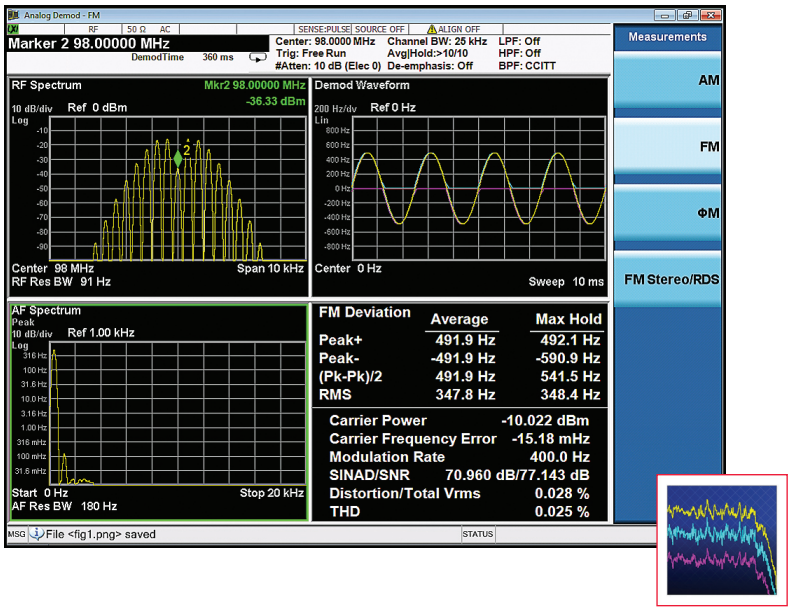
Keysight Technologies
Analog Demodulation
X-Series Measurement App, Traditional UI
N9063EM0D

Technical Overview



- Demodulate AM, FM, or PM
- Quad view, simultaneously displays RF spectrum, demodulated waveform, AF spectrum, demod metrics, and transient events such as attack/release time
- Analyze FM stereo signals for MPX, mono, stereo, channel characterization, and RDS/RBDS decoding
- Most complete set of post-demod filters
- Speaker out (tune and listen) and analog output
- Smooth migration from 8901A/B modulation analyzers
- Flexible licensing provides the option of using perpetual or time based licenses with one or multiple signal analyzers

KEYSIGHT TECHNOLOGIES

Analog Demodulation Measurement Application

Available on all Keysight Technologies, Inc. X-Series signal analyzers, the analog demodulation measurement application transforms the X-Series into an easy-to-use transmitter tester for analog modulated signals, including AM, FM, PM, and FM stereo. By adding fast, one-button measurements, the analog demodulation measurement application helps you design, evaluate, and manufacture your analog devices quickly and accurately. Even in the modern digital world, the analog demodulation measurement application helps you to troubleshoot distortions due to unintentional, analog modulation from digitally modulated transmitters—allowing you to stay on the leading edge of your design and manufacturing challenges.

X-Series measurement applications

X-Series measurement applications increase the capability and functionality of Keysight signal analyzers to speed time to insight. They provide essential measurements for specific tasks in general-purpose, cellular communications, wireless connectivity and digital video applications, covering more than 40 standards or modulation types. Applications are supported on both benchtop and modular, with the only difference being the level of performance achieved by the hardware you select. X-Series measurement applications can help you:

- Gain more insight into device performance with intuitive display and graphs for your application. Select from our library of over 25 different measurement applications.
- Ensure that your design meets the latest standard. Updates are made to the X-Series measurement applications as standards evolve.
- Apply the same measurement science across multiple hardware platforms for consistent measurement results over your design cycle from R&D to production.
- Choose the license structure that meets your business needs. We provide a range of license types (node-locked, transportable, floating or USB portable) and license terms (perpetual or time-based).

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Analog Modulation and Demodulation Overview

Modulation is the process of translating some low-frequency or baseband signal (such as voice, music, or data) to a higher frequency (carrier signal). The primary reasons for modulation include allowing the simultaneous transmission of two or more baseband signals by translating them to different frequencies, and to take advantage of the greater efficiency and smaller size of higher-frequency antennae.

Analog modulation is the most fundamental modulation method. In analog modulation, the variations to the carrier are applied continuously in response to the analog information signal. By definition, the analog signal is continuous in time and amplitude, as opposed to a digital or discrete signal.

A high-frequency carrier signal commonly has sinusoidal form. There are two properties of a carrier signal that can be altered: 1) the amplitude (A) and 2) the angular position. Thus, there are amplitude modulation (AM) and angle modulation. Angle modulation can be further characterized as either frequency modulation (FM) or phase modulation (PM).

FM stereo is an enhancement to FM that uses stereo multiplexing. An FM stereo signal carries stereophonic programs in which signals are transmitted for L (left) and R (right) audio channels. Radio data system (RDS) consists of the text information such as traffic, weather, and radio station information carried in the FM signals. This information can be displayed on the screen of the end-user's device. RBDS is the United States version of RDS.

Table 1 summarizes these three formats of analog modulation.

Analog demodulation is a reverse process of the analog modulation. It offers quantitative assessments for analog modulation qualities. Analog demodulation is not only essential in testing FM or AM transmitters, but is also a powerful troubleshooting tool for analyzing unintentional signals from digitally modulated transmitters such as 2G/3G cellular phones, and wireless LAN and WiMAX™ devices. The FM demodulation measurement is also an excellent alternative for high-volume manufacturing of low-price digital wireless devices, such as *Bluetooth*®, where test throughput and manufacturing costs are critical.

