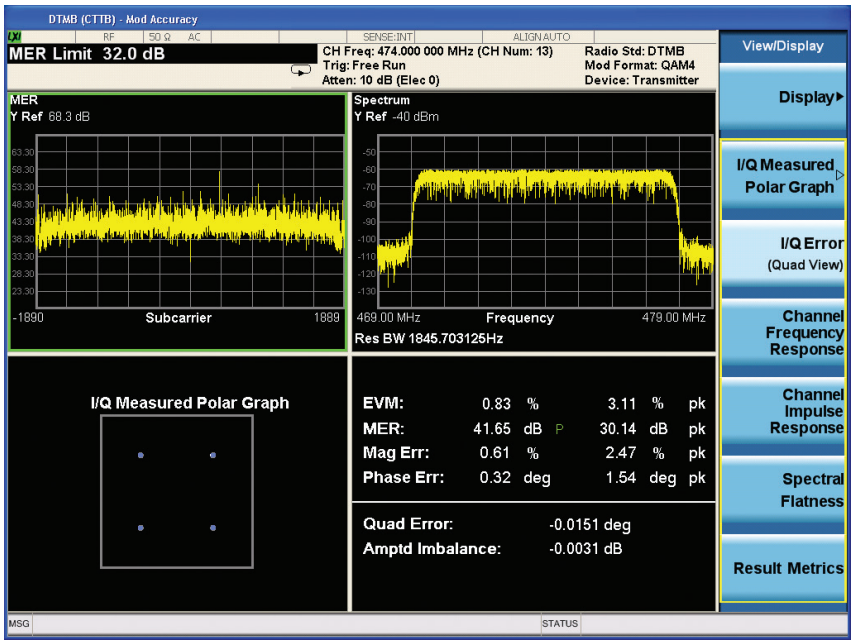
Keysight Technologies
N9051A Pulse Measurement Software

X-Series Signal Analyzers and
PSA Series Spectrum Analyzers

Technical Overview



KEYSIGHT TECHNOLOGIES

Features

- Characterize pulse performance using a wide range of parameters including pulse width, rise/fall time and much more in accordance with IEEE 181 standards
- Use the six registers to display raw data, maximum hold, minimum hold, average, added data and subtracted data
- Analyze up to a 1000 pulses individually; results are continuously updated
- Use up to 10 markers to display absolute data or use one marker as a reference and the other 9 as relative markers
- Evaluate up to 200,000 pulses with advanced statistics toolbox
- Troubleshoot and verify performance of modulated pulses with the phase and frequency analysis options

Pulse Measurement Software

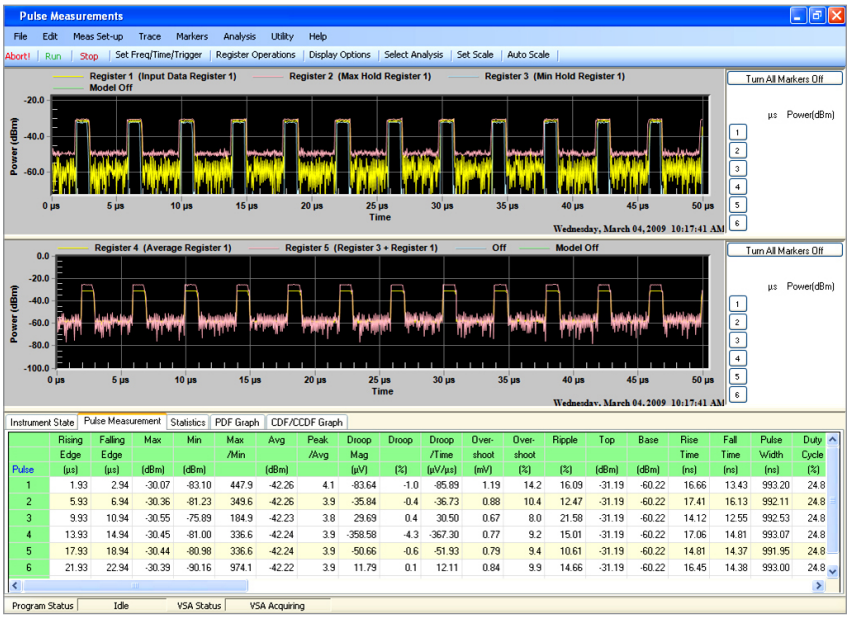


Figure 1. Analyze a wide range of pulse metrics on single pulse, pulse-to-pulse, or statistics of many pulses.

