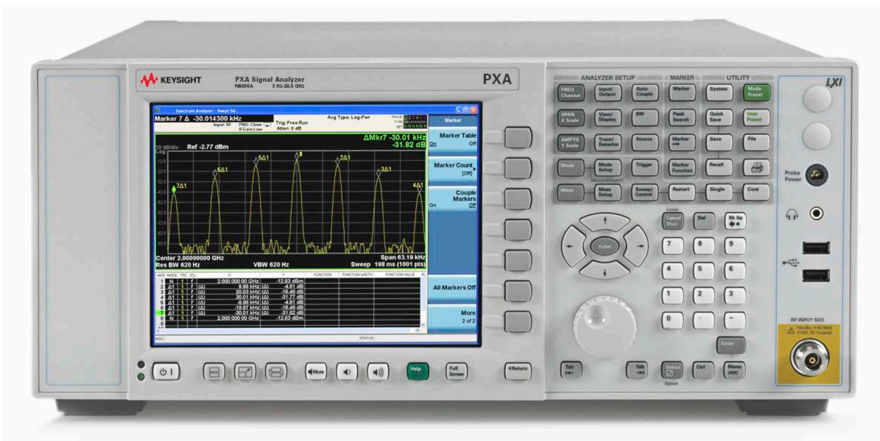
Keysight Technologies
X-Series Signal Analyzers
Demonstration Guide

This demonstration guide will help you take advantage of the extensive standard features of the X-Series signal analyzers.



KEYSIGHT TECHNOLOGIES

Standard features include:

- Auto Tune
- 12 flexible markers
- Peak table
- Marker Table
- Advanced marker functions
- Multiple traces and detectors
- Trace math
- Save/recall capability
- Limit lines
- Amplitude corrections
- Harmonics measurement
- Noise Floor Extension (PXA only)

Demonstration Preparation

This demonstration provides the step-by-step instructions for using the standard features of the Keysight Technologies X-Series N9030A PXA, N9020A MXA, N9010A EXA, and N9000A CXA signal analyzers.

All demonstration key strokes surrounded by [ ] indicate front panel hard keys and key strokes surrounded by { } indicate soft keys on the display.

All images in this demo guide are taken on a high-performance PXA with Noise Floor Extension turned on. If you are using any other X-Series analyzer, the performance you see will vary based on the performance of the analyzer.

Product Type	Model No.	Options
MXG vector signal generator	N5182A	UNT, 019, 1EA, UNV, 652/654
Signal analyzers	N9030A, N9020A, N9010A, N9000A	

Instructions
Connect the analyzer and MXG as shown in the diagram below.
Connect the 10 MHz out of the analyzer to the Ref In of the MXG.
Connect the RF out of the MXG to RF In of the analyzer.
The MXG defaults to 10 MHz reference input, which is the reference frequency of the analyzer.
Power both the analyzer and MXG.
On the MXG, load the wave form segments from the internal media to the base band generator media.
Press [Mode], {Dual Arb}, {Select Waveforms}, {Waveform Segments}, {Load all from Int Media}.

Note: If the signal analyzer application loses focus (the front panel keys become non-responsive), press ALT then TAB together, or you can use the mouse to click on the SA screen.

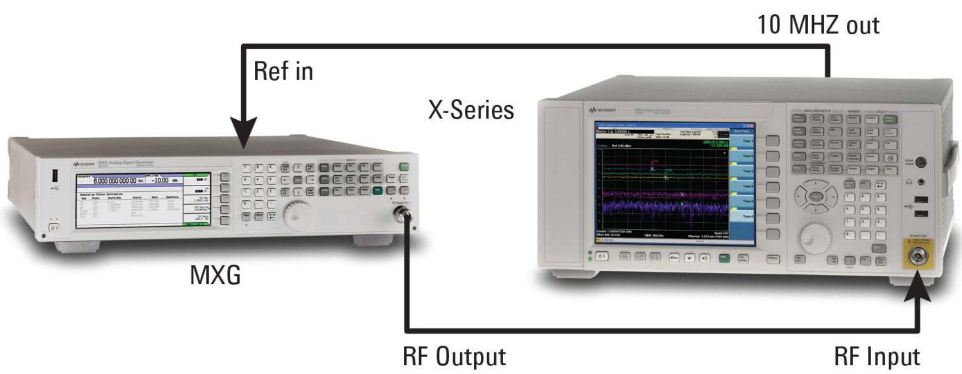


Figure 1. Instrument connection

Demonstration Instructions

Demonstration 1

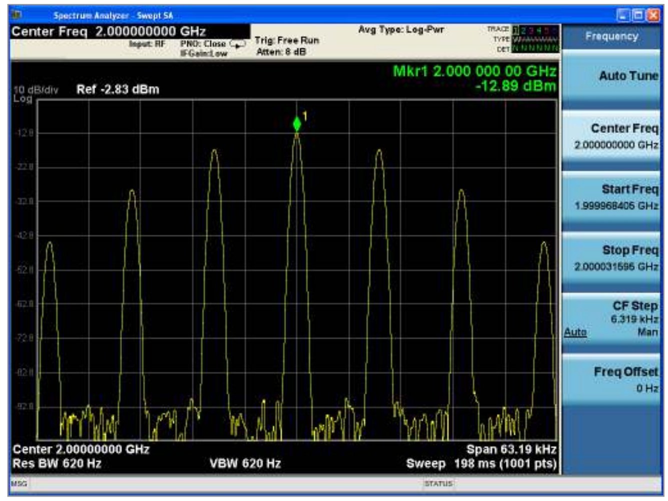
Auto Tune

Auto Tune is an immediate action key. When it is pressed, it causes the analyzer to set the center frequency to the strongest signal in the tunable span of the analyzer, excluding the LO. It is designed to quickly get you to the most likely signal(s) of interest. Auto Tune feature works for signals above –50 dBm.