The analog demodulation measurement application runs on the Keysight X-Series signal analyzers and provides fast, complete, and easy-to-use measurements of AM, FM, PM, or FM stereo/RDS signals.*

The primary targeted markets and use cases for the analog demodulation measurement application include:

- Radio transmitter tests
- Signal generator calibration
- FM stereo transmitter tests
- HP/Keysight 8901A/B replacement
- Incidental modulation analysis (such as AM to PM, AM to FM, etc.)
- Transient events and signal settling time analysis

Table 1. Analog modulation formats

Modulation format	Modulation nature	Primary characteristics
Amplitude modulation (AM)	Amplitude of carrier signal varies in direct proportion to the instantaneous amplitude of the baseband signal	AM depth, AM rate, modulation distortion
Frequency modulation (FM)	Frequency of carrier signal varies in direct proportion to the instantaneous amplitude of the baseband signal	FM deviation, FM rate, modulation distortion
Phase modulation (PM)	Phase shift of carrier signal varies in direct proportion to the instantaneous amplitude of the baseband signal	Phase deviation, PM rate, modulation distortion
FM stereo/RDS	FM stereo is an enhancement to FM that uses stereo multiplexing consisting of a mono (L+R) signal, a stereo signal (L-R) and a pilot signal	FM deviation, FM rate, SINAD, distortion, THD, mono to stereo ratio, left to right ratio, 38 kHz pilot carrier freq error and phase error, RDS decoding

* FM stereo/RDS analysis requires N9063EM0D

Analog Demodulation Measurements

With the analog demodulation measurement application, you can perform analog modulation analysis on various radio transmitting devices. The analysis includes:

- RF spectrum of the modulated signal
- Demod waveform (time-domain view of the baseband signal). FM stereo can view MPX, mono, stereo, left or right demod waveforms.
- AF spectrum (i.e., frequency-domain view of the baseband signal). FM stereo can view MPX, mono, stereo, left or right AF spectrum.
- Modulation metrics
  - AM depth
  - FM deviation
  - Phase deviation
  - Carrier power
  - Carrier frequency error (FM and PM only)
  - Modulation rate
  - Distortion/total Vrms
  - Signal to noise and distortion ratio (SINAD)
  - Total harmonic distortion (THD)
  - Left to right ratio*
  - Mono to stereo ratio*
  - 38 kHz pilot frequency error and phase error*
  - RDS/RBDS decoding (including BLER, basic tuning and switching info, radio text, program item number and slow labeling codes, clock time, and date)*

Measurement details

RF spectrum of the modulated signal

This is the most traditional spectrum analyzer measurement viewing the modulated carrier signal power in frequency domain. Prior to being modulated, the signal power of a sinusoidal carrier concentrates at the carrier frequency. By contrast, modulation causes sidebands indicating the power redistribution over frequencies. The pattern of the sidebands depends upon the modulation format. (Refer to Figure 1.)

Demod waveform

This measurement retrieves the baseband signal from the modulated signal via the demodulation process, and displays the baseband signal in a pattern of modulation depth/deviation versus time. Since the modulation depth/deviation is directly proportional to the instantaneous amplitude of the baseband signal, the measurement result helps to intuitively evaluate the quality of the baseband signal. (Refer to Figure 2.)

AF spectrum

By applying the fast Fourier transform (FFT) to the baseband waveform, this measurement demonstrates the baseband signal behaviors in frequency domain graphically. The AF spectrum reveals the distortion of the baseband signal clearly just as the RF spectrum does for the RF signal. (Refer to Figure 3.)

Modulation metrics

AM depth

The AM depth measurement quantifies the amount of amplitude modulation to which the baseband signal modulates the carrier signal. The AM depth, also refers to AM modulation index (m), and is defined as:

$$m\ (\text{in } \%) = \frac{E_{max} - E_{min}}{E_{max} + E_{min}}$$

where, E_{max} and E_{min} are amplitudes (in voltage) of the modulated signal at its peak and trough, respectively, in time-domain. The AM depth ranges from 0 to 100%.

FM deviation

The FM deviation reflects the amount of the frequency modulation to which the baseband signal modulates the carrier signal. The quantity being measured is the peak frequency deviation that is the maximum frequency excursion from the carrier frequency.

Phase deviation

The phase deviation, also referred to PM deviation, is a measure of the amount of the phase modulation. The quantity being measured is the peak phase deviation (in radians) that is the maximum phase excursion from the average carrier phase.

FM and PM are two forms of angle modulation. They are closely related, as phase is the time integral of the frequency, and frequency is the time derivative of phase.

Carrier power

This measures the power of the carrier signal without the modulation. Ideally, power for a sinusoidal carrier signal is concentrated around its carrier frequency.

* FM stereo/RDS analysis requires N9063EM0D

Analog Demodulation Measurements (continued)

Carrier frequency error
This measurement reports the difference between the nominal frequency and the actual frequency of the carrier. It is only available for the FM and PM.

Modulation rate
The modulation rate quantifies how fast the modulation is and equates to the frequency of the baseband signal that modulates the carrier.

Distortion/total Vrms
Modulation distortion is the undesired alterations added to the modulated signal by modulation processes. To assess the modulation quality of a transmitter, the modulation distortion needs to be quantified.

Modulation distortion is usually measured in a relative term against the total signal power:

$$\text{Modulation distortion(in \%)} = \frac{(P_{total} - P_{signal})^{½}}{(P_{total})^{½}} \times 100\%$$

where, P_{total} is the power of the total signal; P_{signal} is the power of the wanted modulating signal; and $P_{total} - P_{signal}$ is the total unwanted signal which can be further divided into the components of noise and harmonic distortion.

SINAD
Another commonly used distortion measure is signal to noise and distortion ratio (SINAD). SINAD, in nature, is the reciprocal of the modulation distortion provided by the "distortion/total Vrms," but the SINAD is usually expressed in a logarithmic term as follows:

$$\text{SINAD (in dB)} = 20 \times \log \frac{(P_{total})^{½}}{(P_{tota} - P_{signal})^{½}}$$

SNR
Signal to noise ratio (SNR) is defined as the ratio of total signal power to noise power:

$$SNR = P_{Signal} / P_{Noise}$$

However, in practice, when the signal power P_{Signal} is hard to get, and $P_{distortion}$ and P_{Noise} are substantially smaller than P_{Signal}. SNR can be approximated as:

$$SNR \sim (P_{Signal} + P_{distortion} + P_{Noise})/P_{Noise}.$$

This approximation has been adopted by HP/Keysight 8903A and therefore inherited to the N9063EM0D analog demod application.

THD
The total harmonic distortion (THD) measurement further isolates the total harmonic distortion component from the noise component in the total unwanted signal. It helps the user to troubleshoot the root causes of modulation distortion.

Other features

Selection of detectors
Four types of detectors are provided: positive peak (Peak+), negative peak (Peak-), Peak/Peak average ((Pk-Pk)/2), and RMS. The Max Hold values for each detector are also displayed.

