DATA SHEET

N9042B UXA X-Series Signal Analyzer, Multi-Touch

2 Hz to 26.5, 44, or 50 GHz

KEYSIGHT TECHNOLOGIES

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Introduction

The N9042B Signal Analyzer sets a new level of performance for high frequency measurements. Frequency options up to 50 GHz cover the current 5GNR FR1 and FR2 bands, as well as most radar, EW, and satellite bands. Analysis bandwidth can be configured to 1 GHz, 1.5 GHz, 2 GHz, 4 GHz and even up to 11 GHz bandwidth using an external digitizer. A completely new front end provides low-noise performance and high-dynamic range, addressing applications in Tx test, such as EVM and other modulation quality tests – while also excelling at measurements of low-level and unknown signals.

The V3050A Frequency Extender can be combined with the N9042B, to extend the maximum frequency up to 110 GHz. The V3050A features a low-noise design for outstanding sensitivity; a preselector filter-bank to eliminate image responses; fundamental mixing for high dynamic range; and a “remote head” form-factor that interfaces seamlessly to the N9042B.

The N9042B supports the X-series family of multi-touch applications, as well as the 89600 VSA software. A new CPU performs compute-intensive measurements, such as demodulation and EVM, up to 40% faster than prior analyzers.

Upgrades in both frequency and bandwidth are available.

Data Sheet Definition and Terms

This data sheet provides preliminary performance information for Keysight N9042B Signal Analyzers and V3050A Frequency Extenders. Most performance information tagged here as “nominal” will be replaced by warranted ("hard”) specifications or typical specifications in the future.

Specifications describe the performance of parameters covered by the product warranty and apply to temperature ranges 20 to 30 °C, unless otherwise noted.

95th percentile values indicate the breadth of the population (approx. 2 σ) of performance tolerances expected to be met in 95 percent of the cases with a 95 percent confidence, for any ambient temperature in the range of 20 to 30 °C. In addition to the statistical observations of a sample of instruments, these values include the effects of the uncertainties of external calibration references. These values are not warranted. These values are updated occasionally if a significant change in the statistically observed behavior of production instruments is observed.

Typical values (typ) describe additional product performance information that is not covered by the product warranty. It is performance beyond specifications that 80 percent of the units exhibit with a 95 percent confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.

Nominal values (nom) indicate expected performance or describe product performance that is useful in the application of the product but are not covered by the product warranty.

The analyzer will meet its specifications when:

- It is within its calibration cycle
- Under auto couple control, except that Auto Sweep Time Rules = Accy
- Analyzer is used in environment that falls within allowed operating range; and has been in that environment at least 2 hours before being turned on.
- Analyzer has been turned on at least 30 minutes with AutoAlign set to Normal; or, if Auto Align is set to Off or Partial, alignments must have been run recently enough to prevent an Alert message. Note that factory default is with the AutoAlign set to Light, which (compared to Normal) allows wider temperature changes before causing Alignments to run automatically. The benefit is that Alignments interrupt less frequently. The user can change AutoAlign to Normal if desired, and this setting will persist after power cycle or PRESET. If the Alert condition is changed from “Time and Temperature” to one of the disabled duration choices, the analyzer may fail to meet specifications without informing the user. In practice, the impact of such choices is primarily on Absolute Amplitude Accuracy.
- The term “mixer level” is used as a condition for many specifications in this document. This term is a conceptual quantity that is defined as follows: Mixer Level (dBm) = RF Input Power Level (dBm) - (Mechanical Attenuation) (dB) - (Electronic Attenuation) (dB).
- The term “attenuation” is used for many specifications in this document; this refers to the Mechanical Attenuator, unless otherwise stated.

Common abbreviations	
BW	bandwidth
FBP	full bypass path
FFT	fast Fourier transform
IQ	in-phase quadrature-phase (sample data)
IVL	Individual validated license (for export to restricted countries)
LNA	low-noise amplifier
LNP	low-noise path
LO	local oscillator
PA	pre-amplifier
MPB	microwave preselector bypass
RBW	resolution bandwidth (filter)
VBW	video bandwidth (filter)

Frequency and Time Specifications

Frequency option	
526	2 Hz to 26.5 GHz
544	2 Hz to 44 GHz
550	2 Hz to 50 GHz
Minimum Frequency	
Preamp	DC Coupled
Off	2 Hz
On	9 kHz
Frequency reference	
Accuracy (total)	± [(Initial accuracy) + (aging rate x time since last adjustment) + (temperature stability)]
Initial calibration accuracy (immediately following calibration)	± 3.1 x 10^{-8}
Aging rate	± 3 x 10^{-8} / year
Temperature stability	± 4.5 x 10^{-9} over full temperature range
Residual FM	
Center frequency = 1 GHz, 10 Hz RBW, 10 Hz VBW	≤ (0.25 Hz x N) p-p in 20 ms nominal (N = LO multiple, see band table below)
Frequency readout accuracy (start, stop, center, marker) (nom)	
± (marker frequency x frequency reference accuracy + 0.10 % x span + 5 % x RBW + 2 Hz + 0.5 x horizontal resolution [1])	
Marker frequency counter (nom)	
Accuracy	± (marker frequency x frequency reference accuracy + 0.100 Hz)
Delta counter accuracy	± (delta frequency x frequency reference accuracy + 0.141 Hz)
Counter resolution	0.001 Hz
Frequency span (FFT and swept mode)	
Range	0 Hz (zero span), 10 Hz to maximum frequency of instrument
Resolution	2 Hz
Accuracy (nom)	
Stepped/Swept	± (0.1 % x span + horizontal resolution [1])
FFT	± (0.1 % x span + horizontal resolution [1])
Sweep (trace) point range	
All spans	3 to 100,001

