HAROGIC Real-Time Spectrum Analyzer

SAStudio4

User Manual

4.1.55.65

2023-11-21

HAROGIC

Contents

1. Overview

SAStudio4 is a GUI software for spectrum and signal analysis. This manual presents a brief introduction for overview, user UI, analysis mode and analysis capability of SAStudio4. Users can use this document to learn how to perform SAStudio4, what types of measurements the SAStudio4 is capable of. Please refer to the related section or contact for technical support based on the practical measurement application.

1.1 Analysis modes

The software SAStudio4 is capable of many analysis modes, mainly including SWP (standard spectrum sweep), IQS (IQ streaming), DET (detection analysis or zero span), RTA (real-time analysis), phase noise, IM3, OBW (occupied bandwidth), ACPR (adjacent channel power ratio) etc. You can set the analysis mode according to your measurement goal and application scenarios:

Table 1 main analysis mode

Modes	Measurement capability		
SWP	Panoramic spectrum	Harmonic, Spurious	Phase noise
	Spectrum monitoring	Channel power	OBW, ACPR, IM3
IQS	Time domain graph	IQ record and playback	FM/AM demodulation
	Spectrum analysis	Users' application	Digital demodulation (in process)
DET	Pulse signal observation	Power-time viewing	Power-time record and playback
RTA	Burst signal observation	Stealth signal discovery	Spectrum dynamic observation

1.2 Software and manual version

SAStudio4 is a constant updated application and the manual will be updated correspondingly. The version number is employed to distinguish the various software version and use manual version. For example, the version number for SAStudio4 is

4.1.50.40, the user manual will also be updated to 4.1.50.40. Please ensure the version number before referring to the manual.

2. Driver installation

The guide for instrument connection is presented in Quick Start Guide chapter 3 for SA series and chapter 4 for NX series, this section will guide you to install the driver on Windows or Linux system.

2.1 Windows

2.1.1 System requirements

The system requirements are recommended here for obtaining the appreciable measurement results.

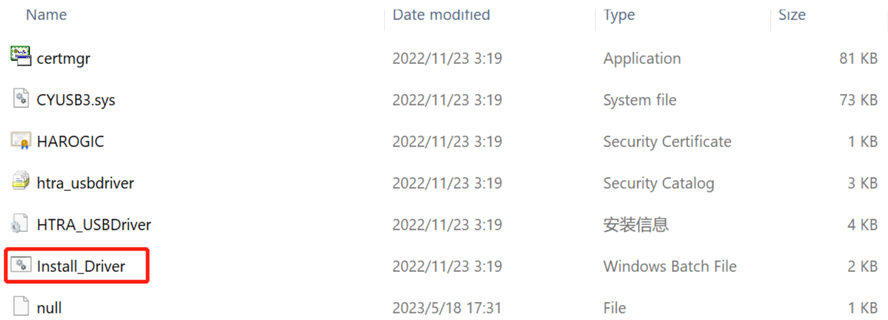
Table 2 the requirements for PC configuration in Windows operating system

Configuration	Details
System	Win7/8/10/11 32-bit or 64-bit, Win-XP is not supported.
Processor	Intel i3 and above.
Ram	4GB and above.
Hard disk	Continuous write bandwidth of hard disk >400 MBytes/s.
Data interface	USB2.0 or USB3.0; IQ recording bandwidth and duration are limited by data interface bandwidth.
Display resolution	>1280 × 800 pixel.
Additional	Some antivirus software may prevent software from functioning properly.

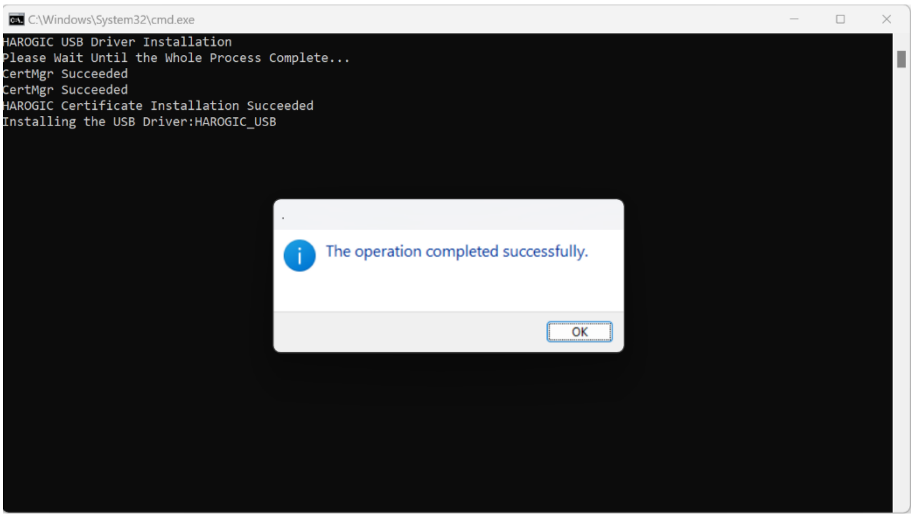
2.1.2 Driver installation

1: Before installing the driver, please confirm your computer's Windows version and bit number. Then, select the corresponding driver version of your computer to install, as shown in the following figure.

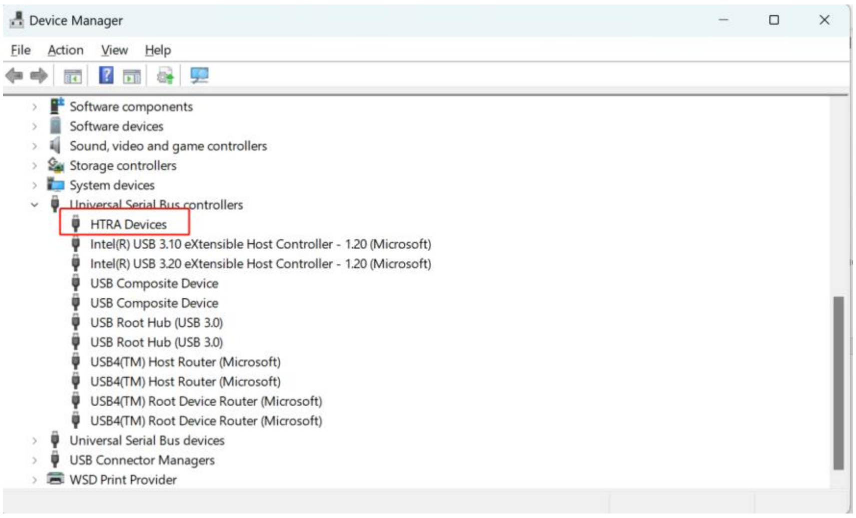
2: Run the Install_Driver.bat file as administrator, as shown in the following figure.



3: After the driver is successfully installed, the result is as shown in the following figure.



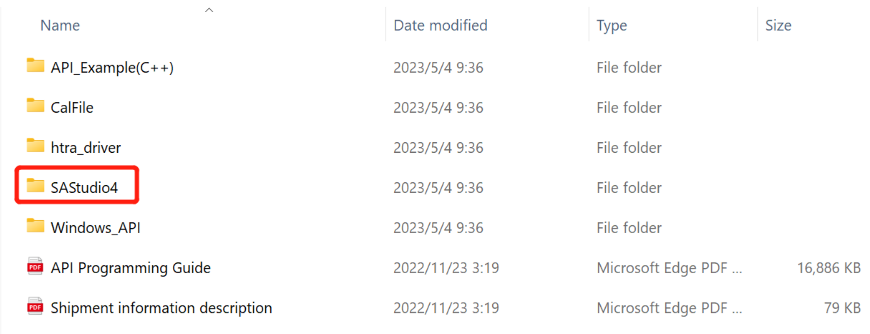
4: After successful installation, you can view the newly installed instruments in device manager, as shown in the following figure.



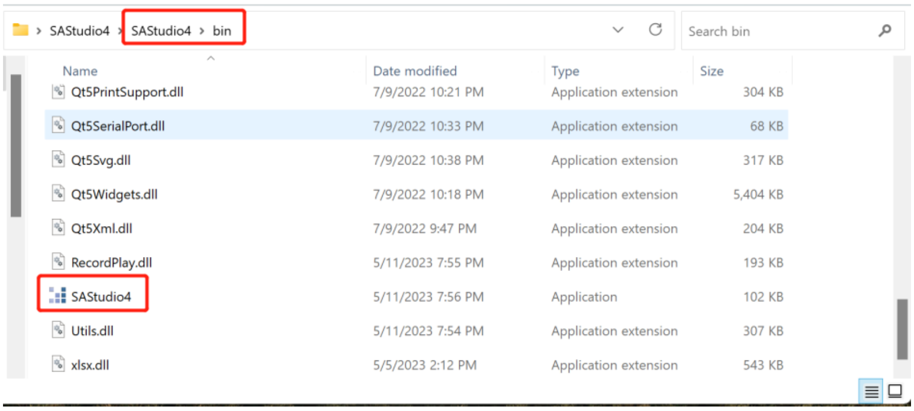
2.1.3 Running the installation-free SAStudio4 software

Once the driver has been installed successfully and the instrument is connected to the PC, you can directly run the installation-free SAStudio4 software.

1: Copy the complete SAStudio4 folder from the USB flash disk to your PC'S hard disk.



2: Open the folder using "…/SAStudio4/bin/SAStudio4.exe" as path to find the SAStudio4.exe application. You could create shortcut in desktop for quick start.



3: Double click the SAStudio4.exe to run the software. The software default user interface (UI) is shown as the following figure.

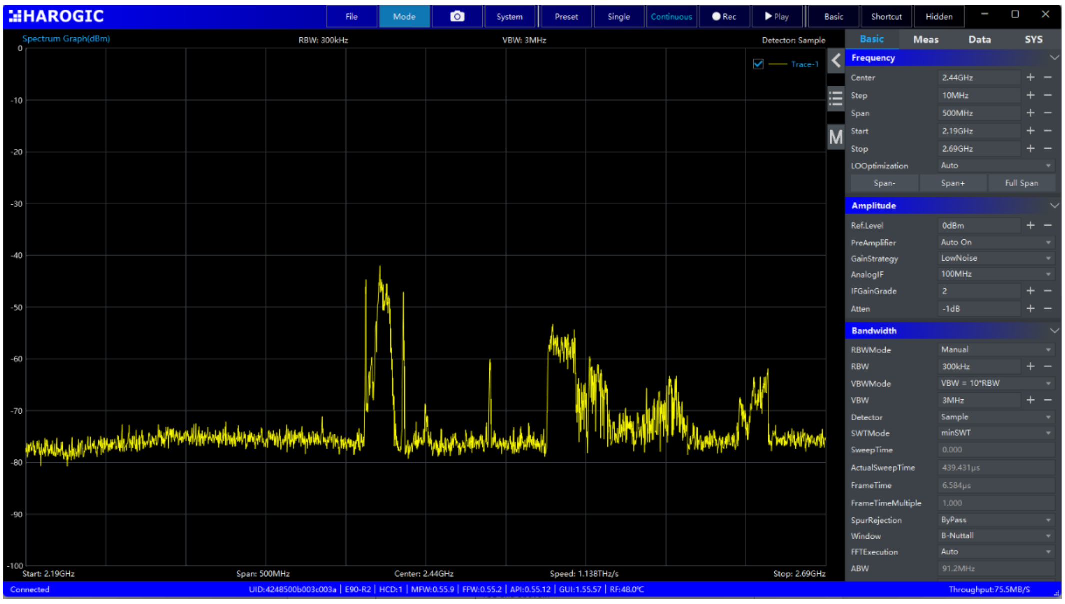


Figure 1 The default UI after theSAStudio4 is opened.

2.2 Linux (in progress)

2.2.1 System requirements

The system requirements are recommended here for obtaining the appreciable measurement results in Linux operating system.

Table 3 the requirements for PC configuration in Linux operating system

Configuration	Requirements
Operating system	Ubuntu 18.04 etc.
Processor	X86 or ARM processor such as RK3588, RK3399.
Ram	4GB and above.
Hard disk	Continuous write bandwidth of hard disk >400 MBytes/s.
Data interface	USB2.0 or USB3.0.
Display resolution	>1280 x 800 pixel
Additional	Some antivirus software may make SAStudio4 work improperly.

3. SAStudio4 UI and system settings

3.1 SAStudio4 UI introduction

The SAStudio4 UI can be divided into four main regions: 1) menu bar; 2) instrument information bar; 3) main setting region; 4) chart region.

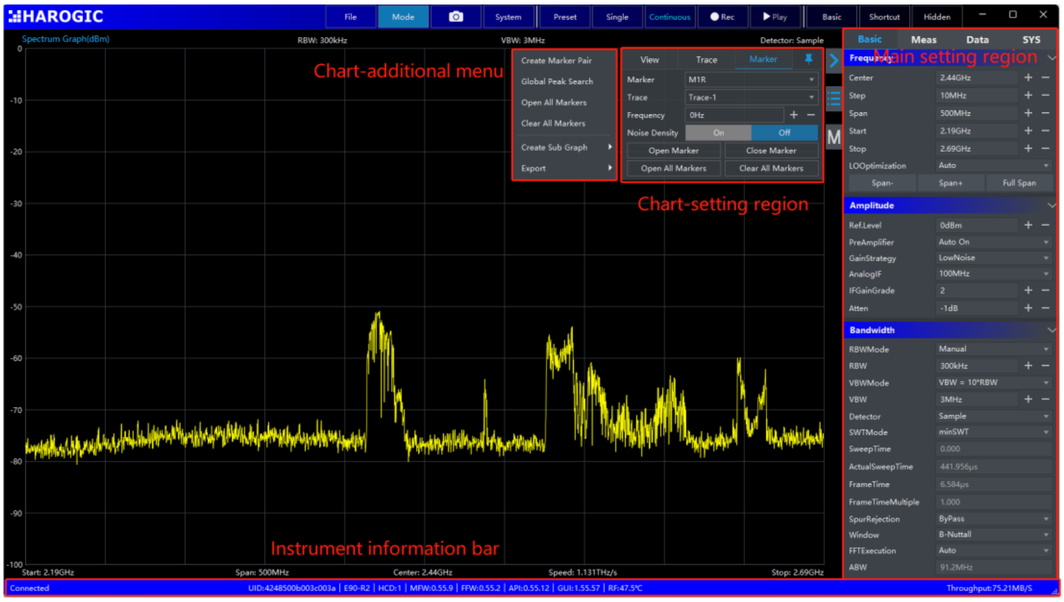


Figure 2 SAStudio4 default UI after launching with HAROGIC SAM60 M3.