In this demonstration, we will perform Auto Tune on an FM, CW and W-CDMA signal. You will see that the Auto Tune function adjusts the span of the analyzer based on the signal bandwidth. For a CW signal, the span is set to 25 kHz.

Did you know?
X-Series analyzers have a comprehensive embedded help that can be accessed using the [Help] key and then the function key about which you would like to know more. Turn off help by pressing [Cancel (Esc)].

Figure 2.
Auto Tune to FM signal.



Instructions for the source	Keystrokes for the source
Set a 2 GHz center frequency, 10 kHz deviation, 10 kHz rate FM signal.	[Preset] [Freq] [2] {GHz} [Amptd] [–10] {dBm} [FM/ΦM] {FM On} {FM Dev} [10] {kHz} {FM Rate} [10] {kHz} [RF On] [Mod On]

Instructions for the analyzer	Keystrokes for the analyzer
Auto Tune to find, tune and zoom on the signal.	[Mode Preset] {Auto Tune} The analyzer is set to measure the FM signal and its sidebands. A peak marker is activated. (See Figure 2)

Instructions for the source	Keystrokes for the source
Set a CW signal.	[FM/ΦM] {FM Off}

Instructions for the analyzer	Keystrokes for the analyzer
Auto Tune to find, tune and zoom on the signal.	[Freq] {Auto Tune} The analyzer is set to measure the CW signal. A peak marker is activated. Note that the span is set to 25 kHz.
The digital IF in the PXA allows accurate measurement of the if the signal is above the reference level, i.e., outside of the amplitude display range of the analyzer.	[AMPTD]. Use the down arrow until the signal is above the reference level. Note that the marker value does not change.

Instructions for the source	Keystrokes for the source
Recall a W-CDMA signal.	[Mode] {Dual Arb} {Select Waveform}, scroll down to WCDMA_TM1_64DPCH_1C_WFM and press {Select Waveform} {Arb On}

Instructions for the analyzer	Keystrokes for the analyzer
Auto Tune to find, tune and zoom on the signal.	[FREQ], {Auto Tune} The analyzer is set to measure the W-CDMA signal. A peak marker is activated.

Demonstration 2

Markers, Relative/Delta Markers, Marker Table, Peak Table

The X-Series analyzers have an extensive set of flexible frequency markers. There are a total of 12 markers which can be used in normal, delta, or fixed mode.

In this demonstration, we will find the absolute values of the FM signal sidebands and then find the relative values of the FM signal sidebands. In the course of the demo, we will use both Peak Table and Marker Table features of the analyzer.

Figure 3. FM sidebands peak values in peak table

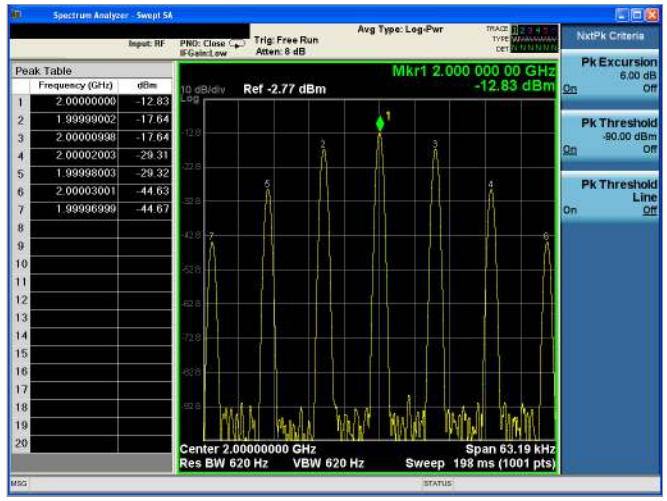
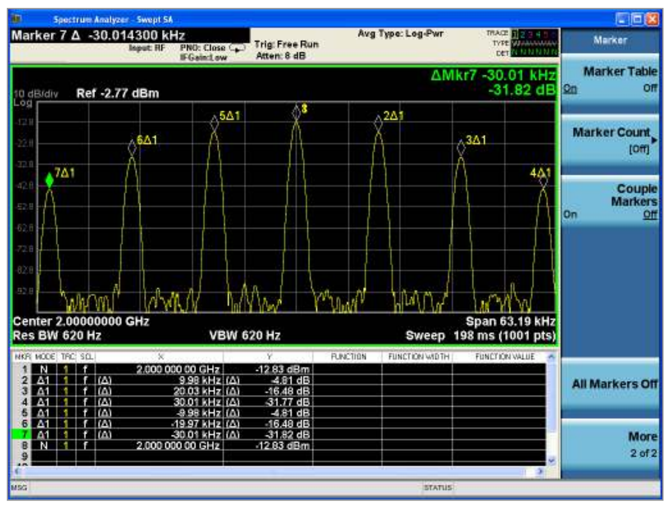


Figure 4. FM sidebands relative values in marker table



Instructions for the source	Keystrokes for the source
Set a 2 GHz center frequency, 10 kHz deviation, 10 kHz rate FM signal.	[Preset] [Freq] [2] {GHz} [Amptd] [–10] {dBm} [FM/ΦM] {FM On} {FM Dev} [10] {kHz} {FM Rate} [10] {kHz} [RF On] [Mod On]