1. Horizontal resolution is Span/(SweepPoints –1).

Phase Noise (SSB)

Phase noise	Offset	Specification
Noise sidebands (20 to 30 °C, CF = 1 GHz)	10 Hz Wide Ref Loop BW	−93 (nom) [1]
	10 Hz Narrow Ref Loop BW	−88 (nom)
	100 Hz	–107 dBc/Hz (nom)
	1 kHz	−124 dBc/Hz (nom)
	10 kHz	–134 dBc/Hz (nom)
	100 kHz	–139 dBc/Hz (nom)
	1 MHz	–145 dBc/Hz (nom)
	10 MHz	–155 dBc/Hz (nom)

1. The factory test line limit is consistent with a warranted specification of –90 dBc/Hz.

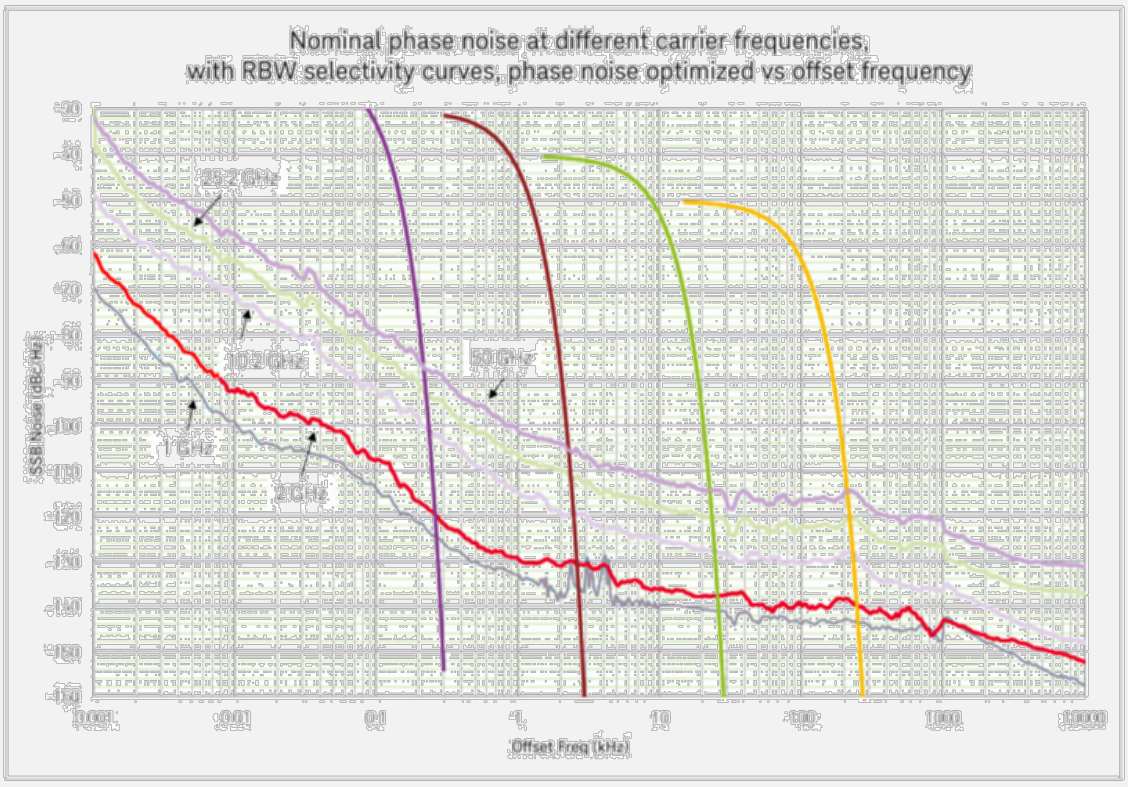

Figure 1. Nominal UXA phase noise at various center frequencies. 50 GHz curve is the predicted phase noise computed from the 25.2 GHz observation. RBW curves added to show impact of analyzer phase noise in resolving two closely spaced signals for various RBW filter choices.

Triggers and Gating

Triggers are methods to begin acquisition at desired point in time. See trigger types below for overview, with “Y” to indicate each trigger is available for “swept SA”, as a gate source for gated SA, or wide-bandwidth IQ measurements. Note that specific applications can make triggers unavailable, modify their behavior, or add triggers not listed here.

