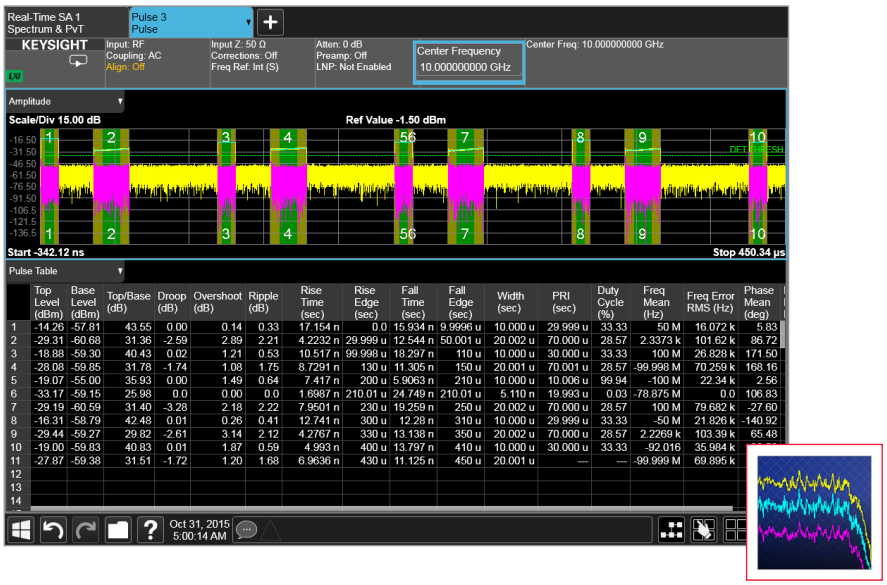
Keysight Technologies
Pulse Analysis
X-Series Measurement App, Multi-Touch
N9067C

Technical Overview



	Top Level (dBm)	Base Level (dBm)	Top/Base (dB)	Droop (dB)	Overshoot (dB)	Ripple (dB)	Rise Time (sec)	Rise Edge (sec)	Fall Time (sec)	Fall Edge (sec)	Width (sec)	PRI (sec)	Duty Cycle (%)	Freq Mean (Hz)	Freq Error RMS (Hz)	Phase Mean (deg)
1	-14.26	-57.81	43.55	0.00	0.14	0.33	17.154 n	0.0	15.934 n	9.9996 u	10.000 u	29.999 u	33.33	50 M	16.072 k	5.83
2	-29.31	-60.68	31.36	-2.59	2.89	2.21	4.2232 n	29.999 u	12.544 n	50.001 u	20.002 u	70.000 u	28.57	2.3373 k	101.62 k	86.72
3	-18.88	-59.30	40.43	0.02	1.21	0.53	10.517 n	99.998 u	18.297 n	110 u	10.000 u	30.000 u	33.33	100 M	26.828 k	171.50
4	-28.08	-59.85	31.78	-1.74	1.08	1.75	8.7291 n	130 u	11.305 n	150 u	20.001 u	70.001 u	28.57	-99.998 M	70.259 k	168.16
5	-19.07	-55.00	35.93	0.00	1.49	0.64	7.417 n	200 u	5.9063 n	210 u	10.000 u	10.006 u	99.94	-100 M	22.34 k	2.56
6	-33.17	-59.15	25.98	0.0	0.00	0.0	1.6987 n	210.01 u	24.749 n	210.01 u	5.110 n	19.993 u	0.03	-78.875 M	0.0	106.83
7	-29.19	-60.59	31.40	-3.28	2.18	2.22	7.9501 n	230 u	19.259 n	250 u	20.002 u	70.000 u	28.57	100 M	79.682 k	-27.60
8	-16.31	-58.79	42.48	0.01	0.26	0.41	12.741 n	300 u	12.28 n	310 u	10.000 u	29.999 u	33.33	-50 M	21.826 k	-140.92
9	-29.44	-59.27	29.82	-2.61	3.14	2.12	4.2767 n	330 u	13.138 n	350 u	20.002 u	70.000 u	28.57	2.2269 k	103.39 k	65.48
10	-19.00	-59.83	40.83	0.01	1.87	0.59	4.993 n	400 u	13.797 n	410 u	10.000 u	30.000 u	33.33	-92.016	35.984 k	
11	-27.87	-59.38	31.51	-1.72	1.20	1.68	6.9638 n	430 u	11.125 n	450 u	20.001 u	—	—	-99.999 M	69.895 k	
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- Automatically synchronize to pulse modulated signals for radar and electronic warfare (EW) applications up to 50 GHz and bandwidth of 1 GHz
- Verify all key pulse signal modulation performance indicators relating to power, droop, overshoot, ripple, time (rise/fall/width/PRI), frequency, phase, and FM modulation using the comprehensive pulse table result metrics
- Integrates with popular real-time instrument functionality (UXA, PXA, MXA) such as frequency mask trigger
- Select from five X-Series signal analyzers with multi-touch to meet your specific design and test goals
- Use multi-touch front panel user interface or SCPI remote control
- Extend test assets with transportable licenses between all X-Series signal analyzers with multi-touch UI

KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

Pulse Analysis Measurement Application

The Keysight Technologies, Inc. N9067C pulse analysis measurement application for multi-touch signal analyzers provides pulsed radar and electronic warfare (EW) analysis to characterize today's dynamic signal environment. In mission-critical aerospace, defense and EW applications, signal design and validation require comprehensive tools for pulsed radar signal analysis and cross-domain - time, frequency and modulation - test capabilities. To help engineers achieve their design validation goals, the N9067C, a powerful multi-touch application, integrates with the powerful multi-touch X-Series signal analyzers for comprehensive analysis and troubleshooting. The N9067C populates a diverse set of pulse metrics in a flexible table format. All metrics, including pulse table results, result statistics, and cumulative statistics are easily saved into formats such as .csv for custom reports and post analysis.

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 established standards and modulation types. Applications are supported across X-Series signal analyzers, with the only difference being the level of performance achieved by the hardware you select.

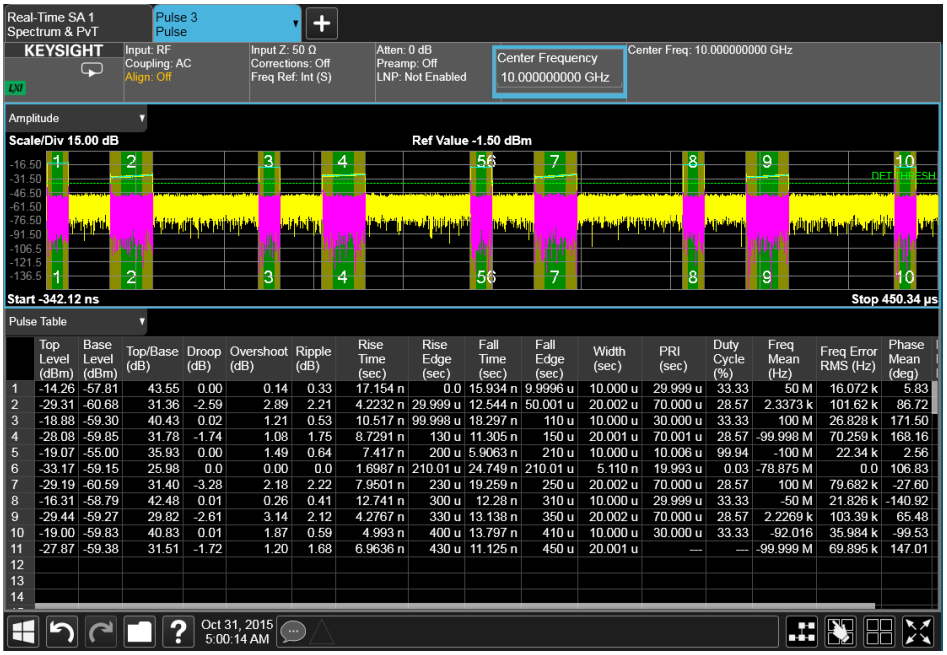

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Figure 1. The N9067C pulse analysis measurement application provides a user interface designed to make quick pulse measurements.