1) Menu bar:

- Open preset and save preset
- Preset
- Analysis mode
- System
- Single and Continuous
- Basic/Profes setting
- Screenshot
- Record and Playback

2) Instrument information bar:

- Current Instrument UID
- Instrument model
- Hardware and MFW version
- Instrument temperature
- Data bus throughput
- Instrument state

3) Main setting region:

- Instrument state setting
- Measurement and analysis setting
- Data record and playback
- System setting

4) Chart region:

- Measurement result display
- Marker setting
- Chart setting

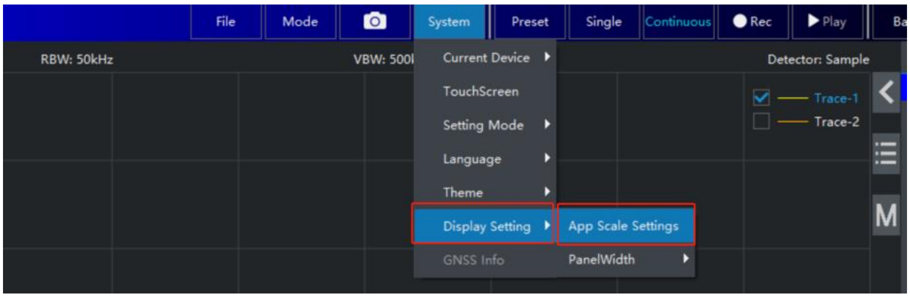
3.2 System setting

3.2.1 Software and hardware version, instrument state checking

Users can check the software, hardware version and instrument state on the bottom of the SAStudio4 UI or in the menu bar-instrument-current instrument.

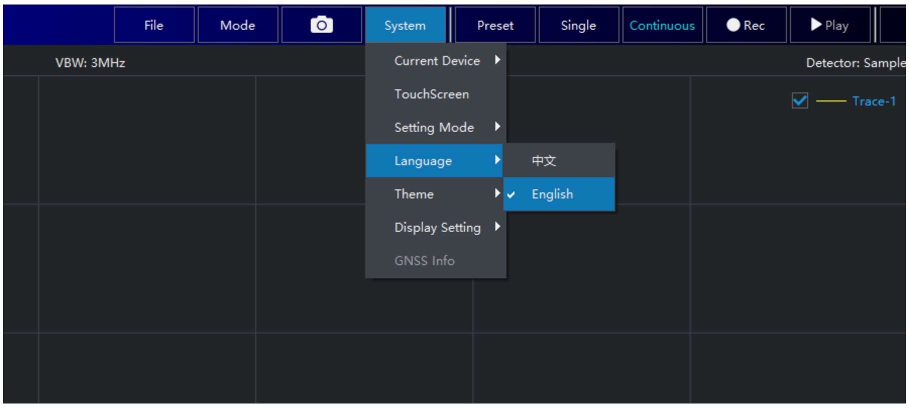
3.2.2 UI zoom setting

SAStudio4 UI zoom setting is available in the menu bar-system-display setting-app scale settings-display scale. Users can use this setting to zoom in the SAStudio4 UI.



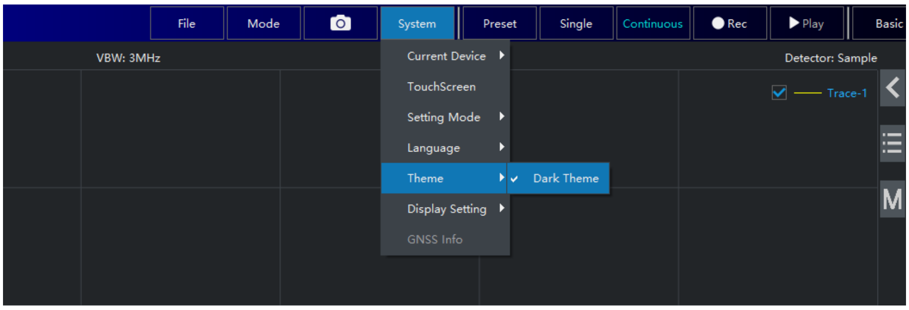
3.2.3 Language selecting

The SAStudio4 offers multiple language choices in menu bar-system-language.



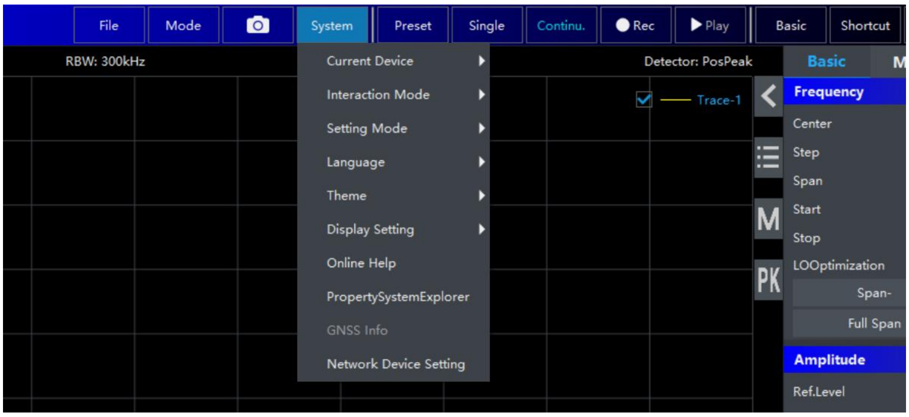
3.2.4 UI theme selecting.

Dark theme: menu bar-system-dark theme.



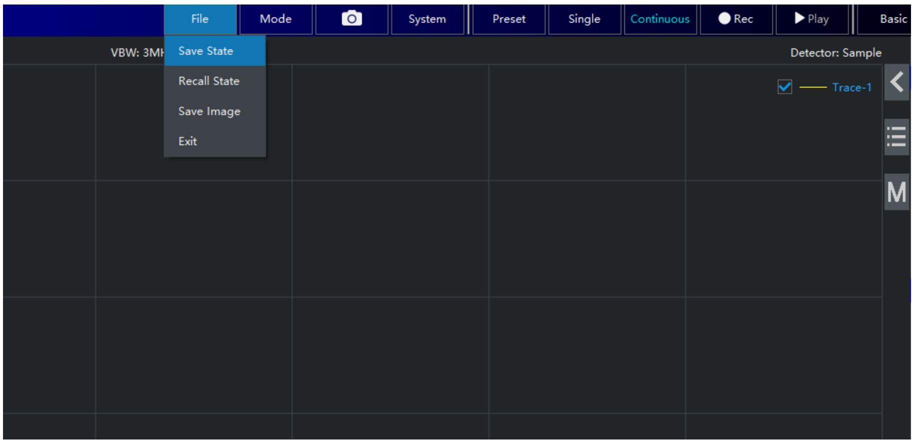
3.2.5 GNSS Information

Menu bar -System -GNSS information to view the date, time, longitude, and latitude after GPS lock signal.



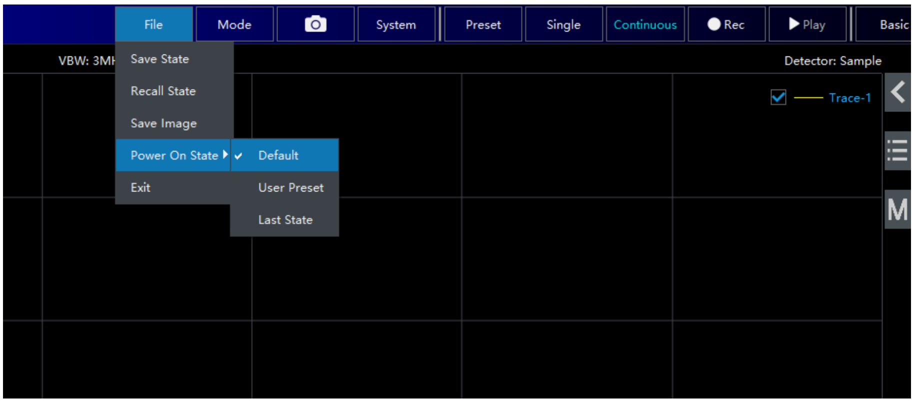
3.2.6 Save/recall state

For measurement setting used in most cased, it’s recommended to save the state for quick start. Menu bar-File-Save/recall state.



3.2.7 Power on state setting

For measurement setting used in most cased, it’s recommended to load the setting when open the software including: 1) Default; 2) user preset; 3) last preset..



3.2.8 Auxiliary signal generator (ASG) setting (Instrument-specific options)

For the instruments with ASG, ASG is activated in menu bar-tools-ASG_AUXS. The details for ASG configuration are listed as the following:

Table 4 detailed information for ASG setting

Category	Detailed information
ReferenceClockSource	ReferenceClockSource_Internal: internal reference clock source; ReferenceClockSource_External: external reference clock source.
ASG_Port	ASG_Port_External: signal for external instruments; ASG_Port_Internal: signal as RF in for the instrument;
ASG_Mode	ASG_Mute: no signal output; ASG_FixPoint: single tone fixed frequency signal; ASG_FrequencySweep: single tone frequency scan signal; ASG_PowerSweep: signal tone fixed frequency, power scan.
ASG_TriggerSource:	ASG_Trigger_FreeRun: free run; ASG_Trigger_External: external trigger signal; ASG_Trigger_Bus: bus trigger.
ASG_TriggerInMode	ASG_TriggerInMode_Null: free run; ASG_TriggerInMode_SinglePoint: single frequency sweep or power sweep; ASG_TriggerInMode_SingleSweep: one cycle scan; ASG_TriggerInMode_Continous: continuous operation.
ASG_TriggerOutMode	ASG_TriggerOutMode_Null: free run; ASG_TriggerOutMode_SinglePoint: frequency hopping output a pulse signal; ASG_TriggerOutMode_SingleSweep: sweep output a pulse signal.

4. Analysis modes

This section gives a brief introduction for the four main analysis modes, the detailed step-by-step guide and notes could be found on the official website and YouTube.

4.1 Standard spectrum sweep analysis (SWP)

4.1.1 Introduction

In SWP analysis mode, the instrument works via frequency hopping process, collecting time domain data at desired LO frequency and performing FFT analysis to get one patch spectrum data. The full span spectrum is acquired through concatenating the results of the FFT processing on each of these patches. SWP analysis mode mainly includes with the following functionalities:

- Spectrum panoramic scanning
- IM3/ XdB/ OBW/ ACPR
- Spectrum zooming
- Channel Power
- Waterfall graph
- Phase noise
- Spectrum record and playback
- Logarithmic Axis

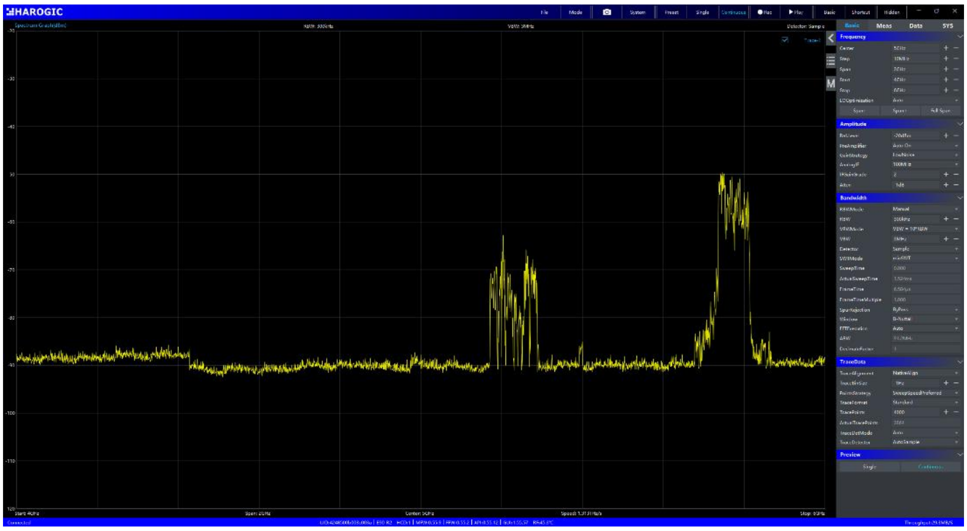


Figure 3 default UI for SWP analysis mode

4.1.2 standard spectrum record and playback

Application version: 4.1.55.46 and later

Location： Main setting region-data

Feature overview： Original spectrum data recording and savings. Playback for saved files. Playback data supports the same analysis as original spectrum data analysis.