Trigger/Gate sources				
	Swept trigger	Gate source	Wide bandwidth IQ trigger	Supplemental information
Free Run	Y		Y	
External 1	Y	Y	Y	Jitter up to ~33 ns p-p (nom)
External 2	Y	Y	Y	
External 3			Y	Jitter < 20 ps (nom)
RF Burst	Y	Y		
Video (IF Mag)	Y		Y [1]	
ADC			Y	Similar to Video, but operates digitally on mag[I,Q], prior to decimation, filtering, and corrections.
Line	Y	Y		
Periodic	Y	Y	Y	Repetitive “frame” trigger, at precise interval, following an External or RF Burst trigger
TV	Y	Y		

1. In 255 MHz IF Path only; at greater bandwidths, ADC trigger is similar.

Triggers		
Video (independent of Display Scaling and Reference Level)	**Specifications**	**Supplemental information**
Minimum settable level	-170 dBm	Useful range limited by noise
Maximum usable level		Highest allowed mixer level [1] + 2 dB (nominal)
Detector and Sweep Type relationships		
Sweep Type = Swept		
Detector = Normal, Peak, Sample or Negative Peak		Triggers on the signal before detection, which is similar to the displayed signal
Detector = Average		Triggers on the signal before detection, but with a single-pole filter added to give similar smoothing to that of the average detector
Sweep Type = FFT		Triggers on the signal envelope in a bandwidth wider than the FFT width
RF Burst	**Specifications**	**Supplemental information**
Level range	−40 to −10 dBm plus attenuation (nominal) [2]	
Level Accuracy [3]		
Absolute	± 2 dB + Absolute Amplitude Accuracy (nominal)	
Relative	± 2 dB (nominal)	
Bandwidth (-10 dB)		
Most cases [4]	> 80 MHz (nominal)	
Start Freq < 300 MHz, RF Burst Level Type = Absolute		
Sweep Type = Swept	16 MHz (nominal)	
Sweep Type = FFT		
FFT Width > 25 MHz	> 80 MHz (nominal)	
FFT Width 8 to 25 MHz	30 MHz (nominal)	
FFT Width < 8 MHz	16 MHz (nominal)	
Frequency Limitations		If the start or center frequency is too close to zero, LO feedthrough can degrade or prevent triggering. How close is too close depends on the bandwidth listed above.
Amplitude Requirements		–65 dBm minimum video carrier power at the input mixer, nominal

1. The highest allowed mixer level depends on the IF Gain. It is nominally –10 dBm for Preamp Off and IF Gain = Low.
2. Noise will limit trigger level range at high frequencies, such as above 15 GHz.
3. With positive slope trigger. Trigger level with negative slope is nominally 1 to 4 dB lower than positive slope.
4. Include RF Burst Level Type = Relative.

Sweep time and triggering		
Range	Span = 0 Hz	1 µs to 6000 s
	Span ≥ 10 Hz	1 ms to 4000 s
Accuracy	Span ≥ 10 Hz, swept	± 0.01% nominal
	Span ≥ 10 Hz, FFT	± 40% nominal
	Span = 0 Hz	± 0.01% nominal
Trigger Delay	Span = 0 Hz or FFT	–150 to +500 ms
	Span ≥ 10 Hz, swept	0 to 500 ms
	Resolution	0.1 µs
Time gating		
Gate methods	Gated LO; gated video; gated FFT	
Gate length range (except method = FFT)	1 µs to 5.0 s	
Gate delay range	0 to 100.0 s	
Gate delay jitter	33.3 ns p-p nominal	

Swept Spectrum Analysis

These bands apply to swept spectrum analysis and are not applicable to wide-bandwidth IQ analysis.

Swept frequency band	LO multiple (N)	Frequency range	
0	1	2 Hz to 3.6 GHz	
1	1	3.5 to 8.4 GHz	
2	2	8.3 to 13.6 GHz	
3	2	13.5 to 17.1 GHz	
4	4	17.0 to 26.5 GHz	
5	4	26.4 to 34.5 GHz	
6	8	34.4 to 50 GHz	
Resolution bandwidth (RBW) filters (see also Wide Bandwidth IQ Analysis section)			
Range (with -3 dB bandwidth, standard)		1 Hz to 3 MHz (10% steps), 4, 5, 6, 8, and 10 MHz	
Bandwidth accuracy (-3 dB)		1 Hz to 1.3 MHz	± 2% (nominal)
Selectivity (-60 dB/-3 dB)			4.1: 1 (nominal)
EMI bandwidths (CISPR compliant)		200 Hz, 9 kHz, 120 kHz, 1 MHz	
EMI bandwidths (Mil STD 461 compliant)		10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz	
Video bandwidth (VBW) filters			
Range		1 Hz to 3 MHz (10% steps), 4, 5, 6, 8 MHz, and wide open (labeled 50 MHz)	
Accuracy		± 6%, nominal	
Detector types			
Normal, peak, sample, negative peak, log power average, RMS average, and voltage average, quasi-peak, EMI average			

Amplitude Accuracy

Amplitude characteristics vary by user-selectable front-end path. Swept SA measurements are normally made with preselector on (in circuit). These settings impact amplitude accuracy and range.

