



Getting the Most Out of Your X-Series Signal Analyzer

Highlighted features of the multi-touch user interface

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Introduction

Keysight's launch of the Multi-touch Graphical User Interface (GUI) for the X-Series Signal Analyzers in 2014 built upon Keysight's long history of innovation in Spectrum/Signal Analyzers that spans back to the late 1960s with the introduction of the first spectrum analyzer, the 8551A. X-Series Signal Analyzers first launched in 2006 with the N9020A MXA which built upon the PSA Series Spectrum Analyzer that was first launched in 2000 and incorporated the first all-digital IF analyzer architecture. The Multi-touch GUI allowed for a larger screen for Signal Analyzers and a more intuitive approach to using gesturing and on-screen control. The number of instrument buttons/hard keys was also reduced over what was present for the previous legacy GUI.

On-screen gesturing for the Multi-touch GUI is like what is used for smart phones. On a smart phone you can use a single touch or swipe on the screen, or you can use more than one touch point at a time by pinching to zoom out or zoom in. Similar gesturing can be used on the analyzer to help quickly set up a measurement and adjust the center frequency, span, and reference level for the signal of interest. The X-Series Signal Analyzers utilize a capacitive display that allows for multiple touch points at a time. Prior to capacitive displays, older touch analyzers utilized resistive displays that only allowed for a single touch point at a time and replicated the functionality of a computer mouse.

This application note will showcase key features of the Keysight X-Series Multi-touch Signal Analyzers.

Background Information

The Multi-touch GUI is made up of the Screen Tab Bar at the top, and the Measurement Bar below it, and the Graph Pane below that. The Measurement Display encompasses both the Measurement Bar and Graph Pane. Below the Measurement Display is the Bottom Bar. To the right of the Measurement Display is the Menu Panel.

The multi-touch user interface is broken up into the following sections.



Figure 1. Multi-touch GUI layout

The Multi-touch GUI allows for multiple Screen Tabs. Screen Tabs can be comprised of different measurement applications. Legacy analyzers essentially had one Screen Tab with only one measurement application active at a time. For the Multi-touch GUI, the Menu Panel changes based on the active menu selection. The Multi-touch GUI accommodates users who are familiar with older analyzers with dedicated hard keys; however, you can access all the measurement settings using only the touch screen. The Measurement Bar gives you quick access to the most important measurement settings by allowing you to view or alter them with a single press.

Gesturing

Multi-touch user interface introduces the concept of gesturing like that seen in smart phones.

For the example below, we have connected a simple dipole antenna to the input of our analyzer to be able to view the ambient radio frequency (RF) signals in the room. The RTSA application intuitively shows a density trace of the spectrum. We can use gesturing to zoom into the 2.4 GHz WLAN signal circled in red. Swiping left increases the center frequency to center the display on the signal of interest.

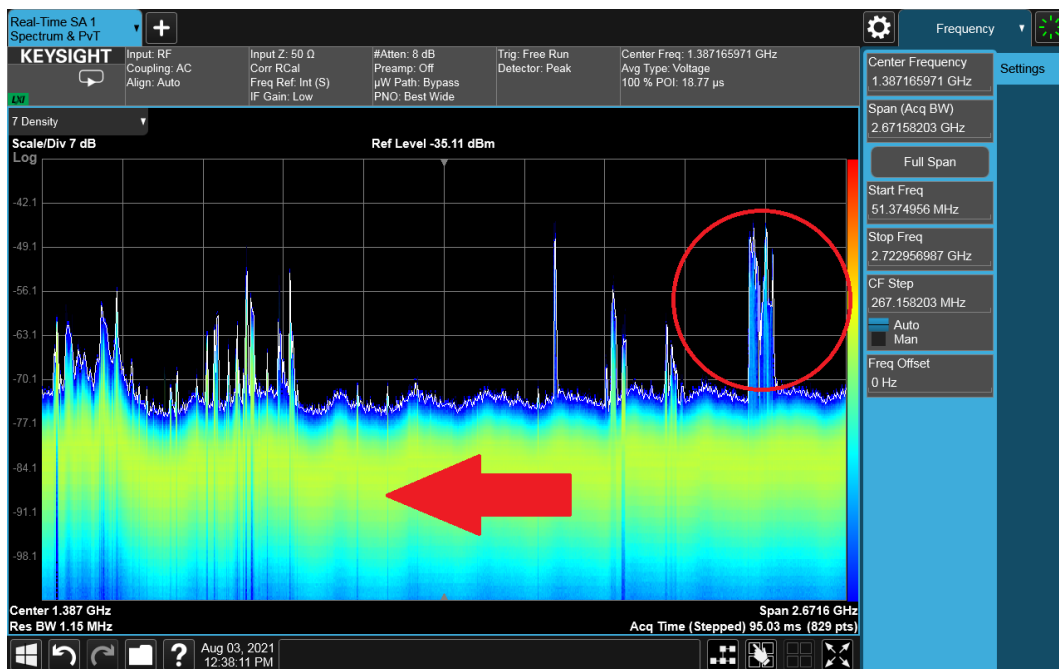


Figure 2. Swiping left gesture

Once the signal is centered, pinching out zooms in on the display, reducing the frequency span.

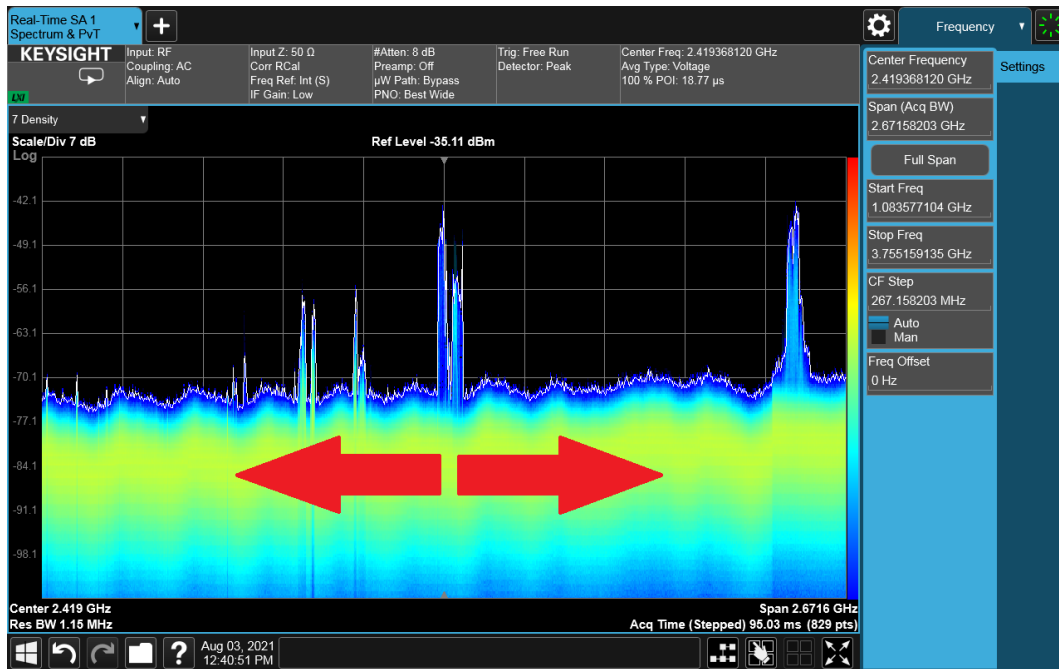


Figure 3. Pinching out gesture

You can also quickly decrease or increase the reference level by swiping up or down.

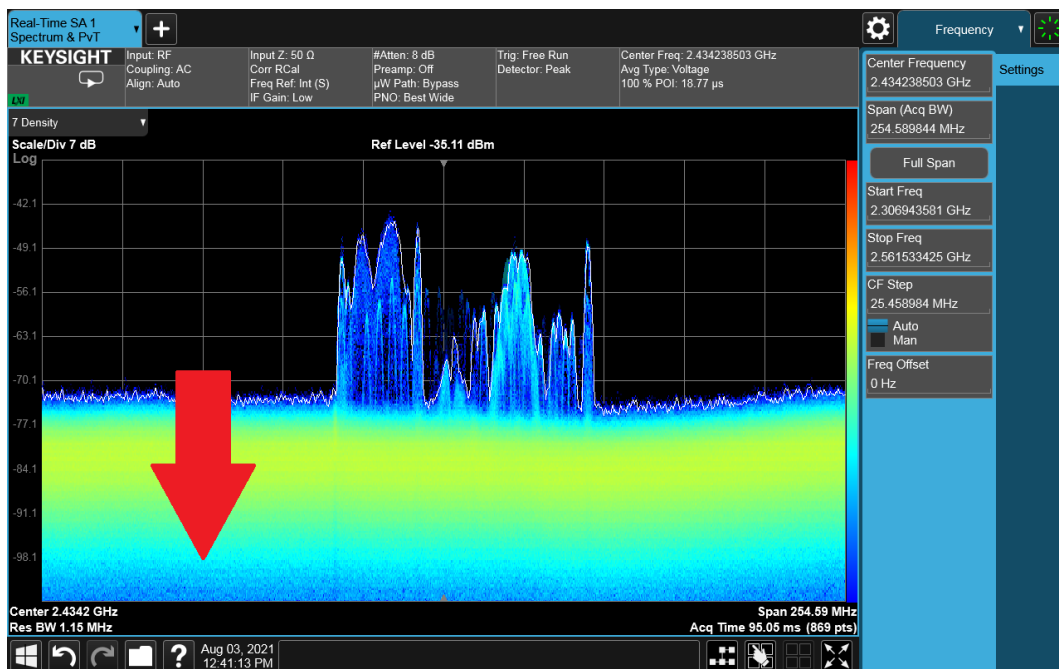


Figure 4. Swiping up/down gesture

Annotation Hot Spots

In the Measurement Bar, Annotation Hot Spots serve as shortcuts to quickly change the parameters shown without having to go to the associated Menu panel setting. Annotation Hot Spots are also available in other parts of the Measurement Display including the Center Frequency, Res BW, Video BW, Span and Sweep settings.

After making a change to a setting in a Hot Spot panel, press outside the panel to exit the selection.

Annotation Hot Spots are convenient, easy to use, and they work in all modes and measurements. They are most useful in Full-Screen mode when the Menu panel is hidden.