Videos & Notes: None

Operating instructions:

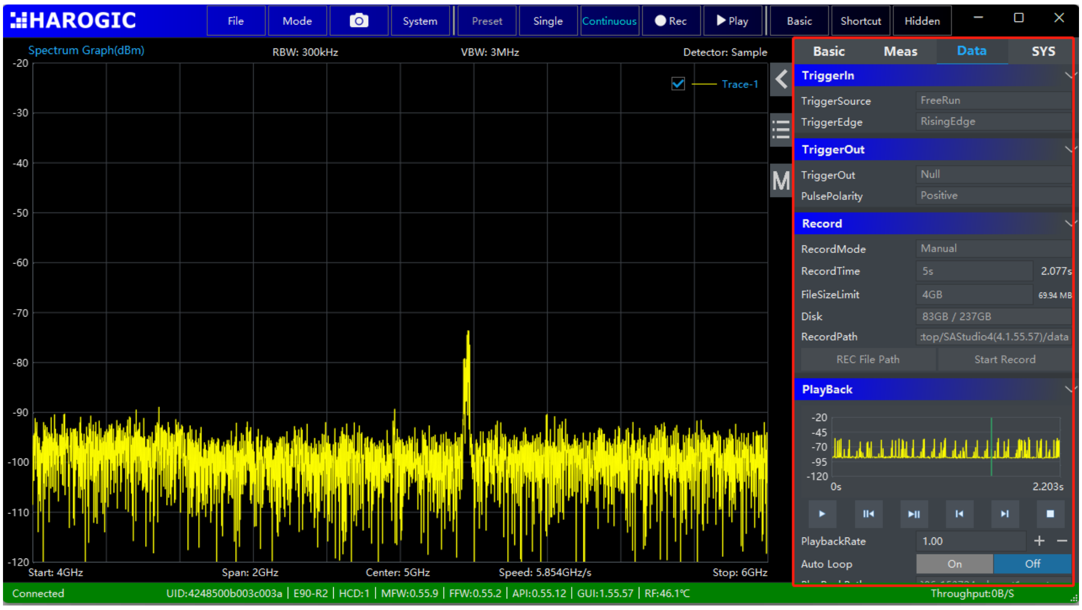


Figure 4 spectrum record and playback control

Spectrum record:

Fixed record mode: 1) select Fixed as record mode, set the record time and record path; 2) click “Start Record”; 3) record the spectrum data (original spectrum data); 4) the recording process will automatically be ended when the user-defined time is reached, the spectrum data is saved as .spectrum format.

Manual record mode: 1) select Manual as record mode, set the record path; 2) click “Start Record”; 3) record the spectrum data (original spectrum data); 4) click “Stop Record” to end up recording process, the spectrum data is saved as .spectrum format.

Playback: 1) click “Open REC File” button to open the spectrum file you record; 2) click “start play” button to playback the original spectrum data. Users can stop, end up, back or forward the playback process. Also you can adjust the playback rate or set auto loop the playback process. If users choose the single playback, the playback UI will return to original SWP UI.

Preview thumbnails: as shown in the following figure, the preview thumbnails will be presented when you open rec file for spectrum playback. In the preview thumbnails, the X axis is the time, Y axis is the maximum power value in the spectrum data at the moment. You can click the preview thumbnails or scroll mouse wheel to reach where you want to observe the spectrum data.

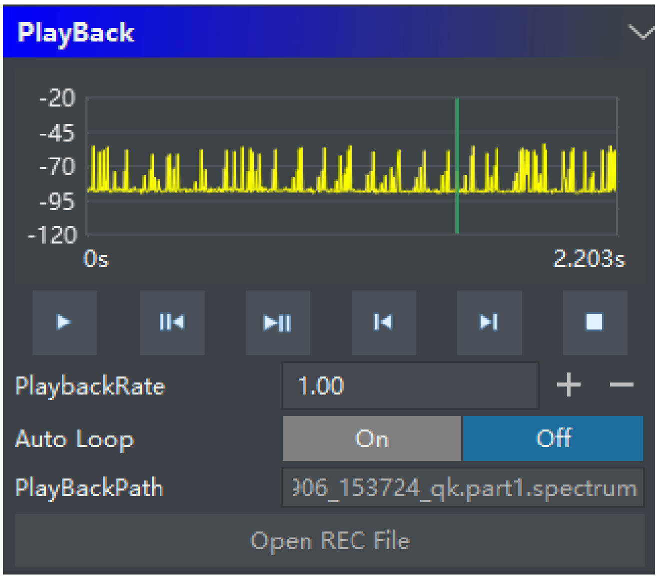


Figure 5 the preview thumbnails for spectrum playback.

4.1.3 Phase noise measurement

Application version: 4.1.50.40 and later

Location: Main Setting region-Meas

Feature overview: SSB phase noise measurement

Videos & Notes: None

Operating instructions:

Main setting region-Meas-PhaseNoiseAnalysis-On. Or chart region-right click-additional menu-Meas-PhaseNoise.

Figure 6 Phase noise analysis in SWP mode.

4.2 IQ streaming (IQS)

4.2.1 Introduction

In IQS analysis mode, the instrument keeps the LO configuration unchanged to obtain IQ time domain data. User conducts further analysis based on the time domain data such as spectrum analysis, DDC, demodulation etc. The instrument runs under high sample rate to achieve IQ streaming, which generates high data bandwidth. Data bandwidth may exceed the bandwidth capacity of the current physical bus like USB3.0, USB2.0, 1000 Mbps etc., causing blocking of the entire data channel after the instrument cache is stuffed (generally 128 MBytes). In this case, software terminates the current operation and you need to start the software again manually. In IQS recording mode, it is necessary to ensure sufficient bandwidth capacity of the physical bus and write bandwidth of the hard disk. The IQS analysis mode offers the following features:

- IQ time-domain waveforms observation
- IQ time-domain graph observation
- FM demodulation
- FM/AM demodulation

- IQ data record and playback
- Multi-channel DDC

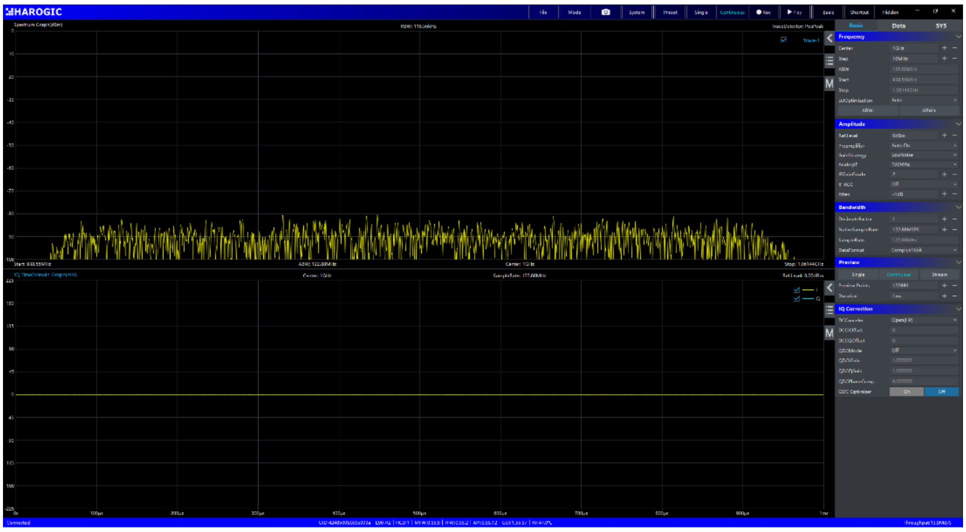


Figure 7 the UI for IQS analysis mode.

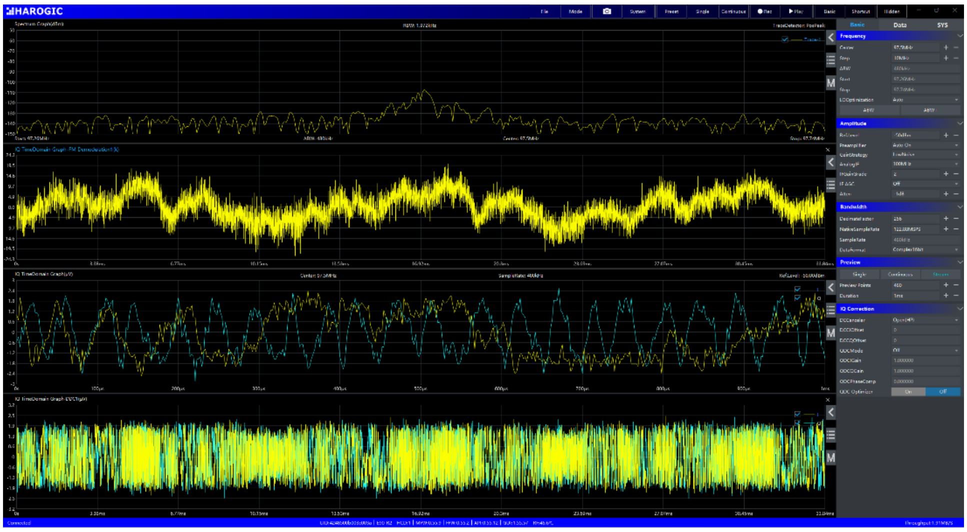


Figure 8 Waterfall graph, DDC nodes, FM/AM demodulation in IQS analysis mode

4.2.2 Data-driven and preview mode

IQS mode provides users with three data-driven mode: single, continue and stream.

In single and continue preview mode, the original IQ data displayed on the UI is organized by non-contiguous fragments. SAStudio4 acquires IQ fragments from the instrument at a frequency of tens of frames per second, and the time domain data inside the IQ fragments is strictly continuous, but the different fragments are discontinuous.

In stream mode, SAStudio4 continuously acquires continuous IQ data from the instrument, a strictly continuous IQ time domain stream. In continuous streaming mode, large data throughput (up to hundreds of MBytes/s) is usually maintained between the host computer and the instrument, and the recording or analysis of high-bandwidth data requires corresponding processing power support. When you perform IQ recording or turns on the demodulation node, the system automatically enters into streaming mode.

4.2.3 the introduction for data nodes

As depicted in the following figure, **node** is the specific concept in IQS mode. Node is introduced in IQS mode base the fact that all information of signal is remained in IQ time domain data. Users can create sub-streams and conduct spectrum analysis or demodulation based on the IQ sub-streams.

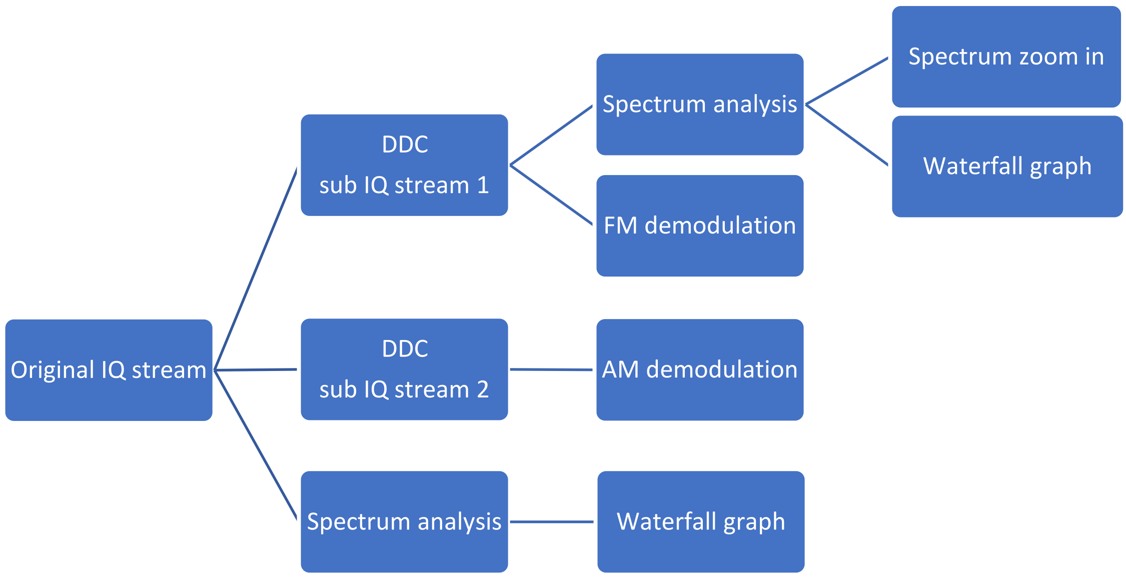


Figure 9 the schematic diagram of IQ stream and nodes.

4.2.4 IQ record and playback

Application version： 4.1.55.46 and later.

Location：	IQS mode-main setting region-data.

Feature overview：	IQ data record and playback.

Videos & Notes:	None.

Operating instructions:

Record:

1: setting the trigger mode

1) Adaptive: in adaptive trigger mode, system will start or end up recording according to the trigger signal (hardware or software triggering). While trigger source is bus, you click the “Start Record” button to start IQ record and click the “Stop Record” button to end up; while the trigger source is external, system waits for the external trigger pin to act, start recording when the external trigger pin rises and end recording when the external pin drop edge arrives.

2) FixedPoints: in fixedpoints mode, the system starts recording according to the trigger signal (hardware or software trigger). Each trigger action initiates a recording and the record duration is determined by record point setting (RecordPoints). While the trigger source is bus, click the “Start Record” to start recording. The recording process is ended when the record points reaches the expected points. You can also click “Stop Record” to end IQ recording forcibly. System responds the “Start Record” and “Stop Record” when the trigger source is bus, while it responds to the action of the external trigger pin when the trigger source is external.

2: click data-record-REC file Path to choose the file path to save IQ data.

3: click “Start Record” to start IQ recording. System will end recording according to the record mode or users click the “Stop Record” to end recording process. IQ data is saved as .iq.wav.

Playback:

1) click “Open REC File” button to open the spectrum file you record; 2) click “start play” button to playback the original spectrum data. Users can stop, end up,

back or forward the playback process. Also you can adjust the playback rate or set auto loop the playback process. If users choose the single playback, the playback UI will return to original IQS UI.