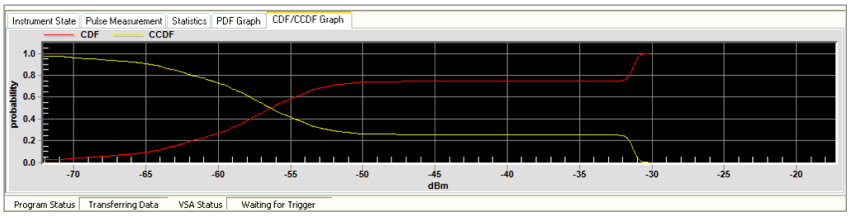


Figure 2. CDF and CCDF of pulses.

Automate pulse measurements and extend the value of your spectrum analyzer by combining signal analysis and time domain measurements.

Electronic warfare and radar design and maintenance engineers can now quickly identify desired pulse parameters with the N9051A pulse measurement software. This software, with Keysight Technologies, Inc. X-Series signal analyzer or PSA spectrum analyzer, performs calibrated pulse analysis for signals up to 50 GHz in carrier frequency. Quickly characterize pulse performance using a wide range of parameters including pulse width, rise/fall time, PRI, PRF, duty cycle, peak to average ratio, and much more in accordance with IEEE 181 standards. When Option 3FP is added, it is possible to analyze frequency and phase measurements. This enables analysis of compressed or modulated pulses as well as stability metrics. And with Option 4FP, the pulse analyzer software can evaluate trend behavior of a catalog of pulses with advanced statistical analysis.

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Free 30-day trials of X-Series measurement applications provide unrestricted use of each application's features and functionality on your X-Series analyzer. Redeem a trial license online today:

www.keysight.com/find/X-Series_trial

Software Features and Measurements

Intuitive user interface

The parameters to be measured are divided into amplitude and time. Amplitude measurements are calibrated based on the accuracy of the spectrum analyzer, or signal analyzer.

Figure 4 shows the two displays with the raw data, maximum hold and average of the raw data in the top display. The bottom display shows the minimum hold of the raw data. The bottom half of the window lists the on-going results of pulse analysis selected in the analysis window on the raw data. Each pulse in the string is analyzed separately and the individual results are continuously updated.

Zooming in on a signal for a closer look is easy (Figure 6)—simply move the cursor and click to form a box around the signal of interest and release the mouse. The x and y axes are rescaled to form an undistorted view of the signal. To return to the original screen, simply right click and select “all the way out.” The pulse measurement software supports multiple units for each scale and also supports up to 10 markers per trace that can be viewed in an exportable marker table. Markers are easily added by simply selecting the marker number and clicking on the trace.

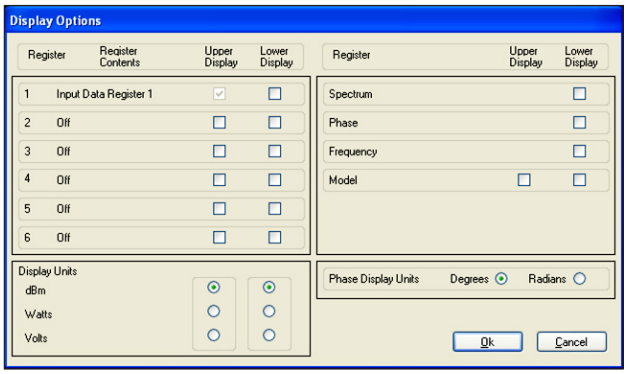

Figure 3. Place different registers in upper or lower display.

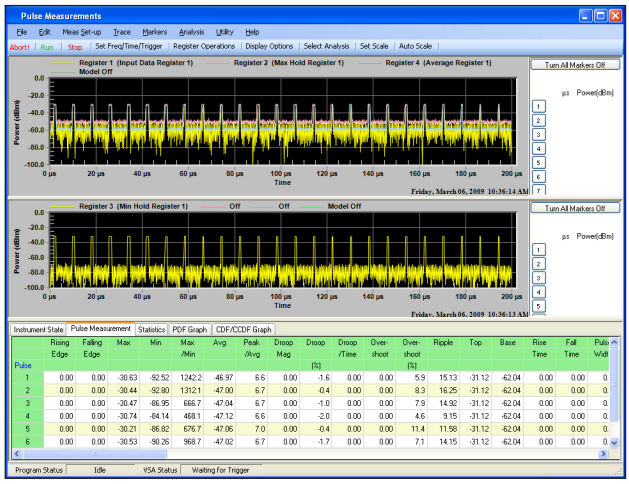

Figure 4. Different display options in different windows.