Top Features

- Verify all key pulse signal modulation performance indicators relating to power, droop, overshoot, ripple, time (rise/fall/width/PRI), frequency, phase, and FM modulation using the comprehensive pulse table result metrics
- Visualize pulse signal modulation characteristics and impairment errors in detail with multiple time-synchronized amplitude, phase, and frequency (FM) trace results, in addition to flexible trace overlay support
- Quickly view statistical variance performance data for each reported pulse metric, accumulated over single or multiple acquisitions, using the pulse cumulative statistics table, graphical histogram, and trend line trace plots
- Gain deeper insights into your signal's time and frequency domain dynamic and spurious performance with powerful and flexible trace views such as spectrogram and cumulative history

Pulse analysis in spectrum and time domain with one tool

Traditionally, pulsed RF signals have been designed by radar and EW system engineers using a spectrum analyzer for frequency domain characteristics and oscilloscopes for time domain characteristics. Making other frequency and time domain measurements with exactly the same time-sampled data is one of the simplest, yet most important, vector signal analysis techniques. This is especially true when characterizing transient or non-stationary signals such as complex pulsed RF signals in aerospace and defense applications. The pulse analysis application provides simple setup for pulse detection, comprehensive pulse analysis parameters in various traces with visualization and reporting of test results.

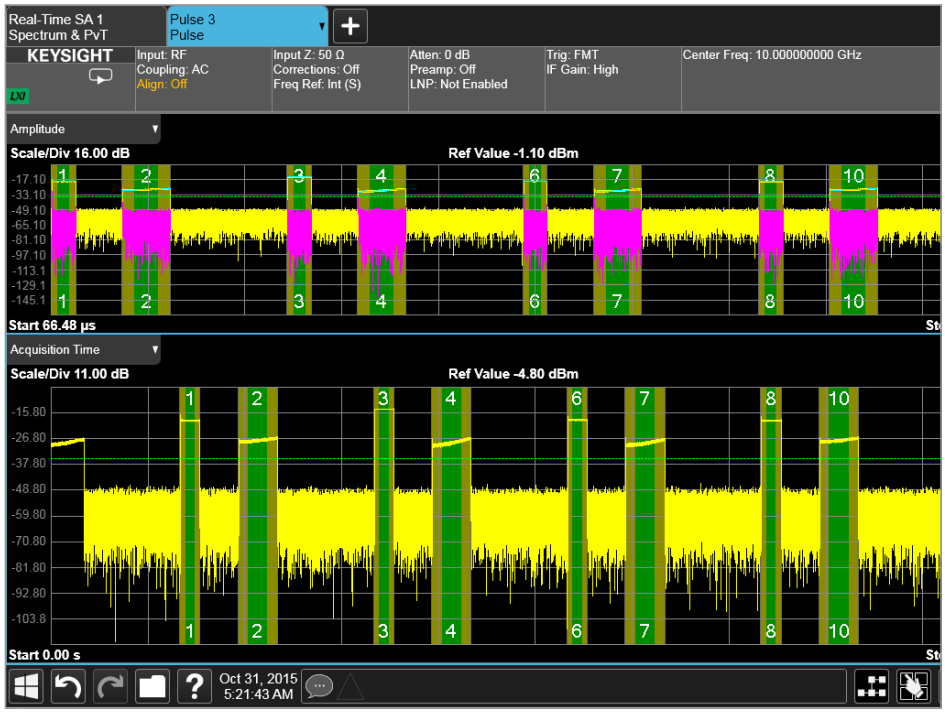

Figure 2. Simultaneous views of pulse signals versus time.

Quickly transition from real-time spectrum analysis to pulse analysis

The indispensable real-time trigger capability offered by the RTSA measurement functionality has been integrated into the N9067C pulse analysis measurement application metrics. Using the multi-window capability, going between 510 MHz real-time analysis and automatic pulse measurements has never been easier.

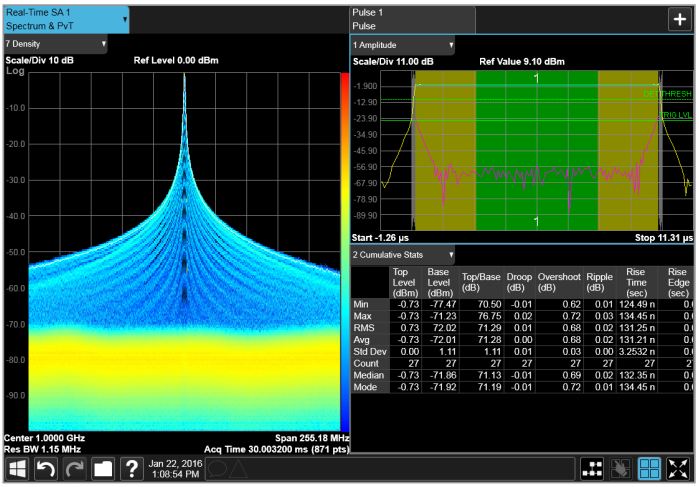

Figure 3. Simultaneous views of pulse magnitude, real-time response and cumulative statistics.