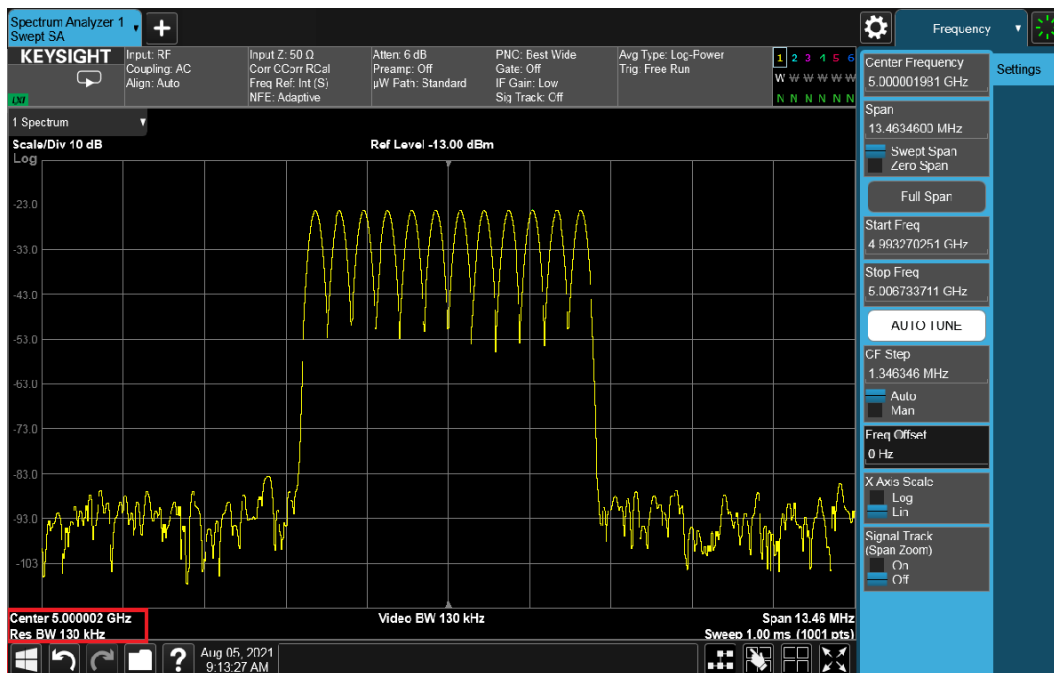


Figure 5. Accessing Center Frequency and Res BW hotspot

After selecting Center Frequency, the Hot Spot panel will appear as shown in Figure 6.

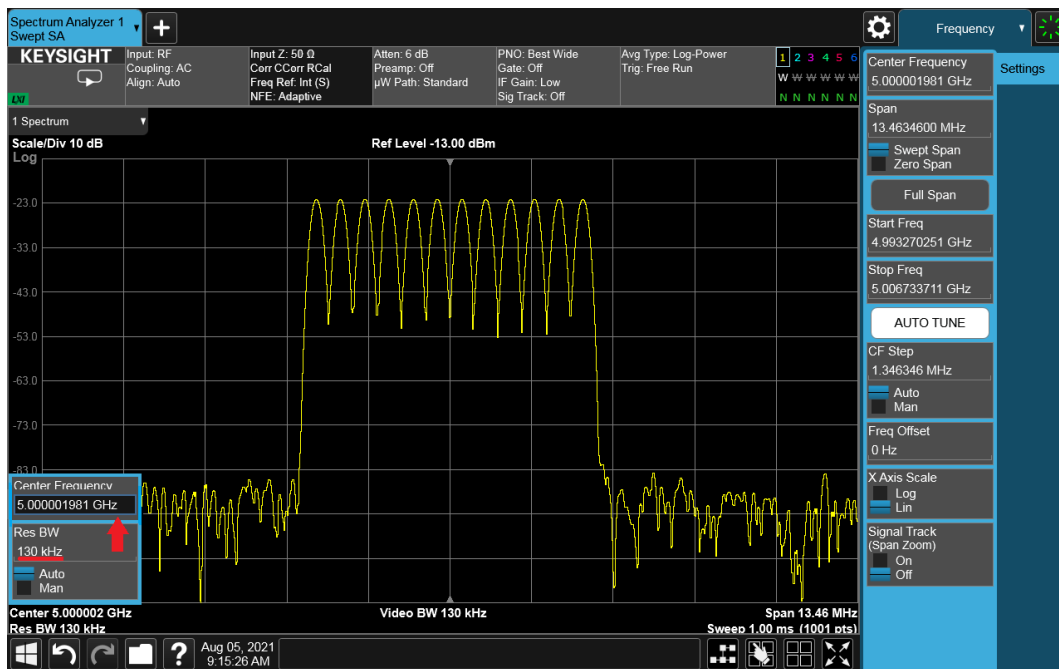


Figure 6. Corresponding hotspot panel for Center Frequency and Res BW

Selecting the settings in the Hot Spot panel allows you to change them, as seen in Figure 7.

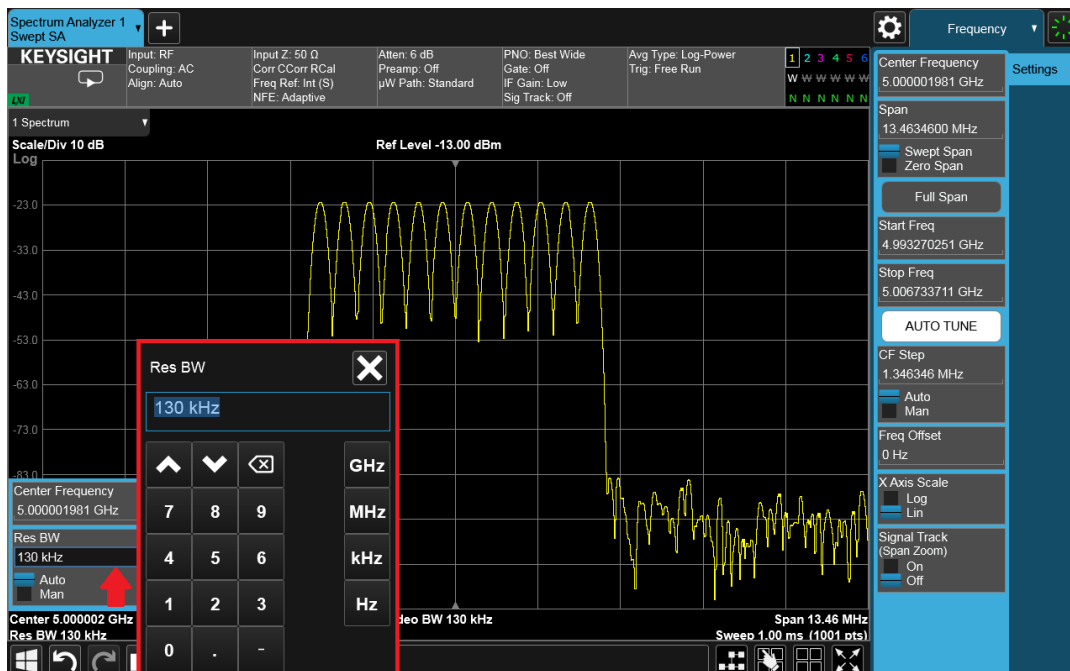


Figure 7. Accessing Res BW numeric entry panel in hotspot panel

Selecting the Trace Detector Hot Spot allows for easy setup of Trace Type, View/Blank, and Detector.

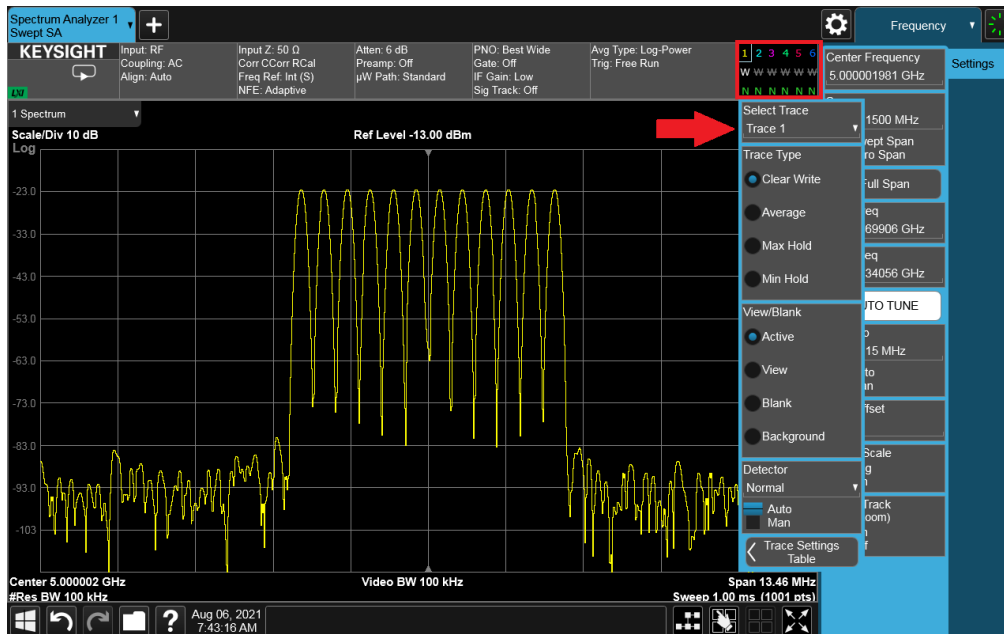


Figure 8. Demonstration of Trace settings hotspot panel

Trace Features

Since the introduction of X-Series Signal Analyzers, it has been possible to have up to six traces with independent detectors displayed simultaneously. The Trace Settings table in the Multi-touch GUI makes it simple to quickly make changes to these settings. Select the Trace Settings table as shown below.

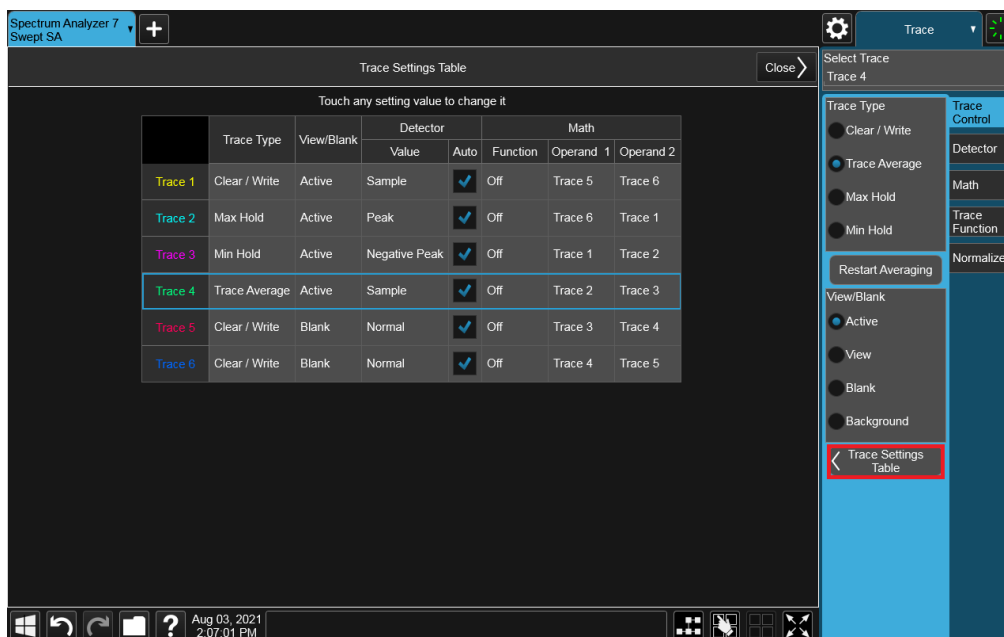


Figure 9. Trace Settings table

The resultant display from the Trace Settings table looks as follows.