Preview thumbnails: as shown in the following figure, the preview thumbnails will be presented when you open rec file for spectrum playback. In the preview thumbnails, the X axis is the time, Y axis is the maximum power value in the spectrum data at the moment. You can click the preview thumbnails or scroll mouse wheel to reach where you want to observe the spectrum data.

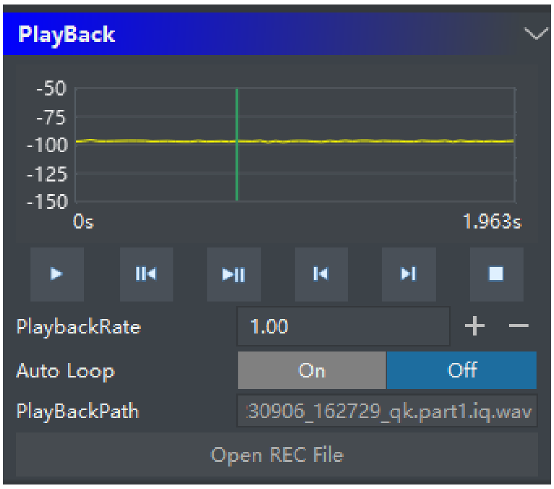


Figure 10 IQS playback preview.

4.2.5 Creating DDC nodes

Application version：	4.1.55.46 and later.
Location：	IQ time domain- chart region-additional menu.
Feature overview：	Original IQ stream-DDC-sub IQ stream-further analysis.
Videos & Notes：	None.

Operating instructions：

IQ time domain graph-right click to open additional menu-create new signal nod-DDC, the IQ time domain graph- DDC1 graph will be displayed on the IQS UI. You can set center frequency, DDC offset frequency, decimate factor on the setting region-Sample on the right side of the DDC1 graph. The frequency offset of complex mix is greater than 0, center frequency is offset to the right, while it is offset to the left when center frequency of complex mix is lower than 0.

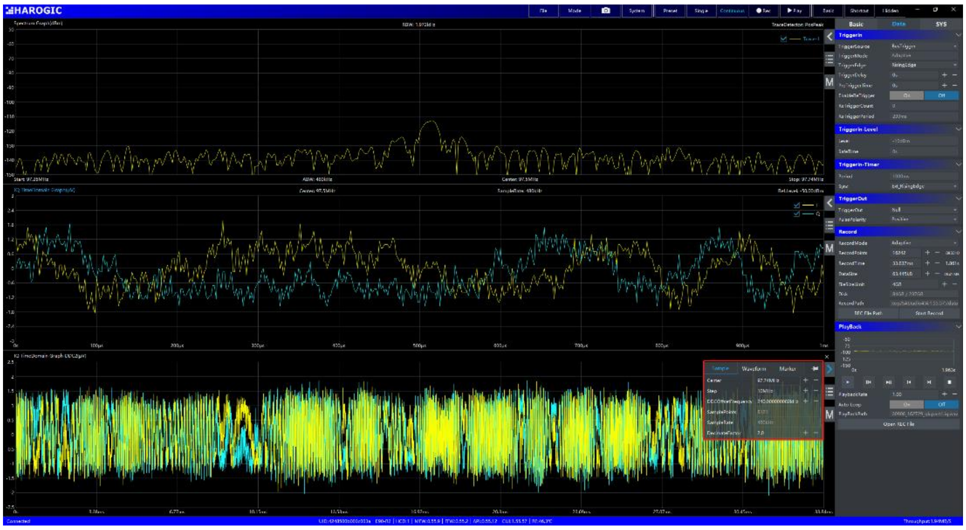


Figure 11 The sub IQ stream generated from original IQ stream via DDC.

IQ time domain graph-DDC1-right click to open additional menu-CreateNewSignalNode-FFT analysis. The IQ time domain graph-DDC1-Spectrum graph 1 is displayed on the IQS UI. The parameters can be configured on the setting region on the right side of this spectrum graph.

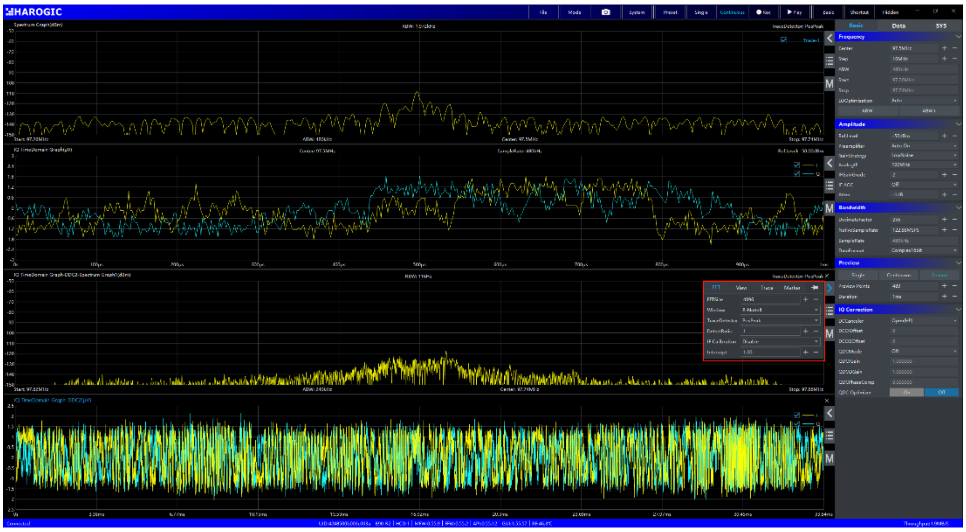


Figure 12 spectrum analysis node from IQ sub stream.

4.2.6 FM and AM demodulation

Application version：　　4.1.55.46 and later

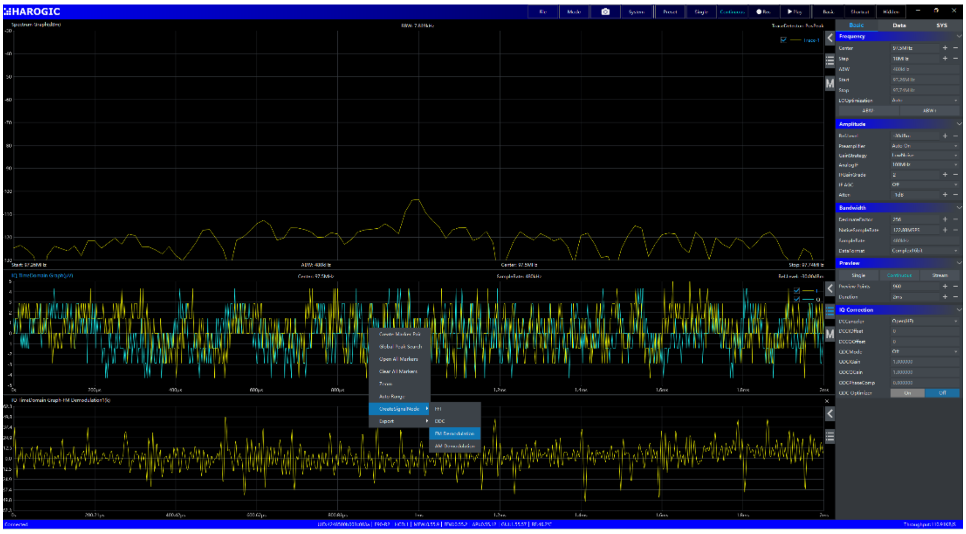
Location: IQ time domain-additional menu

Feature overview: IQ stream-FM/AM demodulation

Videos & Notes: None

Operating instructions:

IQ time domain graph-right click-additional menu-create new signal node-FM demodulation, the FM demodulation1 is displayed on the IQS UI. You can set filter, filter tapped number, cut-off frequency, stopband attenuation on the setting region-Sample on the right side of the FM demodulation1 graph. AM demodulation operation process is the same as FM demodulation.



4.3 Power detection mode (DET)

4.3.1 Introduction

In DET analysis mode, the instrument keeps the LO configuration unchanged to obtain IQ time domain data. User conducts further analysis based on the time domain data such as power detection analysis. The instrument runs under high sample rate to achieve IQ streaming, which generates high data bandwidth. Data bandwidth may exceed the bandwidth capacity of the current physical bus like USB3.0, USB2.0, 1000Mbps etc., causing blocking of the entire data channel after the instrument cache is stuffed (generally 128MBytes). In this case, software terminates the current operation and you need to start the software again manually. In IQS recording mode, it is necessary to ensure sufficient bandwidth capacity of the physical bus and write bandwidth of the hard disk. The DET analysis mode offers the following features:

- Power waveforms observation
- Power waveform record and playback
- Power waveform zooming in

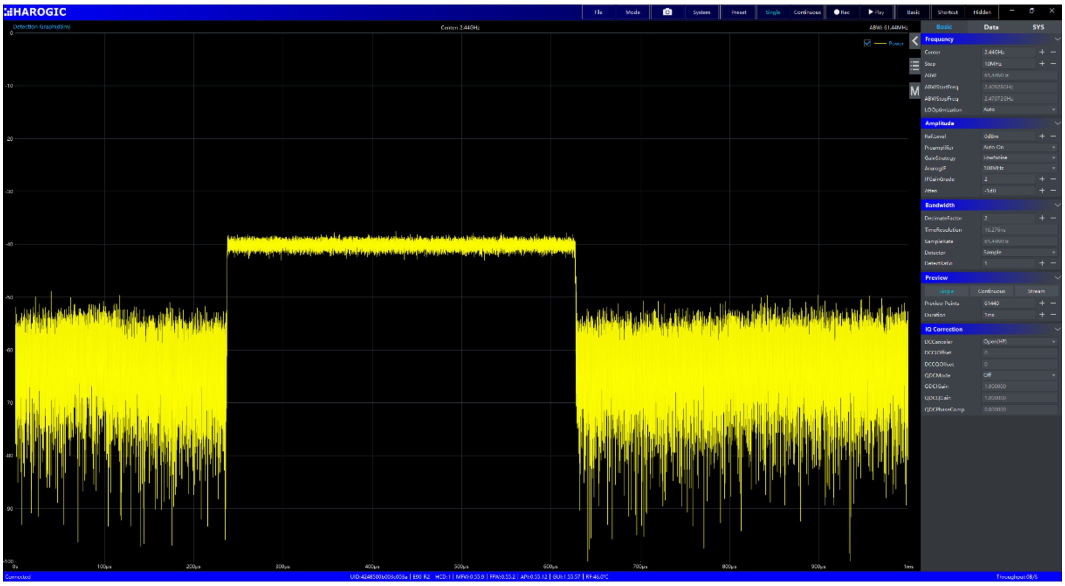


Figure 13 default UI in DET analysis mode.

In DET UI, the waveform chart at the top displays the detected waveform within the current time range and the chart at the bottom displays the result of local zoom of the upper waveform graph.

Data mode in DET analysis mode

DET mode provides users with three data-driven mode: single, continue and stream. In single and continue preview mode, the original IQ data displayed on the UI is organized by non-contiguous fragments. SAStudio4 acquires DET fragments from the instrument at a frequency of tens of frames per second, and the time domain data inside the DET fragments is strictly continuous, but the different fragments are discontinuous.

In stream mode, SAStudio4 continuously acquires continuous DET data from the instrument, a strictly continuous DET continuous stream. In continuous streaming mode, large data throughput (up to hundreds of MBytes/s) is usually maintained between the host computer and the instrument, and the recording or analysis of high-bandwidth data requires corresponding processing power support.

4.3.2 Local zooming operation

Application version: 4.1.55.56 and later.

Location: Detection graph-setting region or Detection graph-additional menu.

Feature overview: Local zoom of DET chart result for observing the details of power waveform.

Videos & Notes: None.

Operating instructions:

Detection graph-right click to open additional menu bar-zoom or Detection graph-setting region to zoom the power waveform for observing the details of the waveform.

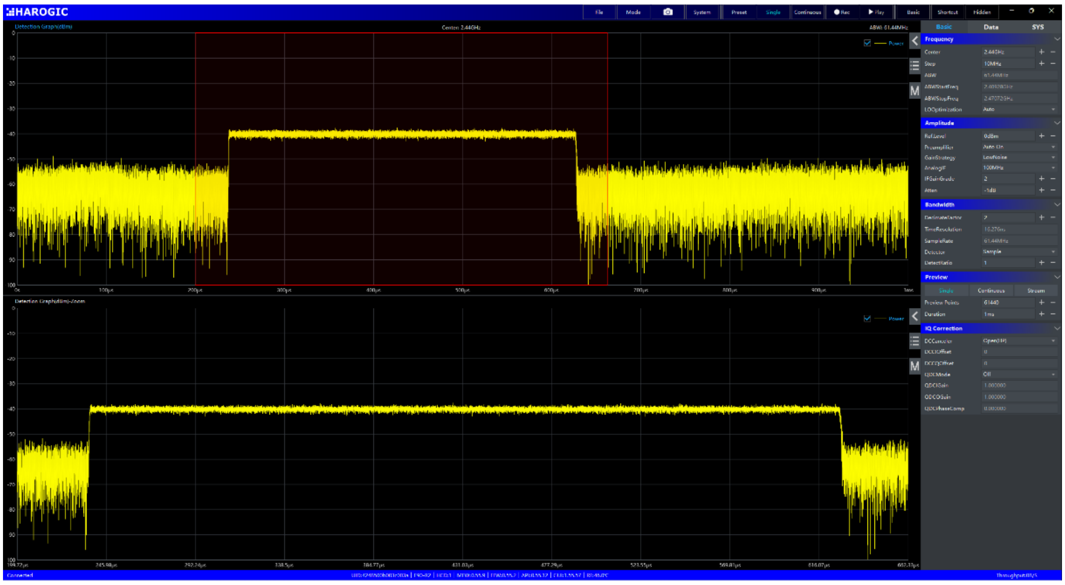


Figure 14 zoom results for Detection graph.