Variable length gated acquisition allows you to capture pulses with varying PRIs and pulse widths

This detection of pulse rise and fall times in hardware allows for capturing only the pulse you want and not the dead time. Variable length gated acquisition along with scatter plots enable you to see longer trends in data and analyze pulses individually.

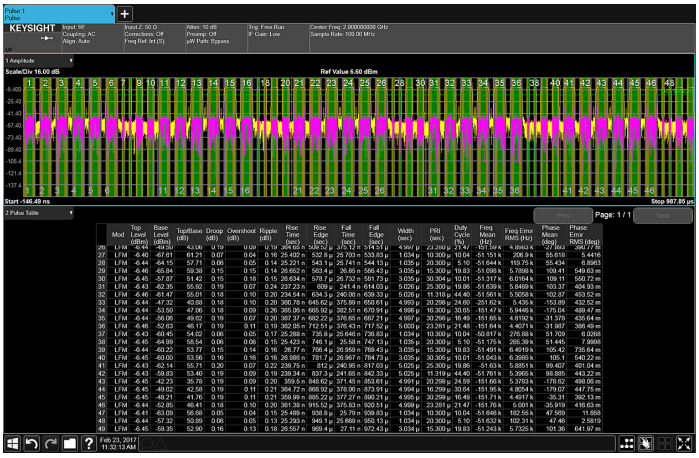

Figure 4. See longer trends in data with variable length gated acquisition.

Deeper understanding of radar and EW signals with scatter plots

Capturing millions of pulses requires a better way to visualize the enormous amount of data acquired. Scatter plots allow the flexibility of plotting any values of X versus Y such as pulse number versus PRI for staggered PRI radars, chart against frequency to view hopping characteristics and power versus PRI.

Figure 5. See deeper into your signals with scatter plots.

Record pulsed signals without having to use any external recorders

Being able to record signals and post process them needs to happen quickly with less setup complexity. The recording feature allows you to capture up to a 4-GB gapless signal without having to configure external triggers, worry about syncing issues and using IQ cables. Used in conjunction with variable length segmented capture enables the recording of just the pulse information without wasting memory on dead time.

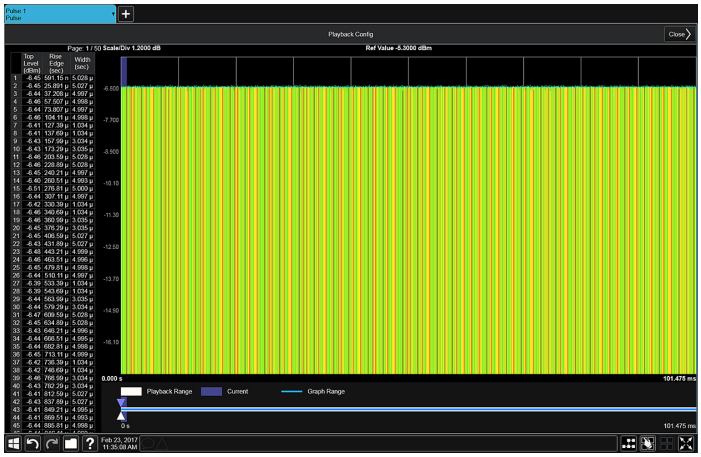

Figure 6. Record and process signals quickly.

Results, statistics & automation

With the N9067C, you can calculate amplitude, time, phase, and frequency, for analog troubleshooting, identification of integration issues and even full system algorithm test. The proprietary high dynamic range wideband ADC built into the UXA and PXA, enables the N9067C to simultaneously determine fast rise/fall times and amplitude parameters such as pulse droop, for cross domain analysis across the entire channel. For example, if there is modulation on pulse, the N9067C can determine the linearity of a chirped signal, auto-detect coding (such as Barker) and display phase shifts in the pulse. Additionally, ECCM activity such as frequency hopping can be measured with each incoming pulse. Using a frequency mask trigger (FMT), the trigger can be initiated at any desired time during the hop sequence.

When analyzing a long data capture, the N9067C can help you identify different pulse modes with time qualified triggers, making troubleshooting a much faster process. The statistics and histograms plots can be used over large acquisition bandwidth to find intermittent issues or verify algorithms over long periods of time.