Comparing the result from the Peak+ detector and from the Peak- detector allows you to check modulation symmetry. For symmetric modulation, the Peak+, Peak-, and the (Pk-Pk)/2 detectors result in identical readings. For asymmetric modulation, the readings generated by the Peak+ and Peak- are different, and using the (Pk-Pk)/2 values is recommended.

The RMS detector results in the RMS (root-mean-square) value of modulation. It is a good choice when measuring noise or residual modulation, where the RMS value is generally more desirable than the peak value. The RMS detector is also a good choice for measuring non-sinusoidal signals.

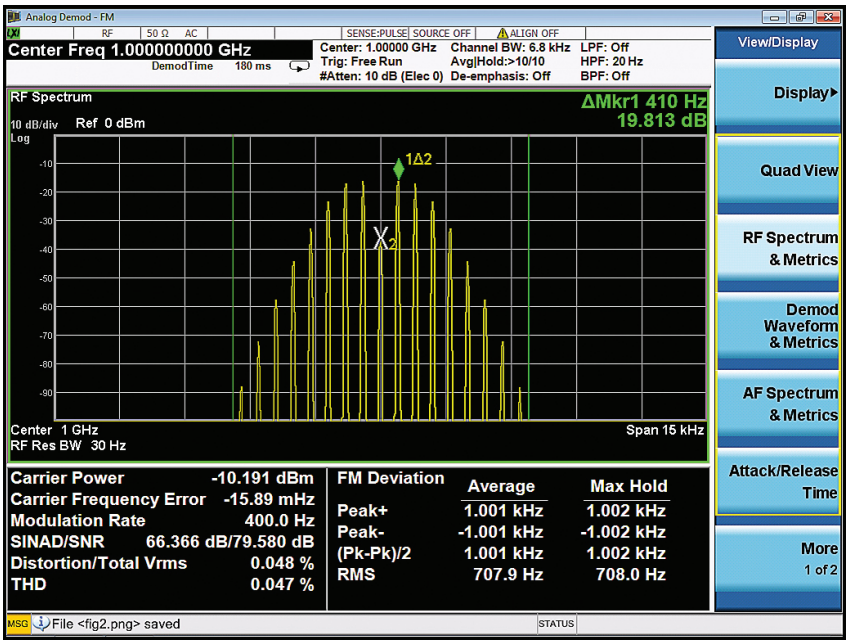

Figure 1. The RF spectrum view presents the modulated signal along with the results of demodulation.

Analog Demodulation Measurements (continued)

Post-demod filters

The post-demod filters help you to optimize the measurement results by filtering out undesired signals such as harmonics, noise, and spurs from the demodulated signal. You may choose a high-pass filter (20, 50, 300, or 400 Hz), and/or a low-pass filter (300 Hz, 3, 15, 30, 80, 100, 300 kHz, or any other user defineable) from the available post-demod filter bank to achieve the best demodulation results. For example, applying an appropriate low-pass filter helps minimize overshoot from square-wave modulation, such as frequency shift keying (FSK).

Additionally, a CCITT filter, which simulates the frequency response behavior of the human auditory system, is also available to help you evaluate the consequences of distortion of the de-modulated signal from the human hearing perspectives. The filter bank also allows you to select from various other filters to optimize your measurements and comply with certain regulatory standards. These filters include:

- A-Weighted
- C-Weighted
- C-Message
- CCIR-1k Weighted
- CCIR-2k Weighted
- CCIR Unweighted
- SIAND notch
- Signaling Notch filters

To accommodate your pre-empha-sized FM signals, the N9063EM0D/ is also equipped with four separate de-emphasis filters (25, 50, 75, and 750 µs) for you to select.

Marker capabilities

The powerful marker capabilities offered by the N9063EM0D further add great convenience to your analog demodulation measurements. You can set up to 12 markers and define them as “normal,” “delta,” or “fixed.”

A marker table is added to AF spectrum view to enable faster and easier analysis of multi-tone audio (CTCSS, DTMF, etc.), audio flatness response, Command Destruct telemetry, etc.

Tune and listen*

Listening to the demodulated signal through a speaker may give you more insights. Many experts and technicians can figure out the cause of a problem by hearing buzzing, humming, and/or clicking noises.

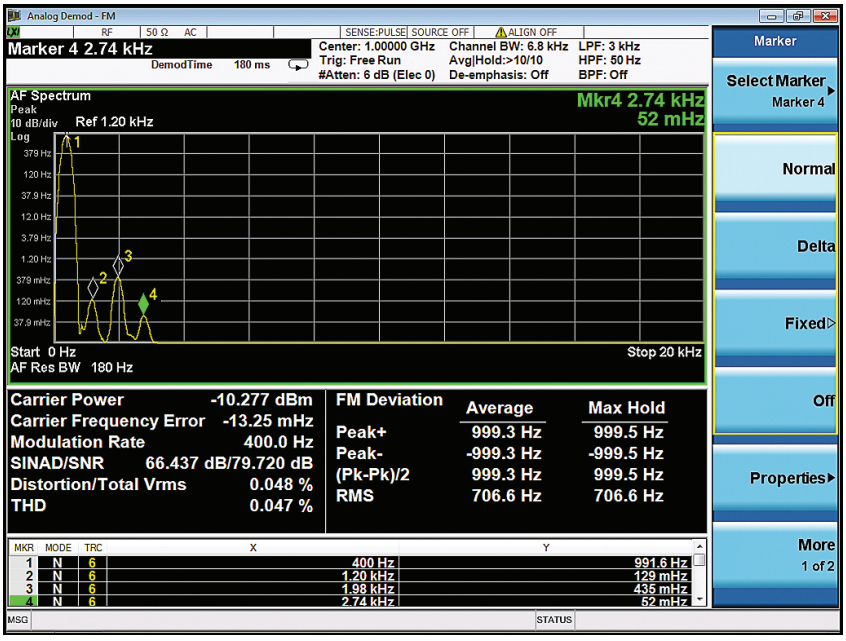

Figure 2. Apply the "post-demod" filters to optimize analysis results for the baseband (AF) spectrum. The marker table facilitates the analysis.

