet to supply additional power to the GNSS module. (This step is not required for standard or high-precision GNSS modules.).

5) Connect the 10MHz reference clock of the GNSS module: Use an MCX-to-MMCX cable to connect port 3 of the device to port 10 of the high-quality GNSS module. (This step is not required for standard or high-precision GNSS modules.).

2. GNSS Module Connection for NX Series Devices

Connect the antenna to an MMCX-to-SMA cable, then attach the MMCX end of the cable to the GA interface of the instrument. For NXE/NXN-400 series instruments, use port 4 (MMCX interface), while for NXM/NXN series instruments (excluding NXN-400), use port 5 (MMCX interface).


Figure 6: NX Series Instrument External Antenna Connection Diagram

### 13.1.4 Viewing GNSS Information

1. Follow the steps in the GNSS Module Connection Method section to correctly connect the instrument and

antenna.

2. Open SAStudio4, click "System", select "GNSS Info", and in the GNSS Info window, set the Antenna Type to "GNSS_AntennaExternal".

3. Wait 1-3 minutes for GNSS to lock. You can check the GNSS lock status from the status bar indicator. If locked, the GNSS lock icon will turn green; if not locked, it will remain gray.


## 13.1.5 Using the 1PPS Trigger of the GNSS Module

The 1PPS trigger of an external GNSS module can only be used in IQS mode, DET mode, and RTA mode. This section explains how to configure the 1PPS trigger function in IQS mode as an example.

1. Follow the steps in the GNSS Module Connection Method section to correctly connect the instrument and antenna.

2. Follow the steps in the Viewing GNSS Information section to ensure that GNSS is locked.

3. Click "Mode", select "IQStreaming", and switch to IQS mode.

4. Set "TriggerSource" to "GNSS-1PPS" to use the GNSS module's 1PPS trigger.

### 13.1.6 Using the 10MHz Reference Clock of the GNSS Module (Only for High-Quality GNSS Modules)

1. Follow the steps in the GNSS Module Connection Method section to correctly connect the instrument and antenna.
2. Follow the steps in the Viewing GNSS Information section to ensure that GNSS is locked.
3. Open SAStudio4, click "System", select "GNSS Info", and open the GNSS Info window.
4. In the GNSS Info window, set "DOCXO" to LockMode and wait 5-10 minutes. If "DOCXO Locked" appears in the GNSS Info window, the OCXO is successfully locked.
5. In the System submenu of the main settings area, set "RefCLKSource" to Internal_Premium and "RefCLKFrequency" to 10MHz. At this point, the reference clock source will be OCXO.


### 13.1.7 GNSS Usage Precautions

When the GNSS module is not locked, it is not recommended to use the 1PPS and 10MHz clock signal outputs.

## 13.2 Trigger Function Introduction

### 13.2.1 SWP Sweep Mode

**Table 22 SWP Trigger Functions in SWP Mode**

| | |
|---|---|
| **Trigger Input** | |
| **Trigger Source** | Scan mode trigger sources: Free run, external frequency hopping trigger, external sweep trigger, external configuration trigger. |
| **Trigger Edge** | Rising edge、 Falling edge、 Both edges. |
| **Trigger Output** | |
| **Trigger Output** | No trigger;<br>Frequency hopping trigger: Outputs a trigger after completing one frame of analysis;<br>Sweep trigger: Outputs a trigger after completing one trace scan;<br>Configuration trigger: Outputs a trigger after switching configurations; |
| **Trigger Output Pulse Polarity** | Positive pulse、 negative pulse |

### 13.2.2 IQS、 DET、 RTA Fixed Frequency Point Modes

**Table 23 Trigger Functions in IQS, DET, and RTA Modes**

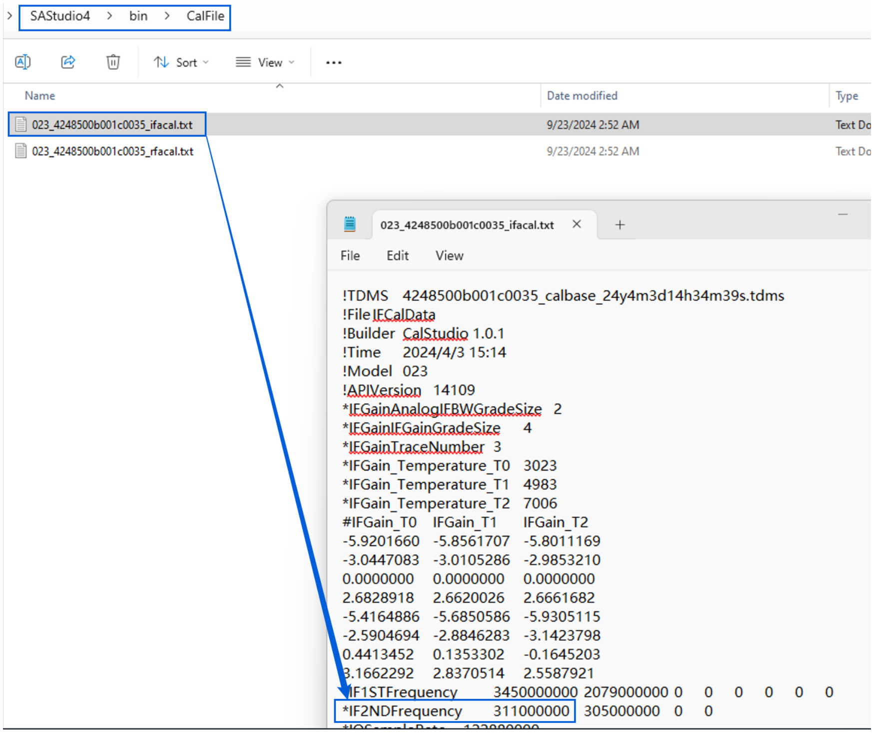
| | |
|---|---|
| **Trigger Input** | |
| **Trigger Source** | Fixed frequency point mode trigger sources: External trigger, bus trigger, level trigger, timer trigger, output trigger from signal source scanning (only for source-equipped devices), multi-device synchronous trigger, GNSS-1PPS trigger, and GNSS-1PPS multi-device synchronous trigger (for SA or NX devices using the GNSS module). |
| **Trigger Edge** | Rising edge, falling edge, both edges. |
| **Trigger Delay** | The time delay before data acquisition after triggering |
| **Pre-trigger** | The time duration for data acquisition before triggering |
| **Retrigger** | The instrument can respond multiple times after capturing a single trigger |
| **Retrigger Count** | The number of additional responses after a single trigger event |
| **Retrigger Interval** | The time interval between multiple responses for a single trigger event (equivalent to the trigger period in timer trigger mode) |
| **Trigger Input - Level** | |
| **Level Threshold** | Sets the threshold for level triggering; a value above the threshold qualifies as a trigger condition |
| **Debounce Safety Time** | Sets the debounce safety time for level triggering |
| **Trigger Input - Timer** | |
| **Timing Period** | The trigger period in timer trigger mode |
| **Synchronization** | Option to synchronize the timer trigger with external trigger edges or operate independently |

**Trigger Output**

| | |
|---|---|
| **Trigger Output** | Please refer to the corresponding parameters in SWP sweep mode |
| **Trigger Output Pulse** | |
| **Polarity** | |

## 13.3 Intermediate Frequency Output Application Guide

The frequency of the simulated IF output signal ranges between 307.2 MHz + 50 MHz. The center frequency of the simulated IF output for each instrument can be found in the instrument's IF calibration file.




## 13.4 External Reference Clock Input

The waveform of the reference clock input can be selected as sine wave, square wave, or peak-limited sine wave. The frequency must be set to 10 MHz, and the amplitude should be 3.3 V CMOS level.