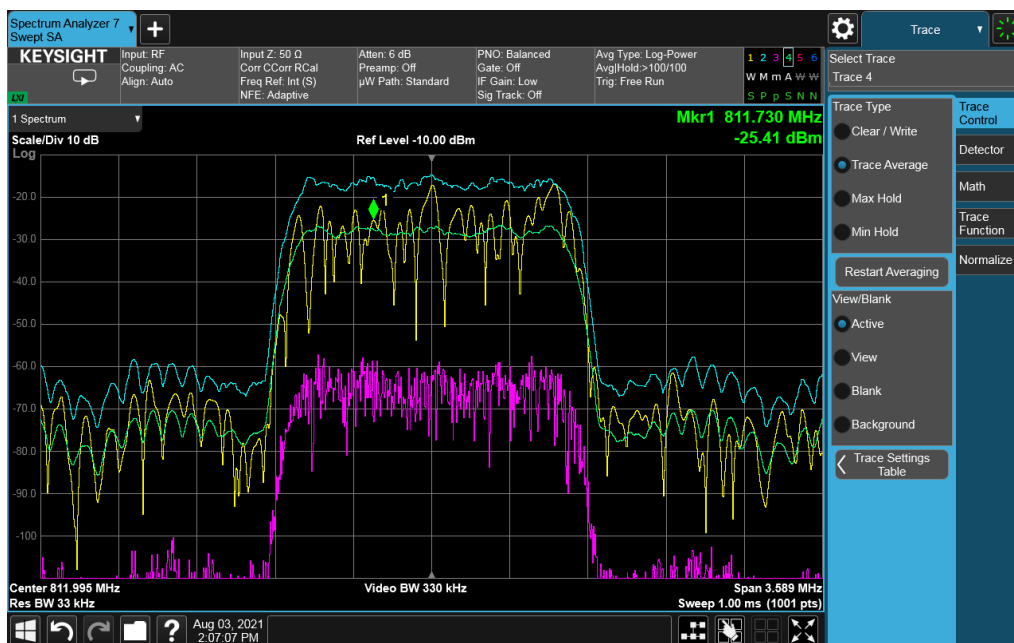


Figure 10. Different trace types displayed at one time

Marker Settings

The Multi-touch GUI provides additional on-screen marker control. In the example below, we have turned on a marker and delta marker. Both markers are at the center of the display. You can select overlapping markers to toggle through which one is the active marker.

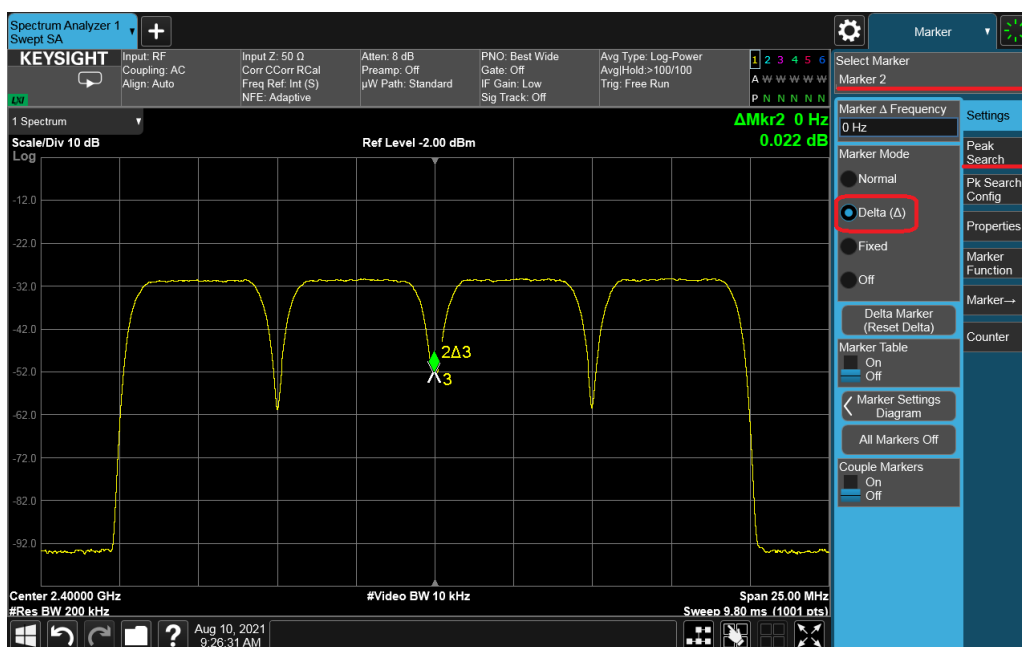


Figure 11. Toggling overlapping markers

After selecting the appropriate marker to make it active, you can easily move it to the desired position on screen.

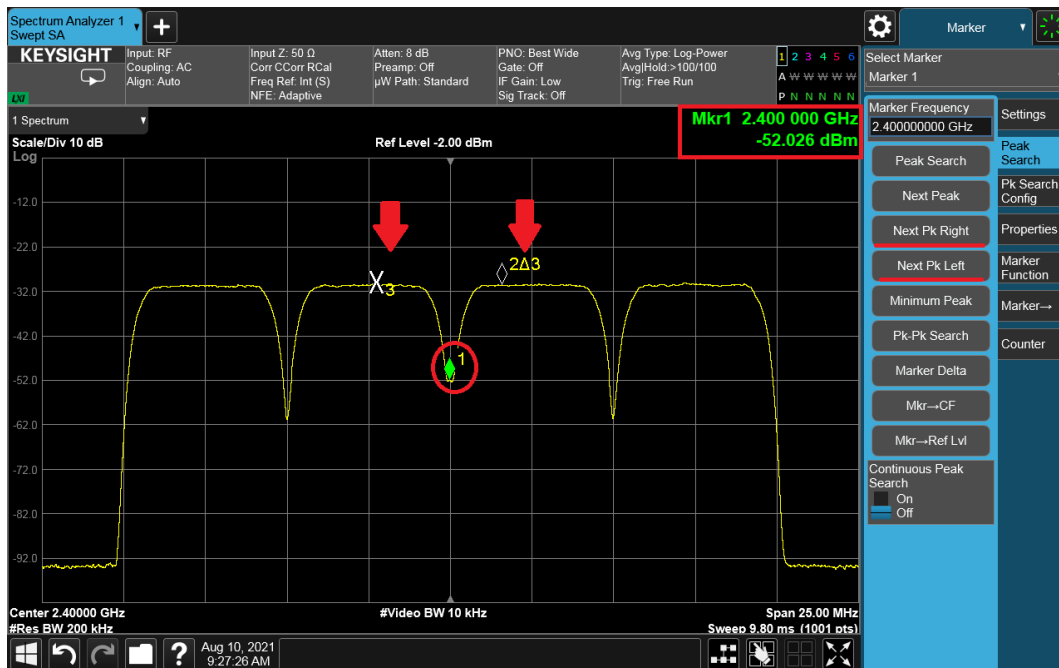


Figure 12. Peak Search example with multiple overlapping markers

The Multi-touch GUI has a convenient Marker Settings Diagram to easily change Marker Modes and Marker Trace settings.

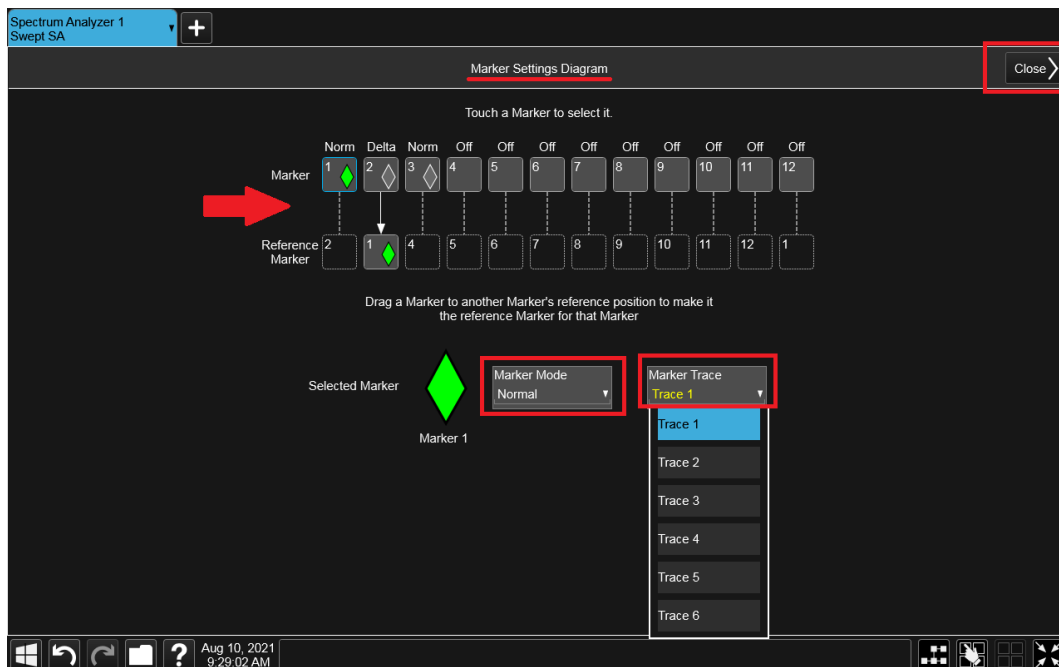


Figure 13. Marker Settings Diagram

Trigger Settings Diagram

Like the Trace and Marker Settings tables, the Trigger Settings Diagram provides an easy way to view and change Trigger, Gate, and Periodic Sync Source settings in one menu. The diagram updates and provides different choices based on the Measurement Mode and Application.

While in the RTSA application, choose Frequency Mask Trigger (FMT) from the Trigger Settings Diagram.

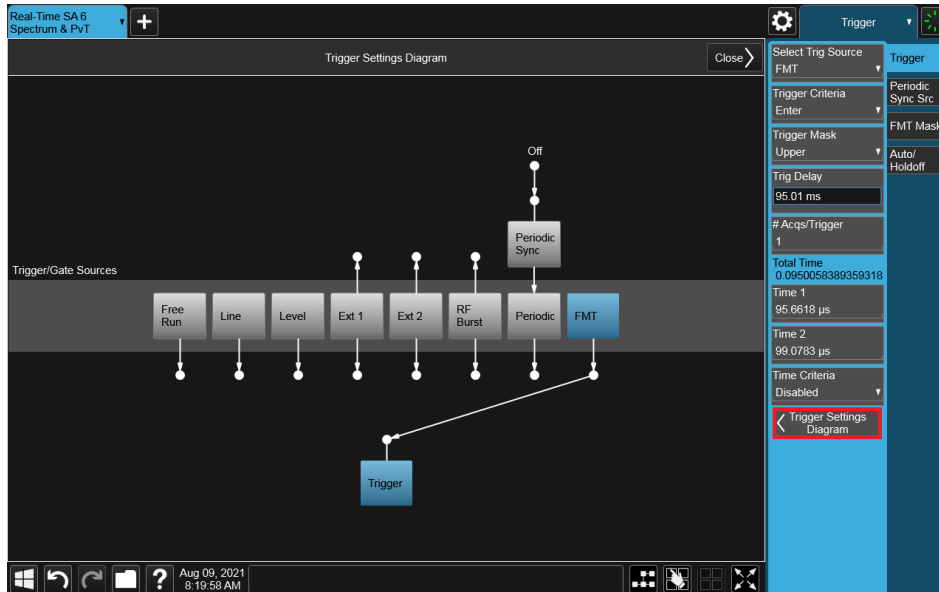


Figure 14. Trigger Settings Diagram in RTSA mode

The FMT is uniquely able to capture when a Bluetooth signal hops to a particular frequency. The initial FMT mask is shown below.