Instructions for the analyzer	Keystrokes for the analyzer
Auto Tune to the FM signal. (refer to demo 1 for the Auto Tune demo).	[Mode Preset] {Auto Tune}
Measure the absolute peak amplitude of all the FM sidebands using the peak search table. Peak Search Table can find up to 20 peaks on the measurement screen.	[Peak Search] {More 1 of 2} {Peak Table} {Peak Table On}. The peak table, that can be sorted by amplitude or frequency, coexists on the measurement screen with the spectrum. Peaks on the spectrum view as well as in the table are numbered for easy identification. Peaks can be sorted by frequency or amplitude. See Figure 3
On peak search criteria.	[Peak Search] {More 1 of 2} {Peak Criteria}. {Next Peak Criteria}, user can set the peak threshold limit and peak excursion limit. You can also set the analyzer to measure peak above or below a certain level. Note that if the peak threshold is defined under [Peak Search] {More 1 of 2} {Peak Criteria} {Next Peak Criteria} and turned on, then the peaks must meet this criteria in addition to the display line requirements. [Peak Search] {More 1 of 2} {Peak Table} {Peak readout} {Above display line} Change the level of the display line with the data entry knob and notice the changes in the peak table. Set the analyzer to measure all peak. Select {Peak readout} {All} Turn the display line off. {View Display} {Display} {Display Line} Off
The peak table updates real time.	On the MXG, press [RF On/off] to Off. Note that there are no signals in the measurement range of the analyzer setup and the peak table is reflecting this. Turn on the RF on the MXG. Press [RF On/Off] to On.
Turn the peak table off.	Note: The peak table can be optionally saved in a .csv form [Save] {Data} {Meas Results} {Peak Table} {Save As} To turn the peak table off, on the analyzer, [Peak Search] {More 1 of 2} {Peak Table} {Peak Table Off}

Did you know?
There is a frequency counter in X-Series analyzers. To find more, press [Help] [Marker] {More 1 of 2} {Marker Count}

Measure the relative peak amplitude of the FM sidebands using delta markers and marker table. In the X-Series analyzers, users can set arbitrary delta markers, so any of the 12 markers can be set relative to any other marker.	[Peak Search] [Marker] {Select Marker} {Marker 2} {Delta} {Properties} {Relative to} {Marker 1} {Select Marker} {Marker 3} {Relative to} {Marker 1} {Select Marker} {Marker 4} {Relative to } {Marker 1} {Select Marker} {Marker 5} {Relative to } {Marker 1} {Select Marker} {Marker 6} {Relative to } {Marker 1} {Select Marker} {More 1 of 2} {Marker 7} {Relative to } {Marker 1}
Distribute the relative markers to the FM sidebands.	[Marker] {Select Marker} {Marker 2} [Peak Search] {Next Pk right} [Marker] {Select Marker} {Marker 3} [Peak Search] {Next Pk right} {Next Pk right} [Marker] {Select Marker} {Marker 4} [Peak Search] {Next Pk right} {Next Pk right} {Next Peak right} [Marker] {Select Marker} {Marker 5} [Peak Search] {Next Peak left} [Marker] {Select Marker} {Marker 6} [Peak Search] {Next Pk left} {Next Pk left} [Marker] {Select Marker} {More 1 of 2} {Marker 7} [Peak Search] {Next Pk left} {Next Pk left} {Next Peak left}
Make Marker 1 the active marker.	[Marker] {Select Marker} {Marker 1}
Turn Marker Table on to see the marker delta values in one single table	[Marker] {More 1 of 2} {Marker Table On} see Figure 4.
Couple the markers and place them in continuous tracking mode.	[Marker] {More 1 of 2} {Couple Markers on} [Peak Search] {More 1 of 2} {Continuous Peak Search On}
Increment the MXG center frequency by 1 kHz steps.	On the MXG, press [Freq] [Incr Set] [1] {kHz} [Freq] and use the up/down arrows to increment frequency. Note the fast tracking capability of the X-Series. The marker table can be optionally saved in a .csv form [Save] {Data} {Meas Results} {Marker Table} {Save As}.

Demonstration 3

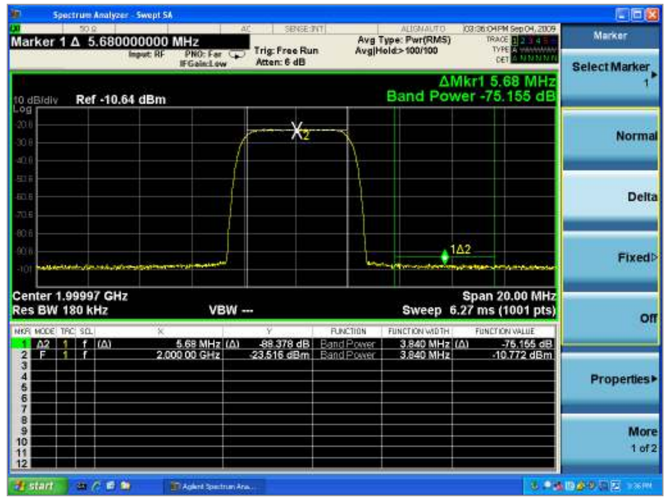
Advanced Marker Functions

The 12 markers in X-Series analyzers can also be used as noise markers, band/interval power, and band/interval density. The interval refers to measurements made in zero spans.

Band markers can be especially useful for making power measurements on bursted or pulsed signals.

In this demonstration we will perform a noise-to-carrier power measurement.