Front end settings			
1a	Standard path	Preselector	Default selection following power-on, boot-up, or PRESET. Settings provide best dynamic range and lowest internally-generated distortion. Suitable for harmonics, IMD, spurious in presence of large signals, etc. unless noise-limited.
1b		Preselector, LNA on	Requires P26, P44, P4L, P50, or P5L. Settings provide lower DANL, compared to 1a, while preserving very good dynamic range. Suitable for distortion measurements (harmonics, IMD, etc.) when a lower noise floor is needed. Operates down to 10-20 MHz
1c		Preselector, PA on	Requires P26, P44, P4L, P50, or P5L. Settings provide lower DANL, compared to 1b. Allows tuning down to 100 kHz.
1d		Preselector, LNA on, PA on	Requires P26, P44, P4L, P50, or P5L. Settings provide lowest possible DANL, compared to 1c. Best for finding low-level spurs, oscillations, etc. near the noise floor. Allows use of wider RBW setting to achieve equivalent noise floors, so can make spur searching faster.
2a	Low-noise path (LNP)	Preselector, LNP	Settings provide the lowest distortion and best dynamic range, yet with lower DANL at higher frequencies, when compared with 1a. Path not active below 3.6 GHz.
2b		Preselector, LNP, LNA on	Settings provide the lower DANL, compared to 2a, while preserving very good dynamic range. Path not active at below 3.6 GHz.
3a	Microwave Preselector Bypass path (MPB)	MPB	Settings provide very good EVM floor at mid-high input power region (using attenuation), including below 3.6 GHz. Good for wideband digitizer and FFT measurements. Recommend using path 4a if above 3.6 GHz.
3b		LNA on	Settings provide best EVM at low input power for below 3.6 GHz. Good for wideband digitizer and FFT measurements. Otherwise use path 4b if above 3.6 GHz.
3c		PA on	Requires P26, P44, P4L, P50, or P5L. Good for wideband digitizer and FFT measurements. Settings allowed only for very low power levels since preselector is bypassed.
3d		LNA on, PA on	Requires P26, P44, P4L, P50, or P5L. Good for wideband digitizer and FFT measurements. Settings provide best EVM at very low power, including below 3.6 GHz
4a	Full Bypass path (FBP)	LNP, MPB	Settings provide best EVM floor for mid-high input power region (using attenuation) for above 3.6 GHz. Best for wideband digitizer and FFT measurements. Otherwise use path 3a if below 3.6 GHz.
4b		LNP, MPB, LNA on	Settings provide best EVM floor for low input power region (using attenuation) for above 3.6 GHz. Best for wideband digitizer and FFT measurements. Otherwise use path 3b if below 3.6 GHz.

Absolute amplitude accuracy	
(10 dB attenuation, RBW < = 1 MHz, input signal -10 to -50 dBm, all settings auto-coupled except Auto Swp Time = Accy, any Reference Level, any vertical Scale)	
at 50 MHz	± 0.12 dB (nom)
at any frequency, any path, any LNA or PA setting	± (0.12 dB + Frequency Response) (nom)
EA3	± 0.12 dB (nom) (10 dB attenuation, RBW < = 1 MHz, input signal -7 to -25 dBm, all settings auto-coupled except Auto Swp Time = Accy, any Reference Level, any vertical Scale)

Frequency response
Standard path (10 dB attenuation, relative to reference conditions (50 MHz), preselector centering applied > 3.6 GHz), 20 to 30 °C

Frequency	1a. Std	1b. Std, LNA on	1c. Std, PA on	1d. Std, LNA on, PA on
50 MHz to 3.6 GHz	± 0.52 dB ± 0.22 dB (typ)	± 0.54 dB ± 0.24 dB (typ)	± 0.50 dB ± 0.20 dB (typ)	n/a
> 3.6 to 5.2 GHz	± 1.90 dB ± 1.00 dB (typ)	± 2.28 dB ± 1.24 dB (typ)	± 2.30 dB ± 1.20 dB (typ)	± 0.75 dB (nom)
> 5.2 GHz to 8.4 GHz	± 1.40 dB ± 0.60 dB (typ)	± 2.06 dB ± 1.02 dB (typ)	± 1.64 dB ± 0.66 dB (typ)	± 0.75 dB (nom)
> 8.4 to 13.6 GHz	± 1.50 dB ± 0.52 dB (typ)	± 2.02 dB ± 1.04 dB (typ)	± 1.80 dB ± 0.58 dB (typ)	± 0.75 dB (nom)
> 13.6 to 17.1 GHz	± 1.70 dB ± 0.68 dB (typ)	± 2.16 dB ± 0.92 dB (typ)	± 2.00 dB ± 0.70 dB (typ)	± 0.75 dB (nom)
> 17.1 to 26.5 GHz	± 1.90 dB ± 0.76 dB (typ)	± 2.40 dB ± 1.10 dB (typ)	± 2.20 dB ± 0.74 dB (typ)	± 0.75 dB (nom)
> 26.5 to 34.5 GHz	± 2.30 dB ± 0.98 dB (typ)	± 2.60 dB ± 1.30 dB (typ)	± 2.44 dB ± 1.00 dB (typ)	± 0.80 dB (nom)
> 34.5 to 50 GHz	± 3.10 dB ± 1.26 dB (typ)	± 4.40 dB ± 2.38 dB (typ)	± 4.00 dB ± 1.82 dB (typ)	± 1.10 dB (nom)

Frequency response
Low-noise path (10 dB attenuation, relative to reference conditions (50 MHz), preselector centered)

Frequency	2a. LNP (nom)	2b. LNP, LNA on (nom)
< 3.6 GHz	(if tuning to < 3.6 GHz, then actually using Standard Path)	(if tuning to < 3.6 GHz, then actually using Standard Path with LNA on)
3.6 to 8.4 GHz	± 0.60 dB	± 0.80 dB
> 8.4 to 13.6 GHz	± 0.50 dB	± 0.70 dB
> 13.6 to 17.1 GHz	± 0.50 dB	± 0.70 dB
> 17.1 to 26.5 GHz	± 0.50 dB	± 0.70 dB
> 26.5 to 34.5 GHz	± 0.60 dB	± 1.0 dB
> 34.5 to 50 GHz	± 0.80 dB	± 1.4 dB

Frequency response Electronic attenuator path (EA3) (10 dB mechanical attenuation, relative to reference conditions (50 MHz))	
Frequency	
≤ 50 MHz	± 0.30 dB (nom)
> 50 MHz to 3.6 GHz	± 0.30 dB (nom)