Below is the connection diagram for using a GPSDO as a 10 MHz reference clock input:

For SA series devices:

1. Connect the GPSDO "10 MHz" output to the device's reference clock input interface: use a BNC to MCX cable for SAM/SAN (except SAN-400) to Interface 3, and a BNC to MMCX cable for SAE/SAN-400 to Interface 4.


Figure 6: External reference clock connection diagram for SAM/SAN (except SAN-400)


Figure 7: External reference clock connection diagram for SAE/SAN-400.

For NX Series Devices:

1. Connect the "10MHz" port of the GPSDO to the reference clock input of the device (where NXM/NXN

(except NXN-400) is connected to Port 1 of the device via a BNC-to-MCX cable; NXE/NXN-400 is connected to Port 7 of the device via a BNC-to-MMCX cable).

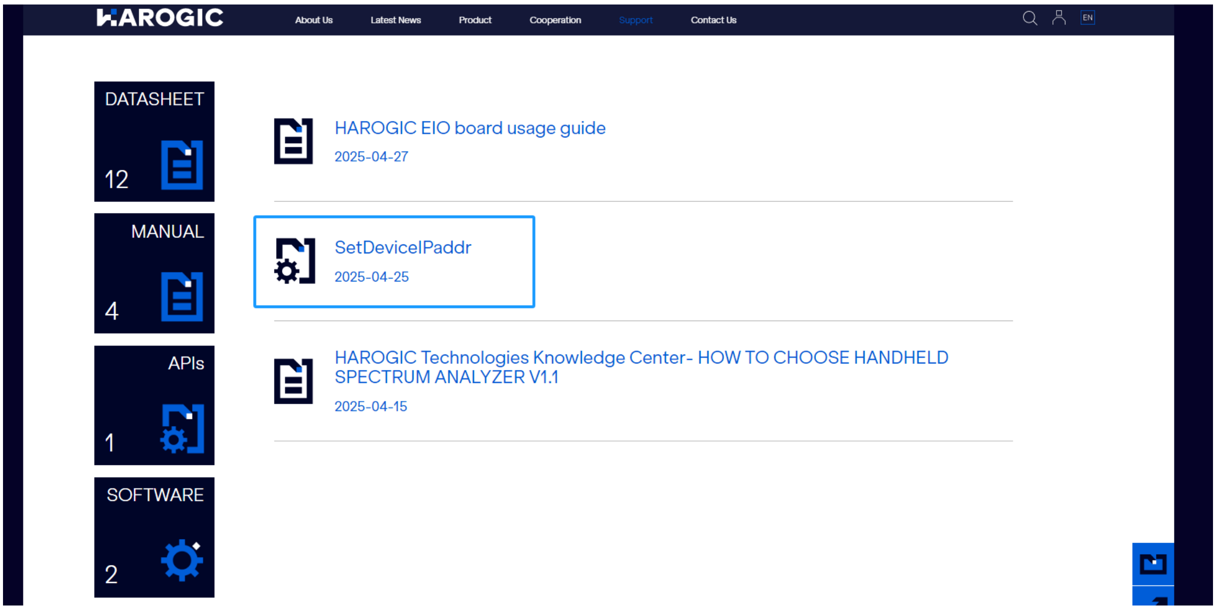

Figure 8 External Reference Clock Connection Diagram for NXE/NXN-400

After correctly connecting the external reference clock input:

2. Set "RefCLKSource" to External and "RefCLKFreq" to 10MHz under the main settings section "System". If the reference clock source displays "External", the switch was successful. If it reverts to "Internal", the switch has failed.

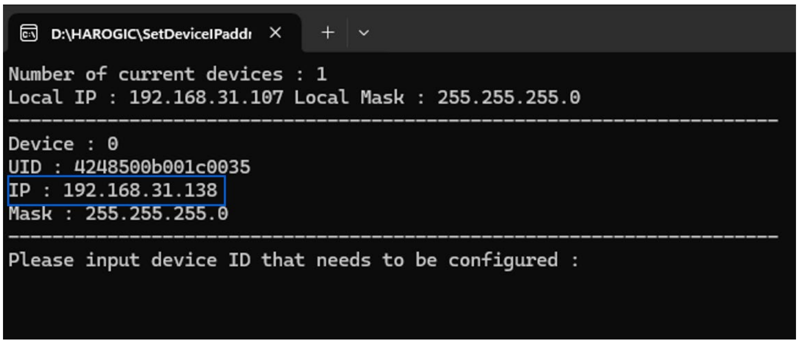

## 13.5 Remote Control Guide

1. Visit the HAROGIC official website (https://www.harogic.com/support/download-center/) to download and extract the SetDeviceIPaddress package(in FAQs) to the desktop or another directory;



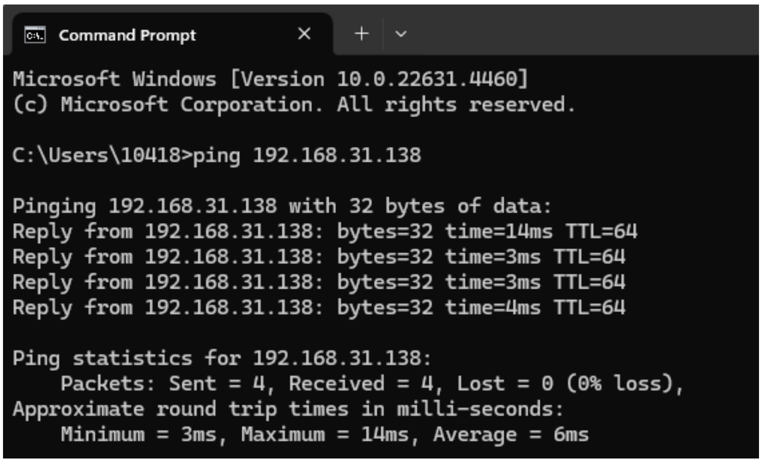

2. Connect the NX device to the router's network port using an Ethernet cable;


3. Connect the PC to the same router via Wi-Fi, ensuring it is on the same local network as the instrument. Double-click SetDeviceIPaddr.exe to check the IP address assigned to the instrument by the router. In this example, the IP address is "192.168.31.138". Users can modify the instrument's IP address within the same subnet as needed. If the instrument's DHCP is disabled, an IP address from a different subnet can be set under the router.

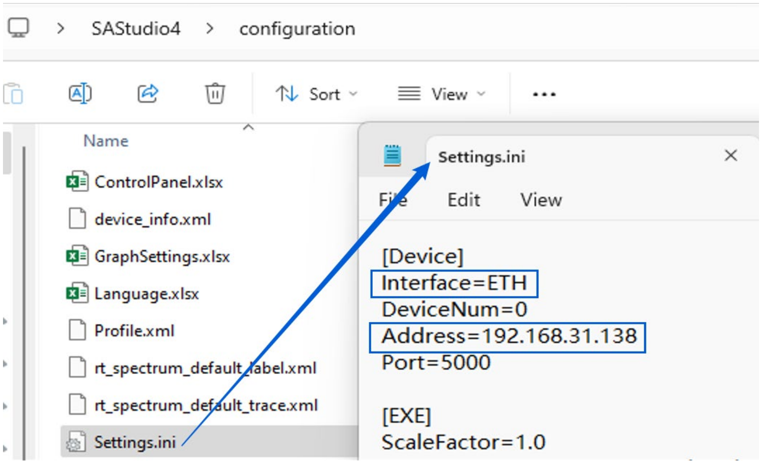



4. Open the cmd window and enter "ping 192.168.31.138". If the ping is successful, the network connection

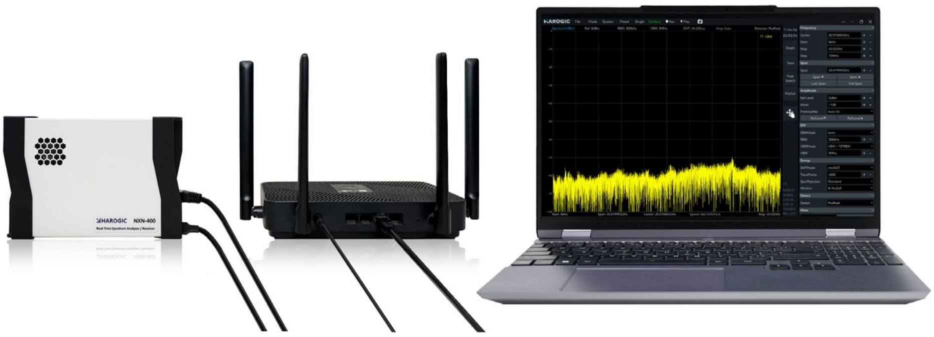
is established;