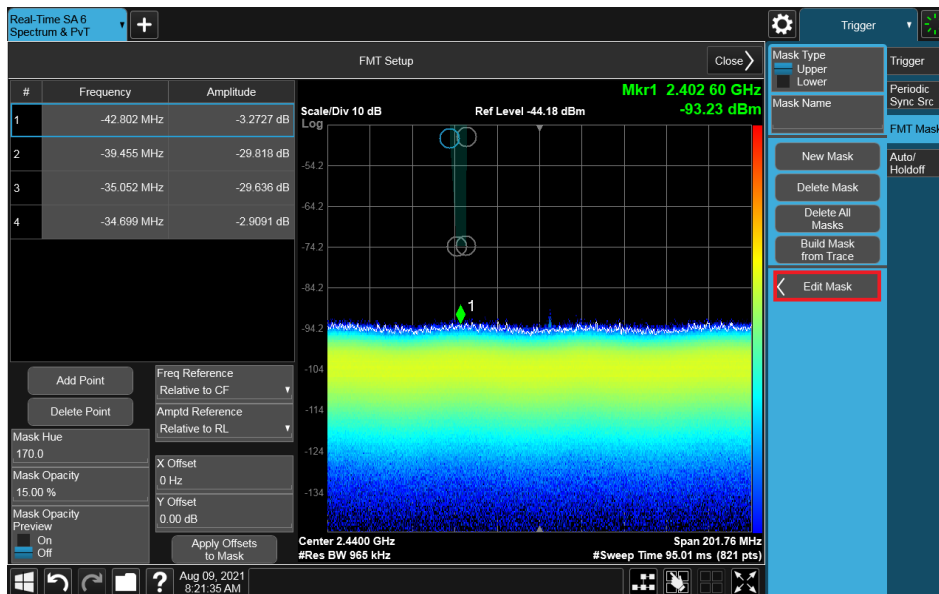


Figure 15. Initial display when editing FMT Mask

The Multi-touch GUI allows you to easily manipulate the mask of the FMT by grabbing the portion of the mask and dragging it.

Note: when setting up the mask, set the trigger type to Free Run so the display updates while defining the outline of the mask.

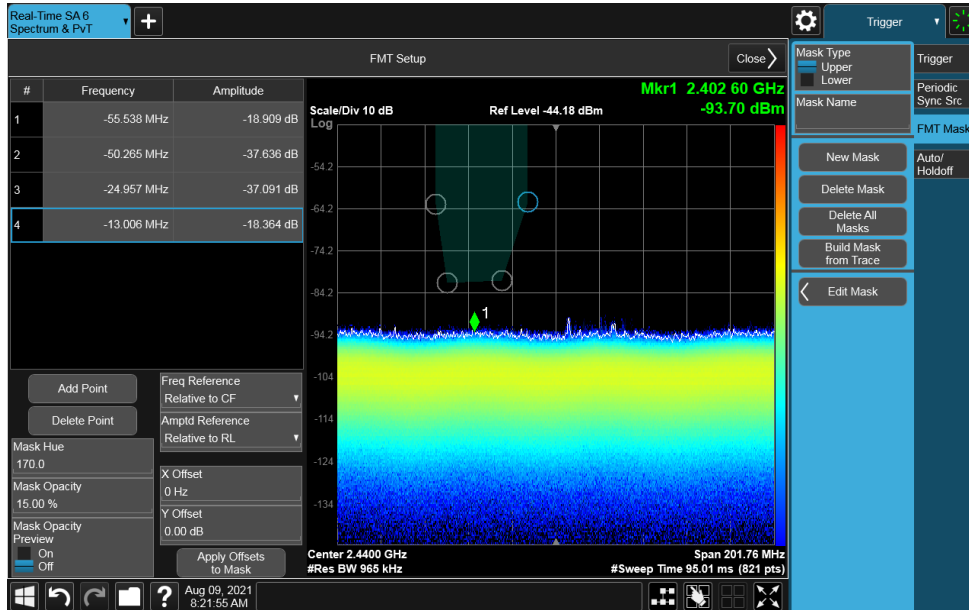


Figure 16. Adjusted FMT Mask

Once the mask has been defined, set the trigger source to FMT. When the Bluetooth signal hops within the mask, the measurement will trigger. Since our acquisition time encompasses the carrier of interest as well as four subsequent frequency hops in time, we see all five carriers on screen.

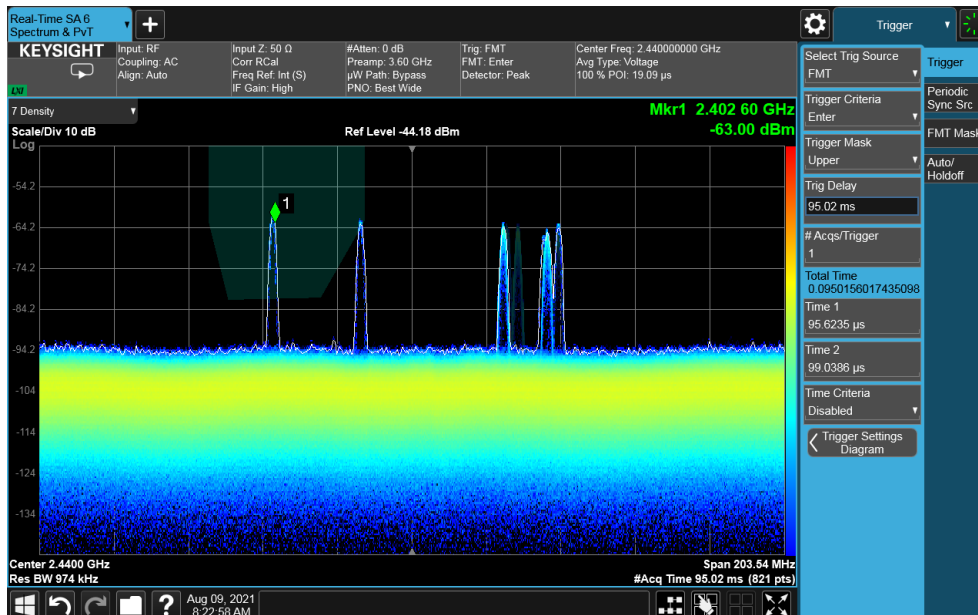


Figure 17. Measured Bluetooth signal

Measurement Setup

The Block Diagram feature shows the current internal hardware setup and signal processing path. It reduces the number of menus and steps needed to change settings. Selecting on any gray block in the path highlights it blue and opens the menu corresponding with the selection.

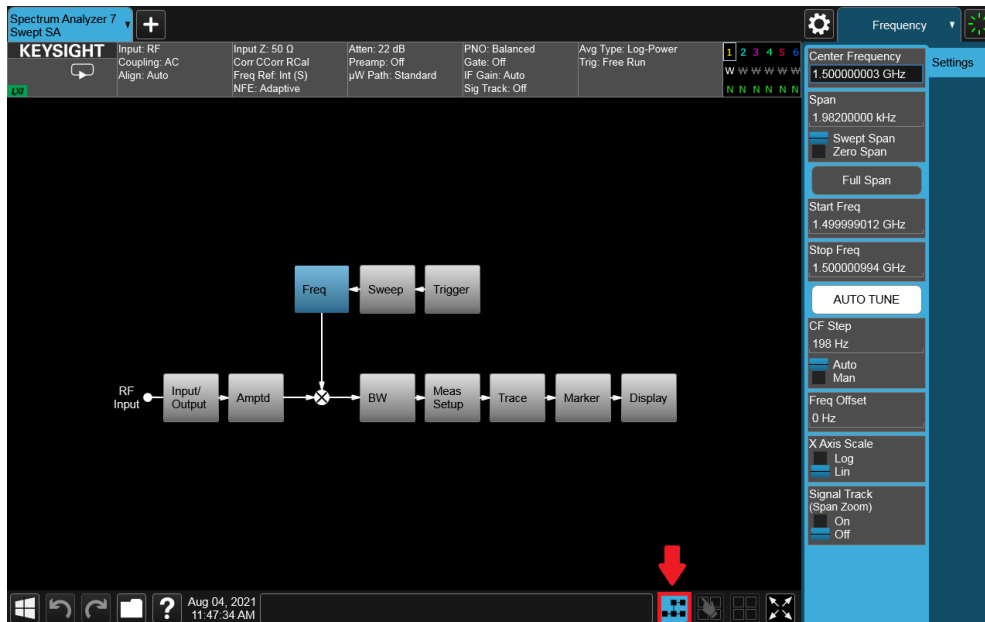


Figure 18. Block Diagram in Spectrum Analyzer mode

The Meas Setup Summary table also gives access to advanced settings such as Averaging Type, Phase Noise Optimization, IF Gain, and more.

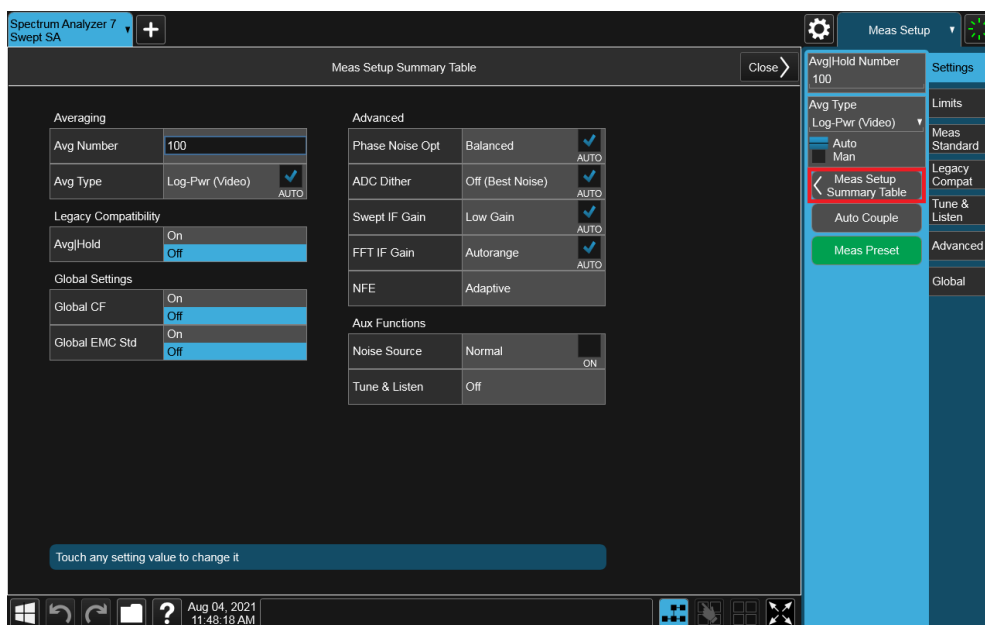


Figure 19. Meas Setup Summary table

The User Menu is a flexible, personalized menu that allows you to store frequently changed settings. “Right-clicking” (or selecting and holding while using the Multi-touch GUI) on any setting provides the option to add it to the User Menu. The User Menu will display all settings that have been added, and they can be updated or removed at any time.