Figure 5. Noise-to-carrier power measurement



Instructions for the source	Keystrokes for the source
Recall W-CDMA signal at 2 GHz and -10 dBm.	[Preset] [Freq] [2] {GHz} [Amptd] [-10] {dBm} [Mode] {Dual Arb}, {Select Wave form} Scroll to W-CDMA_1DPCH_WFM and press {Select Waveform} {Arb On} [Mod On] [RF On]

Instructions for the analyzer	Keystrokes for the analyzer
Tune the analyzer to the signal, set the span to 20 MHz and activate the band power marker. Switch on the marker table.	[Mode preset] {Auto Tune} [Marker] [2] {GHz} [Span] [20] {MHz} [Trace/Detector] {Trace Average} [Marker Function] {Band/Interval power} {Band Adjust} [3.84] {MHz}. Press [Marker] {More 1 of 2} {Marker Table on}.
Create a reference delta band power marker.	[Marker] {Delta} This creates a relative copy of the marker 1. Move the delta marker over to the noise to make the noise-to-carrier power measurement. See Figure 5.

Did you know?
X-Series analyzers offer manual as well as auto selection for log-power (video) averaging and power (rms) averaging. Log averaging is the only type available in legacy analog IF analyzers. Log averaging is faster, but can show up to 2.51 dB lower power measurement for noise-like signal due to averaging of the logarithmic values. Go to [Meas Setup] {Average Type} to access this menu. This will set averaging for:

a. Trace averaging
b. Average detector
c. Band power markers
d. Video bandwidth averaging

Demonstration 4

Multiple Traces and Detectors

The X-Series analyzers have a total of six traces and multiple detectors. The standard detectors are peak, average, sample, negative peak, and the normal detector.

In this demonstration, we will manually change phase noise optimization of the analyzer and see the effect of phase noise optimization change using two different traces.

Figure 6. Multiple traces with markers.

Instructions for the source	Keystrokes for the source
Generate a 2 GHz, –10 dBm CW signal.	[Preset] [Freq] [2] {GHz} [Amptd] [–10] {dBm} [Mod Off] [RF On]

Instructions for the analyzer	Keystrokes for the analyzer
Set the start frequency and span.	[Mode Preset] {Start Freq} [2] {GHz} {Stop Freq} [2.0003]{GHz}
Change the reference level and set the number of averages to 50.	[Amptd] Use the down arrow key twice. Note that since X-series analyzers have digital IF, the analyzer can measure correctly even if the peak of the signal is off-screen. [Meas Setup] {Average/Hold Number} 50
Since we are interested in noise in this demo, we will perform trace averaging and also change the trace detector to average.	[Trace/Detector] {Trace Average} {More 1 of 3} {Detector} {Average}
Put Trace 1 in view mode	[Trace/Detector] {View/Blank} {View}
Go to the phase noise optimization setup.	[Meas Setup] {PhNoise Opt} Note that in the X-Series, you can let the analyzer auto set the phase noise optimization loop; manually set it to your interest, or configure the analyzer for fast tuning.
Turn Trace 2 on and set it to average detector	[Trace/Detector] {Select Trace} {Trace 2} {Trace Average} {More 1 of 3} {Detector} {Average}. This will be a blue color trace.
Change the phase noise optimization manually on Trace 2 and see the effect.	[Meas Setup] {PhNoise Opt} If it is auto set to close-in offset, set it to wide-offset and vice-versa. Note that the auto setting will depend on the phase noise loop optimization bandwidth which is different for the X-Series.
Zoom in on the signal	[Amptd] {Scale/Division} [5] {dB} {Ref Level} Use the down arrow key till the noise of the 2 traces is visible.

Did you know?
All six traces can be displayed on the screen at the same time. Also up to three different detectors can be used simultaneously on different traces which are concurrently updated in a single sweep. Detector for each trace can be set under [Trace/Detector], {Select Trace}, <Trace of interest>, {More 1 of 3}, {Detector}

Put markers on the 2 traces to find the difference in the noise level.	[Marker] {Select Marker} {Marker 1} {Normal} [2] {GHz} {Properties} {Marker Trace} {Trace 1} [Marker] {Select Marker} {Marker 2} {Normal} [2] {GHz} {Properties} {Marker Trace} {Trace 2} [Return] {More 1 of 2} {Couple Markers} On.
Turn on the Marker Table.	[Marker] {More 1 of 2} {Marker Table} On
Turn the marker function on to measure noise in the 1 Hz bandwidth.	[Marker Function] {Select Marker} {Marker 1} {Marker Noise} {Band Adjust} [0] {Hz} {Return} {Select Marker} {Marker 2} {Marker Noise} {Band Adjust} [0] {Hz} [Marker] You can now move the markers using the data entry knob and see the changes due to phase noise optimization at whatever frequency offset you select.

Demonstration 5

Trace Math Functions

The math functions in the X-Series analyzers are true power calculations—the measurements are converted to power, the math function is performed, and the results are displayed in dBm. In this demonstration, we will subtract –6 dBm from 0 dBm and the result will be –1.2 dBm.