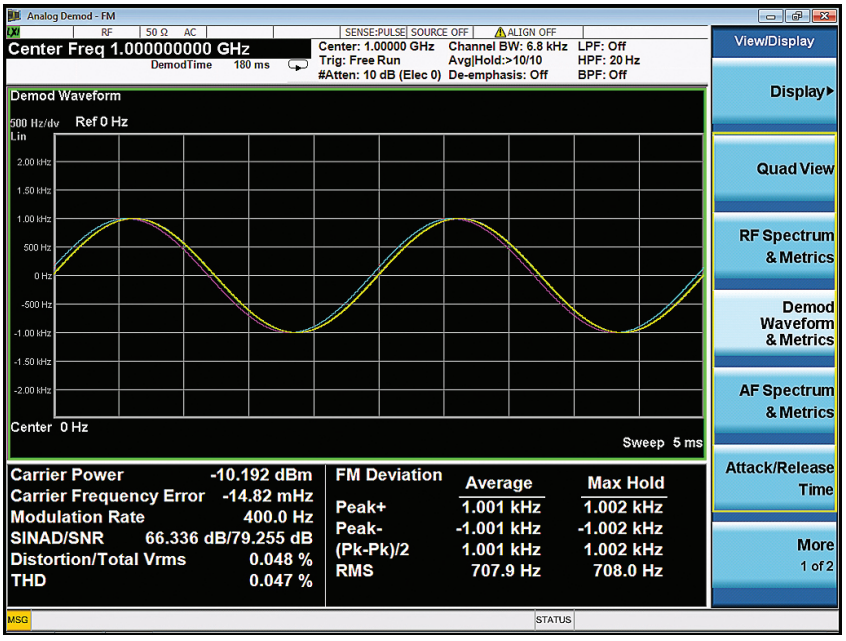

Figure 3. The demod waveform view displays the baseband signal in time domain.

* Not available on the CXA-m

Analog Demodulation Measurements (continued)

Accelerating measurements further

The X-Series signal analyzers offer great advantages in throughput with their industry-leading speed for measurements including the analog demodulation. By turning off the unneeded metrics, the analog demod measurement application allows you to further speed up your measurements.

Quantify the transient events with "Attack/Release" time view

Attack/Release Time is a new view type for measuring transient events, such as “attack” (transmitter turn-on), “release” (transmitter turn-off), and VCO settling characteristics. The upper display is RF Envelope (magnitude) vs. time; the lower display is FM Demod Waveform (frequency) vs. time. Transient measurements are single-shot, and require an External trigger edge to establish time t=0 (e.g. from the PTT button).

Certain measurements from TIA-603 - such as Carrier Attack Time, Transient Frequency Behavior, and Encoder Response Time - are much easier to make with this new view. The view can be used for general amplitude and frequency transient or settling measurements. And transmitters that use FM or FSK in a burst can also be captured and measured, with RF Burst trigger.

The view supports long post-demod waveforms, storing a post-demod FM Waveform up to 3.6M samples (previously limited to 1001 pts); this data is available for query via SCPI. Additionally, limit lines for FM Waveform can be imported from customer-defined CSV files and displayed.

The InfoBW control allows the user to trade off the bandwidth of the measurement (frequency range of demod) with the noise in the frequency measurement. Figure 4, the "Attack/Release view", captures the transient events in time domain when the modulation starts and the carrier power switches to different levels.

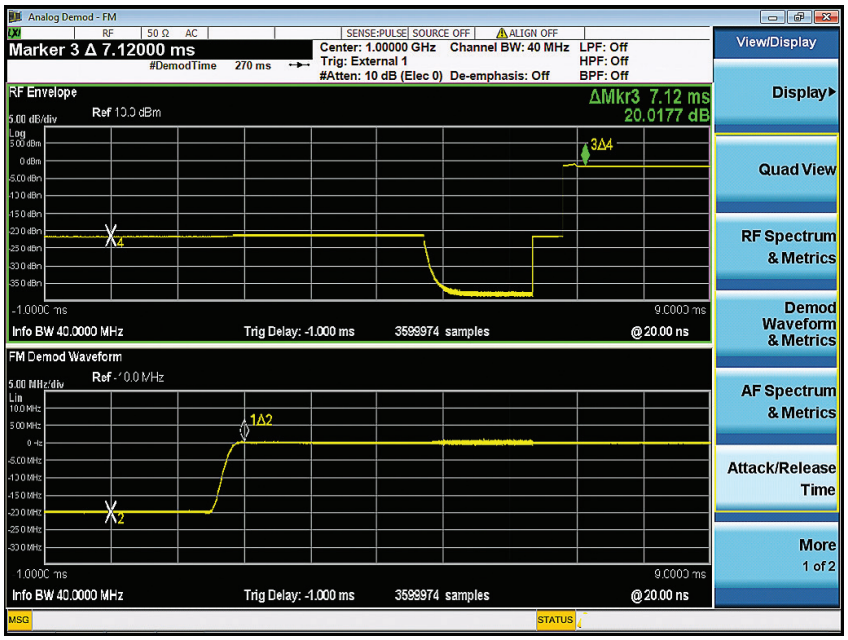

Figure 4. "Attack/Release Time" view helps quantify the transient events in time domain.

Analog Demodulation Measurements (continued)

FM stereo/RDS MPX view

FM MPX consists of FM signal multiplexing with the mono signal (L+R), stereo signal (L-R), pilot signal (at 19 kHz), and optional RDS signal (at 57 kHz). Figure 4 shows the FM stereo MPX view with four measurement windows. The top left window contains RF spectrum, the bottom left contains MPX AF spectrum, the top right contains MPX demodulated waveform, and the bottom right contains demodulation metrics with deviation, carrier power, carrier frequency error, SINAD and distortion results.