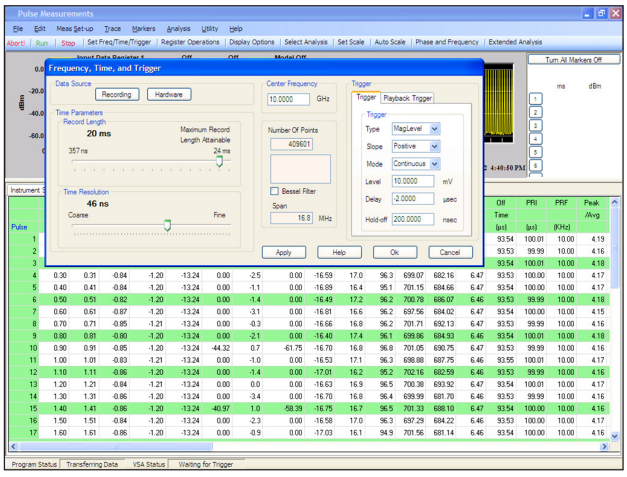

Figure 5. Measurement configuration.

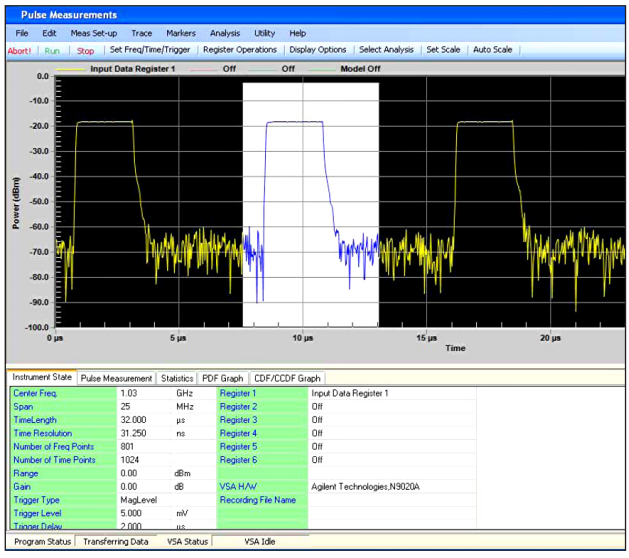

Figure 6. Zoom in on signals—simply click mouse to form a box around the area of interest.

Absolute and relative measurements

Place up to 10 markers on signals. They can all be absolute values or one can be a reference and the others relative to that reference. Figure 8 shows the markers placed on signals.

Phase and frequency measurements

With Option 3FP, phase and frequency measurements are added enabling users to do vector based measurements such as pulse-to-pulse phase stability and intra-pulse analysis. With the PXA's industry-leading noise floor and phase noise, these measurements can be done accurately with the pulse measurement software.

With the phase and frequency measurements capability, it is also possible to analyze more complex waveforms such as chirp waveforms. The following measurements can be made with the Option 3FP:

- Pulse-to-pulse phase
- Phase mean
- Phase trend
- Bandwidth
- Frequency mean
- Chirp slope
- Frequency deviation
- Cumulative statistics of the above

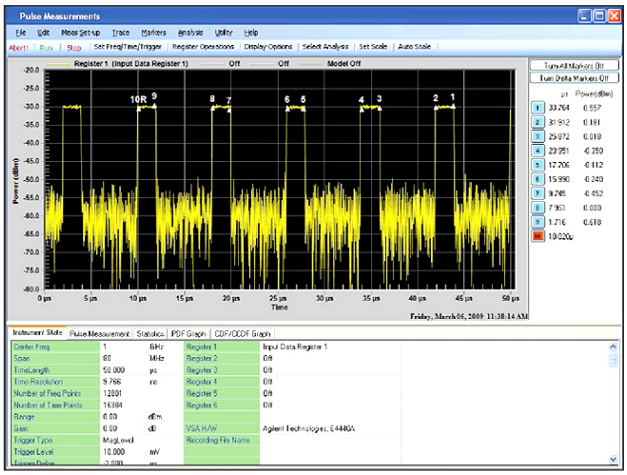

Figure 7. Up to 10 markers can be placed on any one of the registers displayed in the window by simply clicking on the register. Figure 8 has the marker placed on register 2, which is the average of the raw data in register 1.