In order to get the correct results, the source should be adjusted to as close to the required power as possible as shown by the analyzer marker:

0 dBm = 1 mw
–6 dBm = 0.25 mw
–1.2 dBm = 0.75 mw

Did you know?
You can copy/exchange one trace into another trace. Go to [Trace/Detector] {More 1 of 3} {More 2 of 3} {Copy/Exchange}

Instructions for the source	Keystrokes for the source
Generate a 2 GHz, –30 dBm CW signal.	[Preset] [Freq] [2] {GHz} [Amptd] [0] {dBm} [RF On] [Mod Off]

Instructions for the analyzer	Keystrokes for the analyzer
Tune the analyzer to the signal.	[Mode Preset] {Auto Tune} Peak marker is activated.
Set span, reference level and scale.	[Span] {Zero Span} [Amptd] [4] {dBm} {Scale/Div} [2] {dB} If need be, adjust amplitude on the MXG so that the marker on the X-Series reads 0 dBm.
Place Trace 1 in view mode and Trace 2 in clear wrote mode.	[Trace/Detector] {Select Trace} {Trace1} {View/Blank} {View} {Select Trace} {Trace 2} {Clear Write}
Place Marker 1 on Trace 2.	[Marker] {Properties} {Marker Trace} {Trace 2}

Instructions for the source	Keystrokes for the source
Adjust the power of the signal to -6 dBm on the analyzer.	[Amptd] [–6] {dBm} Adjust the knob so that the marker on the analyzer reads -6 dBm.

Instructions for the analyzer	Keystrokes for the analyzer
Subtract Trace 2 from Trace 1 and place the result in Trace 3.	[Trace/Detector] {More 1 of 3} {More 2 of 3} {Math} {Select Trace} {Trace 3} {Trace Operands} {Operand 1} {Trace 1} {Operand 2} {Trace 2} [Return] {Power diff}
Move the marker to Trace 3 and read the results.	[Marker] {Properties} {Marker Trace} {Trace 3} The marker will read approximately - 1.2 dBm. To see the difference between rms power difference and log difference, go to [Trace/Detector] {More 1 of 3} {More 2 of 3} {Math} {Log Diff}

Demonstration 6

Save and Recall Functions

The X-Series analyzers let you save the state, trace data, measurement results (peak and marker table), limit lines, corrections factors and screen captures to an internal file, a USB drive, or remotely via LAN, GPIB or USB. State files and trace data can also be stored to a time-stamped internal register. Saving states to the internal registers allows quick retrieval for measurements requiring several setups (or states).

Trace data can also be stored as a .csv file. The .csv files contain amplitude/frequency pairs and X-Series setup information. These files can be used for further analysis.

You can capture screen images in four different formats: 3D color, 3D monochrome, flat color, and flat monochrome. These files are in .png format.

In this demonstration, we will save and recall system state/set-up files and state+trace files.

Did you know?
The Quick Save button allows you to save with a single button press. This is very useful for multiple measurements. Once you decide on a format and set up the X-Series analyzer, simply press Quick Save for consecutive saves.

Instructions for the source	Keystrokes for the source
Generate a 1 GHz, –10 dBm CW signal	[Preset] [Freq] [1] {GHz} [Ampld] [–10 dBm] [Mod off] [RF On].

Instructions for the analyzer	Keystrokes for the analyzer
Tune the analyzer to the signal.	[Mod Preset] {Auto Tune}
Save the current setup to register 3 and preset the measurement mode.	[Save] {State} {Register 3}. Note the date and time the state is saved in this register. Press [Mode Preset].
Recall the saved state on the analyzer.	[Recall] {State} {Register 3}. The analyzer is set to the setup that was saved.
Save three traces and their states to an internal file.	[Mod Preset] {Auto Tune} [Amptd] {Scale/Div} [20] {dB} [Trace/Detector] {Max Hold} {Select Trace} {Trace 2} {Trace Average} {Select Trace} {Trace 3} {Min Hold} Press [Save] {Trace +State} {From Trace} {All} {To File}. At this point, a file manager box appears. You can create a new folder and change the file name as in a Windows environment. Press {Save}.
Recall the traces and states.	[Mode Preset] [Recall] {Trace +State} {From File} {Open} [↑] to highlight file, {Open}. Note the traces are shown in View mode.

Figure 7. Example of flat monochrome.

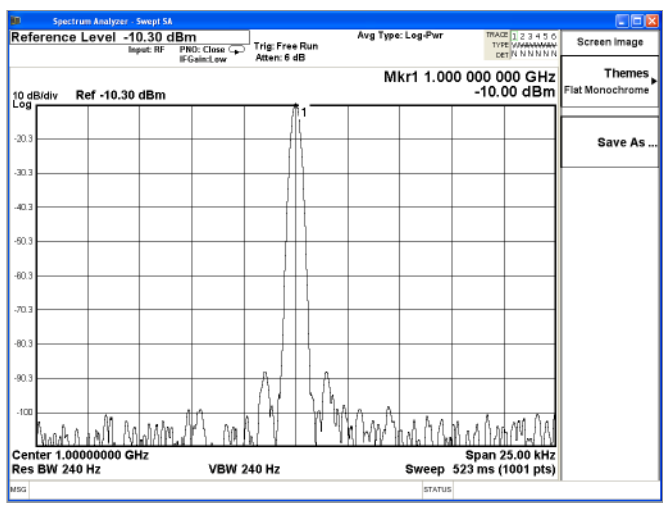


Figure 8.
Example of 3D monochrome.

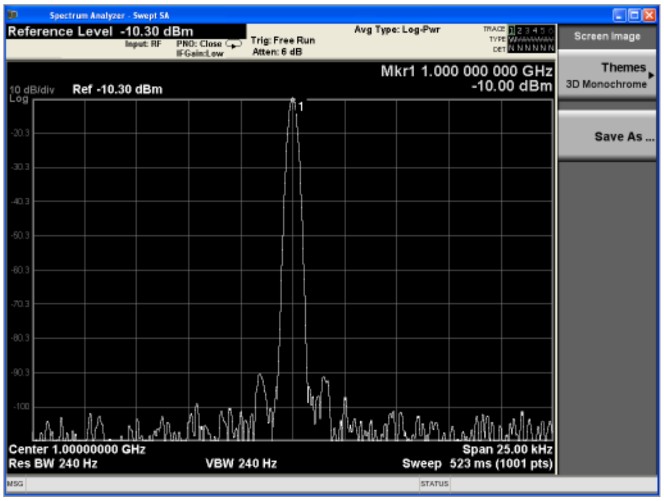


Figure 9.
Example of flat color.