Attenuator switching uncertainty (relative to 10 dB, LNA off, PA off; excludes 0 dB setting)	
50 MHz	± 0.05 dB (nom), EA3 ± 0.06 dB (nom)
< 8.4 GHz	± 0.5 dB (nom)
8.4 to 26.5 GHz	± 0.7 dB (nom)
> 26.5 to 50 GHz	± 1.0 dB (nom)

VSWR (voltage standing wave ratio) at RF Input (nom)	
	1a Std, (10 dB input attenuation)
10 MHz to 12 GHz	1.2
> 12 GHz to 22 GHz	1.3
> 22 to 28 GHz	1.4
> 28 to 43 GHz	1.7
> 43 to 50 GHz	2.1

RBW switching uncertainty (reference to 30 kHz RWB), 20 to 30 °C	
1 Hz to 1.5 MHz RBW	< ± 0.03 dB (nom)
1.6 MHz to 2.7 MHz RBW	< ± 0.05 dB (nom)
3 MHz RBW	± 0.1 dB (nom)
4, 5, 6, 8, 10 MHz RBW	± 0.3 dB (nom)
Display scale switching uncertainty	
Switching between linear and log	0 dB [1]
Log scale/div switching	0 dB [1]
Display scale fidelity, 20 to 30 °C	
Between -10 and -18 dBm input mixer level	± 0.04 dB (nom)
Below -18 dBm input mixer level	± 0.02 dB (nom)

1. Only affects the display, not the measurement, so it causes no additional error in measurement results from trace data or markers.

Amplitude Range

Describes factors which impact amplitude range over which a measurement can be made; at low levels, noise (DANL) and spurious responses; at high levels, distortion.

Maximum safe input level (max applied to RF input connector)		
RF power, max	+30 dBm (1 W) max	Damage level; includes LNA on and PA on conditions
	+20 dBm max in full bypass path	
DC Bias at RF Input	0 VDC max (DC coupled)	Use external DC block as needed
	0.2 VDC max in full bypass path	
Amplitude range		
Measurement range	DANL to +30 dBm, LNA off, PA off	
Input attenuator		
Mechanical (2 Hz to 50 GHz)	0 to 70 dB in 2 dB steps	
Electronic (2 Hz to 3.6 GHz)	0 to 24 dB in 1 dB steps	
Full attenuation range	0 to 94 dB, 1 dB steps	(Mechanical + Electronic)
Preamplifiers (2 stages: Low-Noise Amplifier LNA, Pre-Amplifier PA)		
	Low-Noise Amplifier (LNA)	**Pre-Amplifier (PA)**
Option P26	20 MHz to 26.5 GHz	9 kHz to 26.5 GHz
Option P44, P4L	20 MHz to 44 GHz	9 kHz to 44 GHz
Option P50, P5L	20 MHz to 50 GHz	9 kHz to 50 GHz
Noise figure	4 to 8 dB (nom) (see DANL)	10 dB (nom)
Gain	20 dB (nom)	30 dB (nom)

DANL (Displayed Average Noise Level)

DANL defined as average indicated power, using RMS detection, with input terminated in 50 Ohm, and Attenuation set to 0 dB; normalized to a 1 Hz bandwidth, 20 to 30 °C.

1a. Standard path DANL (swept, preselector on, LNA off, PA off)		
Noise Floor Extension (Option NF2) improves DANL by 8 to 11 dB, for standard path.		
Frequency	**DANL, 20 to 30 °C**	**Typical, unless otherwise stated**
2 to 10 Hz	-	-90 dBm (nom)
> 10 to 100 Hz	-	-115 dBm (nom)
> 100 Hz to 1 kHz	-	-130 dBm (nom)
> 1 to 9 kHz	-	-137 dBm (nom)
> 9 to 100 kHz	-140 dBm	-146 dBm
> 100 kHz to 1 MHz	-152 dBm	-155 dBm
> 1 to 10 MHz	-153 dBm	-156 dBm
> 10 MHz to 1.2 GHz	-152 dBm	-156 dBm
> 1.2 to 2.1 GHz	-150 dBm	-154 dBm
> 2.1 to 3.0 GHz	-148 dBm	-152 dBm
> 3.0 to 3.6 GHz	-148 dBm	-152 dBm
> 3.6 to 6.6 GHz	-146 dBm	-150 dBm
> 6.6 to 8.4 GHz	-146 dBm	-151 dBm
> 8.4 to 13.6 GHz	-146 dBm	-150 dBm
> 13.6 to 17 GHz	-145 dBm	-149 dBm
> 17.0 to 22.5 GHz	-141 dBm	-146 dBm
> 22.5 to 26.5 GHz	-138 dBm	-143 dBm
> 26.5 to 30 GHz	-136 dBm	-141 dBm
> 30 to 34 GHz	-134 dBm	-139 dBm
> 34 to 37 GHz	-129 dBm	-135 dBm
> 37 to 40 GHz	-127 dBm	-133 dBm
> 40 to 45 GHz	-127 dBm	-132 dBm
> 45 to 50 GHz	-122 dBm	-129 dBm