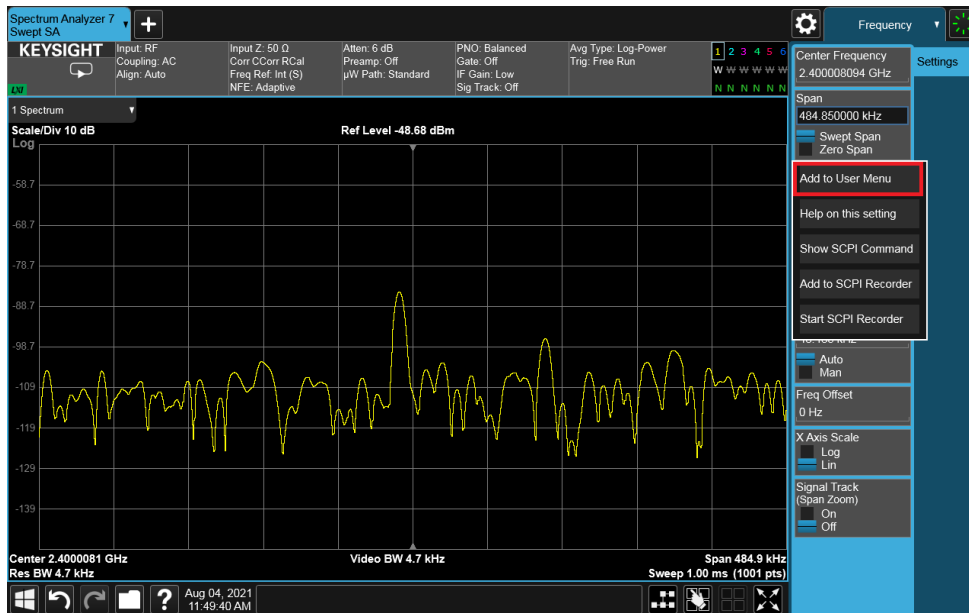


Figure 20. Accessing menu by “right clicking” any setting

The User Interface settings can be found in the System dialog, and can be used to configure specific functions of the User Interface, such as menu panel orientation and display color theme.

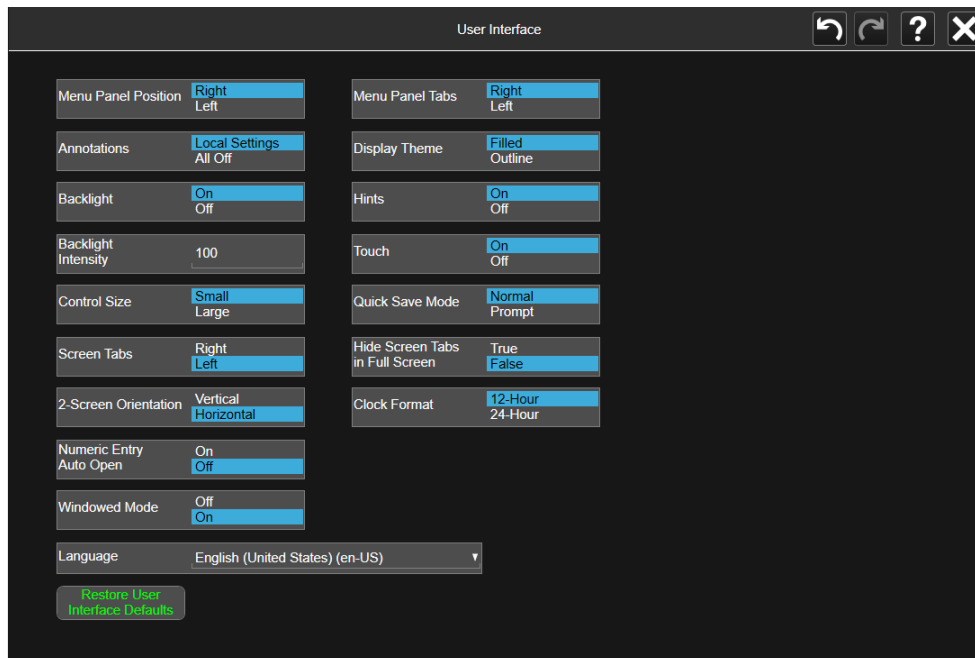


Figure 21. User Interface settings

Bottom Bar

The Bottom Bar at the bottom of the display contains buttons and status related to system and measurement settings. Pictured below is an example display for the Bottom Bar.

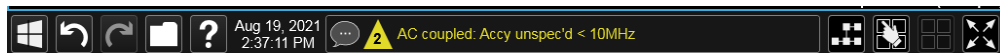


Figure 22. Example Bottom Bar

The first icon on the left of the bar is the Windows icon which gets you to the Windows Start menu. The X-Series Analyzers use an open Windows platform that allows other programs to be run.

The Undo and Redo buttons are used to go back and forth through recent setting changes and each time will display a message describing the change. Legacy analyzers did not have the ability to undo the last settings change.

The File button opens the menu seen below allowing you to save and recall states, screen images and other files.

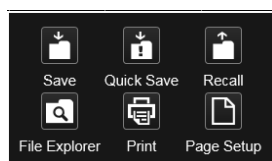


Figure 23. File menu

Selecting the Help button will display information about any mode, measurement, and setting available in the analyzer.

The Status Bar displays warnings and errors for the current setup condition. For example, a common warning condition message when tuning below 10 MHz while AC input coupled is shown in Figure 22. Selecting the Status Bar will display the complete history of condition messages or just the current conditions.

We discussed the Block Diagram Feature earlier in the **Measurement Setup** section.

As shown below, the View Editor can be used to adjust the size of different windows on your screen. It can also let you move window location and change contents of the result window by selecting on the window title. Any customized views can be saved as a User View in the View menu. In the Phase Noise application Log Plot measurement, we have chosen to also show the Decade table. For our setup, the table is not large enough to show all values. With the View Editor on, you can resize the table to show all values.

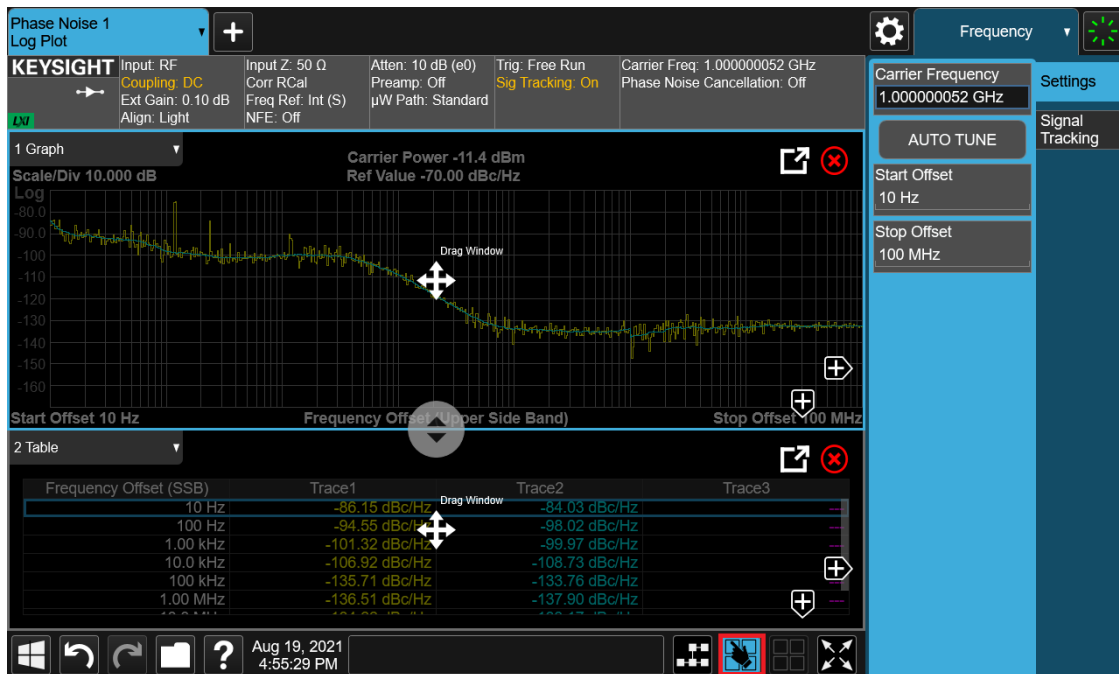


Figure 24. View Editor display

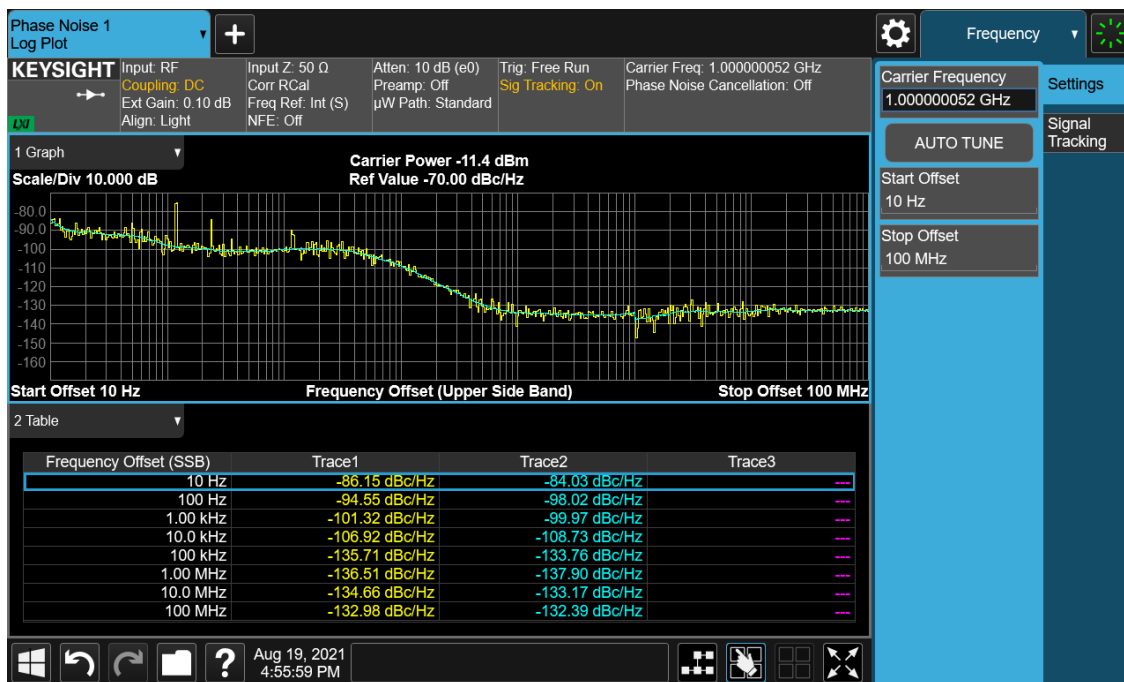


Figure 25. Lower table has been resized to fit

The Multiscreen icon allows you to display multiple measurement tabs on the same display. We discuss this in the **Screen Tabs** section of this document. Refer to Figures 32 and 33 for an example of how the Multiscreen icon functions.