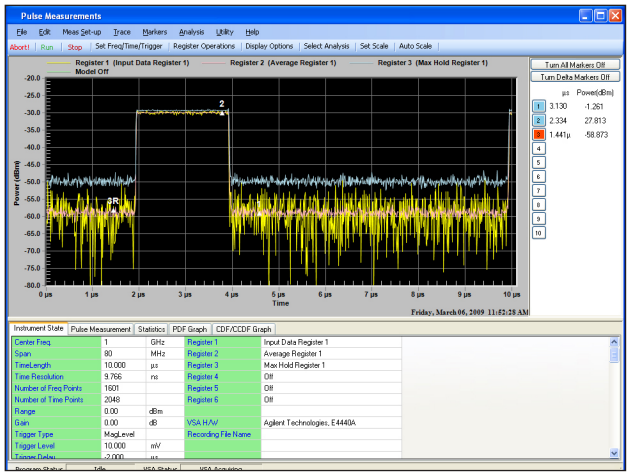

Figure 8. Place markers on selected registers.

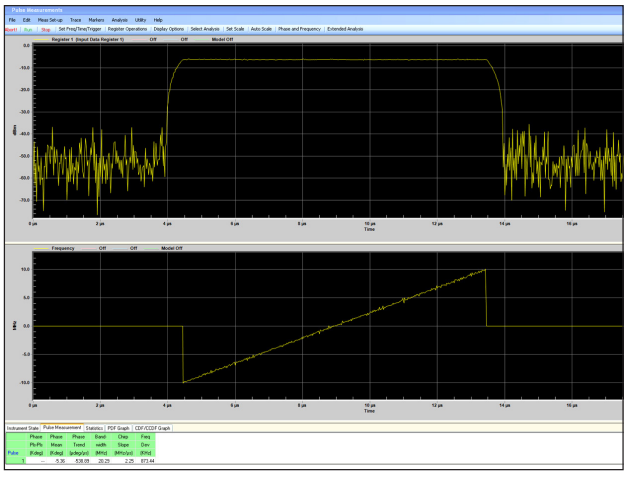

Figure 9. Analysis of an ascending FM chirp—displaying time envelope (top portion) and change in frequency versus time (bottom portion).

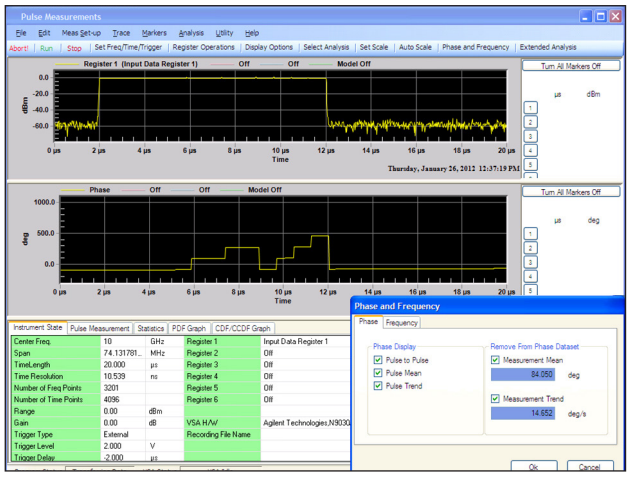

Figure 10. Analysis of Barker-coded pulses.

Extended analysis and statistics

The extended analysis (Option 4FP) adds the ability to review trends in the waveform as well as view data via a histogram plot for up to 200,000 pulses. Specifically, users can view trend data for amplitude, time, phase, and frequency, as well as ratio data such as duty cycle. In addition, users can halt on a value that is outside an acceptable threshold value so they can identify irregularities and find problems in the system performance.

The user interface allows for easy manipulation of the data for users to save and export plots to other software packages for reporting or further analysis. Users can analyze current pulse parameters in selected areas and still compile statistical metrics inside the extended analysis window. There are over 30 different metrics that can be analyzed via the trend capability. Trends can be viewed over the entire collection of pulses or specified recent activity.