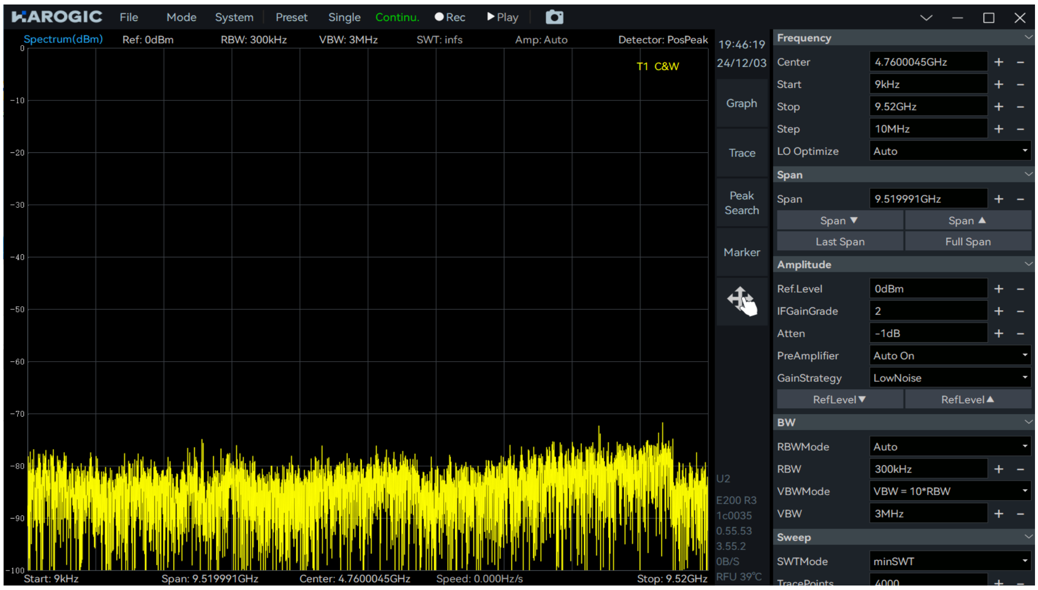



5. Navigate to the "...\SAStudio4\configuration\" folder and double-click to open the Settings.ini file. Set Interface to ETH and Address to 192.168.31.168;




a) Copy the device calibration file to the PC's "..\SAStudio4\bin\CalFile" folder. Then, double-click SAStudio4.exe in "..\SAStudio4\bin" to launch the SAStudio4 interface, enabling remote control of the NX series instruments.



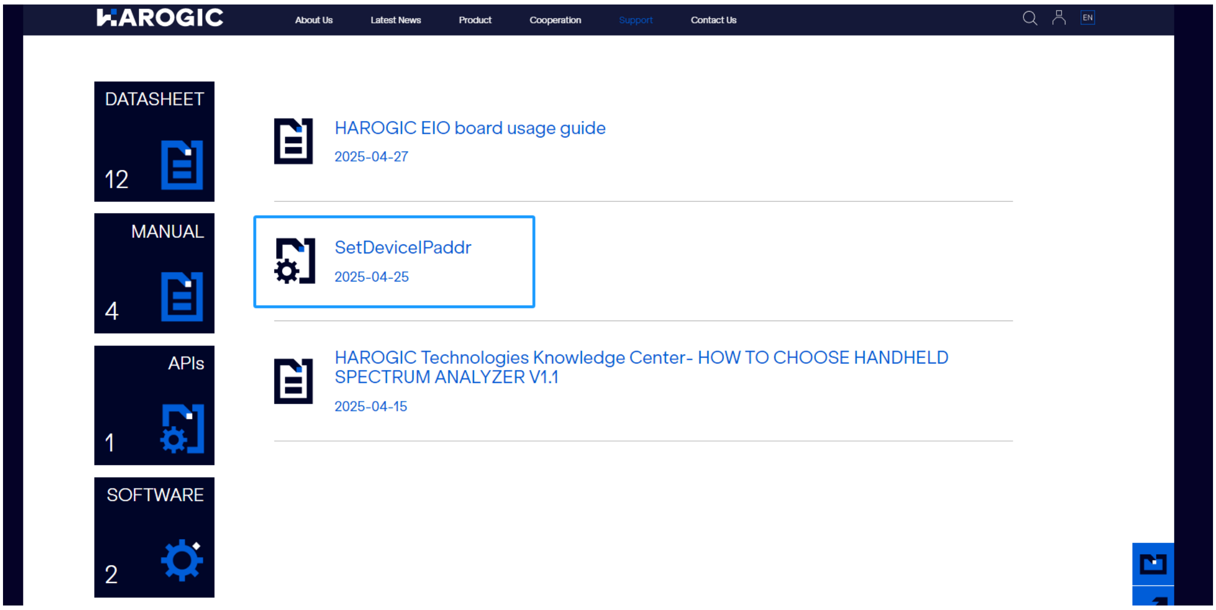



## 13.6 Modifying the IP Address of NX Series Devices

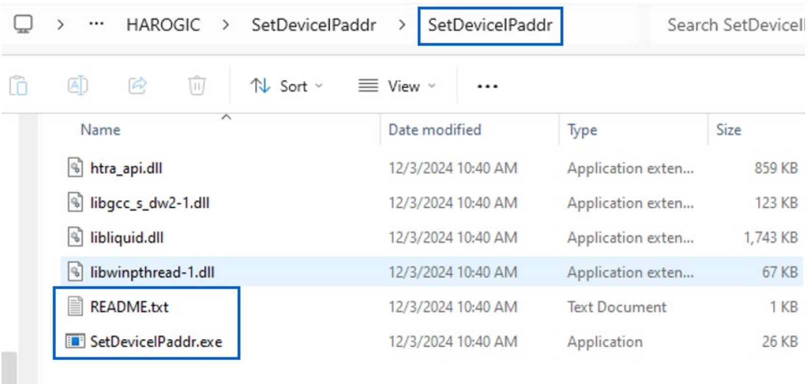
NX series devices come with two default IP addresses: 192.168.1.100 (fixed, non-modifiable) and 192.168.3.100 (modifiable). Users can modify the configurable IP using the program package available on the official website. When modifying the IP, ensure that the receiver's network card IP does not belong to the same subnet as any other non-physical network cards on the host computer to avoid network conflicts. Additionally, the IP address should not end in .0, 1, or 255, as these addresses have special purposes in a network (such as network addresses, broadcast addresses, or potential gateway addresses). Using them as the device IP may cause network issues.