The final button on the far right is the Zoom icon which will put the display into Fullscreen mode.

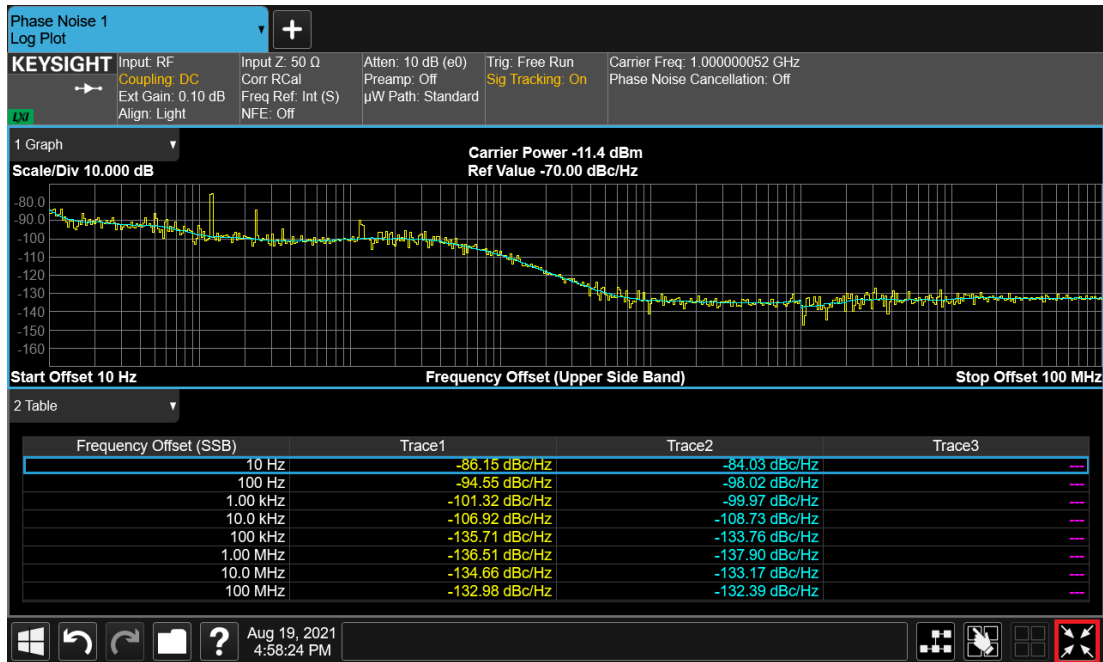


Figure 26. Fullscreen mode

Fullscreen mode will remove the Menu Panel from the display and extend all other regions to cover the entire screen. You can toggle back and forth by hitting the Zoom button again.

Context-Sensitive Help

Context-Sensitive Help directly gets you to the specific section in the Help documentation for the selected measurement setting. Select and hold on the setting to emulate the equivalent of a right mouse click. Then choose “Help on this setting”.

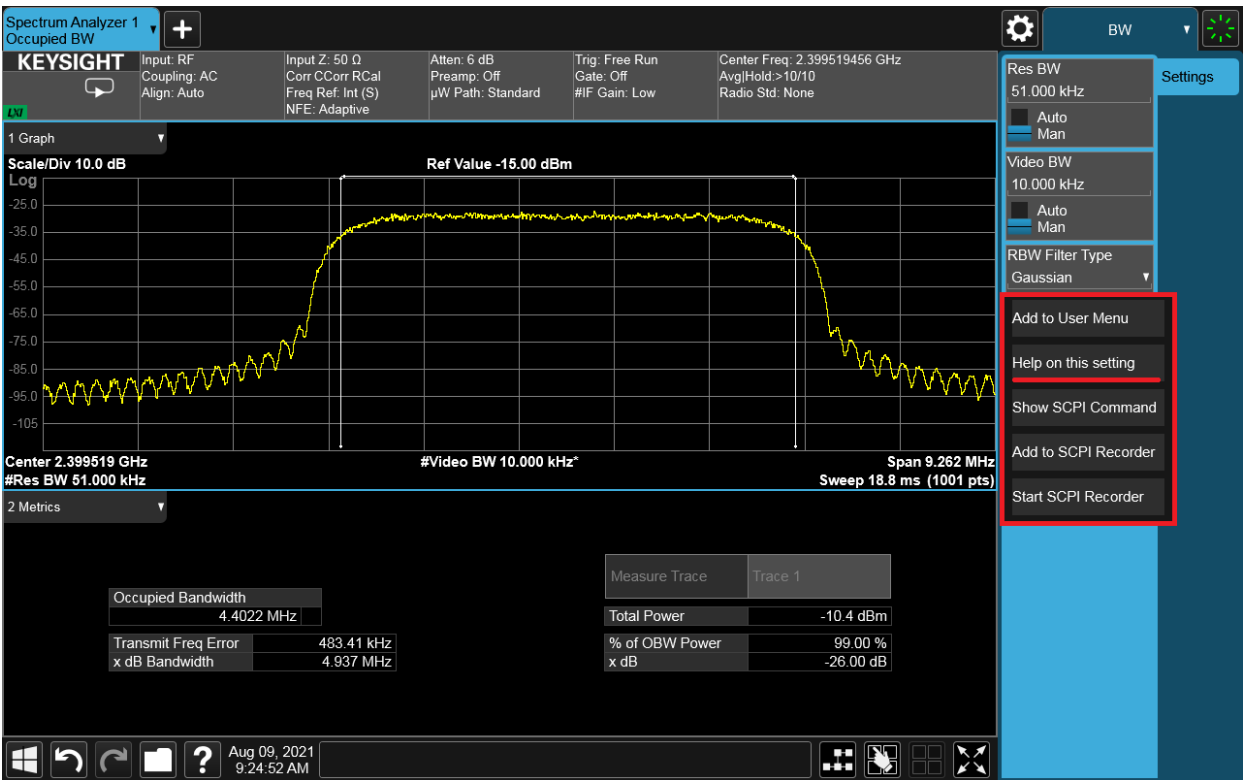


Figure 27. Right-Clicking on Res BW Filter Type and Choosing “Help on this setting”

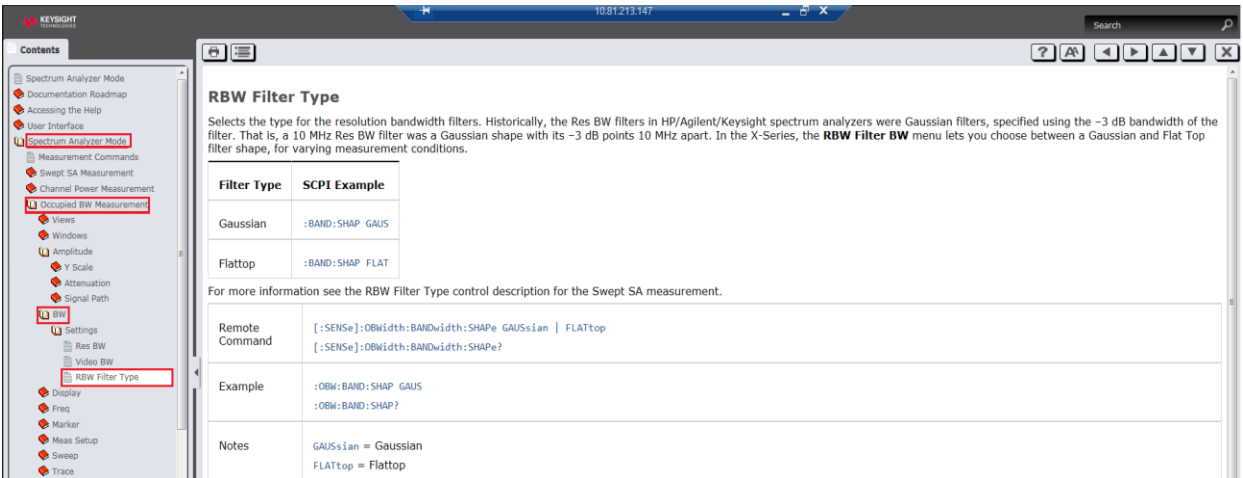


Figure 28. Context Sensitive help for Res BW Filter Type

Screen Tabs

One of the more powerful features available with the Multi-touch GUI is Screen Tabs, which supports the setup of various modes and measurements to run simultaneously (up to 16 of them). Selecting any active Screen Tab brings you to the Mode/Measurement/View selector screen.

Below we will press on the + next to the existing Spectrum Analyzer Screen Tab.

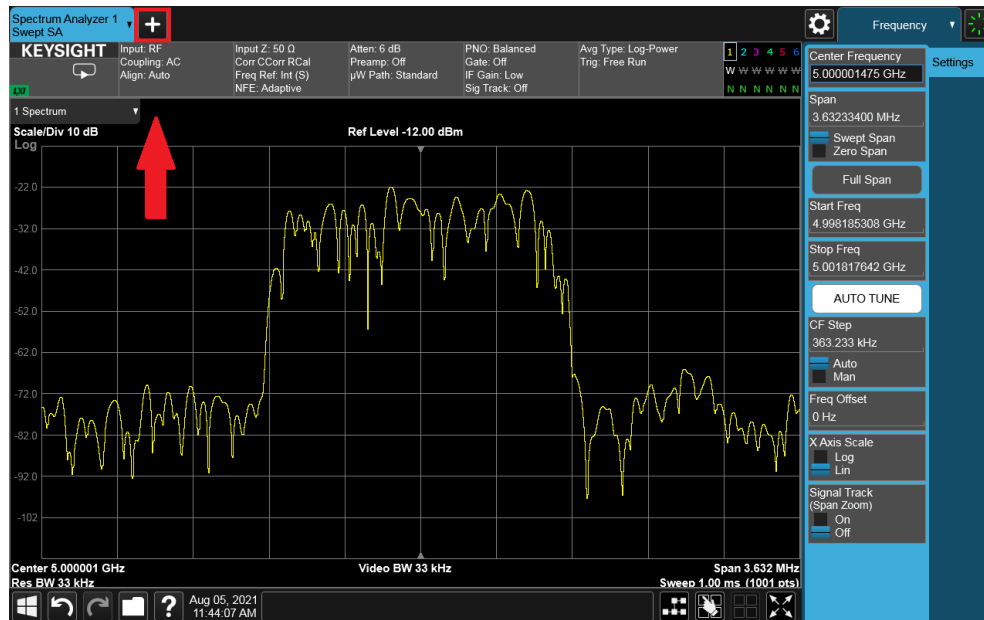


Figure 29. Single measurement running

Another Screen Tab has opened with the same setting as the previous one.