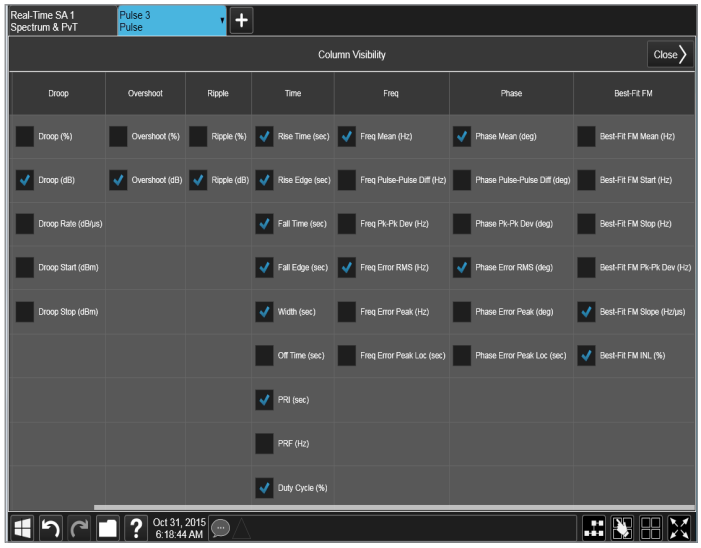

Figure 7. Specify results view from extensive list of parameters.

Figure 8. Easily measure pulse linearity and use qualified trigger to select appropriate signal to analyzer.

Measurement Summary

Category	Measurements	Result/Parameter
Amplitude	Amplitude error time, amplitude meas time, amplitude ref time	
Phase	Phase error time, phase meas time, phase ref time	
FM	FM error spectrum, FM error time, FM meas spectrum, FM meas time, FM ref spectrum, FM ref time	
Pulse result table	Level (in dBm, unless otherwise noted)	Top level, base level, top/base ratio (dB), on level, peak level, mean level, peak to average (dB)
	Droop	Droop (%), droop (dB), droop rate (dB/us), droop start (dBm), droop stop (dBm)
	Overshoot	Overshoot (%), overshoot (dB)
	Ripple	Ripple (%), ripple (dB)
	Time (in seconds, unless otherwise noted)	Rise time, rising edge, fall time, falling edge, width, off time, PRI,PRF (Hz), duty cycle (%)
	Frequency (in Hz, unless otherwise noted)	Freq mean, freq pulse-pulse difference, freq pk-pk deviation, freq error time, freq error peak, freq error peak location (sec)
	Phase (in degrees, unless otherwise noted)	Phase mean, phase pulse-pulse difference, phase pk-pk deviation, phase error rms, phase error peak, phase error peak location (sec)
	Best-fit FM (in Hz, unless otherwise noted)	Best-fit FM mean, best-fit FM start, best-fit FM stop, best-fit FM pk-pk deviation, best-fit FM slope (Hz/µsec), best-fit FM INL (%, integral non linearity)
Current statistics table	Same as above results with Min, Max, RMS, Average, Std Dev, Count	
Cumulative statistics table	Same as above results with Min, Max, RMS, Average, Std Dev, Count, Median, Mode	

Key Specifications

Nominal definition

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. Note: data is subject to change.

Accuracy - Amplitude and timing	**PXA (N9030B)**	**UXA (N9040B)**
Description	**Nominal**	**Nominal**
Top level [1]	±0.2 dB + Absolute amplitude accuracy (CW)	
	±0.2 dB + Absolute amplitude accuracy + IF frequency response (chirp)	
On level [1]	±0.1 dB + Absolute amplitude accuracy (CW)	
	±0.1 dB + Absolute amplitude accuracy + IF frequency response (chirp)	
Mean level [1]	±0.1 dB + Absolute amplitude accuracy (CW)	
	±0.1 dB + Absolute amplitude accuracy + IF frequency response (chirp)	
Peak level [1]	±0.2 dB + Absolute amplitude accuracy (CW)	
	±0.2 dB + Absolute amplitude accuracy + IF frequency response (chirp)	
Width [1]	±1/Sample rate	
PRI [1]	±1/Sample rate	
Accuracy - Frequency and phase CW (non-chirp signal)	**PXA (N9030B)**	**UXA (N9040B)**
Frequency error RMS [2,3]		
CF 2 GHz		
Option B40	±1.6 kHz	±1.6 kHz
Option B85	±3.5 kHz	
Option B1X	±8.3 kHz	
Option B2X		±21 kHz
Option B5X		±62 kHz
CF 10 GHz		
Option B40	±3.5 kHz	±3.5 kHz
Option B85	±5.4 kHz	
Option B1X	±13 kHz	
Option B2X		±31 kHz (±18 kHz [4])
Option B5X		±87 kHz (±110 kHz [4])
CF 20 GHz		
Option B40	±5.9 kHz	±5.9 kHz
Option B85	±5.9 kHz	
Option B1X	±5.9 kHz	
Option B2X		±52 kHz (±17 kHz [4])
Option B5X		±150 kHz (±88 kHz [4])