1b. Standard path, LNA on DANL (swept, preselector on, LNA on, PA off)		
Noise Floor Extension (Option NF2) improves DANL by 9 to 10 dB, for standard path, LNA on		
Frequency	**DANL, 20 to 30 °C**	**Typical**
> 10 to 40 MHz	-153 dBm	-158 dBm
> 40 to 500 MHz	-163 dBm	-166 dBm
> 500 MHz to 2.5 GHz	-164 dBm	-168 dBm
> 2.5 to 3.6 GHz	-163 dBm	-167 dBm
> 3.6 to 4.7 GHz	-162 dBm	-166 dBm
> 4.7 to 17 GHz	-161 dBm	-165 dBm
> 17 to 22 GHz	-157 dBm	-162 dBm
> 22 to 26.5 GHz	-154 dBm	-159 dBm
> 26.5 to 27 GHz	-154 dBm	-158 dBm
> 27 to 34.5 GHz	-149 dBm	-154 dBm
> 34.5 to 42.5 GHz	-141 dBm	-148 dBm
> 42.5 to 47 GHz	-138 dBm	-144 dBm
> 47 to 50 GHz	-134 dBm	-141 dBm

1c. Standard path, PA on DANL (swept, preselector on, LNA off, PA on)		
Noise Floor Extension (Option NF2) improves DANL by 7 to 9 dB, for standard path, PA on.		
Frequency	**DANL, 20 to 30 °C**	**Typical**
>100 to 200 kHz	-156 dBm	-160 dBm
> 200 to 500 kHz	-158 dBm	-162 dBm
> 500 kHz to 1 MHz	-161 dBm	-165 dBm
> 1 MHz to 2.1 GHz	-163 dBm	-166 dBm
> 2.1 to 3.6 GHz	-161 dBm	-164 dBm
> 3.6 to 17 GHz	-162 dBm	-166 dBm
> 17 to 20 GHz	-162 dBm	-165 dBm
> 20 to 26.5 GHz	-160 dBm	-163 dBm
> 26.5 to 30 GHz	-158 dBm	-162 dBm
> 30 to 34 GHz	-157 dBm	-161 dBm
> 34 to 37 GHz	-155 dBm	-159 dBm
> 37 to 41 GHz	-153 dBm	-158 dBm
> 41 to 46 GHz	-150 dBm	-155 dBm
> 46 to 50 GHz	-148 dBm	-153 dBm

1d. Standard path, LNA on, PA on DANL (swept, preselector on, LNA on, PA on)	
Noise Floor Extension (Option NF2) improves DANL by 9 to 10 dB, for standard path, LNA on, PA on.	
Frequency	**DANL (nom)**
< 10 MHz	Not permitted with LNA on
> 10 to 40 MHz	-158 dBm [1]
> 40 to 500 MHz	-166 dBm [1]
> 500 MHz to 2.5 GHz	-168 dBm [1]
> 2.5 to 3.6 GHz	-167 dBm [1]
> 3.6 to 8.4 GHz	-168 dBm
> 8.4 to 13.5 GHz	-169 dBm
> 13.5 to 17.1 GHz	-168 dBm
> 17.1 to 23 GHz	-167 dBm
> 23 to 27 GHz	-166 dBm
> 27 to 36.5 GHz	-164 dBm
> 36.5 to 43.5 GHz	-162 dBm
> 43.5 to 47 GHz	-160 dBm [2]
> 47 to 50 GHz	-159 dBm [2]

1. In the range 10 MHz to 3.6 GHz, when both LNA and PA are set to on, only the LNA is actually in circuit. Therefore, DANL is similar to 1b in this frequency range.
2. Option P5L and P4L are variants of Option P50 and P44. P50, P44, P5L and P4L provide use of both LNA and PreAmp (PA) to 50 GHz. However, only P50 and P44 allow use of LNA and PA *together* (simultaneously) to 50 GHz; while P5L actually by-passes the PA (uses LNA only) in the tuning range > 43.5 to 50 GHz. See DANL for path 1b for LNA-only DANL in this range. Likewise, P44 and P4L to 44 GHz.

2a. Low-noise path (low-noise path enable, preselector on, LNA off, PA off)	
Noise Floor Extension (Option NF2) improves DANL by 9 to 11 dB, for low-noise path.	
Frequency	**DANL (nom)**
< 3.6 GHz	Not permitted with low noise path
3.6 to 17.1 GHz	-154 dBm
> 17.1 to 23 GHz	-152 dBm
> 23 to 26.5 GHz	-149 dBm
> 26.5 to 29 GHz	-148 dBm
> 29 to 34.5 GHz	-146 dBm
> 34.5 to 45 GHz	-142 dBm
> 45 to 50 GHz	-138 dBm

It is possible, but not common, to make swept SA measurements with preselector by-passed. The impact to DANL and TOI is estimated here, relative to comparable paths with preselector.

- DANL for MPB is ~6 dB better than Standard (see 1a in DANL table above).
- DANL for MPB, PA on is ~3 dB worse that Standard, PA on (see 1c in DANL table above).

TOI

Third-Order Intercept (TOI) is a figure of merit for the 3rd-order intermodulation distortion in the RF front end.