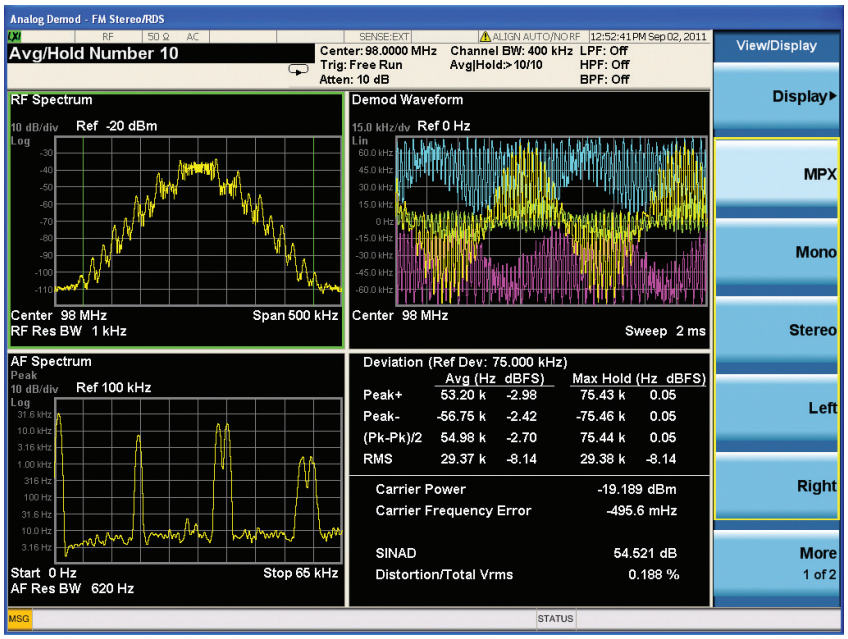

Figure 5. FM stereo MPX view/display with RF spectrum, AF spectrum, demod waveform and demodulation metrics results.

FM stereo mono/stereo/left/right view

For FM stereo, mono signal (L+R) occupies the lower part of the baseband spectrum (50 Hz to 15 kHz) in order to maintain backward compatibility with the previous monophonic FM systems. The stereo signal (L-R) is amplitude modulated onto a suppressed subcarrier at 38 kHz. A pilot signal is transmitted at 19 kHz and is used by the receiver to identify a stereo transmission and reconstruct L and R audio signals from the multiplexed signal. In the receiver, mono and stereo signals will be demodulated first and then the mono signal (L+R) is added to the stereo signal (L-R) to get the L signal, and the stereo signal (L-R) is subtracted to get the R signal. The mono/stereo/left/right views will display the demodulated waveform, AF spectrum and deviation, SINAD, distortion and THD results for the selected channel. Figure 6 is an example of FM stereo left channel demodulation results.

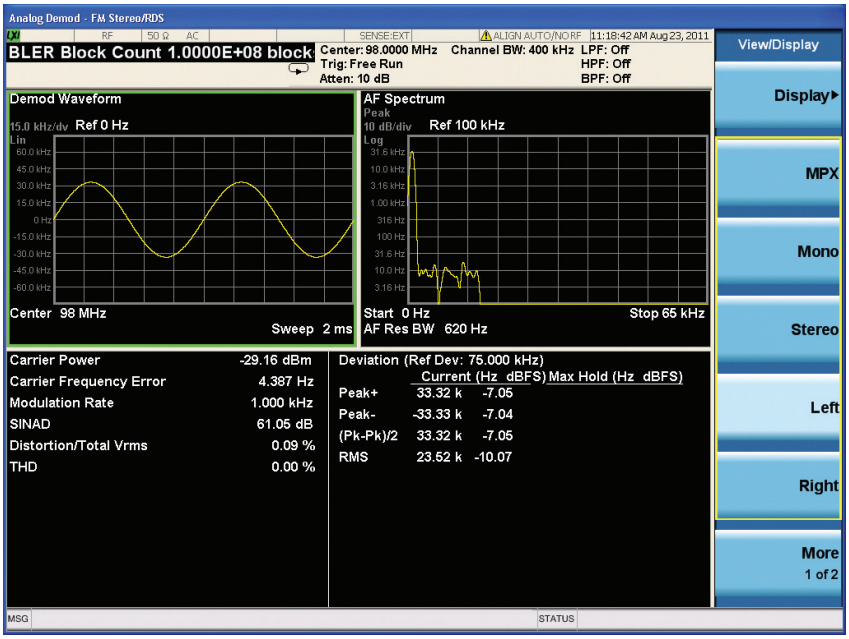

Figure 6. FM stereo mono/stereo/left/right view/display with demod waveform, AF spectrum and demodulation metrics results.

Analog Demodulation Measurements (continued)

RDS/RBDS decoding results view

The main objectives of FM RDS/RBDS are:

- To enhance functionality for FM receivers
- To make the receivers more user-friendly by using features such as PI (program identification), PS (program service) name display, and, if applicable, automatic tuning for portable and car radios.

RDS/RBDS uses the 57 kHz subcarrier to carry the data at 1.1875 kbps bitrate. The 57 kHz subcarrier is chosen to be the third harmonic of the pilot tone. The deviation range of the FM carrier due to the unmodulated RDS/RBDS subcarrier is 1.0 kHz ± 7.5 kHz. Figure 7 is an example of the RDS/RBDS decoding view showing the results of the BLER, basic tuning and switching info, radio text, program item number and slow labeling codes, clock-time, and date information.

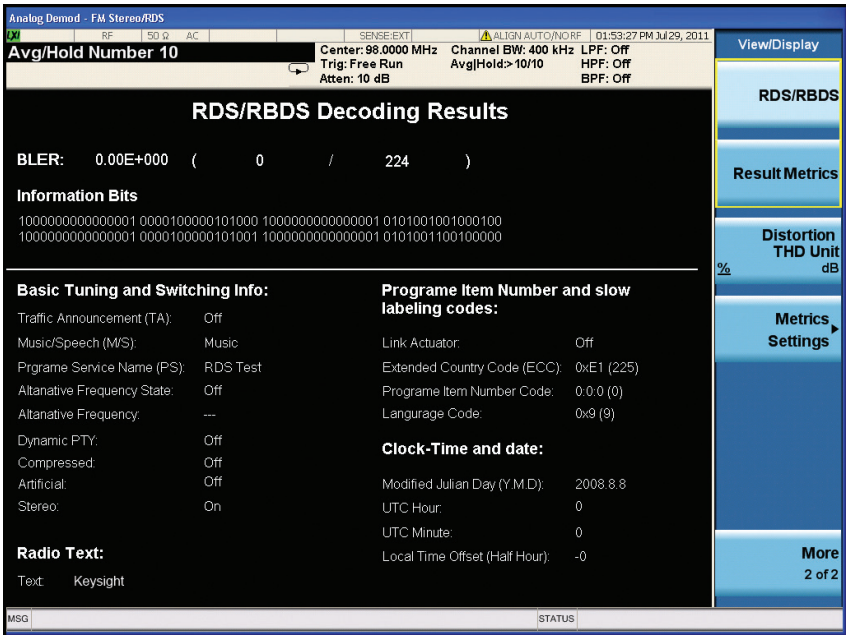

Figure 7. FM stereo RDS/RBDS decoding results view/display with BLER and decoded RDS information.