For detailed modification steps, follow the instructions below:

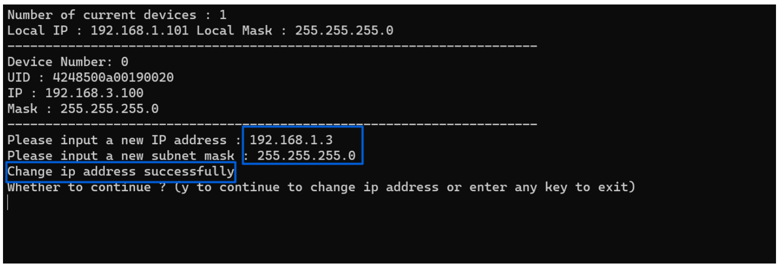
1. Visit the HAROGIC official website (https://www.harogic.com/support/download-center/) to download and extract the SetDeviceIPaddress package(in FAQs) to the desktop or another directory;



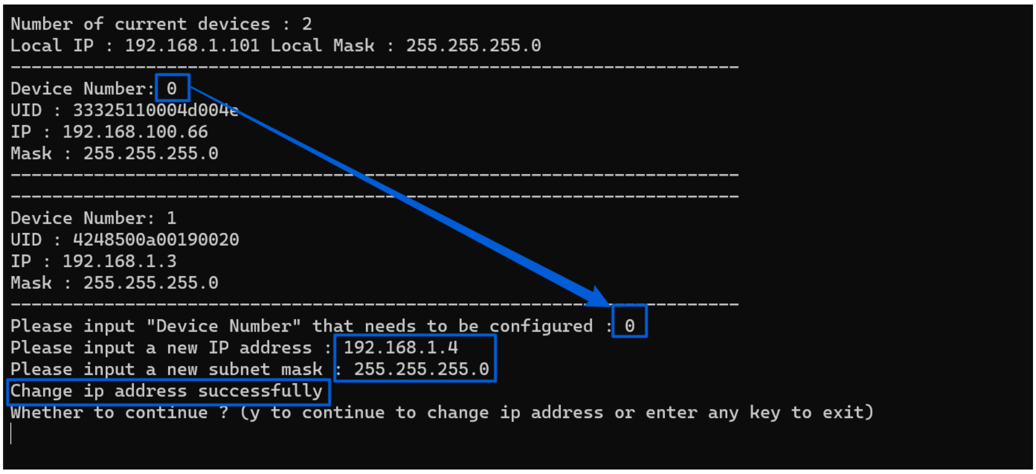

2. Double-click SetDeviceIPaddr.exe with the left mouse button and follow the instructions in the "README.txt" document to open the IP modification program;




3. Enter the Device ID (each device has a unique ID, corresponding to the Device number displayed when opening the software), IP address, and subnet mask in sequence. Then, press Enter and wait a few seconds. If "Modified successfully" appears, the modification is successful. (Users must enter a valid IP address and a subnet mask in CIDR-compliant format).




4. If the host computer is connected to multiple instruments, please fill in the instrument number of the instrument that needs to modify the IP in sequence (each instrument corresponds to a unique Device Number, that is, the instrument number displayed when the software is started. This article takes the instrument with UID 33325110003e0029 as an example), IP address and subnet mask. Press the Enter key and wait for a few seconds. If Change ip address successfully appears, the modification is successful (users need to enter a legal IP address and a subnet mask in CIDR format).

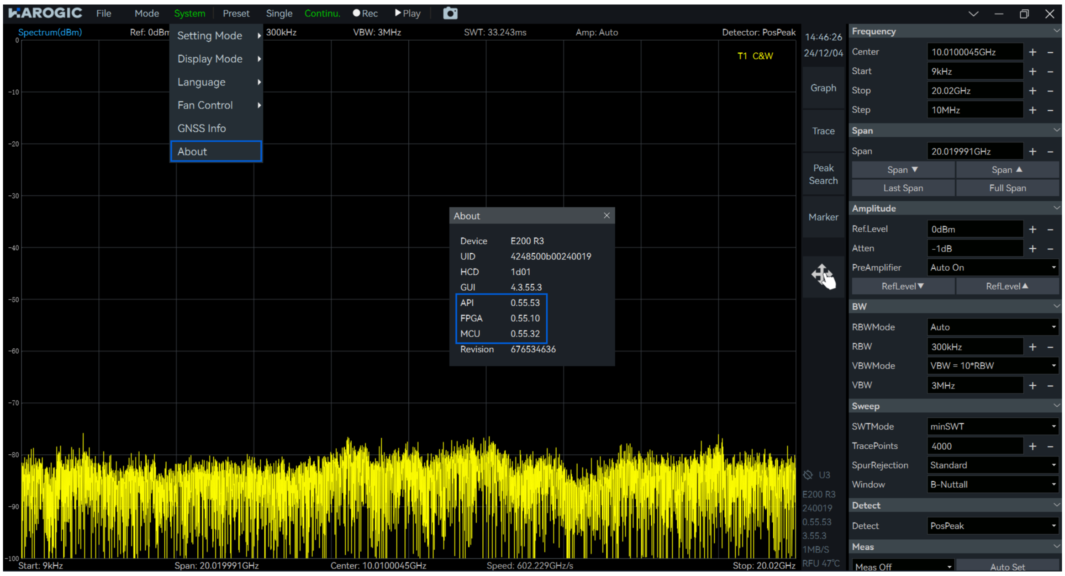


# 14. Software and Firmware Updates

This chapter explains how to update the MCU firmware, FPGA firmware, and GNSS firmware of SA/NX instruments using the firmware update program, as well as how to obtain the latest SAStudio4 software.

## 14.1 Software and Firmware Update Requirements

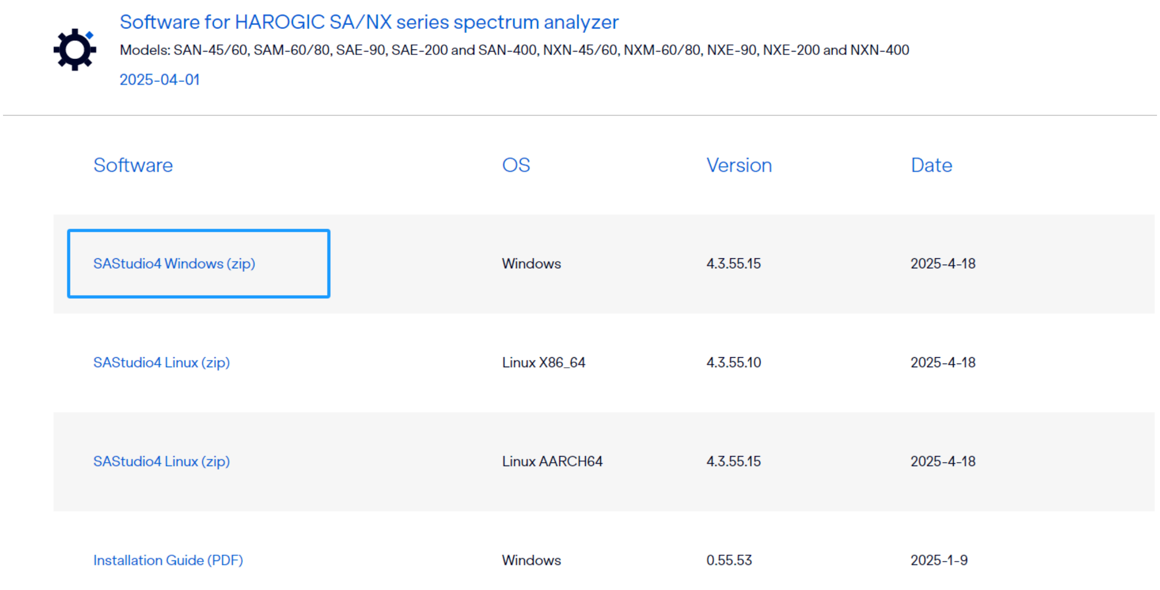
The instrument firmware update must meet the following version requirements: SA series firmware version must be 0.54.0 or higher, and NX series firmware version must be 0.55.12 or higher. If updating the GNSS module, the MCU firmware version must be 0.55.32 or higher. To check the current firmware version, click System - About in the menu bar and view the instrument version information.