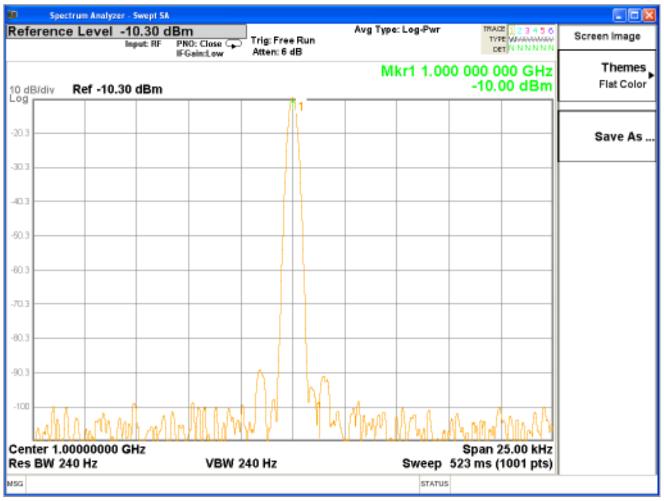
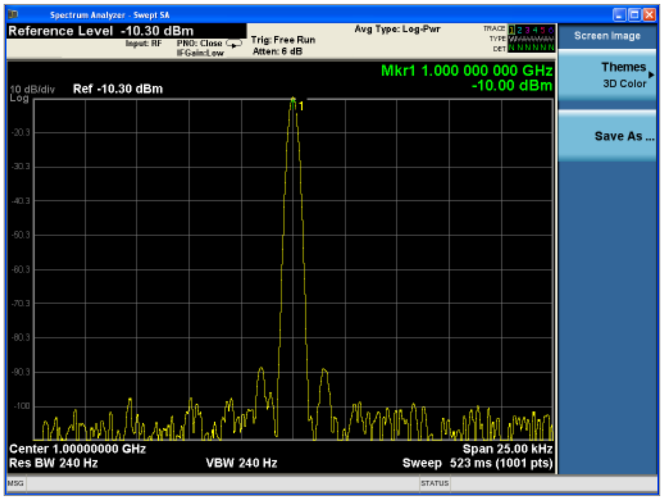


Figure 10.
Example of 3D color.



Demonstration 7

Limit Lines

Limit lines and associated margins allow you to quickly and easily identify signals that do not meet specified requirements. The X-Series analyzers offer up to six different limit lines that can be applied to up to six different traces at the same time.

In this demonstration, we will recall an internally provided limit line and perform a limit test against it.

Did you know?
X-Series analyzer lets you create a limit line from a golden trace. [Meas Setup], {Limits}, {Edit}, {More 1 of 2}, {Build from Trace}.

Also, as you can see from the Figure 11, the test trace gets color coded for enhanced user experience. Signals within margin turn amber and signals that break limit turn red.

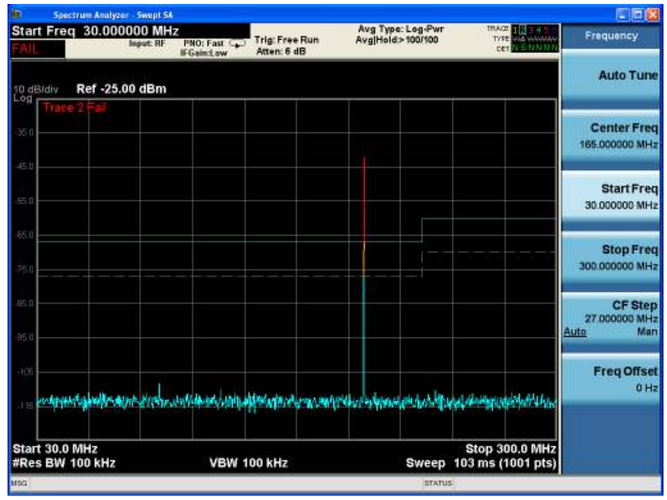


Figure 11.
Limit lines

Instructions for the source	**Keystrokes for the source**
Generate a 200 MHz, –30 dBm CW signal.	[Preset] [FREQ] [200] {MHz} [AMPLD] [–30] {dBm} [Mod Off] [RF On].

Instructions for the analyzer	**Keystrokes for the analyzer**
Set the analyzer for measurement and make Trace 2 the active trace so the color differentiation is more identifiable.	[Mode Preset] [FREQ] {Start} [30] [MHz] {Stop} [300] {MHz} [Amptd] [–25] {dBm} [Trace/Detector] {View/Blank} {Blank} {Select Trace} {Trace 2} {Trace Average}.
Load a limit line from internal memory. In this case load EN55022 class A radiated 10 meter which is an EMI test limit.	[Recall] {Data} {Limit} {Limit 1} {Open}. Under "My Documents" scroll to "EMC limits and Ampcor" and open. Select file type as .lim. Open Limits. Scroll to EN55022 Class A radiated 10 meter and open. Note: To lower the noise floor reduce the RBW. [BW] {Res BW} [100] {kHz}
Add margin to limit line.	{Meas. Setup} [Limits] [Select limit] {Select Limit 1} {Margin On} [–10] {dB}.
Set limit 1 to measure Trace 2.	[Meas Setup] {Limits} {Properties} {Test Trace} Trace 2. Note that trace pass/fail indicator appears on the left corner of the screen. For quick visual inspection, signals above the limit turn red, signals within margin turn amber.
Edit limit by changing a segment level.	[Meas Setup] {Limits} {Edit}. The list of amplitude pair appears on the left. Press the [Navigation] button and scroll to the pair you wish to edit. Note that the cursor follows the frequency selected. Press {Amplitude} and use the data entry knob to change the amplitude. The limit changes as the knob is adjusted.
Save the edited limit as a .csv file.	[Save] {Data} {Limit 1} {Save as}. Use the file structure to locate Limits which is under the EMI limits and Ampor. Type in the file name and the file will be saved as a .csv file.