FM stereo numeric result summary view

Figure 8 shows the numeric result summary view with detailed MPX, mono, stereo, left, right, pilot, and RDS deviation, mod rate, SINAD and THD results in the top section. Furthermore, the left to right ratio, mono to stereo ratio, RF carrier power, RF carrier frequency error, 38 kHz carrier frequency error, and 38 kHz carrier phase error will be shown on the bottom section.

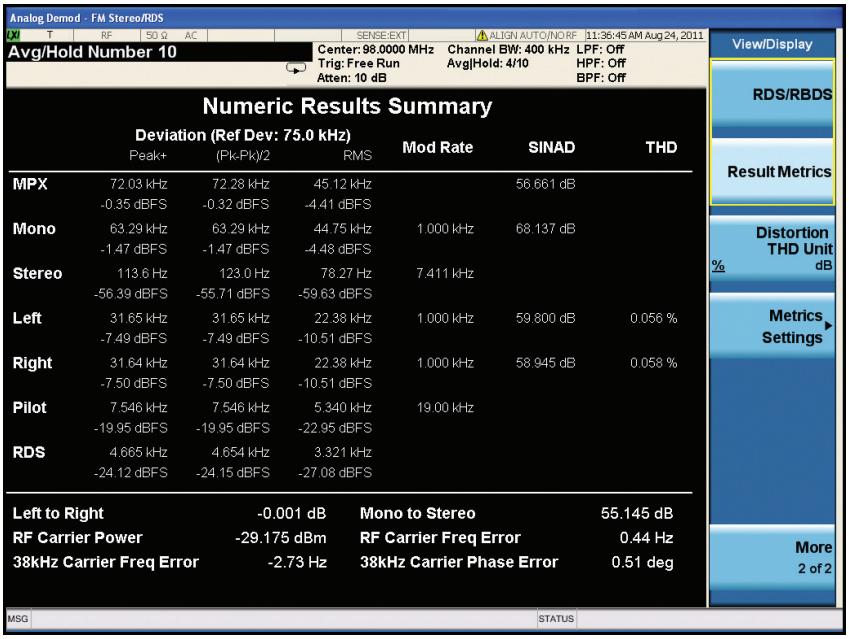

Figure 8. FM stereo numeric result metrics view/display with deviation, mod rate, SINAD, THD, left to right ratio, mono to stereo ratio and 38 kHz carrier frequency error, and phase error.

Analog Demodulation Measurements (continued)

Measurement details

All of these measurements are available with the press of a button (Table 2). The measurements are fully remote controllable via the IEC/IEEE bus or LAN, using SCPI commands.

Table 2. One-button measurements provided by the N9063EM0D measurement application.

Technology	**AM**	**PM**	**FM**	**FM stereo/RDS**
Measurement application	N9063EM0D	N9063EM0D	N9063EM0D	N9063EM0D
X-Series signal analyzer	PXA, MXA, EXA, CXA, MXE, CXA-m			
Measurement				
RF spectrum	●	●	●	●
RF carrier power (dBm)	●	●	●	●
RF carrier freq error (Hz)		●	●	●
AF spectrum	●	●	●	MPX, mono, stereo, left, right
Demodulated waveform	●	●	●	MPX, mono, stereo, left, right
Demodulation	AM depth (%)	PM deviation (rad, deg)	FM deviation (Hz)	FM deviation (Hz)
Peak+	●	●	●	●
Peak–	●	●	●	●
(Pk-Pk)/2	●	●	●	●
RMS	●	●	●	●
Modulation rate (Hz)	●	●	●	●
SINAD (dB)/SNR (dB)	●	●	●	●
THD (dB or %)	●	●	●	●
Distortion/total power (dB or %)	●	●	●	●
Left to right ratio (dB)				●
Mono to stereo ratio (dB)				●
38 kHz carrier power (dB)				●
38 kHz freq error (Hz)				●
RDS/RBDS decoding				●
BLER				●
Radio text				●
Attack/release time			●	
Long capture (3.6 MSa)	●	●	●	●

Key Specifications

Definitions

- Specifications describe the performance of parameters covered by the product warranty.
- Nominal values are designated with the abbreviation "nom." These values indicate expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty.

Note: Data subject to change

You Can Upgrade!

Options can be added after your initial purchase.

All of our X-Series application options are license-key upgradeable.

Performance specifications

Description	PXA	MXA	EXA	CXA	CXA-m	MXE
Analog demodulation performance						
Maximum safe input level	+30 dBm (1 W)					
RF frequency range						
Minimum frequency	3 Hz	10 Hz	10 Hz	9 kHz	10 Hz	20 Hz
Maximum frequency						
Option 503	3.6 GHz	3.6 GHz	3.6 GHz	3.0 GHz		
Option F03					3.0 GHz	
Option 507			7.0 GHz	7.5 GHz		
Option F07					7.5 GHz	
Option 508	8.4 GHz	8.4 GHz				8.4 GHz
Option 513	13.6 GHz	13.6 GHz	13.6 GHz	13.6 GHz		
Option F13					13.6 GHz	
Option 526	26.5 GHz	26.5 GHz	26.5 GHz	26.5 GHz		26.5 GHz
Option F26					26.5 GHz	
Option 532			32 GHz			
Option 543	43 GHz					
Option 544	44 GHz		44 GHz			44 GHz
Option 550	50 GHz					
Demodulation bandwidth	Up to 160 MHz	Up to 160 MHz	Up to 40 MHz	Up to 25 MHz	Up to 25 MHz	Up to 40 MHz
Capture memory	3.6 MSa					
Filters						
Low pass	300 Hz, 3 kHz, 15 kHz, 30 kHz, 80 kHz, 300 kHz, 100 kHz (> 20 kHz Bessel), and manually settable by user					
High pass	20, 50, 300, 400 Hz					
Band pass	CCITT A-Weighted, C-Weighted, C-Message, CCIR-1k Weighted, CCIR-2k Weighted, CCIR Unweighted					
De-emphasis (FM only)	25, 50, 75, 750 µs					
Notch	SINAD notch, signaling notch					