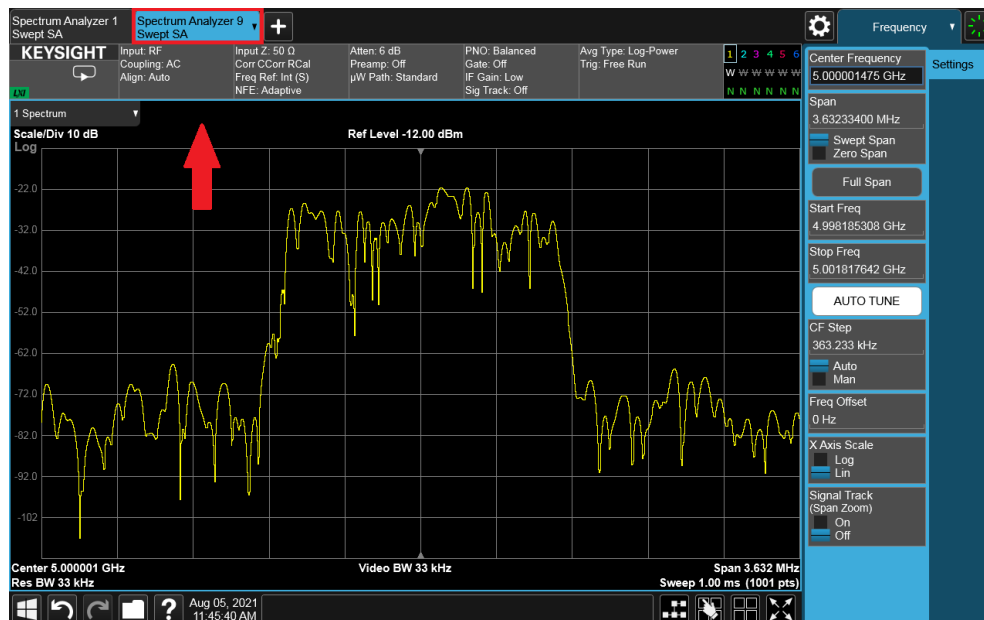


Figure 30. Additional Screen Tab has been created

Selecting the tab highlighted in blue will open the Mode/Measurement/View screen and give access to all possible modes and measurements.

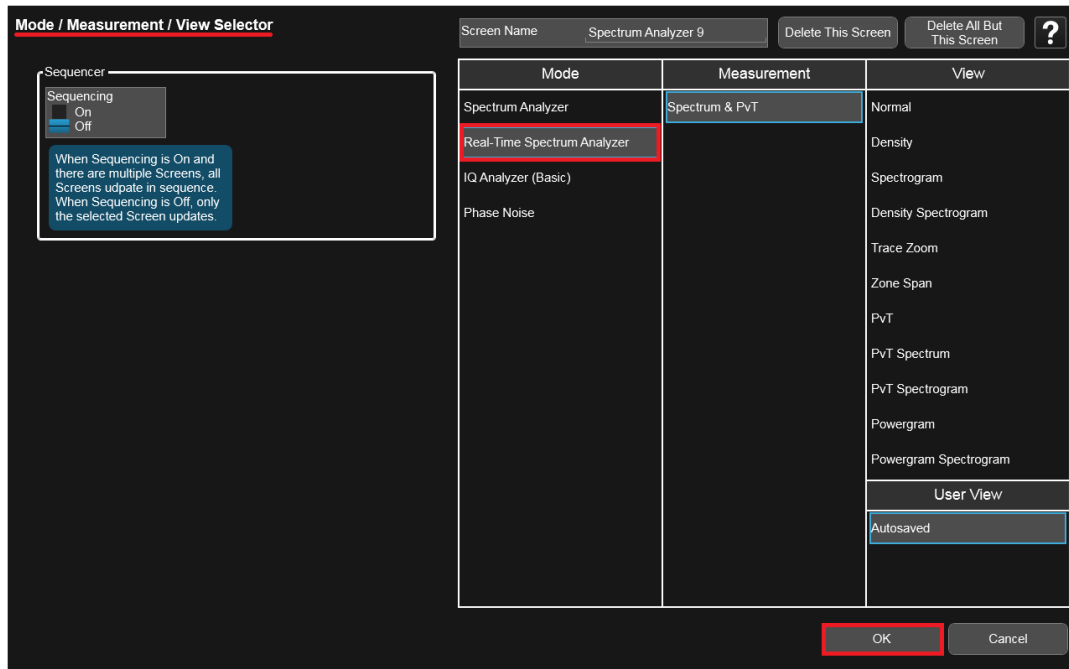


Figure 31. Mode/Measurement/View selector

You can also press the Multiscreen button at the bottom right of the display to view multiple screens and measurements together.

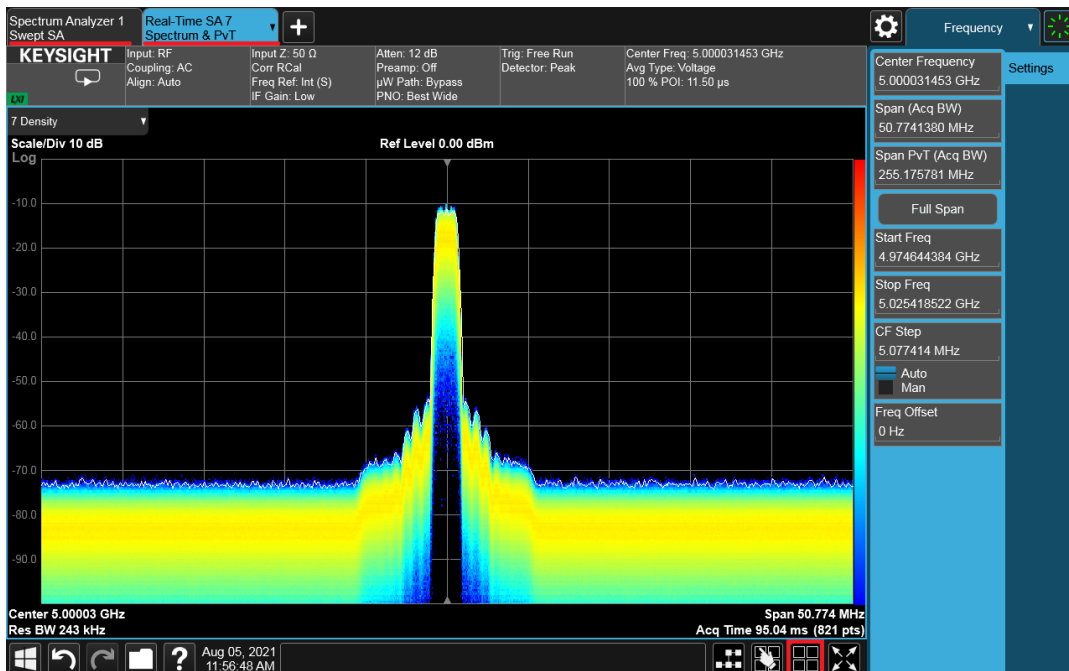


Figure 32. Second screen displaying RTSA mode

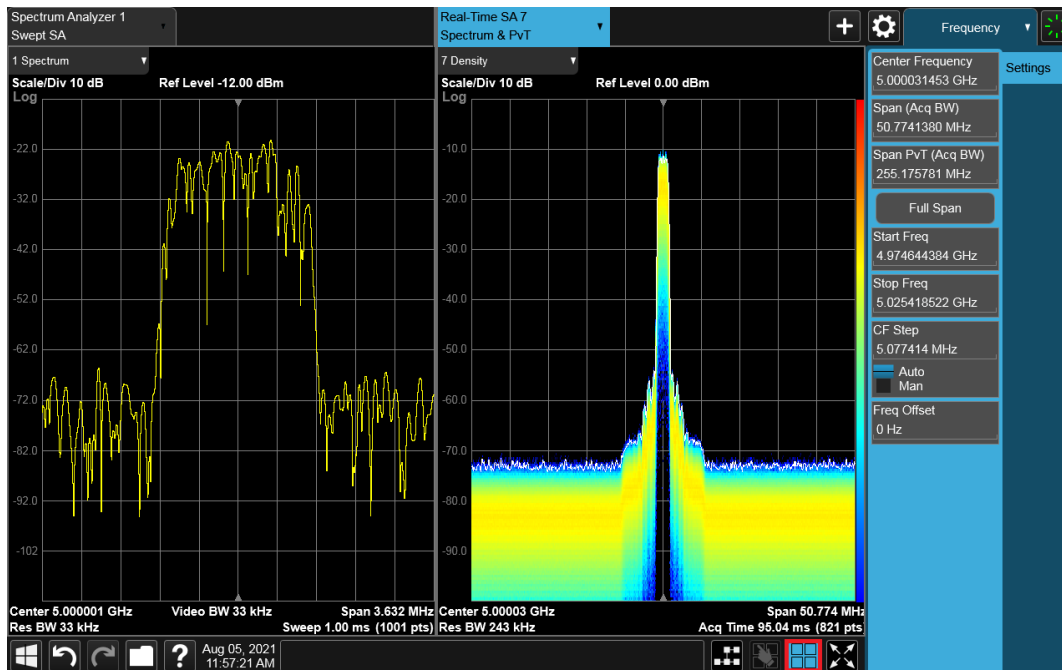


Figure 33. Both screens displaying different measurements

Sequencer

The Sequencer feature gives the ability to sequentially update all screens while in Multiscreen mode. The control for the Sequencer can be found by tapping the active window tab and opening the Mode/Measurement/View Window.

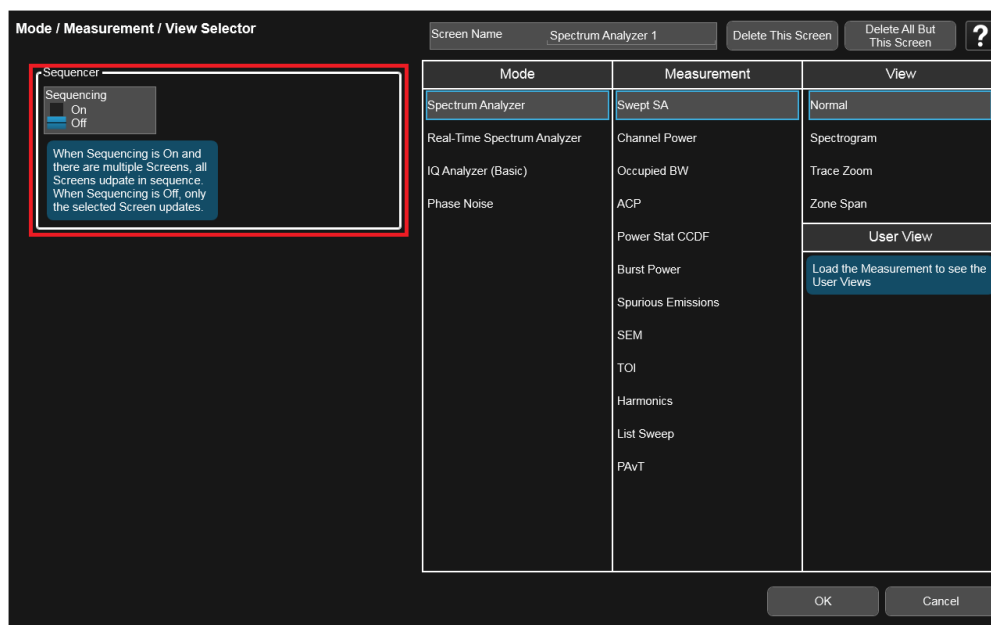


Figure 34. Control for Sequencer

Once turned on, the Sequencer will close the menu and begin updating and highlighting the active window in blue in the sequence they were created. Touching anywhere on the display or any of the buttons will stop the Sequencer and a message will pop-up reflecting this.