After updating the instrument firmware, ensure that the MCU firmware, FPGA firmware, and SAStudio4 software (API) are within the same major version for proper functionality. Different major versions are not compatible with each other; for example, only versions within 0.55.x can be used together.

## 14.2 Obtaining SAStudio4 Software

Visit the HAROGIC official website (https://www.HAROGIC.com/software-for-HAROGIC-sa-nx-series-spectrum-analyzer/) to download the latest version of SAStudio4 software.



Software for HAROGIC SA/NX series spectrum analyzer

Models: SAN-45/60, SAM-60/80, SAE-90, SAE-200 and SAN-400, NXN-45/60, NXM-60/80, NXE-90, NXE-200 and NXN-400

2025-04-01

| Software | OS | Version | Date |
|---|---|---|---|
| SAStudio4 Windows (zip) | Windows | 4.3.55.15 | 2025-4-18 |
| SAStudio4 Linux (zip) | Linux X86_64 | 4.3.55.10 | 2025-4-18 |
| SAStudio4 Linux (zip) | Linux AARCH64 | 4.3.55.15 | 2025-4-18 |
| Installation Guide (PDF) | Windows | 0.55.53 | 2025-1-9 |

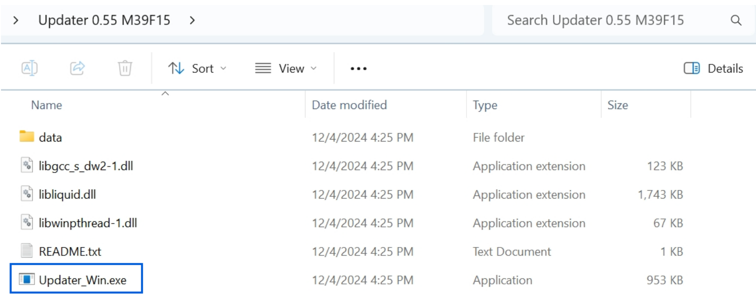
## 14.3 Obtaining the Software and Firmware Update Package

Visit the HAROGIC official website https://www.HAROGIC.com/software-for-HAROGIC-sa-nx-series-spectrum-analyzer/ to download the latest version software.

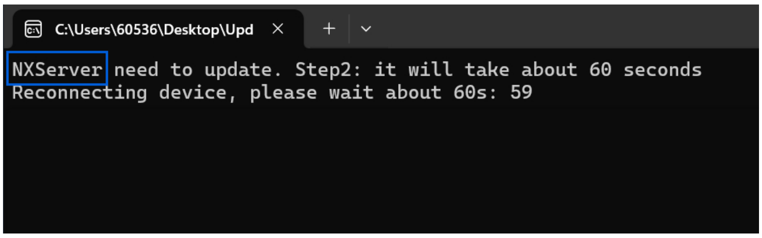
## 14.4 Updating Software and Firmware with Updater

Note: If an error occurs during the update process, please refer to the Error Handling section.

1. Follow the steps in the Quick Start Guide to connect the SA/NX instrument and use SAStudio4 for testing to ensure the device is functioning properly;
2. Navigate to the Updater 0.55 M39F15 folder and double-click Updater_Win.exe to run the updater.

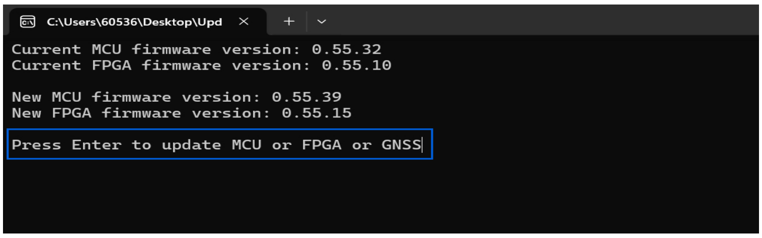



3. When using the firmware update program, NX instruments will first update the internal software (this process does not apply to SA devices). Wait 60 seconds for the update to complete, as shown in the figure.

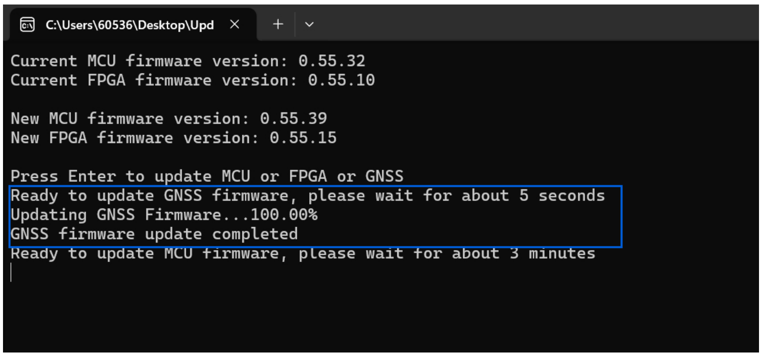



4. For SA devices, simply launching the Updater program normally will begin the update process. For NX devices, after the internal software update is complete, the program will display both the current firmware version of the device and the firmware version in the update package. After verifying the information, press Enter

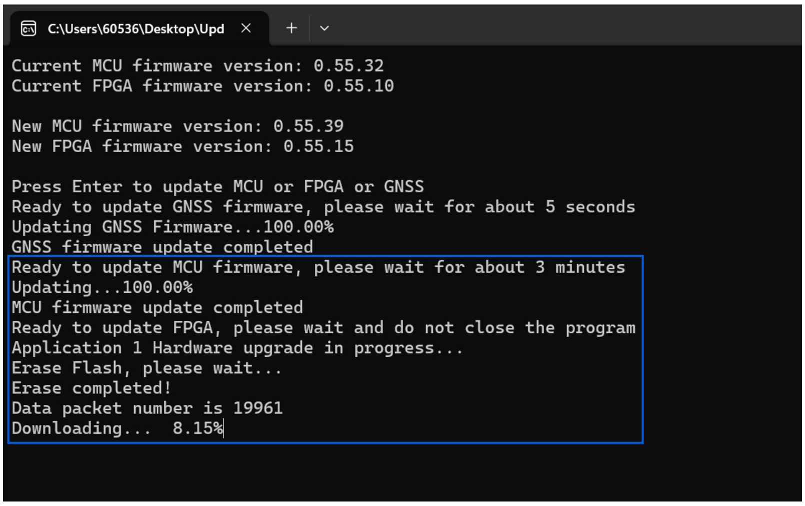
to start the upgrade. (For example, in Updater 0.55 M39F15, the MCU version is 0.55.39, and the FPGA version is 0.55.15.)



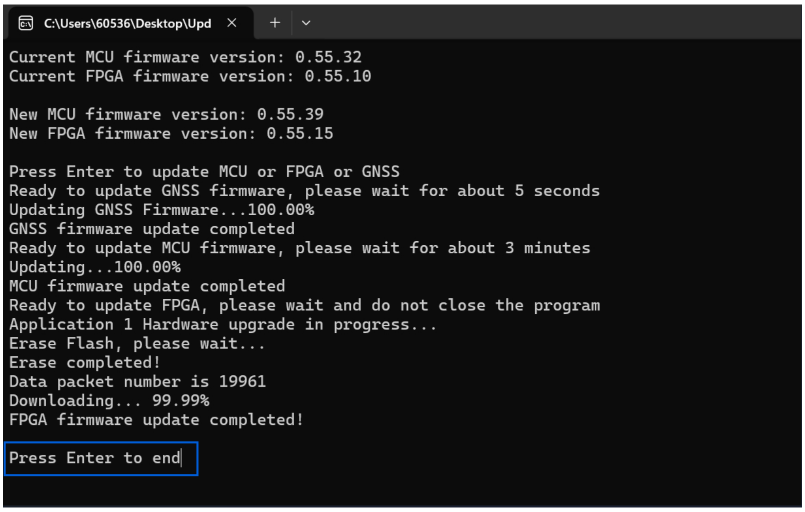

5. During the update, the terminal will display a progress percentage. Devices equipped with the GNSS option will automatically update the GNSS firmware during the process.