Key Specifications (continued)

Performance specifications (continued)

Description	PXA	MXA[1]	EXA[1]	CXA[1]	MXE	CXA-m
FM demodulation (all in nominal)						
FM deviation accuracy	±0.2%[2]	±0.2%[2]	±0.4%[2]	±0.4%[2]	±0.4%[2]	±0.4%[2]
FM rate accuracy	±0.001% x rate	±0.001% x rate	±0.01% x rate	±0.01% x rate	±0.001% x rate	±0.01% x rate
Carrier frequency accuracy	±0.1 Hz	±0.2 Hz	±0.2 Hz	±0.5 Hz	±0.2 Hz	±0.5 Hz
Residual						
THD	0.25%[3]	0.25%[3]	0.35%[3]	0.4%[3]	0.25%[3]	0.4%[3]
Distortion	0.10%	0.18%	0.30%	0.30%	0.18%	0.30%
SINAD	60 dB	55 dB	50 dB	50 dB	55 dB	50 dB
AM rejection	2.9 Hz	3.9 Hz	4 Hz	4 Hz	4 Hz	4 Hz
Residual FM	1 Hz	1 Hz	4 Hz	2 Hz	1 Hz	2 Hz
AM demodulation						
AM depth accuracy	±0.2% + 0.002 x reading (nom)					
AM rate accuracy	±0.05 Hz (nom)					
Residual						
THD	0.16% (nom)	0.16% (nom)	0.16% (nom)	0.16% (nom)	0.16% (nom)	0.16% (nom)
Distortion	0.1% (nom)	0.17% (nom)	0.3% (nom)	0.3% (nom)	0.17% (nom)	0.3% (nom)
SINAD	60.0 dB (nom)	55.5 dB (nom)	50 dB (nom)	50 dB (nom)	55.5 dB (nom)	50 dB (nom)
FM rejection	0.05% AM peak	0.05% AM peak	0.5% (nom)	0.5% (nom)	0.5% (nom)	0.5% (nom)
Residual AM	0.02% AM rms	0.02% AM rms	0.2% (nom)	0.2% (nom)	0.2% (nom)	0.2% (nom)
PM demodulation						
PM deviation accuracy	±0.1%[4]	±0.2%[5]	±(1 rad x (0.05 + (Rate/1 MHz))) (nom)			
PM rate accuracy	±0.1 Hz (nom)	±0.1 Hz (nom)	±0.2 Hz (nom)	±0.2 Hz (nom)	±0.2 Hz (nom)	±0.2 Hz (nom)
Residual						
THD	0.1% (nom)	0.1% (nom)	0.1% (nom)	0.1% (nom)	0.1% (nom)	0.1% (nom)
Distortion	0.5% (nom)	0.5% (nom)	0.8% (nom)	0.8% (nom)	0.5% (nom)	0.8% (nom)
SINAD	45 dB (nom)	45 dB (nom)	42 dB (nom)	42 dB (nom)	45 dB (nom)	42 dB (nom)
AM rejection	3 mrad (nom)	3 mrad (nom)	4 mrad (nom)	4 mrad (nom)	3 mrad (nom)	4 mrad (nom)
Residual PM	2 mrad (nom)	2 mrad (nom)	4 mrad (nom)	4 mrad (nom)	2 mrad (nom)	4 mrad (nom)
FM stereo/RDS (all in nominal)	**FM stereo with 67.5 kHz reference deviation and 1 kHz modulation rate plus 6.75 kHz pilot deviation**					
SINAD (with A-Weighted filter)	69 dB	62 dB	61 dB	59 dB	62 dB	59 dB
SINAD (with CCITT filter)	71 dB	69 dB	68 dB	67 dB	69 dB	67 dB
Left to right ratio (with A-Weighted filter)	72 dB	63 dB	61 dB	59 dB	63 dB	59 dB
Left to right ratio (with CCITT filter)	76 dB	72 dB	69 dB	68 dB	72 dB	68 dB

1. FM performance listed is for newer vintage of MXA (SN prefix ≥ MY/SG/US5233, ship standard with Option EP2) or EXA (SN prefix ≥ MY/SG/US5340, ship standard with Option EP3) or CXA (SN prefix ≥ MY/SG/US5423, ship standard with Option EP4).
2. Value times (deviation + rate)
3. Value times square root of ModIndex
4. Value times (reading + 2 mrad)
5. Value times (reading + 3 mrad)

For a complete list of specifications, refer to the appropriate specifications guide:

PXA: www.keysight.com/find/pxa_specifications
MXA: www.keysight.com/find/mxa_specifications
EXA: www.keysight.com/find/exa_specifications
CXA: www.keysight.com/find/cxa_specifications
MXE: www.keysight.com/find/mxe_specifications
PXIe CXA-m: www.keysight.com/find/cxa-m_specifications
PXIe VSA up to 6 GHz: www.keysight.com/find/m9391a
PXIe VSA up to 50 GHz: www.keysight.com/find/m9393a
PXIe VXT: www.keysight.com/find/m9421a

Ordering Information

Flexible licensing and configuration

- **Perpetual:** License can be used in perpetuity.
- **Time-based:** License is time limited to a defined period, such as 12-months.
- **Node-locked:** Allows you to use the license on one specified instrument/computer.
- **Transportable:** Allows you to use the license on one instrument/computer at a time. This license may be transferred to another instrument/computer using Keysight's online tool.
- **Floating:** Allows you to access the license on networked instruments/computers from a server, one at a time. For concurrent access, multiple licenses may be purchased.
- **USB portable:** Allows you to move the license from one instrument/computer to another by end-user only with certified USB dongle, purchased separately.
- **Software support subscription:** Allows the license holder access to Keysight technical support and all software upgrades

You Can Upgrade!

All of our X-Series application options are license-key upgradeable.