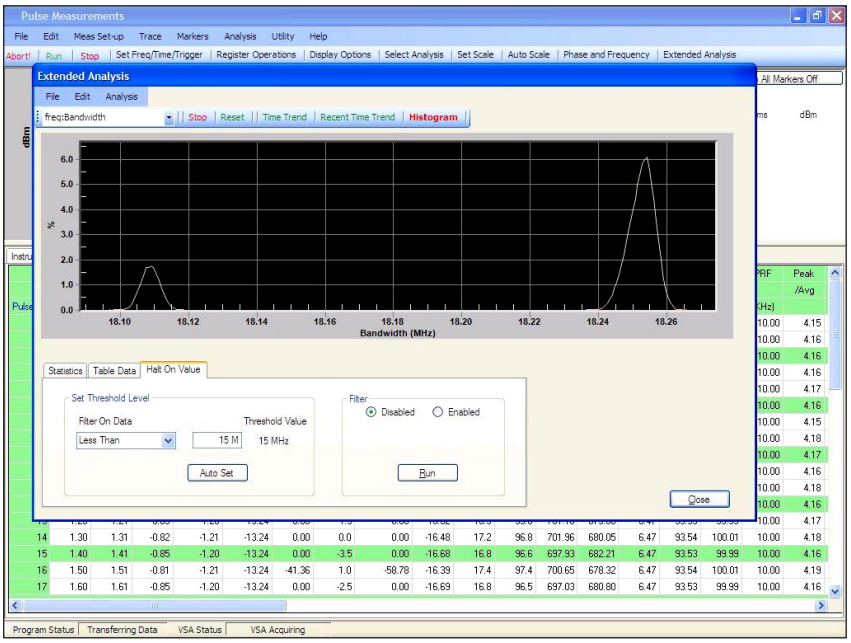

Figure 11. Extended analysis and statistics. Halt On feature running with histogram updates.

Performance Characteristics

The pulse measurement software performance is based on the instrument or measuring device used. The following table shows the nominal performance for select X-Series signal analyzers and Keysight PSA spectrum analyzers. More detailed descriptions of measurement definitions can be found in the respective user guides. These documents can be found in the software under the utility menu. The pulse measurement software can also be used with Keysight's Infiniium oscilloscopes, however performance with these instruments has not been fully characterized.

Keysight signal/spectrum analyzer characteristics

Instrument/ model number	Maximum carrier frequency	Maximum bandwidth	Maximum sample rate/second	Minimum instrument rise time (nom)	Minimum detectable pulse width (nom)
N9030A-B1X PXA[1]	50 GHz	160 MHz	400 MSamples	8 ns	40 ns
Opt B25 for PXA, MXA, EXA and CXA	26.5 GHz	25 MHz	90 MSamples	25 ns	150 ns
Opt B40 for PXA, MXA and EXA	26.5 GHz; 50 GHz for PXA	40 MHz	200 MSamples	25 ns	100 ns
Standard PXA, MXA, EXA and CXA signal analyzers	26.5 GHz; 50 GHz for PXA	10 MHz	30 MSamples	100 ns	400 ns
E444XA PSA with Options 122 and 123	50 GHz	80 MHz	200 MSamples (effective)	10 ns	50 ns
E444XA Series PSA	50 GHz	8 MHz	30 MSamples	120 ns	500 ns

N9051A-3FP pulse measurement software characteristics

	Pulse-to-pulse phase (Opt 3FP required)	Pulse-pulse frequency
N9030A-B1X PXA	0.5 degrees	250 kHz
Opt B25/B40 for PXA, MXA and EXA	0.4 degrees	40 kHz

Note: Pulse width > 10 µs, duty cycle 10%, reference locked; Bessel filter Off. Please consult user manual for definitions of Option 3FP features.

1. Instruments with 160 MHz bandwidth will display "N9030A-B1Y analysis bandwidth extension, 160 MHz" after pressing: System, Show, System on the instrument.