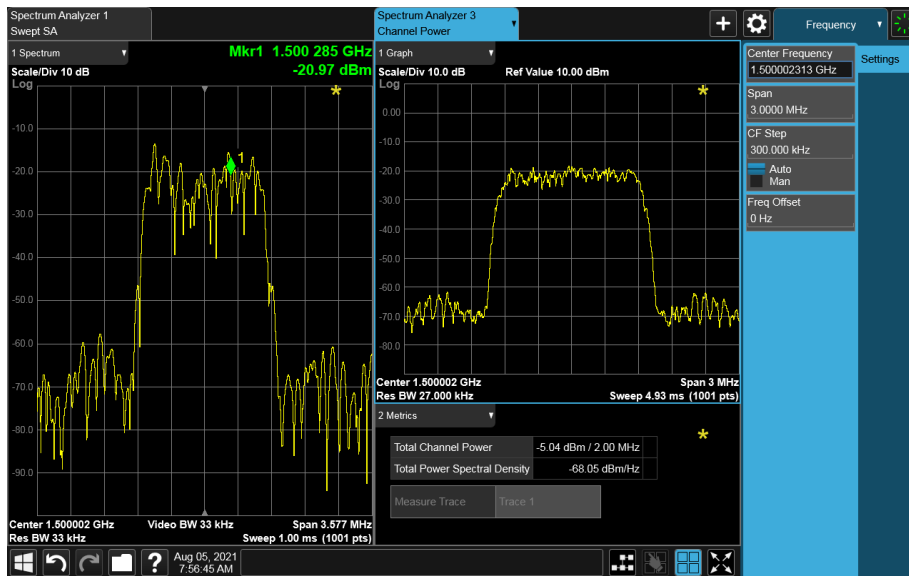


Figure 35. Second window becoming active

After the Sequencer is turned on, the left-side window is updated, then right-side window will be highlighted and update.

SCPI Recorder

A new feature introduced in the A.33 release of X-Series Signal Analyzer software is the SCPI Recorder. This feature additionally requires a core software subscription. The SCPI Recorder can track and record all measurement and settings changes that the user makes that have corresponding remote-interface SCPI commands. Each command will be stored and can be displayed in the System Settings Menu. The command history size is defaulted to 250 commands but is expandable. The SCPI Recorder can also play the recording back. You also have the option to copy or save the SCPI Recording file. This is handy when writing external programs to control the analyzer via SCPI.

You can right click on any setting that has a corresponding SCPI command to display its SCPI command.

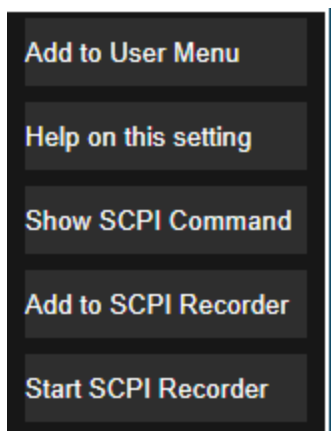


Figure 36a. Menu with Recorder off

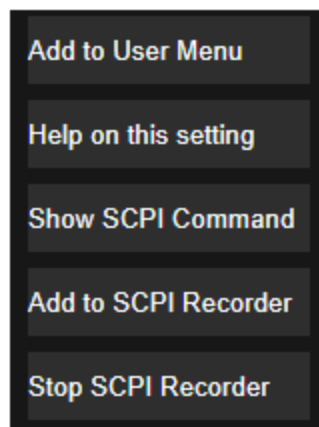


Figure 36b. Menu with Recorder on

Figure 37 below demonstrates the ability to show the corresponding SCPI Commands for an on-screen menu function

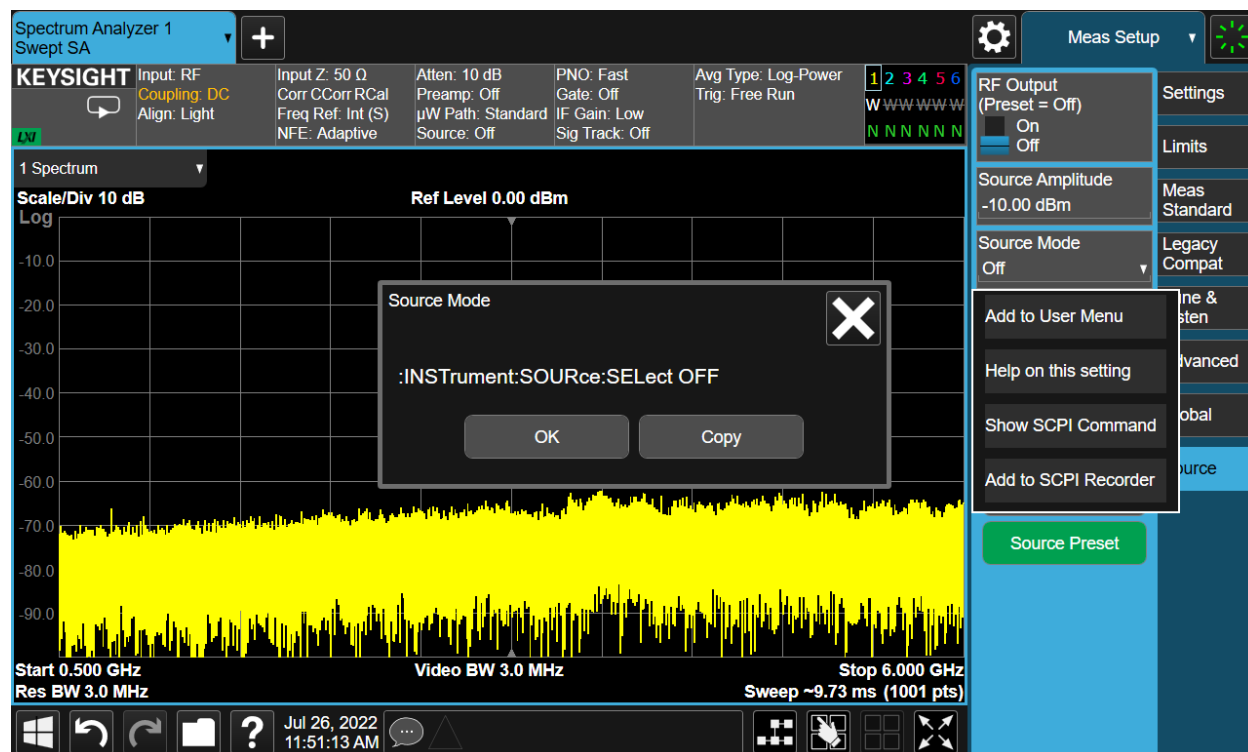


Figure 37. Example of Show SCPI Command Menu

You can also add a SCPI command to the SCPI in Recorder without turning the Recorder on. This allows you to specifically choose which commands to record without having all actions recorded.

Figure 38 shows the SCPI Recorder dialog that has an On/Off toggle switch to start the Recorder. This tab also contains the Copy function and the Play function. When the Recorder is on, the dialog will capture and display all the commands executed with their function description and the SCPI mnemonic.

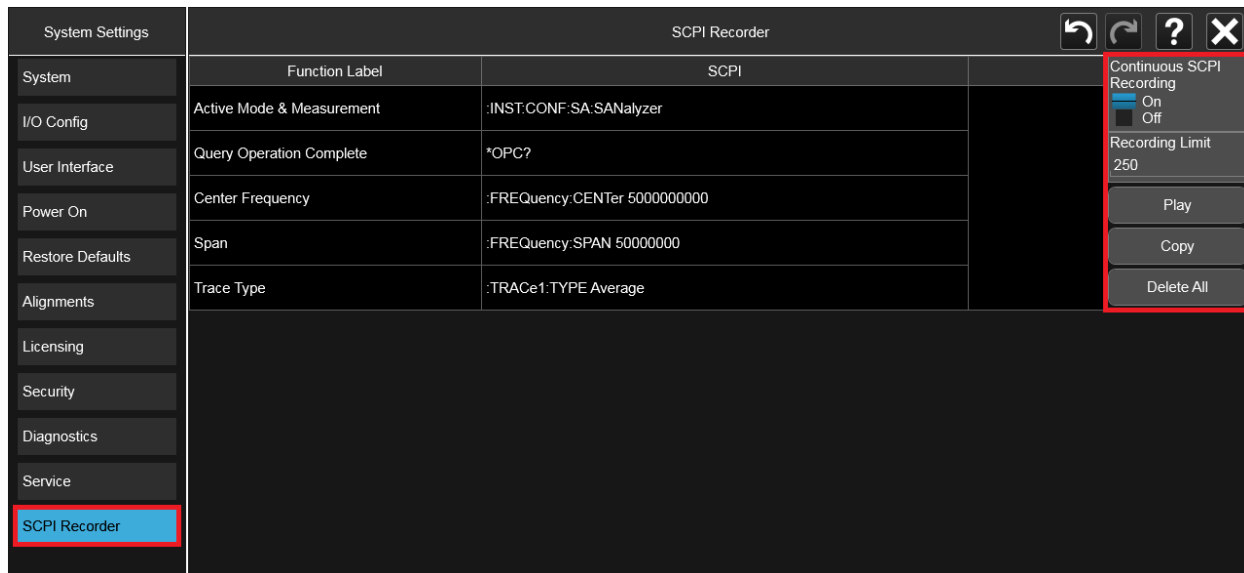


Figure 38. Demonstration of SCPI Recorder

Once commands have been stored in the dialog, you have the option to save the SCPI Recording content to a file by navigating to the Save Dialog. The file will be saved as a .txt file containing just the SCPI mnemonics.

You can also recall a previously saved SCPI Recorder file. If the file is from an X-Series Analyzer with a different set of options, there could be unexpected data changes or errors as the system tries to process the commands. To recall from a file, navigate to the SCPI Recorder tab in the Recall Dialog.

Simultaneous interaction between the front panel and sending SCPI commands externally is not supported with the SCPI Recorder. Only commands with corresponding SCPI will be recorded, and commands without them could interfere with the playback features. Settings such as Marker Mode and various settings tables and diagrams don't have corresponding SCPI. Instead, right click on corresponding setting in the Menu Panel and choose Add to SCPI Recorder.

Additional Resources

X-Series Signal Analyzers Getting Started and Troubleshooting Guide:

<https://www.keysight.com/us/en/assets/9018-04675/user-manuals/9018-04675.pdf>

Keysight Signal Analyzer Product Page

www.keysight.com/find/sa

Keysight Signal Analyzer Upgrade Page

www.keysight.com/find/sa_upgrades

X-Series Measurement Applications

<https://www.keysight.com/us/en/assets/7018-01758/brochures/5989-8019.pdf>

X-Series Signal Analyzers Brochure

<https://www.keysight.com/us/en/assets/7018-05092/brochures/5992-1316.pdf>

Spectrum Analysis Basics (AN150)

<https://www.keysight.com/us/en/assets/7018-06714/application-notes/5952-0292.pdf>



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