4.3.3 DET record and playback

Application version: 4.1.55.56 and later.

Location: Main setting region-data-record

Feature overview： DET record and playback.

Videos & Notes: None

Operating instructions:

Record: please refer to section 4.2.4. DET data is saved as .det.wav.

Playback: please refer to section 4.2.4.

4.4 Real time analysis mode (RTA)

4.4.1 Introduction

In RTA analysis mode, the instrument keeps the LO configuration unchanged to obtain IQ time domain data. It conducts further FFT analysis based on the time domain data and ensures that every time domain sample is included in at least one FFT analysis. The RTA analysis mod offers the following features:

- real-time spectrum probability density plot observation
- Waterfall graph
- Real-time spectrum recording and playback

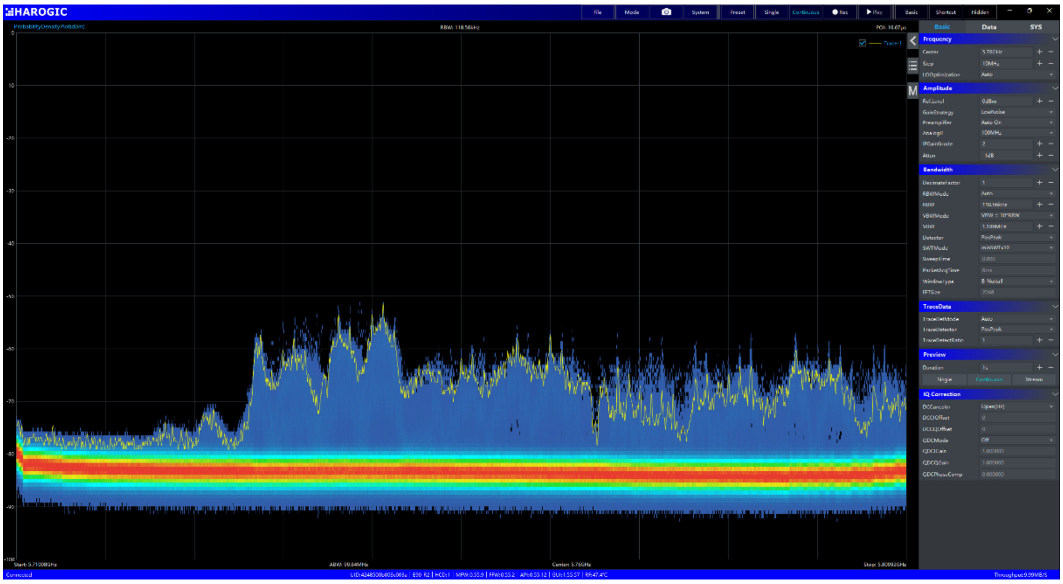


Figure 15 Default UI in RTA analysis mode.

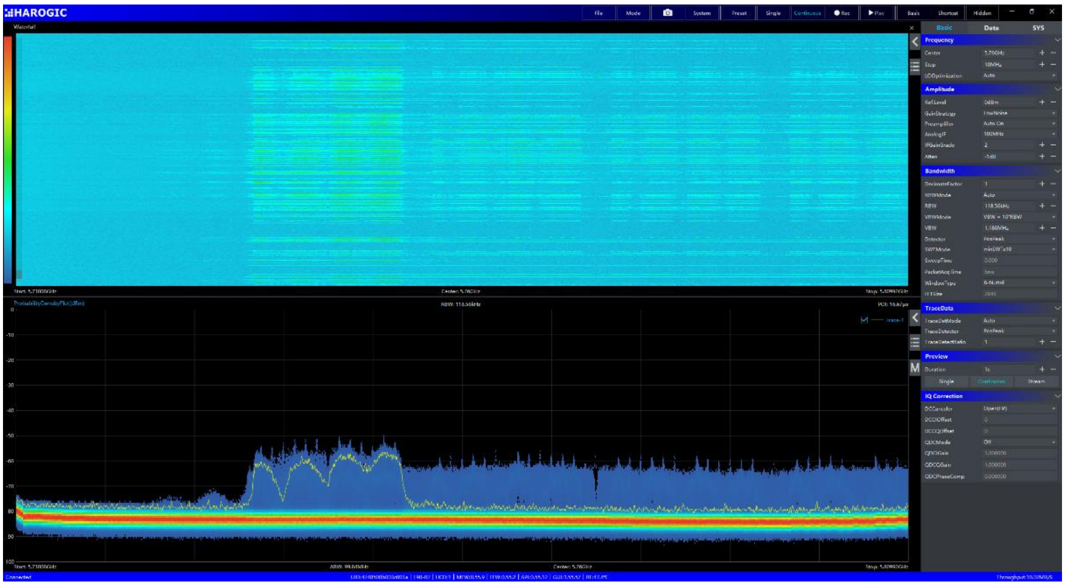


Figure 16 Waterfall graph in RTA mode.

4.4.2 Real time spectrum record and playback

Application version： 4.1.50.40 and later.

Location： Main setting region-data-record

Feature overview： Real time spectrum record and playback

Videos & Notes: None

Operating instructions:

Record： Please refer to section 4.2.4. RTA data is saved as .rtaspectrum.

Playback： Please refer to section 4.2.4.

5. Chart function and operation

The data is displayed in Chart region in SAStudio4, the same chart operation may be supported in various analysis modes. This section gives brief introduction for the chart operation. The detailed guide and notes could be found on the official website and **YouTube**.

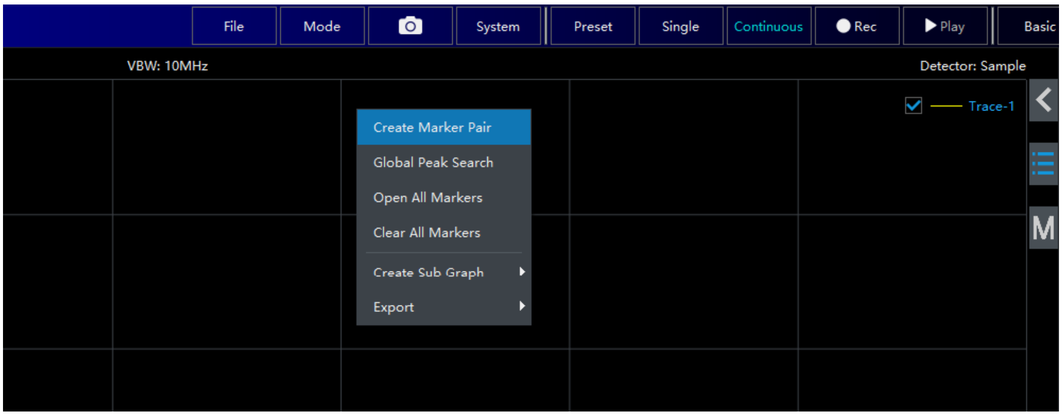
5.1 General operation in Chart

5.1.1 Marker controls

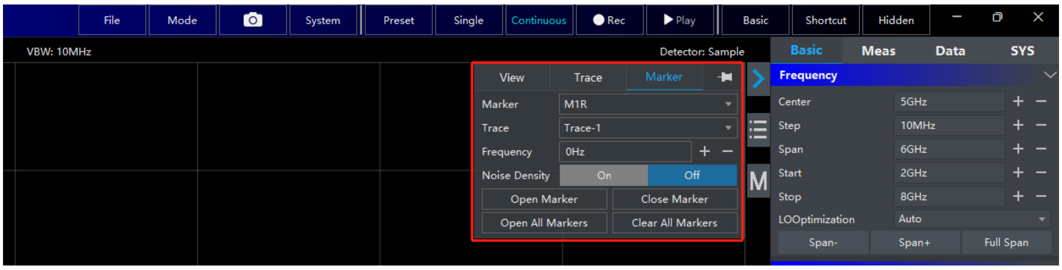
Application version：	4.1.55.46 and later.
Location:	Chart region-additional menu (or setting region).
Feature overview:	Open or close marker.
Videos & Notes:	None.

Operating instructions

Chart region (workstation mode)- right click-additional menu-Create marker. The marker operation includes with marker open and close, global peak search.



The marker operation can also be found in setting region on the right side of the chart.



5.1.2 Local peak searching and marking-double click

Application version： 4.1.55.46 and later.

Location: Chart region.

Feature overview: Local peak searching and marking in Chart region.

Videos & Notes: None.

Operating instructions:

Double click the Chart region where you are interested in.

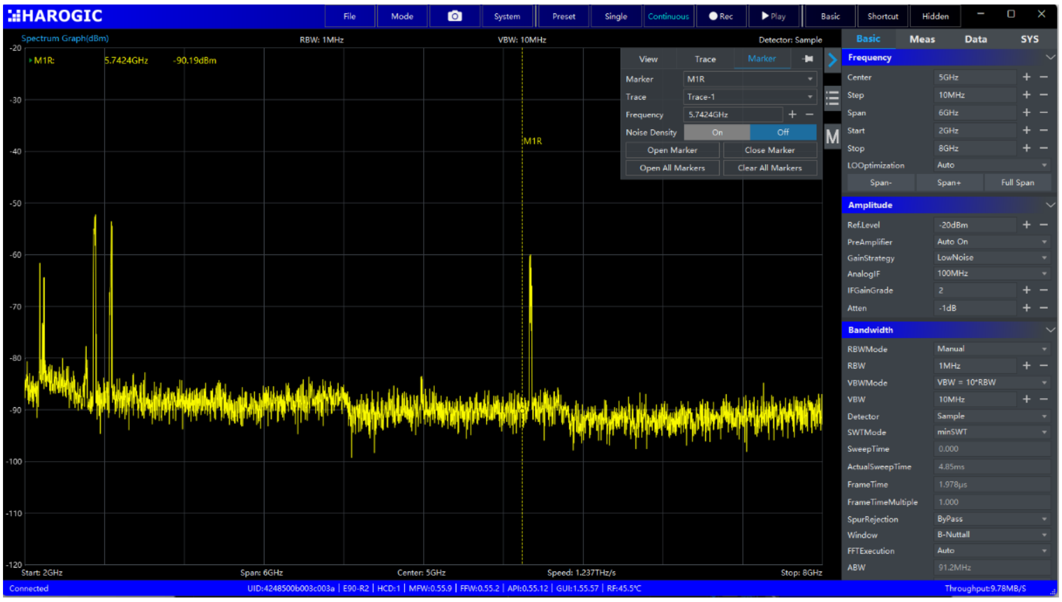


Figure 17 Default UI in SWP mode after mark is activated.

If there is no activated marker on the chart region, system will automatically open a marker and mark local peak value after users double click in the chart region.

5.1.3 Image and data export

Application version: 4.1.55.46 and later.

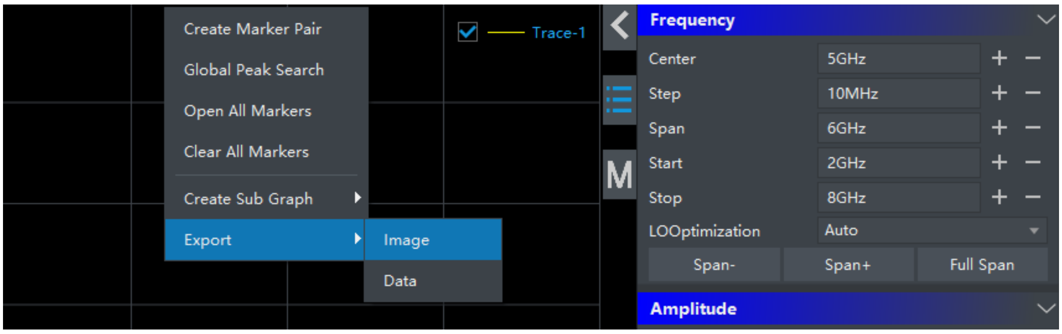
Location: Chart region-additional menu.

Feature overview: Exporting the data as image or csv file.

Videos & Notes: None.

Operating instructions:

Chart region-right click-additional menu- Export-Image or Data.



5.2 Standard spectrum graph

The standard spectrum graph is the common use chart, X-axis is the frequency axis and the Y-axis is the amplitude axis.

5.2.1 Creating waterfall graph

Application version: 4.1.55.46 and later.

Location: Standard spectrum graph-additional menu.

Feature overview: Creating waterfall graph.

Videos & Notes: None.

Operating instructions:

Standard spectrum graph-right click-additional menu-create sub graph-Waterfall Graph.

The waterfall graph is supported in SWP, IQS and RTA mode.

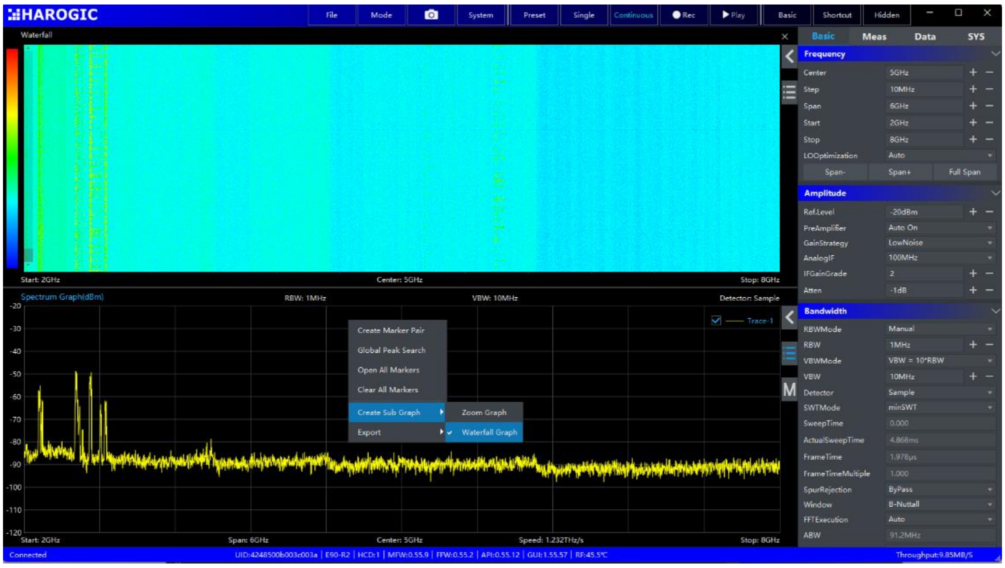


Figure 18 Creating Waterfall graph.