Software characteristics

Maximum number of traces	**6 total**
Trace operations	Raw data, Max Hold, Min Hold, average, add and subtract
Maximum markers	10 markers (reference or delta)
Frequency points	Variable: 51 to 409,601
Record length[1, 2]	T = 512,000 / (span x 1.28)
Resolution[3]	t = 1/ (1.28 x span)
Types of triggers	Freerun, Level, External, Trigger Variable: 51 to 409,601
Waveform file types (import)	.sdf
Waveform file types (export)	.csv (trace data), .bmp, .jpg, .gif, .tif, .png Variable: 51 to 409,601
Max # of continuous pulses	1,000
Max # of collected pulses	200,000

1. The value displayed may not be realized based on certain sample rates.
2. If not limited by instrument's memory
3. Longer record lengths can limit minimum resolution

Ordering Information

N9051A pulse measurement software

Model-Option	Description	Notes
N9051A-2FP	Pulse measurement software, fixed perpetual license	
N9051A-3FP	Phase and frequency measurements	Requires 2FP
N9051A-4FP	Extended analysis and statistics	Requires 2FP

Hardware configurations

N9030A PXA signal analyzer

Model-Option	Description	Notes
N9030A-503, -508, -513, -526, -543, -544, or -550	3.6, 8.4, 13.6, 26.5, 43, 44, or 50 GHz frequency range	One required
N9030A-B1X	140 MHz analysis bandwidth	Recommended
N9030A-P03, -P08, -P13, -P26, -P43, -P44, or -P50	Preamplifier, 3.6, 8.4, 13.6, 26.5, 43, 44, or 50 GHz	One recommended

N9020A MXA signal analyzer

Model-Option	Description	Notes
N9020A-503, -508, -513, or -526	3.6, 8.4, 13.6, or 26.5 GHz frequency range	One required
N9020A-B40	40 MHz analysis bandwidth	Recommended
N9020A-P03, -P08, -P13, or -P26	Preamplifier, 3.6, 8.4, 13.6, or 26.5 GHz	One recommended

N9010A EXA signal analyzer

Model-Option	Description	Notes
N9010A-503, -507, -513, or -526	3.6, 7.0, 13.6, or 26.5 GHz frequency range	One required
N9010A-B25	25 MHz analysis bandwidth	Recommended
N9010A-P03 or -P07	Preamplifier, 3.6 or 7.5 GHz	One recommended

N9000A CXA signal analyzer

Model-Option	Description	Notes
N9000A-503, -507, -513, or -526	3.0, 7.5, 13.6, or 26.5 GHz frequency range	One required
N9000A-B25	25 MHz analysis bandwidth	Recommended
N9000A-P03, P07, P13 or -P26	Preamplifier, 3.0, 7.5, 13.6 or 26.5 GHz	One recommended

E444xA PSA spectrum analyzers

Model-Option	Description
One of the following models is required:	
E4440A	3 Hz to 26.5 GHz
E4443A	3 Hz to 6.7 GHz
E4445A	3 Hz to 13.2 GHz
E4446A	3 Hz to 44 GHz
E4447A	3 Hz to 42.96 GHz
E4448A	3 Hz to 50 GHz
One of the following options is required:	
E444xA-B7J	Digital demodulation hardware
E444xA-122	80 MHz analysis bandwidth
E444xA-140	40 MHz analysis bandwidth
Recommended options:	
E444xA-110	Internal preamplifier
E444xA-123	Preselector bypass

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www.keysight.com/find/X-Series_trial

User-supplied PC requirements

Microsoft operating system	Windows XP Professional, Windows 7
CPU	> 1770 MHz Pentium or AMD-K6; > 2 GHz recommended
RAM	512 MB, 1 GB recommended
Video RAM	4 MB, 16 MB recommended
Hard disk	1 GB available
Required drive	CD-ROM or USB 2.0

Additional Resources

Web

Product pages: **www.keysight.com/find/n9051a**
X-Series measurement applications: **www.keysight.com/find/x-series_apps**
X-Series signal analyzers: **www.keysight.com/find/x-series**
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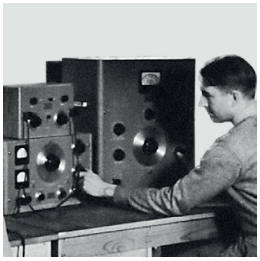
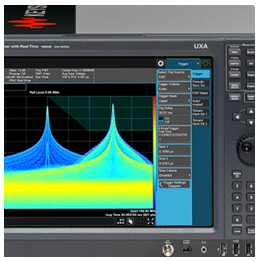


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