1. SNR ≥ 30 dB, pulse width ≥ 100/bandwidth
2. ATT = 0 dB. IF gain = low, signal condition with pulse on power = -10 dBm and pulse width ≥ 100/bandwidth, modulation setup with FM filter bandwidth = 10%
3. Frequency/phase analysis setup width = 50%
4. Pulse to pulse analysis setup: reference time = center, offset = 0.0 s, window length = 0.0 s

	PXA (N9030B)	UXA (N9040B)
Frequency pulse to pulse difference [1,2]		
CF 2 GHz		
Option B40	±3.3 kHz	±3.3 kHz
Option B85	±7.1 kHz	
Option B1X	±17 kHz	
Option B2X		±47 kHz
Option B5X		±130 kHz
CF 10 GHz		
Option B40	±7.4 kHz	±7.4 kHz
Option B85	±12 kHz	
Option B1X	±26 kHz	
Option B2X		±62 kHz (±22 kHz [2])
Option B5X		±180 kHz (±56 kHz [2])
CF 20 GHz		
Option B40	±13 kHz	±13 kHz
Option B85	±23 kHz	
Option B1X	±52 kHz	
Option B2X		±110 kHz (±30 kHz [2])
Option B5X		±290 kHz (±68 kHz [2])
Phase pulse to pulse difference [1,2]		
CF 2 GHz		
Option B40	±0.3°	±0.3°
Option B85	±0.3°	
Option B1X	±0.3°	
Option B2X		±0.3°
Option B5X		±0.6°
CF 10 GHz		
Option B40	±0.7°	±0.7°
Option B85	±0.7°	
Option B1X	±0.7°	
Option B2X		±0.45° (±0.3° [2])
Option B5X		±0.6° (±0.3° [2]
CF 20 GHz		
Option B40	±1.3°	±1.3°
Option B85	±1.3°	
Option B1X	±1.3°	
Option B2X		±0.75° (±0.55° [2])
Option B5X		±1.1° (±0.55° [2])

1. ATT = 0 dB. IF gain = low, signal condition with pulse on power = -10 dBm and pulse width ≥ 100/bandwidth, modulation setup with FM filter bandwidth = 10%
2. Pulse to pulse analysis setup: reference time = center, offset = 0.0 s, window length = 0.0 s

Accuracy - Frequency and Phase Chirp (Linear Chirp Signal)	PXA (N9030B)	UXA (N9040B)
Frequency Error RMS [1,2]		
CF 2 GHz		
Option B40	±3.5 kHz	±3.5 kHz
Option B85	±6 kHz	
Option B1X	±15 kHz	
Option B2X		±21 kHz
Option B5X		±87 kHz
CF 10 GHz		
Option B40	±5 kHz	±5 kHz
Option B85	±12 kHz	
Option B1X	±25 kHz	
Option B2X		±31 kHz
Option B5X		±87 kHz
CF 20 GHz		
Option B40	±7.5 kHz	±7.5 kHz
Option B85	±20 kHz	
Option B1X	±35 kHz	
Option B2X		±55 kHz
Option B5X		±150 kHz
Frequency pulse to pulse difference [1,3]		
CF 2 GHz		
Option B40	±3.5 kHz	±3.5 kHz
Option B85	±7.3 kHz	
Option B1X	±17 kHz	
Option B2X		±47 kHz
Option B5X		±140 kHz
CF 10 GHz		
Option B40	±7 kHz	±7 kHz
Option B85	±15 kHz	
Option B1X	±30 kHz	
Option B2X		±70 kHz
Option B5X		±200 kHz
CF 20 GHz		
Option B40	±12 kHz	±12 kHz
Option B85	±25kHz	
Option B1X	±60 kHz	
Option B2X		±125 kHz
Option B5X		±320 kHz