5.2.2 Creating spectrum zoom graph

Application version: 4.1.55.46 and later.

Location: Standard spectrum graph-additional menu.

Feature overview: obtain more spectrum detailed information.

Videos & Notes: None.

Operating instructions:

Standard spectrum graph-right click-create sub graph-zoom graph.

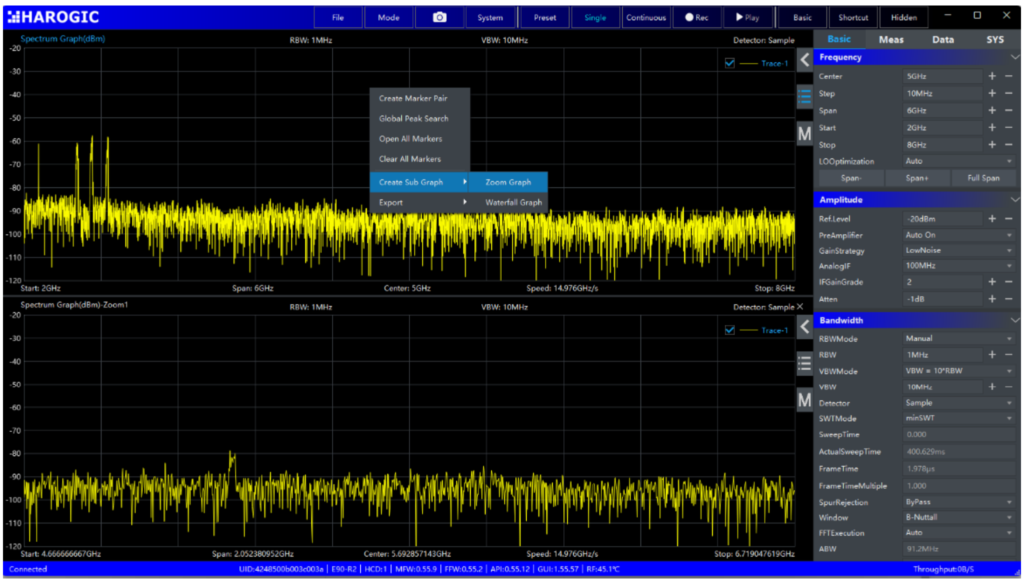


Figure 19 spectrum zoom graph in SWP mode.

Cautions: the trace points of original spectrum will not be changed in spectrum zoom graph. If the original trace points are few, the spectrum information may be inaccurate in spectrum zoom graph.

5.2.3 Trace memory operation

Application version: 4.1.55.46 and later.

Location: Standard spectrum graph -setting region-View.

Feature overview: Remember selected trace at the current moment.

Videos & Notes: None.

Operating instructions:

Standard spectrum graph-the setting region-View-click Memory box.

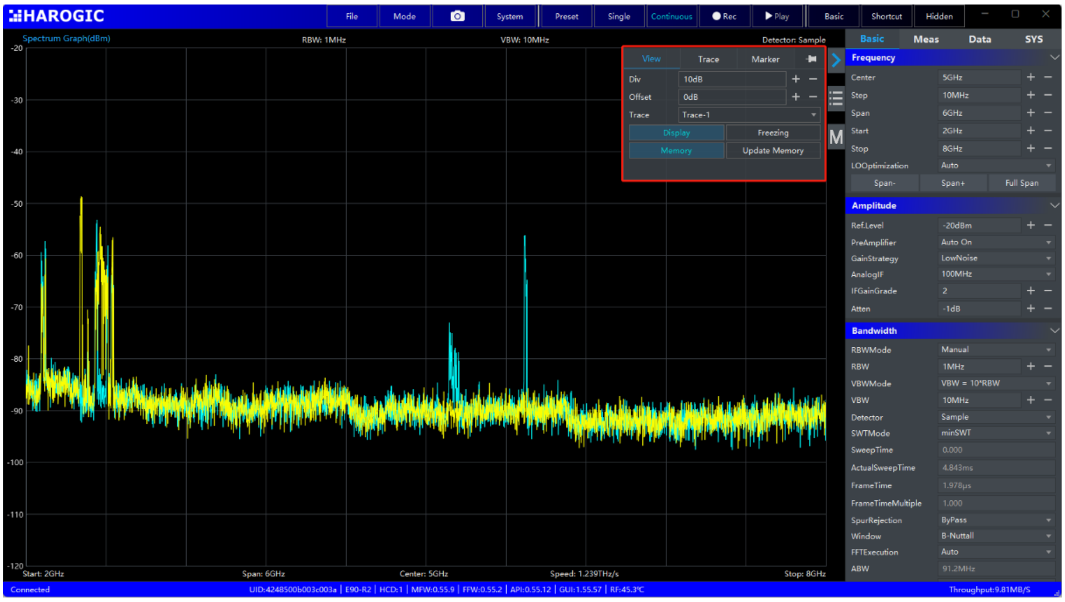


Figure 20 trace memory operation UI in SWP mode.

5.2.4 Multiple trances control

Application version: 4.1.55.46 and later.

Location: SWP mode： main setting region-basic-Trace.

IQS mode： standard spectrum graph-setting region.

RTA mode： setting region-Trace.

Feature overview: Set multiple display traces, such as trace 1 to display the maximum hold value, trace 2 to display the minimum hold value to show the time variation characteristics of the data.

Videos & Notes: None.

Operating instructions:

Setting region-Trace-click add button to add a new trace. Trace 1: MaximumHold, Trace 2: MinimumHold, Trace 3: ClearWrite_Sample

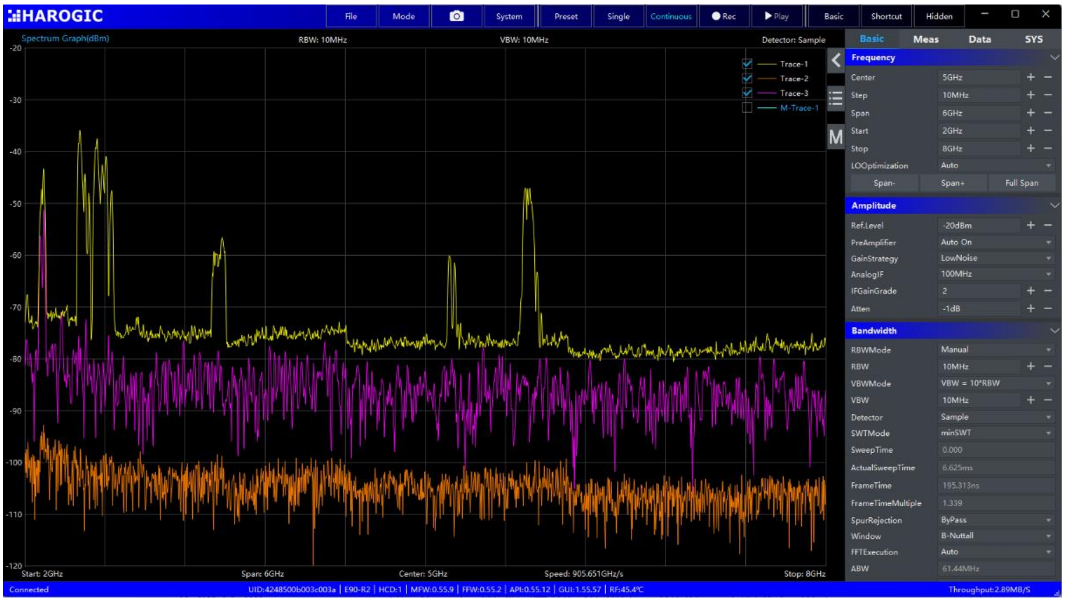


Figure 21 Multiple trace display in SWP mode.

5.2.5 IM3 analysis

Application version： 4.1.55.46 and later.

Location: main setting region-Meas-IM3.

Feature overview: IM3 analysis.

Videos & Notes: None.

Operating instructions:

IM3 mode automatically identifies the signal components and intermodulation products in the spectrum graph, listing the frequency and power information of the signal and intermodulation products, and obtaining the measured IM3 and IP3 values.

Instructions:

1: Input the signal to be measured. For example, use two signal generator to synthesize or an ARB signal source to produce test waveforms and input spectrum analyzer.

2: Configure the frequency, reference level in order to make dual tone signal and its IM3 component fall into the observation frequency range. Please set reasonable analysis parameters to ensure the most accurate possible measurement results.

For example, signal 1 and signal 2 power: -10 dB, frequency internal 1MHz. the measurement parameter recommendation: Span =10MHz，Ref.Level = 0dBm（Large enough to avoid too high an IM3 component on the instrument itself）， Scale/Div = 12dBm， RBW = 10kHz， Window = FlatTop， Detector = PosPeak， TracePoints = 104800， SpurRejection = Enhanced， Enable trace average = 50.

3: main setting region-Meas-IM3 analysis on or Chart region-right click-additional menu bar-Meas-IM3.

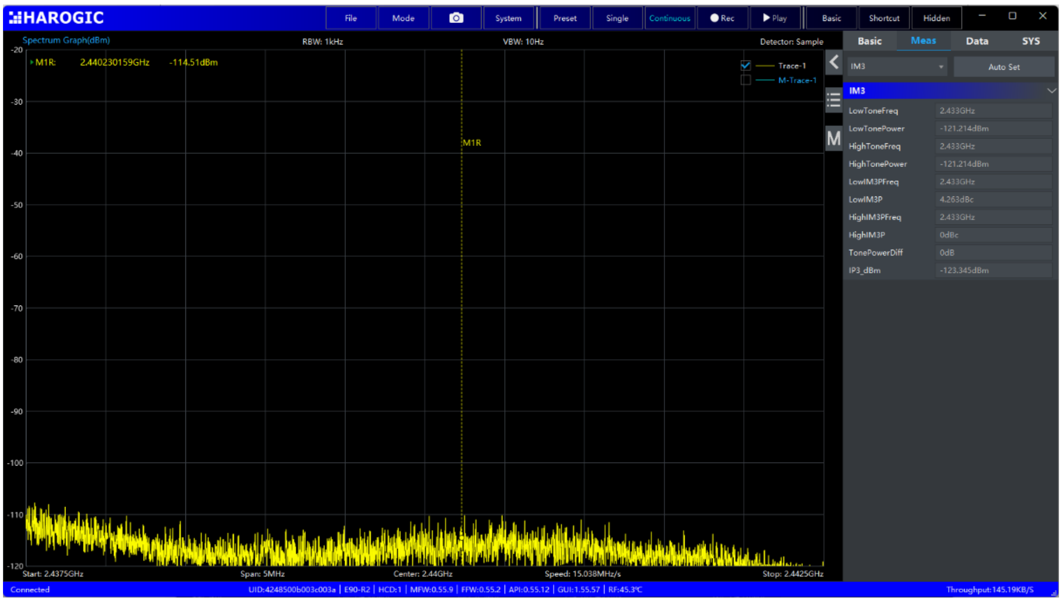


Figure 22 IM3 and IP3 analysis in SWP mode.

5.2.6 Channel power analysis.

Application version: 4.1.55.44 and later.

Location: Main setting region-Meas-ChannelPower.

Feature overview: Channel power analysis.

Videos & Notes: None.

Operating instructions:

Channel power refers to the average power in the frequency bandwidth of the signal, specified as the integrated power within the measured frequency bandwidth. This function measures the channel power by integrating the power density in the channel bandwidth to obtain the average power in the channel bandwidth.

Main setting region-Meas-Channel power analysis on or Chart region-right click-additional menu-Meas-Channel power. Configure the center frequency and meas bandwidth to get the channel power and power density within this bandwidth. You can move the red box to change the center frequency and bandwidth. The RBW should be small relative to the channel bandwidth to ensure accurate measurement, usually set to 1%~3% of the channel bandwidth. Channel power measurement should be made using RMS detection (basic-analysis-trace detector), and the results obtained from RMS detection can be calculated to obtain true in-channel average power.

Figure 23 Channel power measurement result in SWP analysis mode.

5.2.7 Adjacent channel power ratio (ACPR) analysis

Application version: 4.1.55.46 and later.

Location: Main setting region-Meas-ACPR analysis.

Feature overview: ACPR analysis of the target signal

Videos & Notes: None.

Operating instructions:

Main setting region-Meas-ACPR analysis.