1a. Standard path (swept, preselector on, LNA off, PA off)	
State following power-on, boot-up, or PRESET.	
Frequency	**TOI (nom)**
10 to 350 MHz	+18 dBm
> 350 MHz to 2.2 GHz	+20 dBm
> 2.2 GHz to 2.8 GHz	+19 dBm
> 2.8 GHz to 3.0 GHz	+20 dBm
> 3.0 to 3.6 GHz	+22 dBm
> 3.6 to 8.4 GHz	+19 dBm
> 8.4 to 13.6 GHz	+22 dBm
> 13.6 to 21 GHz	+15 dBm
> 21 to 26.5 GHz	+22 dBm
> 26.4 to 34.5 GHz	+20 dBm
> 34.5 to 50 GHz	+17 dBm
1b. Standard path, (swept, preselector on, LNA on, PA off)	
Frequency	**TOI (nom)**
10 to 500 MHz	-2 dBm
> 500 MHz to 2 GHz	0 dBm
> 2 to 3.6 GHz	+3 dBm
> 3.6 to 13.6 GHz	0 dBm
> 13.6 to 21 GHz	-4 dBm
> 21 to 26.5 GHz	+2 dBm
> 26.5 to 34 GHz	+3 dBm
> 34 to 50 GHz	-3 dBm
1c. Standard path (swept, preselector on, LNA off, PA on)	
Frequency	**TOI (nom)**
10 to 400 MHz	0 dBm
> 400 to 800 MHz	+1 dBm
> 800 MHz to 3 GHz	+2 dBm
> 3 to 3.6 GHz	+3 dBm

SHI

Second-Harmonic Intercept (SHI) is a figure of merit for analyzer distortion at the 2nd harmonic of input signal. Frequency refers to the fundamental signal and extends to ½ the maximum measurable frequency; the 2nd harmonic is at 2*{Freq}.

1a. Standard path: SHI (swept, preselector on, LNA off, PA off)	
Frequency of the fundamental	**SHI (nom)**
10 MHz to 1.8 GHz	+47 dBm
> 1.8 to 3 GHz	+62 dBm
> 3 to 6.5 GHz	+66 dBm
> 6.5 to 10 GHz	+72 dBm
> 10 to 13.5 GHz	+67 dBm
> 13.5 to 25 GHz	+60 dBm
1b. Standard path: SHI (swept, preselector on, LNA on, PA off)	
Frequency of the fundamental	**SHI (nom)**
10 MHz to 1.8 GHz	+12 dBm
> 1.8 to 13.5 GHz	+15 dBm
1c. Standard path: SHI (swept, preselector on, LNA off, PA on)	
Frequency of the fundamental	**SHI (nom)**
10 MHz to 1.8 GHz	+28 dBm
> 1.8 to 13.5 GHz	+5 dBm
2a. Low-noise path: SHI (swept, Low-noise path enable, preselector on, LNA off, PA off)	
Frequency of the fundamental	**SHI (nom)**
1.75 to 2.5 GHz	+87 dBm
> 2.5 to < 5 GHz	+92 dBm
5 to 13.5 GHz	+96 dBm
> 13.5 to 25 GHz	+85 dBm

Gain Compression

Standard path: 1 dB gain compression (swept, standard, preselector on, LNA off)		
Frequency	**Gain Comp (nom) PA Off (1a)**	**Gain Comp (nom) PA On (1c)**
Large signals, even at frequencies not shown on the screen, can cause the analyzer to mismeasure on-screen signals because of two-tone gain compression. This specification tells how large an interfering signal must be in order to cause a 1 dB change in an on-screen signal. Mixer power level (dBm) = total power at the input (dBm) − input attenuation (dB).		
20 to 40 MHz	+2 dBm	-14 dBm
40 MHz to ,3.6 GHz	+5 dBm	-14 dBm
3.6 to 13.5 GHz	+8 dBm	--
13.5 to 26.5 GHz	+3 dBm	--

Residuals, Images, and Spurious Responses

Residual responses (input terminated, 0 dB attenuation)			
200 kHz to 8.4 GHz (swept)	-100 dBm (nom)		
Zero span or FFT or other frequencies	-100 dBm (nom)		
Image responses	**Tuned freq (f)**	**Excitation freq**	**Response**
Mixer level at -10 dBm	10 MHz to 26.5 GHz	f+45 MHz	-80 dBc (nom)
	10 MHz to 3.6 GHz	f+10,245 MHz	-80 dBc (nom)
	10 MHz to 3.6 GHz	f+645 MHz	-80 dBc (nom)
	> 3.6 to 13.6 GHz	f+645 MHz	-80 dBc (nom)
	> 13.6 to 17.1 GHz	f+645 MHz	-80 dBc (nom)
	> 17.1 to 22 GHz	f+645 MHz	-80 dBc (nom)
	> 22 to 26.5 GHz	f+645 MHz	-70 dBc (nom)
Mixer level at -30 dBm	> 26.5 to 50 GHz	f+45 MHz	-90 dBc (nom)
	> 26.5 to 34.5 GHz	f+645 MHz	-70 dBc (nom)
	> 34.5 to 42 GHz	f+645 MHz	-60 dBc (nom)
	> 42 to 50 GHz	f+645 MHz	-75 dBc (nom)

Other spurious responses (input-related, standard path, LNA off, PA off)	Mixer level	Response
Carrier frequency ≤ 26.5 Hz		
First RF order		
f ≥ 10 MHz from carrier	-10 dBm	-80 dBc + 20log(N) including IF feedthrough, LO harmonic mixing responses (nom)
Higher order		
f ≥ 10 MHz from carrier	-40 dBm	-80 dBc + 20log(N) including higher order mixer responses (nom)
Carrier frequency > 26.5 Hz		
f ≥ 10 MHz from carrier	-30 dBm	-90 dBc (nom)
LO-related spurious responses 200 Hz ≤ f < 10 MHz from carrier	-10 dBm	-68 dBc + 20log(N) (nom)
		Nominally –40 dBc under large magnetic (0.38 Gauss rms) or vibrational (0.21 g rms) environmental stimuli.
Line-related spurious responses		-73 dBc + 20log(N) (nom)
		Nominally –40 dBc under large magnetic (0.38 Gauss rms) or vibrational (0.21 g rms) environmental stimuli.