1. ATT = 0 dB. IF gain = low, signal condition with pulse on power = -10 dBm and pulse width ≥ 100/bandwidth, modulation setup with FM filter bandwidth = 10%
2. Frequency/phase analysis setup width = 50%
3. Pulse to pulse analysis setup: reference time = center, offset = 0.0 s, window length = 0.0 s

Accuracy - frequency and phase chirp (linear chirp signal), continued		
Phase pulse to pulse difference [1,2]	**PXA (N9030B)**	**UXA (N9040B)**
CF 2 GHz		
Option B40	±0.35°	±0.35°
Option B85	±0.35°	
Option B1X	±0.4°	
Option B2X		±0.3°
Option B5X		±0.45°
CF 10 GHz		
Option B40	±0.7°	±0.7°
Option B85	±0.7°	
Option B1X	±0.9°	
Option B2X		±0.5°
Option B5X		±0.6°
CF 20 GHz		
Option B40	±1°	±1°
Option B85	±1.2°	
Option B1X	±1.5°	
Option B2X		±1.0°
Option B5X		±1.2°

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2. Pulse to pulse analysis setup: reference time = center, offset = 0.0 s, window length = 0.0 s

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

UXA: www.keysight.com/find/uxa_specifications
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

Ordering Information

Software Licensing and Instrument Configuration

Choose from two license types::

- **Fixed, perpetual license:**
  This allows you to run the application in the X-Series analyzer in which it is initially installed.
- **Transportable, perpetual license:**
  This allows you to run the application in the X-Series analyzer in which it is initially installed, plus it may be transferred from one multi-touch X-Series analyzer to another.

For more information, please visit www.keysight.com/find/n9067c

You Can Upgrade!

Options can be added after your initial purchase. All of our X-Series application options are license-key upgradeable.

UPGRADE

Pulse analysis measurement application

Model-Option	Description, license type
N9067C-1FP [1]	Pulse analysis measurement application, fixed perpetual license
N9067C-1TP [1]	Pulse analysis measurement application, transportable perpetual license
N9067C-2FP [2]	Advanced pulse analysis, fixed perpetual license
N9067C-2TP [2]	Advanced pulse analysis, transportable perpetual license

1. N9067C application requires an X-Series signal analyzer with multi-touch user interface. For more information, see hardware configurations.
2. N9067C-2FP/2TP enables fixed and variable length gated acquisition for capturing pulses of varying pulse width and PRI; requires 4 GB capture memory Option DP4

Hardware Configuration

For optimizing noise figure measurements with noise figure measurement application, Keysight recommends a minimum level of X-Series multi-touch signal analyzer hardware functionality at each instrument performance point.

Supported analyzers include:

- UXA N9040B
- PXA N9030B
- MXA N9020B
- EXA N9010B
- CXA N9000B

Capability	Instrument Option	Benefit
Analysis bandwidth	25 MHz minimum (-B25) or wider	Required: Wider analysis bandwidth to support enhanced sample interval, time resolution, rise/fall time and minimum pulse width
Microwave pre-selector by-pass	-MPB	Required : When input frequency is > 3.6 GHz on bandwidths 40 MHz or greater
Real-time spectrum analyzer	-RT1 or –RT2	Required: Detect signals as short as 3.33 ns with 100% POI
Frequency mask trigger	-FT1 or –FT2	Required: Focus on the signal of interest in a complex signal environment
Pre-amplifier	3.6 GHz (-P03) or higher	Recommended: For maximizing the measurement sensitivity
Fine resolution step attenuator	-FSA on EXA and CXA only	Recommended: Useful for maximizing useable dynamic range to see signals

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Our unique combination of hardware, software, services, and people can help you reach your next breakthrough. We are unlocking the future of technology.
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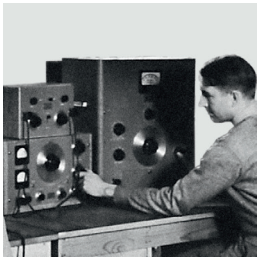

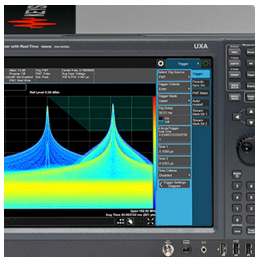

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