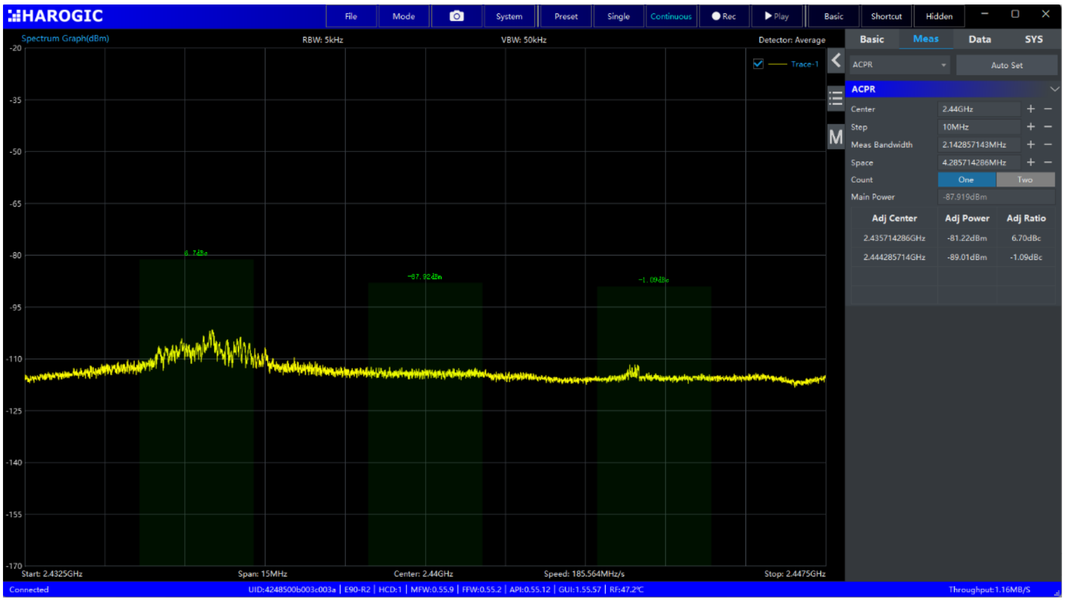


Figure 24

5.2.8 Occupied bandwidth (OBW) analysis

Application version: 4.1.55.46 and later.

Location: Main setting region-Meas-OBW analysis.

Feature overview: OBW analysis of the signal.

Videos & Notes: None.

Operating instructions:

Main setting region-Meas-OBW analysis-On.

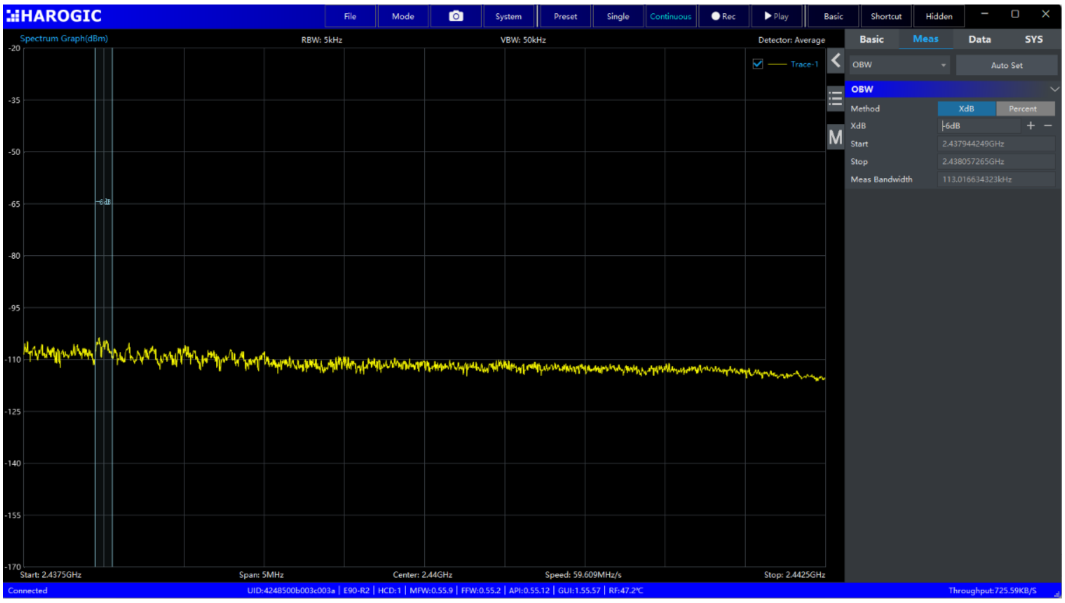


Figure 25 OBW analysis in SWP mode.

5.2.9 Phase noise display in marker view.

Application version: 4.1.55.46 and later.

Location: Standard spectrum analyzer-setting region-marker-phase noise. (only DELTA marker).

Feature overview: The def marker is displayed as a 1Hz normalized value to the ref marker. Single-sideband phase noise for quick and easy measurement of signals.

Videos & Notes: None.

Operating instructions:

1: Chart region-right click -additional menu bar-create marker pair. Use MARK-Ref to mark the carrier and MARK-Delta to mark the frequency offset position to be measured.

2: setting region-Marker- MARK-Delta-Phase noise. The numerical display of MARK-Delta normalizes the resolution bandwidth (RBW). For example, the original value of the MARK-Delta is -80 dBc, RBW = 1 kHz, then after checking the phase noise curb function, the value of the MARK-Delta will be displayed as -110dBc/Hz.

To measure phase noise more accurately, it is also necessary to reasonably set the average of traces (setting region-Basic-Trace), the number of trace points, and the detection method in addition to turning on the phase noise display of the Marker. For phase noise testing, it is recommended to turn on trace averaging (50~100 times), use more trace points (more than 2000) and use sample detection.

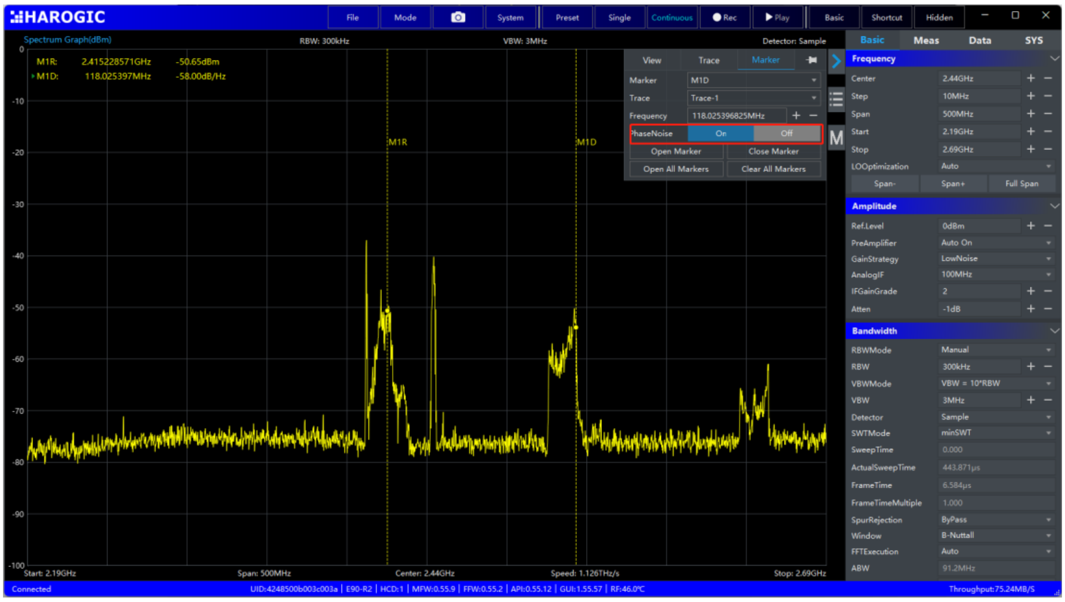


Figure 26 Phase noise analysis in SWP mode.

5.2.10 Density noise display of the marker

Application version: 4.1.55.46 and later.

Location: Standard spectrum graph-setting region-Marker-density noise. (Only REF marker).

Feature overview: The reference marker is displayed as a 1Hz normalized value to quickly measure the noise density at a certain frequency point.

Videos & Notes: None.

Operating instructions:

Chart region-double click to open a reference marker-setting region-Marker-Density Noise.

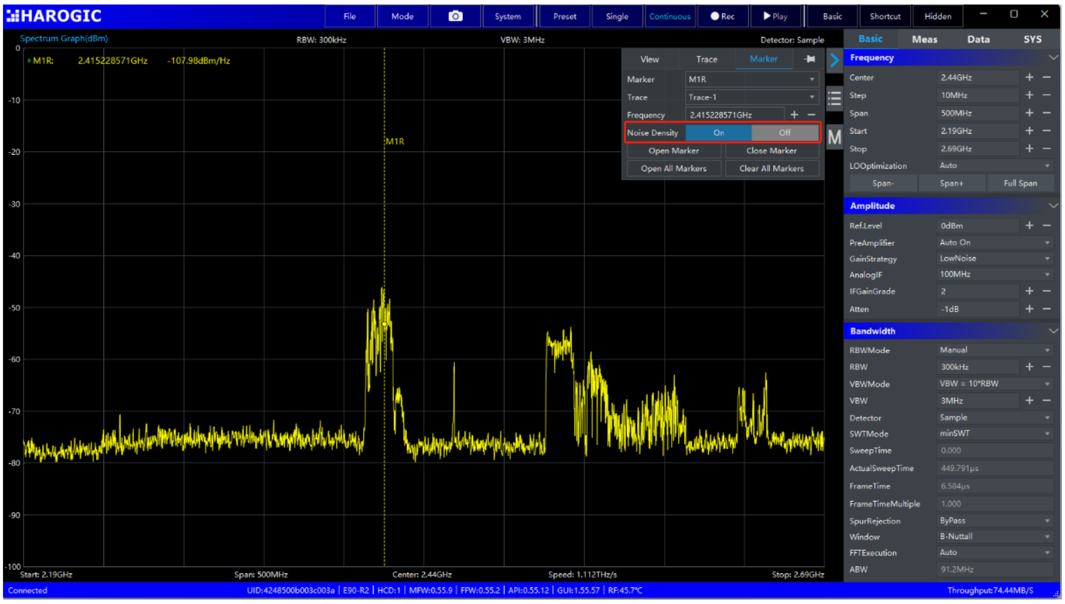
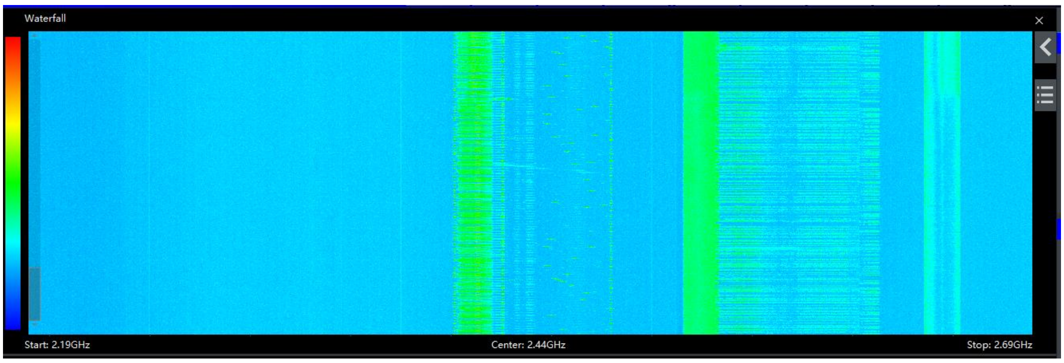


Figure 27 Density noise analysis in SWP mode.

5.3 Waterfall Graph

In waterfall graph, X axis is the frequency axis, the Y axis is the time axis, and the color depth indicates the power intensity. The waterfall graph additional menu allows you to set the color, time density, and marker of the waterfall graph. Use the right-click menu to pause, resume, clear, create markers, and export images on the waterfall graph.



5.4 Time domain waveform graph

In time domain waveform X axis is the time axis and the Y axis is the signal voltage, which is used to display the time domain waveform of digital IQ.

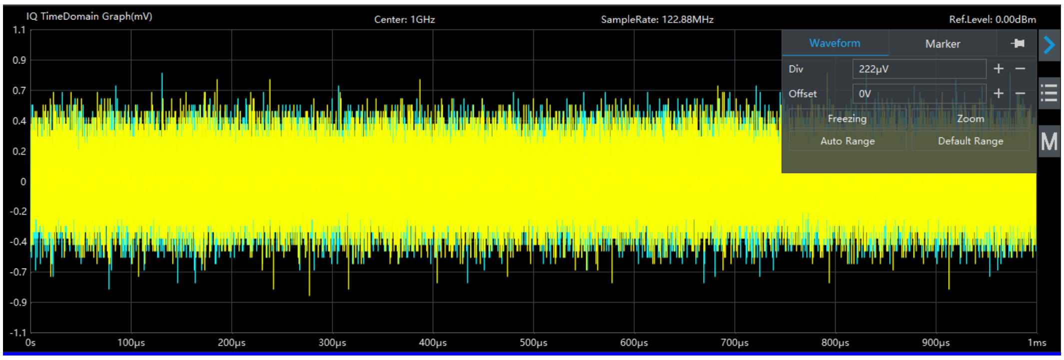


Figure 28 - Time domain waveform graph in IQS mode.

5.4.1 Creating FFT analysis node from time domain graph

Application version： 4.1.50.40 and later.

Location: Time domain graph-additional menu-create new signal node.

Feature overview: FFT analysis based on IQ time domain data.

Videos & Notes: None.

Operating instructions:

Time domain graph-additional menu-create new signal node-FFT analysis.