Demonstration 8

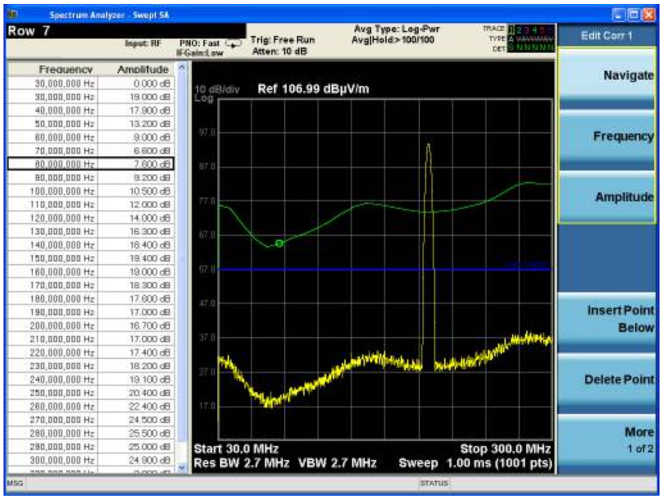
Amplitude Correction Factors

Amplitude correction factors are pairs of frequency and amplitude values. that are applied to the measurement as the measurement trace is being taken. They are used to correct for external loss/gain in the measurement setup. The X-Series analyzers offer up to four different corrections that can be applied simultaneously.

In this demonstration, we will recall a previously stored amplitude correction file, edit it and save it again.

Did you know?
In the edit mode, the correction values are shown as a green trace relative to zero corrections, which is the blue trace. A cursor indicates to which pair of values you have navigated. As the values are edited the green trace will change to give you direct feed back to the new value.

Figure 12. Amplitude correction.



Instructions for the source	Keystrokes for the source
Generate a 200 MHz, –30 dBm CW signal.	[Preset] [FREQ] [200] {MHz} [AMPLD] [–30] {dBm} [Mod Off] [RF On].

Instructions for the analyzer	Keystrokes for the analyzer
Set the start and stop frequencies	[Mode Preset] [FREQ] {Start} [30] [MHz] {Stop} [300] {MHz} [Trace/Detector] {Trace Average}
Load correction factors from internal memory. In this case load the corrections for a biconical is an EMI test limit. antenna.	[Recall] {Data} {Amplitude Correction} {Correction 1} {Open}. Under "My Documents" scroll to "EMC limits and Ampcor" and open. Select file type as .ant. Open Ampcor. Scroll to Biconical antenna and open. Note that the trace has changed to the shape of the correction factors.
Edit the correction factors.	[Input/Output] {More} {Corrections} and {Edit}. Note that the list of Frequency/amplitudes appears in a table to the left. {Navigate} and scroll the pair you wish to edit. In this case we will edit an amplitude factor. Note that the cursor follows the Freq/amp pairs as you scroll down. {Amplitude} and adjust to a new value by using the data entry knob.
Save the edited amplitude correction factors.	[Save] {Data} {Amplitude Correction} {Correction 1} and {Save as}. In the file select ampcor and type in a new name and Save.

Demonstration 9

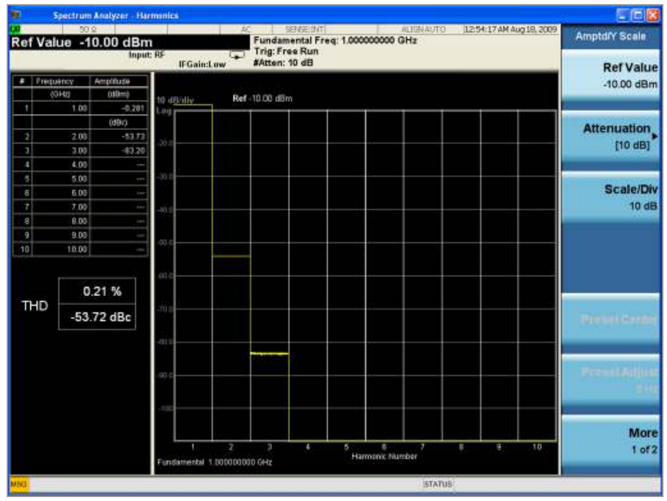
Harmonics Measurements

The X-Series analyzers provides one-button harmonic measurement capability that can measure up to 10 harmonics of the fundamental. The analyzer also provides the Total Harmonic Distortion.

In this demonstration, we will generate a CW signal on the signal source and measure the harmonics generated.

Did you know?
X-Series analyzers offer 10 standard one-button power measurements such as channel power, spurious emissions, TOI and more. Go to [Meas]

Figure 13.
Harmonics.