UP GRADE

Analog demodulation measurement application (N9063EM0D)

Model	Software License Type	Support Contract	Support Subscription (12-month) [1,2]
N9063EM0D-1FP	Node-locked perpetual	R-Y5C-001-A[2]	R-Y6C-001-L[2]
N9063EM0D-1FL	Node-locked 12-month	R-Y4C-001-L[1]	Included
N9063EM0D-1TP	Transportable perpetual	R-Y5C-004-D[2]	R-Y6C-004-L[2]
N9063EM0D-1TL	Transportable 12-month	R-Y4C-004-L[1]	Included
N9063EM0D-1NP	Floating perpetual	R-Y5C-002-B[2]	R-Y6C-002-L[2]
N9063EM0D-1NL	Floating 12-month	R-Y4C-002-L[1]	Included
N9063EM0D-1UP	USB portable perpetual	R-Y5C-005-E[2]	R-Y6C-005-L[2]
N9063EM0D-1UL	USB portable 12-month	R-Y4C-005-L[1]	Included

One month software support subscription extensions[3]

Model	Description
R-Y6C-501[3]	1-month of software support subscription for node-locked license
R-Y6C-502[3]	1-month of software support subscription for floating license
R-Y6C-504[3]	1-month of software support subscription for transportable license
R-Y6C-505[3]	1-month of software support subscription for USB portable license

1. All time-based X-Series measurement application licenses includes a 12-month support contract which also includes the 12-month software support subscription as same duration.
2. Support contract must bundle software support subscription for all perpetual licenses in the first year. All software upgrades and Keysight support are provided for software licenses with valid support subscription.
3. After the first year, software support subscription may be extended with annual or monthly software support subscription extension.

Try Before You Buy!

Evaluate a full-featured version of our X-Series measurement application with our ***FREE*** trial. Redeem one 30-day trial license of each measurement application online at: www.keysight.com/find/X-Series_apps_trial

Hardware Configurations

To learn more about compatible platforms and required configurations, please visit: www.keysight.com/find/X-Series_apps_platform

Software Models & Options

To learn more about X-Series measurement application licensing, model numbers and options, please visit: www.keysight.com/find/X-Series_apps_model

Hardware Configuration

For optimizing the analog demodulation measurement application, Keysight recommends a minimum level of instrument hardware functionality at each instrument performance point. Supported instruments include:

Benchtop:
- PXA N9030A
- MXA N9020A
- MXE N9038A
- EXA N9010A
- CXA N9000A

PXIe:
- VSA (6 GHz) M9391A
- VSA (50 GHz) M9393A
- VXT M9420/21A
- CXA-m M9290A

N90x0A X-Series signal analyzer

Capability	Instrument Option	Benefit
Analysis bandwidth	10 or 25 MHz as default or higher	**Required**: Wider analysis bandwidth options such as 25/40/85/125/160 MHz can be selected depending on the specified signal analyzer model
Precision frequency reference	-PFR	**Recommended**: For enhanced frequency accuracy and repeatability for lower measurement uncertainty
Electronic attenuator	-EA3	**Recommended**: Fast and reliable attenuation changes ideal for manufacturing without the wear associated with mechanical attenuators up to 3.6 GHz in 1 dB steps
Pre-amplifier	3.6 GHz (-P03) or higher	**Recommended**: For maximizing the measurement sensitivity
Fine resolution step attenuator	-FSA	**Recommended**: Useful for maximizing useable dynamic range to see signals
Analog baseband I/Q inputs	-BBA on PXA and MXA only	**Optional**: To extend measurements at baseband if required by device under test

M9391/93A PXIe VSA vector signal analyzer

Description	Model-Option	Additional information
Frequency range 3 or 6 GHz	M9391A-F03, or F06	One required for M9391A
Frequency range 8.4, 14, 18, or 27 GHz Frequency extension to 43.5 or 50 GHz	M9393A-F08, F14, F18, or F27 M9393A-FRZ or FRX	One required for M9393A Optional (requires M9393A-F27)
Analysis bandwidth 40, 100 or 160 MHz	M9391A/M9393A-B04, B10 or B16	One required
Memory 128, 512 or 1024 MSa	M9391A/M9393A-M01, M05 or M10	One required
Frequency reference 10 MHz and 100 MHz	M9391A/M9393A-300	One required

M9420/21A PXIe VXT vector transceiver

Description	Model-Option	Additional information
Frequency range 3.8 or 6 GHz	M9420A/M9421A-504, or 506	One required
Analysis bandwidth 40, 80 or 160 MHz	M9420A/M9421A-B40/B80/B1X	One required
Memory 256 or 512 MSa	M9420A/M9421A-M02/M05	One required
Half duplex port	M9420A/M9421A-HDX	Optional
High output power	M9420A/M9421A-1EA	Optional

M9290A CXA-m PXIe signal analyzer

Description	Model-Option	Additional information
Frequency range 3, 7.5, 13.6 or 26.5 GHz	M9290A-F03, F07, F13, or F26	One required
Analysis bandwidth 25 MHz	M9290A-B25	Optional
Preamplifier, 3, 7.5, 13.6 or 26.5 GHz	M9290A-P03, P07, P13 or P26	One required
Fine resolution step attenuator	M9290A-FSA	Optional
Precision frequency reference	-PFR	Optional

Related Literature

N9063A & W9063A Analog Demodulation, Self-Guided Demonstration, literature number 5990-5921EN
Spectrum Analysis Amplitude and Frequency Modulation, Application Note 150-1, literature number 5954-9130EN
N9063A & W9063A Analog Demod, Measurement Guide, part number: N9063-90006

Web

Product page:
www.keysight.com/find/N9063D

X-Series measurement applications:
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MXE EMI Receiver
www.keysight.com/MXE

CXA-m PXIe signal analyzer
www.keysight.com/find/CXA-m

PXIe VXT vector transceiver
www.keysight.com/find/VXT

PXIe VSA vector signal analyzer
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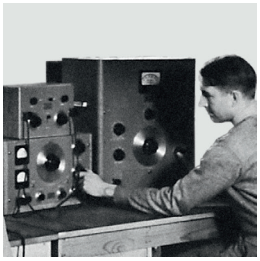

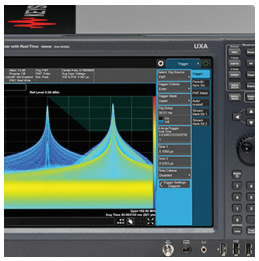

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