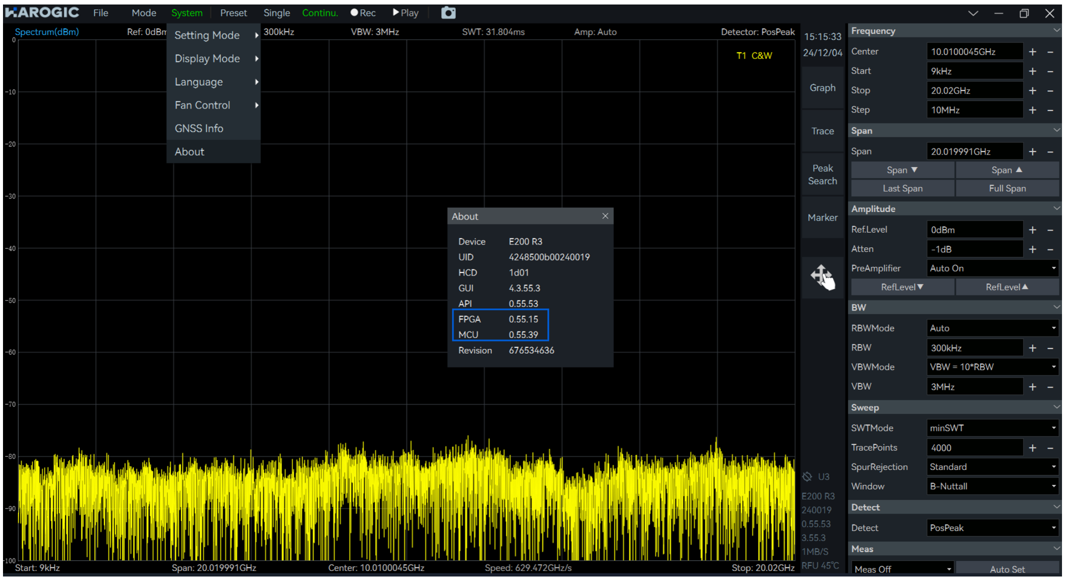

6. During the MCU and FPGA update process, the update times vary between SA and NX series devices. For SA series devices, the MCU update takes approximately 3 minutes, while the FPGA update takes around 12 minutes. For NX series devices, the MCU update requires about 6 minutes, and the FPGA update takes approximately 20 minutes.




7. Once the update is complete, press Enter to exit the update or click the close button (X) in the upper right corner to close the program.




8. After closing the program, launch SAStudio4 and check whether the MCU and FPGA versions have been successfully updated to the target versions.

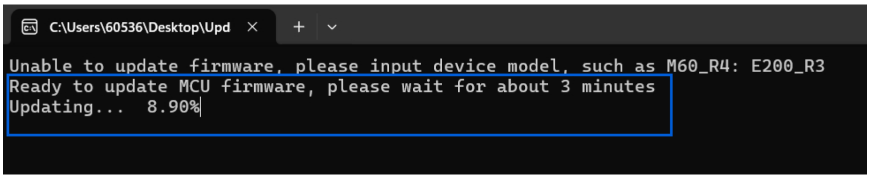



## 14.5 Error Handling

### 14.5.1 Firmware Update Error Handling

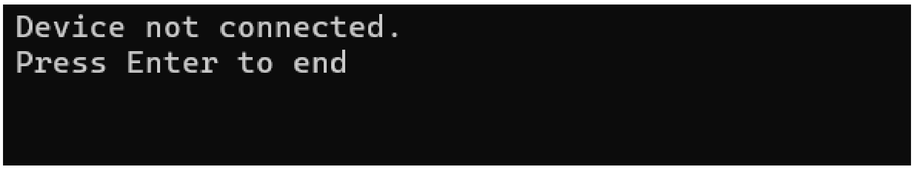
If the MCU, FPGA, or GNSS update fails due to unexpected disconnections, such as a data cable or network cable disconnection, restart the update program and wait for about 1 minute. When the screen displays the prompt shown in the figure, follow the instructions to enter the device model into the terminal and press Enter to restart the update (using E200_R3 as an example).


After the update is complete, close the program.

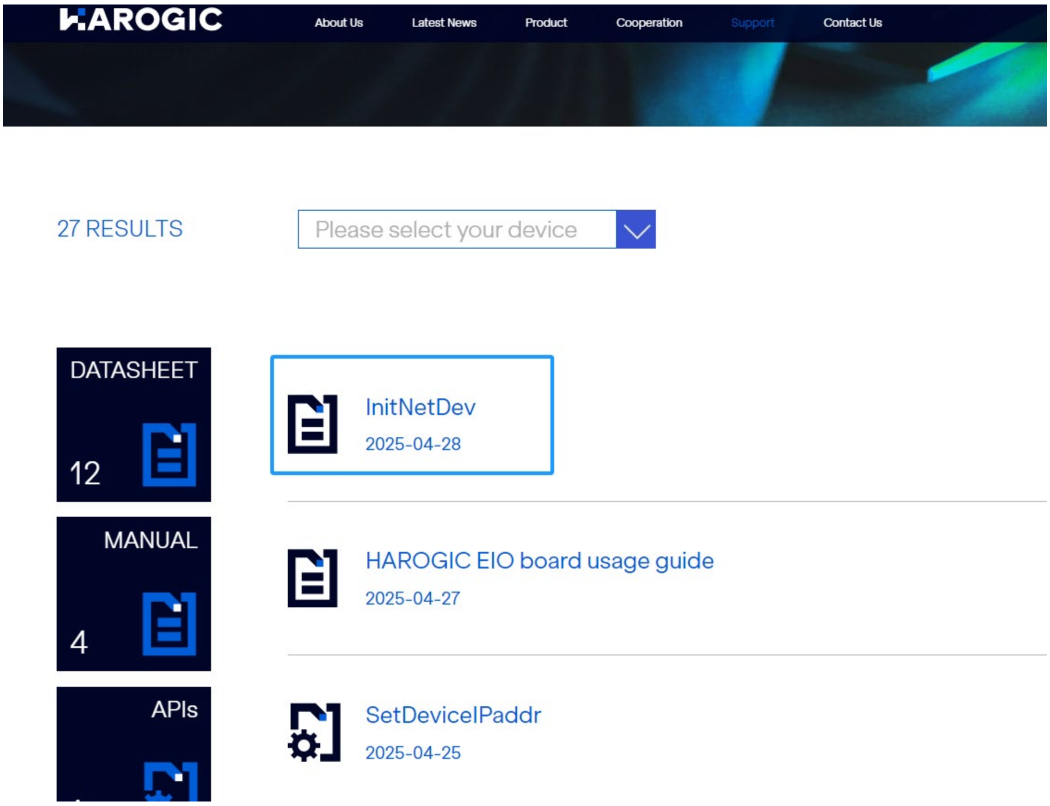



### 14.5.2 Internal Software Update Error Handling (NX Devices Only)

If an NX device experiences a network disconnection or power failure during the internal software update, the software package may become corrupted. When attempting to update again, if the screen displays the error message shown in the figure, follow the steps below to repair the internal software.




1) Visit the HAROGIC official website [https://www.harogic.com/support/download-center/](https://www.harogic.com/support/download-center/) to download and extract the NX Series Software Repair Program(InitNetDev in FAQs) to the desktop.