Instructions for the source	Keystrokes for the source
Generate a 1 GHz, 0 dBm CW signal.	[Preset] [Freq] [1] {GHz} [Amptd] [0] {dBm} [Mod Off] [RF On]

Instructions for the analyzer	Keystrokes for the analyzer
Set the analyzer to make the harmonics measurement.	[Mode Preset] {Center Freq} [1] {GHz} [Meas] {More 1 of 2} {Harmonics} If you see the ADC Overload message on the screen, increase the attenuation.
The analyzer can measure up to 10 harmonics, but for this demonstration we will measure only the first three.	[Meas Setup] {Harmonics} [3]
We will manually reduce the resolution bandwidth manually to lower the displayed noise level of the analyzer. This will enable accurate measurement of low power level harmonics.	[BW] {Res BW} [100] {Hz} There is a "Range Table" that can be used to make harmonic measurements. This is useful to manually set the harmonic parameters, such as frequency, measurement bandwidth, etc., for each harmonic being measured, especially useful for modulated signals. To access the range table while making the harmonic measurements, go to {Meas Setup} {RangeTable}.
If needed, change the reference level so you see the low level higher harmonics.	[Amptd] Press the down arrow key a few times to see the higher harmonics.

Demonstration 10

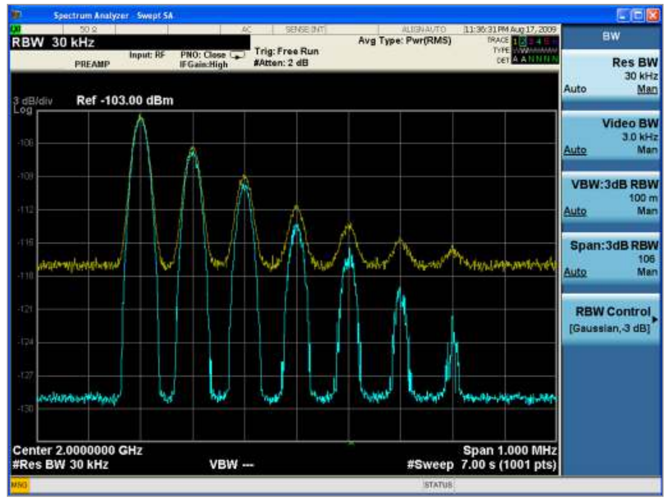
Noise Floor Extension (PXA only)

Based on the customer use case, there are many different measures of dynamic range in spectrum analyzers: TOI, phase noise of the analyzer, gain compression, and noise floor of the analyzer. The noise floor of the analyzer has an influence on every measure of dynamic range. Noise Floor Extension capability, an industry-exclusive feature that is standard in the PXA, very accurately models the noise floor of the analyzer and subtracts it from the signal to reduce the effective noise level of a spectrum analyzer. This provides a noise floor improvement on the order of 8 to 10 dB (nominal) when analyzing noise-like or pulsed RF signals, thus improving the signal-to-noise ratio (and hence measurement accuracy) for close to noise signals. The improvement is most effective for highly averaged signals. The noise floor extension technique can be used without a preamplifier, with a preamplifier, or when using the low noise path in PXA.

In this demonstration, we will measure very low level signals accurately with the use of Noise Floor Extension.

Did you know?
PXA is the only analyzer in the industry with Noise Floor Extension.

Figure 14. Harmonics.



Instructions for the source	Keystrokes for the source
Generate a low power level multi-tone signal	[Preset] [Freq] [2] {GHz} [Amptd] [–100] {dBm} [Mode] {Multitone} {Initialize Table} {Number of Tones} [7] {Freq Spacing} [0.1] {MHz} {Done} Navigate through the power entries of the tones and set the first one to -3 dB, the second one to -6 dB, third to -9 dB) and so on. {Apply Multitone} [Mod On] [RF On]

Instructions for the analyzer	Keystrokes for the analyzer
Preset the analyzer.	
Set the analyzer to measure the multi-tone signal.	[Freq] {Center Frequency} [2] {GHz} [Span] [1] {MHz}
Set the detector and reduce the resolution bandwidth to improve analyzer sensitivity.	[BW] {Res BW} [30] {kHz} [Trace/Detector] {More 1 of 3} {Detector} {Average} [Sweep/Control] {Sweep Time} [7] {s} We are trying to reduce the variance. The average detector is best for reducing variance in noise-like signals or noise. Also, Noise Floor Extension works best with a high amount of averaging, so we will select the average detector and also increase the sweep time to provide within-trace frequency bucket/bin averaging.
Further improve sensitivity of the analyzer by reducing attenuation and adding gain.	[Amptd] [Attenuation] {Mech Atten} [2] {dB} Note that it is not advisable to have 0 dB attenuation when making measurements because: (a) there might be a transient in the input signal that might damage the analyzer front end and (b) 0 dB attenuation will degrade the VSWR (reflections) at the input. [Return] {More 1 of 2} {Internal Preamp} {Low Band}
Zoom in on the signal	[Amptd] {Scale/Div} [3] {dB} {Ref Level} [103] {dBm}
Place Trace 1 in view mode and activate Trace 2.	[Trace/Detector] {View/Blank} {View} {Select Trace} {Trace 2} {More 1 of 3} {Detector} {Average}

Turn NFE on.	[Mode Setup] {Noise Reduction} {Noise Floor Extension} On. The noise floor drops 9 to 12 dB and due to the improved signal-to-noise ratio, the noise contributions are reduced from the measured signal, resulting in a more accurate measurement. In certain cases, using the Noise Floor Extension technique might provide faster measurements than reducing resolution bandwidth to improve the analyzer sensitivity.

More information about the X-Series signal analyzers can be found at the Agilent website:

PXA signal analyzers:
www.keysight.com/find/PXA

MXA signal analyzers:
www.keysight.com/find/MXA

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