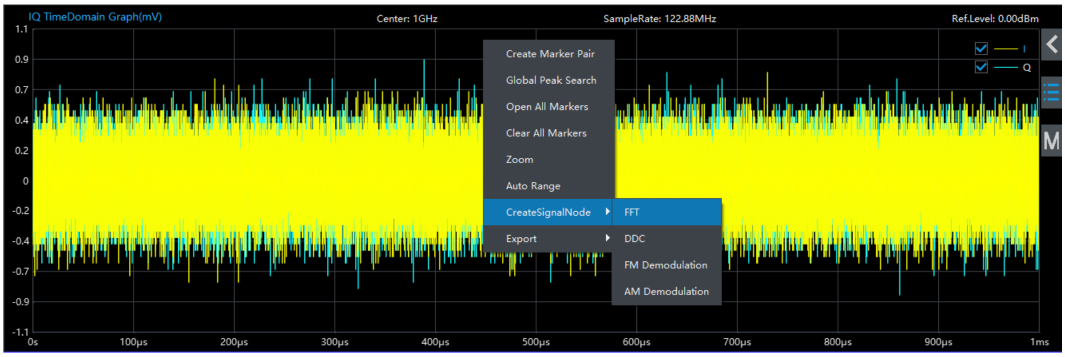


Figure 29 spectrum graph created from time domain IQ graph.

5.4.2 Creating DDC node from time domain graph

Application version: 4.1.50.40 and later.

Location: IQ time domain graph-additional menu-create new signal node.

Feature overview: DDC of the IQ signal and multiple DDC nodes is available.

Videos & Notes: None.

Operating instructions:

Time domain graph-additional menu-create new signal node-DDC.

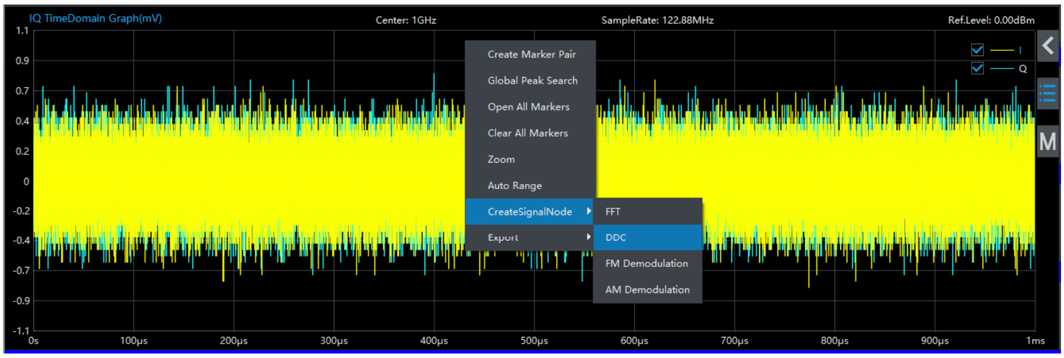


Figure 30 DDC analysis from IQ time domain graph.

5.4.3 Creating demodulation node from time domain graph

Application version: 4.1.50.40 and later.

Location: IQ time domain graph-additional menu-create new signal node.

Feature overview: Demodulation of IQ data.

Videos & Notes: None.

Operating instructions:

IQ time domain graph-right click-additional menu-create new signal node-FM demodulation/AM demodulation.

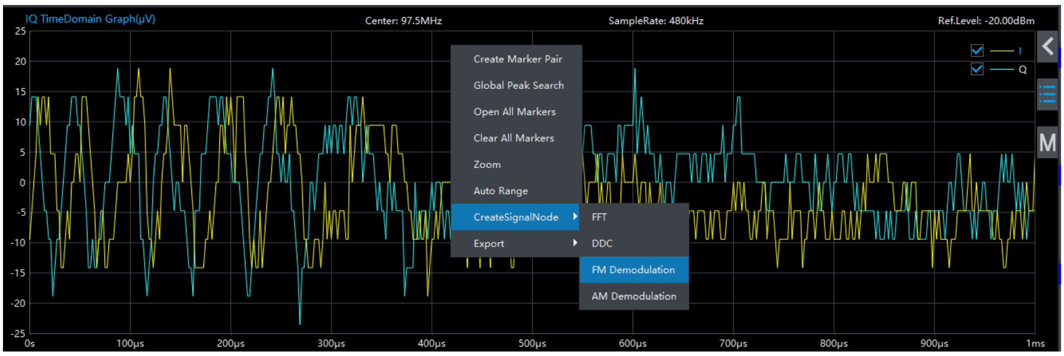


Figure 31 schematic diagram for opening FM demodulation process.

Figure 32 FM demodulation analysis in IQS mode.

5.5 Power waveform graph

The power waveform describes the change of signal power (specified analysis bandwidth) over time. The X axis is time and the Y axis is signal power.

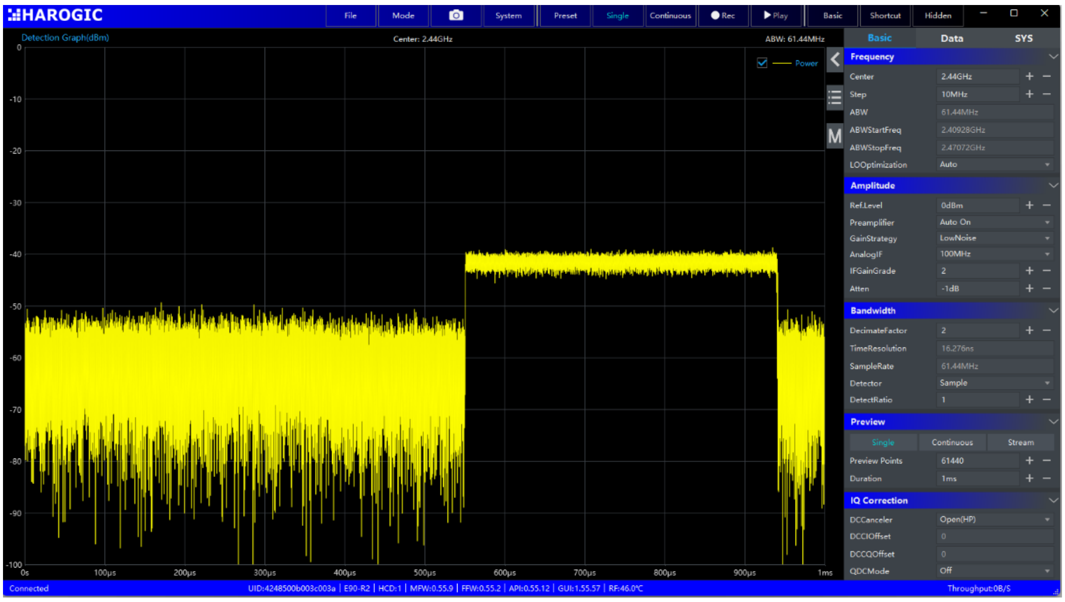


Figure 33 Power waveform graph.

5.5.1 Creating Detection graph zoom.

Application version: 4.1.50.40 and later.

Location: Detection graph-additional menu-Waveform-Zoom.

Feature overview: The details of the power waveform are magnified to observe dynamic changes in more detail, such as the rise and fall of the pulse waveform.

Videos & Notes: None.

Operating instructions:

Detection graph-additional menu-Waveform-Zoom. When zoom is enabled, the main waveform graph will display a column range of the magnified area. You can adjust this region by mouse dragging and the scroll wheel.

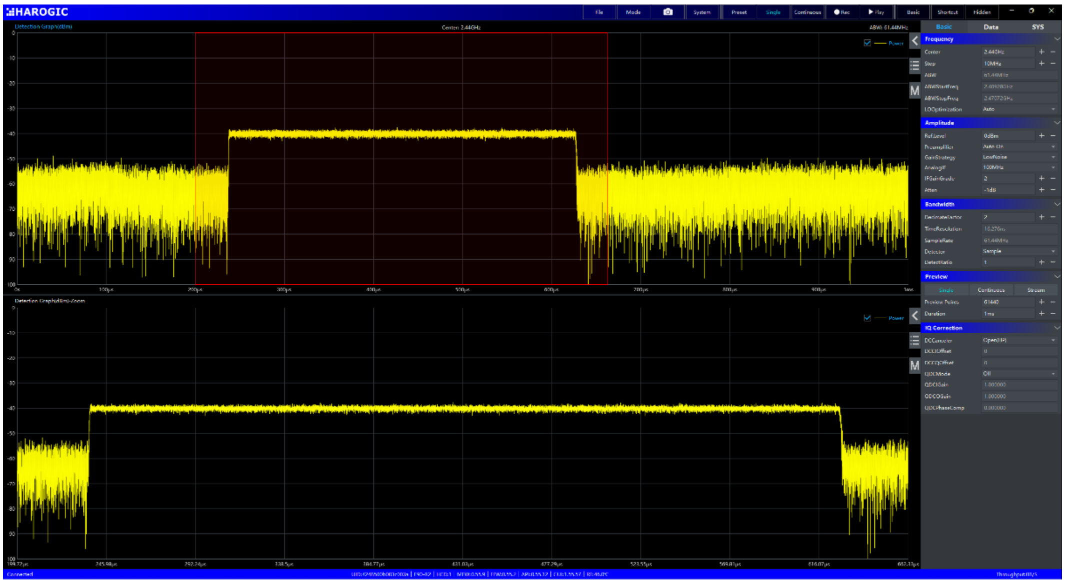


Figure 34 The UI in DET mode after enabling zoom.

5.6 Probability density plot

In probability density plot, X axis is the frequency, Y axis is power, and the color depth represents the repetition rate of the signal in a specified time.

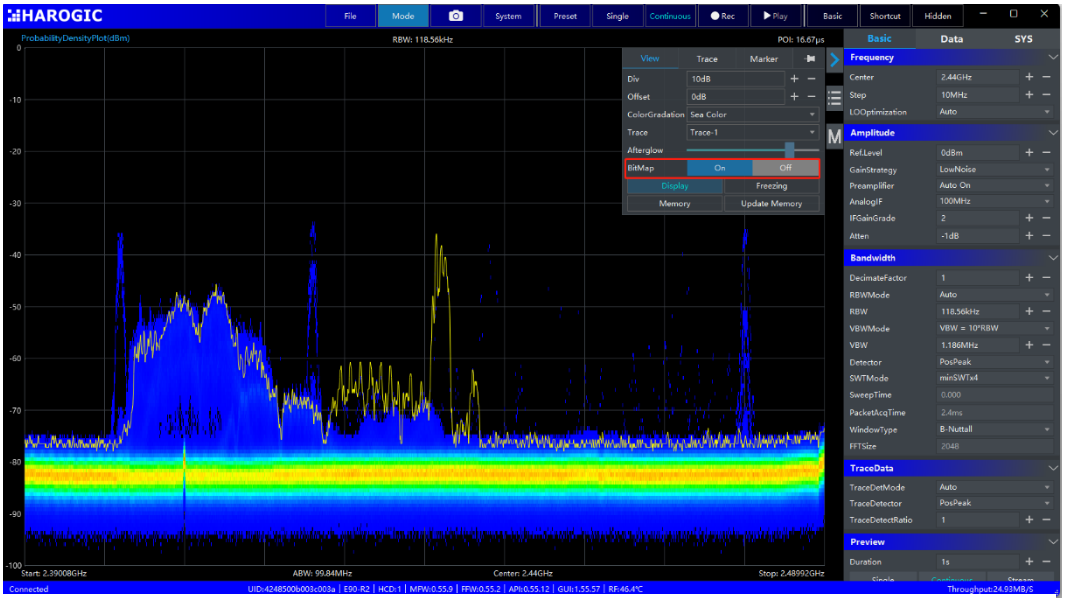


Figure 35 UI in RTA mode after probability density plot is enabled.

5.6.1 Creating waterfall graph

Application version： 4.1.38.0 and later.

Location: Probability density plot-additional menu.

Feature overview: Creating waterfall graph

Videos & Notes: None.

Operating instructions:

Probability density plot-right click-additional menu-create sub graph-waterfall graph.

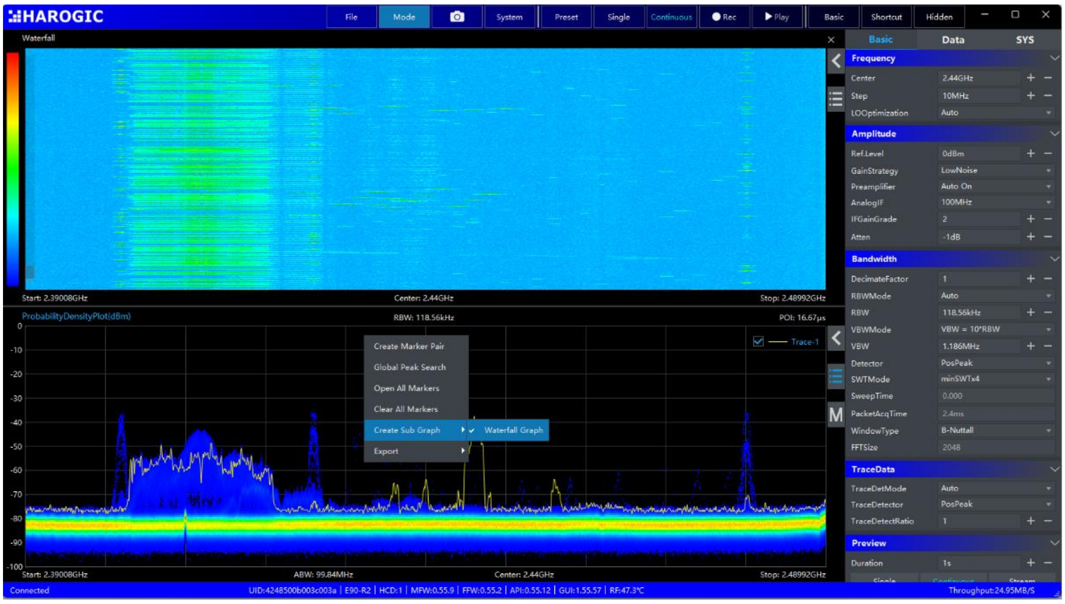


Figure 36 UI in RTA mode after creating waterfall graph.

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SAStudio4 User Manual