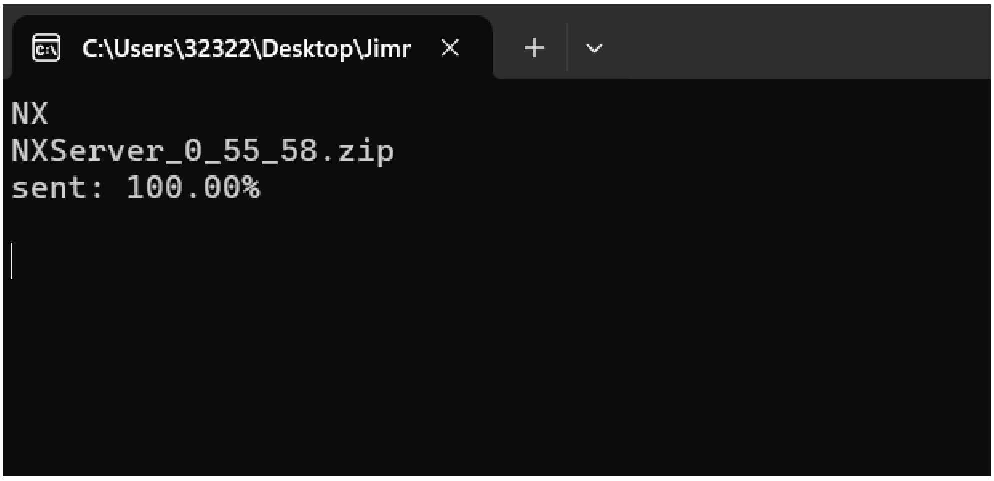



2) Extract the “InitNetDev.zip”.

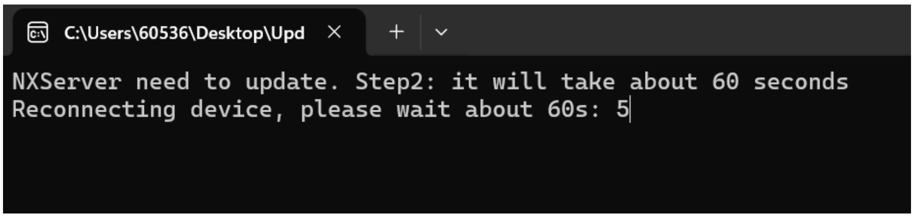
3) Open the InitNetDev > InitNetDev_v0.55.58 folder and run InitNetDev_v0.55.58.exe as an administrator.

4) If a security prompt appears during execution, select Allow for all prompts.

5) Once the repair process is complete, the program will automatically exit, as shown in the figure.




6) After successfully repairing the internal software, run the Updater program again to restart the firmware update.



# 15. Appendix

## 15.1 Record File Format Description

### 15.1.1 File Naming Format

The file name consists of the last 4 digits of the device ID, the date and time (year month day hour minute second) when the recording started, the index of the sub-file, and the file extension. For example: “0028_yyyymmdd_hhmmss_partx.suffix”. Regardless of the duration of continuous recording, all sub-files generated during the same recording session will share the same date and time in their file names, which is determined by the start time of the recording.

### 15.1.2 Structure to Byte Array Conversion Method

SWP_Profile_TypeDef, SWP_TraceInfo_TypeDef, IQS_Profile_TypeDef, IQS_StreamInfo_TypeDef, DET_Profile_TypeDef, DET_StreamInfo_TypeDef, RTA_Profile_TypeDef, RTA_FrameInfo_TypeDef structures are converted into byte arrays using a third-party tool “msgpack”. Therefore, these structures must also be read using msgpack.

### 15.1.3 Standard Spectrum Analysis - SWP

The SWP recording file uses a custom spectrum format. The format is described in the table below:

| Byte Offset | Description |
|---|---|
| 0 ~ 71+10M | This section stores file information and packet index, where 1M = 1024 × 1024. |
| 72+10M ~ 73+10M+ length | This section stores the structures: SWP_Profile_TypeDef, SWP_Profile_TypeDef (default configuration), and SWP_TraceInfo_TypeDef. |
| 74+10M+ length ~ End of File | This section stores the byte length of each data packet and the corresponding SWP data packets in sequence. Each SWP data packet mainly contains the frequency and power arrays, HopIndex, FrameIndex, and the MeasAuxInfo_TypeDef structure. |

Detailed format description is shown in the table below:

Table 1 spectrum format

| Byte Offser | Byte Count | Data Type | Field Name | Endian |
|---|---|---|---|---|
| 0 | 2 | uint16_t | File Number | 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 | 0x01Protocol Version | Big Endian |
| 8 | 4 | uint32_t | Api Version Information | Big Endian |
| | | | … | |
| 64 | 8 | quint64 | Number of Data Packets in Current File(approximate) | Big Endian |
| 72 | 10M=10*1024*1024 | QList | Packet Index | Big Endian |

| | | | | |
|---|---|---|---|---|
| 72+10M | 2 | uint16_t | Configuration + Default Configuration + Trace Information Length | Big Endian |
| 74+10M | | double | StartFreq_Hz | |
| | | double | StopFreq_Hz | |
| | | double | CenterFreq_Hz | |
| | | double | Span_Hz | |
| | | double | RefLevel_dBm | |
| | | 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 | |
| | | uint8_t | AnalogIFBWGrade | |
| | | uint8_t | IFGainGrade | |
| | | uint8_t | EnableDebugMode | |
| | | uint8_t | CalibrationSettings | |

| | | | | |
|---|---|---|---|---|
| | | int8_t | Atten | |
| | | int | TraceType | |
| | | int | LOOptimization | |
| | | | The Default Configuration Structure Same as Above | |
| | | 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 | |
| 74+10M+ length | 4 | int | Packet Length | Big Endian |
| | 8*N | double*N | Frequency Array | Platform Dependent |
| | 4*N | float*N | Power Array | Platform Dependent |
| | 4 | int | HopIndex | Big Endian |
| | 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 |
| | | | … | |

### 15.1.4 IQ Data Recording - IQS

The IQ recording file uses the standard WAV format. The format is described in the table below:

| chunk | Description |
|---|---|
| RIFF chunk | |
| RIFF chunk size | |
| File Format Type “WAVE” | |
| fmt chunk | |
| fmt chunk size | |
| fmt chunk data | |
| prof chunk | Chunk ID: "prof" |
| prof chunk size | Chunk Size |
| prof chunk data | This chunk is used to store IQS_Profile_TypeDef, IQS_StreamInfo_TypeDef, DeviceInfo_TypeDef and other related information. |
| trig chunk | Chunk ID: "trig" |
| trig chunk size | Chunk Size |
| trig chunk data | This chunk is used to store the corresponding IQS_TriggerInfo_TypeDef, DeviceState_TypeDef, IQS_ScaleToV, MaxPower_dBm and MaxIndex for each IQ data packet in sequence, aligned one-to-one with the data chunk. |
| data chunk | Chunk ID: "data" |
| data chunk size | Chunk Size |
| data chunk data | This chunk is used to store IQ data packets in sequence. |

Detailed format description is shown in the table below:

Table 2 iq.wav File Format

| chunk | Byte Offset | Offset Wkithin Chunk | Byte Count | Data Type | Field Name | Field Description | Endian |
|---|---|---|---|---|---|---|---|
| RIFF | 0 | | 4 | | Document Identifier | "RIFF" | |
| | 4 | | 4 | uint32_t | Data Length | Chunk Size | Little Endian |
| | 8 | | 4 | | File Format Type | "WAVE" | |
| fmt | 12 | | 4 | | Chunk ID | "fmt " | |
| | 16 | | 4 | uint32_t | Chunk Size | 16 | Little Endian |
| | 20 | | 2 | uint16_t | Audio Format Code | 1 | Little Endian |
| | 22 | | 2 | uint16_t | Number of Channels | 2 | Little Endian |
| | 24 | | 4 | uint32_t | Sampling Rate | | Little Endian |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 28 | | 4 | uint32_t | Byte Rate | | Little Endian |
| | 32 | | 2 | uint16_t | Block Align | | Little Endian |
| | 34 | | 2 | uint16_t | Bits per Sample | | Little Endian |
| prof | 36 | | 4 | | Chunk ID | "prof" | |
| | 40 | | 4 | uint32_t | Chunk Size | | Little Endian |
| | 44 | 0 | 2 | uint16_t | File Number | | 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 |
| | | | | | … | | |
| | 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 | | |
| | | | | 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 | | |
| | | | | int | QDCMode | | |
| | | | | float | QDCIGain | | |
| | | | | float | QDCQGain | | |
| | | | | float | QDCPhaseComp | | |
| | | | | int8_t | DCCIOffset | | |
| | | | | int8_t | DCCQOffset | | |
| | | | | int | LOOptimization | | |
| | | | | double | Bandwidth | | |
| | | | | double | IQSampleRate | | |
| | | | | uint64_t | PacketCount | | |
| | | | | uint64_t | StreamSamples | | |
| | | | | uint64_t | StreamDataSize | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | uint32_t | PacketSamples | | |
| | | | | uint32_t | PacketDataSize | | |
| | | | | uint32_t | GainParameter | | |
| | | | 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 |
| | | | | | … | | |
| trig | 400 | | 4 | | Chunk ID | “trig” | |
| | 404 | | 4 | uint32_t | Chunk Size | | Little 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 |
| | | | 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 |
| | | | 4 | float | IQS_ScaleToV | | Big Endian |
| | | | 4 | float | MaxPower_dBm | | Big Endian |
| | | | 4 | uint32_t | MaxIndex | | Big Endian |
| | | | | | … | | |
| data | 25*1024*1024+400 | | 4 | | Chunk ID | “data” | |
| | 25*1024*1024+404 | | 4 | uint32_t | Chunk Size | | Little Endian |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 25*1024*1024+408 | | 64968 | | IQ Data Packet | | Platform Dependent |
| | | | 64968 | | IQ Data Packet | | Platform Dependent |
| | | | | | ... | | |

### 15.1.5 Detection Analysis - DET

The DET recording file uses the standard WAV format, but it is not supported for playback by third-party software. The format is described in the table below:

| chunk | Description |
|---|---|
| RIFF chunk | |
| RIFF chunk size | |
| File Format Type ”WAVE” | |
| fmt chunk | |
| fmt chunk size | |
| fmt chunk data | |
| prof chunk | Chunk ID: "prof" |
| prof chunk size | Chunk Size |
| prof chunk data | This chunk is used to store DET_Profile_TypeDef, DET_StreamInfo_TypeDef, and other related information. |
| trig chunk | Chunk ID "trig" |
| trig chunk size | Chunk Size |
| trig chunk data | This chunk is for store the corresponding IQS_TriggerInfo_TypeDef, MeasAuxInfo_TypeDef and ScaleToV for each DET data packet, in sequence, aligned one-to-one with the data chunk. |
| data chunk | Chunk ID: "data" |
| data chunk size | Chunk Size |
| data chunk data | This chunk is used to store DET data packets in sequence. |

Detailed format description is shown in the table below:

Table 3 det.wav File Format

| chunk | Byte Offset | Offset Withi | Byte Count | Data Type | Field Name | Field Description | Endian |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | n Chunk | | | | | |
| RIFF | 0 | | 4 | | Document Identifier | "RIFF" | |
| | 4 | | 4 | uint32_t | Data Length | Chunk Size | Little Endian |
| | 8 | | 4 | | File Format Type | "WAVE" | |
| fmt | 12 | | 4 | | Chunk ID | "fmt " | |
| | 16 | | 4 | uint32_t | Chunk Size | 16 | Little Endian |
| | 20 | | 2 | uint16_t | Audio Format Code | 1 | Little Endian |
| | 22 | | 2 | uint16_t | Number of Channels | 2 | Little Endian |
| | 24 | | 4 | uint32_t | Sampling Rate | | Little Endian |
| | 28 | | 4 | uint32_t | Byte Rate | | Little Endian |
| | 32 | | 2 | uint16_t | Block Align | | Little Endian |
| | 34 | | 2 | uint16_t | Bits per Sample | | Little Endian |
| prof | 36 | | 4 | | Chunk ID | “prof” | |
| | 40 | | 4 | uint32_t | Chunk Size | | Little Endian |
| | 44 | 0 | 2 | uint16_t | File Number | | 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 |
| | | | | | … | | |
| | 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 | | |
| | | | | 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 | | |
| | | | | float | QDCQGain | | |
| | | | | float | QDCPhaseComp | | |
| | | | | int8_t | DCCIOffset | | |
| | | | | int8_t | DCCQOffset | | |
| | | | | int | LOOptimization | | |
| | | | | uint64_t | PacketCount | | |
| | | | | uint64_t | StreamSamples | | |
| | | | | uint64_t | StreamDataSize | | |
| | | | | uint32_t | PacketSamples | | |
| | | | | uint32_t | PacketDataSize | | |
| | | | | double | TimeResolution | | |
| | | | | uint32_t | GainParameter | | |
| | | | | | … | | |
| trig | 400 | | 4 | | Chunk ID | “trig” | |
| | 404 | | 4 | uint32_t | Chunk Size | | Little 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 |
| | | | 2 | uint16_t | MeasAuxInfo 结构体字节长度 | | 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 |
| | | | 4 | float | ScaleToV | | Big Endian |
| | | | | | … | | |
| data | 25*1024*1024+ 400 | | 4 | | Chunk ID | “data” | |
| | 25*1024*1024+ 404 | | 4 | uint32 _t | Chunk Size | | Little Endian |
| | 25*1024*1024+ 408 | | 6496 8 | | DET Data Packet | | Platform Depende nt |
| | | | 6496 8 | | DET Data Packet | | Platform Depende nt |
| | | | | | … | | |

### 15.1.6 Real-Time Spectrum - RTA

The RTA recording file uses a custom rtspectrum format. The format is described in the table below:

| Byte Offset | Description |
|---|---|
| 0 ~ 71+10M | This section stores file information and packet index, where 1M = 1024 * 1024 |
| 72+10M ~ 73+10M+ length | This section stores the RTA_Profile_TypeDef and RTA_FrameInfo_TypeDef structures. |
| 74+10M+ length ~ End of File | This section stores the byte length of each data packet and the RTA data packets in sequence. Each RTA data packet mainly contains the SpectrumStream array, RTA_PlotInfo_TypeDef, RTA_TriggerInfo_TypeDef, and MeasAuxInfo_TypeDef structure. |

Detailed format description is shown in the table below:

Table 4 rtspectrum Format

| Byte Offset | Byte Count | Data Type | Field Name | Endian |
|---|---|---|---|---|
| 0 | 2 | uint16_t | File Number | 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 |
| | | | … | |
| 64 | 8 | quint64 | Number of Data Packets in Current File(approximate) | Big Endian |
| 72 | 10M=10*1024*1024 | QList | Packet Index | Big Endian |
| 72+10M | 2 | uint16_t | Configuration + Trace Information Length(length) | Big Endian |
| 74+10M | | double | CenterFreq_Hz | |
| | | double | RefLevel_dBm | |
| | | double | RBW_Hz | |
| | | double | VBW_Hz | |
| | | int | RBWMode | |
| | | int | VBWMode | |
| | | 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 | |
| | | 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 | |
| | | 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 | |
| 74+10M+ length | 4 | int | 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 |
| | 4 | int | Packet Length | Big Endian |
| | | | … | |

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