Note: N is the LO multiplication factor. Refer to earlier table for the N value versus frequency ranges.

Performance is nominally the same, with PA on, and in low-noise path (LNP).

Wide-Bandwidth IQ Analysis (Demod)

Several wide-bandwidth IF paths and digitizers are available to acquire IQ data, with LO tuning fixed (not swept), typically to characterize the modulation quality of intentional transmitters (e.g. EVM).

All specifications based on preselector by-passed (RF Path either Microwave Preselector Bypass or Full Bypass) (except < 3.6 GHz), unless otherwise noted.

Bandwidth			
Bandwidth option [1]	**IF path name**	**Analysis bandwidth or span range, max**	**Comments**
Standard	10 MHz	10 MHz	
Standard	25 MHz	25 MHz	Licensed as B25
Standard	40 MHz	40 MHz	Licensed as B40
Standard	255 MHz	255 MHz	Licensed as B2X
R10	1.0 GHz	1.0 GHz	
R15	1.5 GHz	1.5 GHz	
R20	2.0 GHz	2.0 GHz	
R40	4.0 GHz	4.0 GHz	
	External	Up to 11.0 GHz	Requires Options EDC and CRW. Requires M8131A Digitizer.

1. IF Paths at 10, 25, 40, and 255 MHz are enabled by any of R10, R15, R20, or R40. Each bandwidth option includes and enables all others with lesser bandwidth (except External Digitizer); e.g. instruments with R20 also have R15 and R10 licenses, plus B2X, B40, and B25 paths.

5GNR EVM Residuals (“Floor”) vs Power (“Bathtub Curves”)

Example measurement results are demonstrations of performance (not specifications). EVM residual plots include contributions from the signal generator; the N9042B signal analyzer alone would have lower residuals (by ~3 dB, if assume equal contributions).

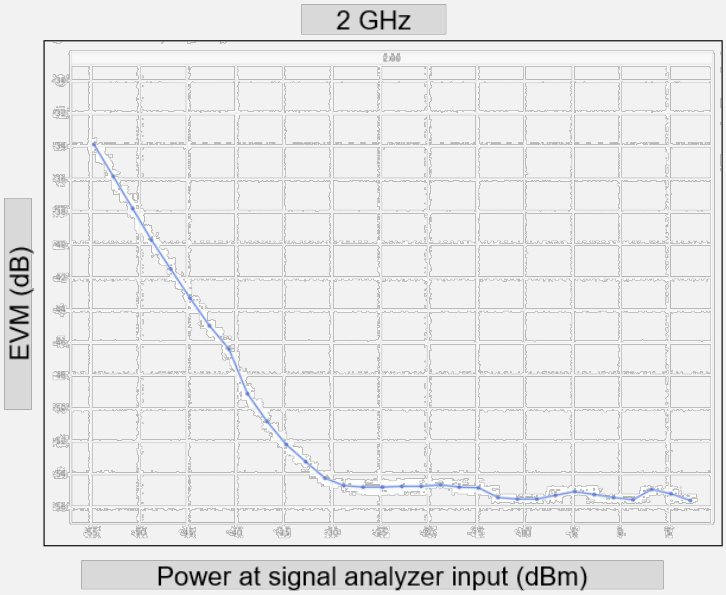

Figure 2. 5GNR FR1, 2.0 GHz carrier, 100 MHz single carrier, 256 QAM, 30 kHz SCS, DC Punc off, phase tracking on

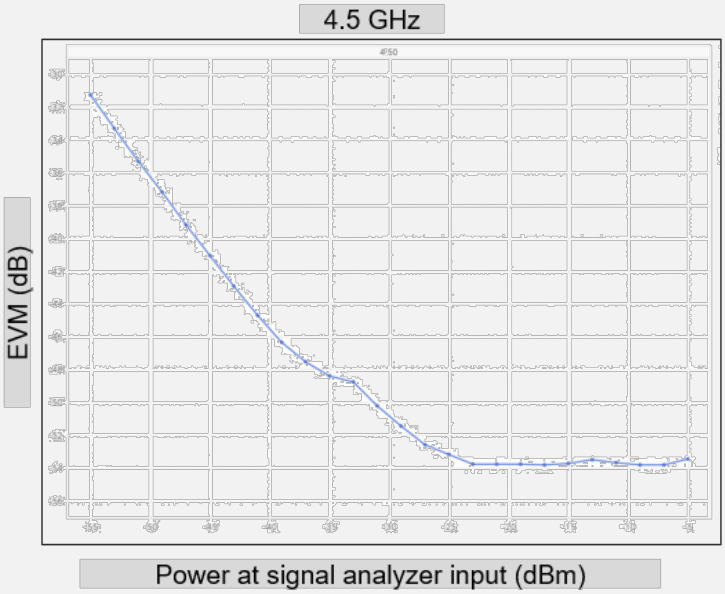

Figure 3. 5GNR FR1, 4.5 GHz carrier, 100 MHz single carrier, 256 QAM, 30 kHz SCS, DC Punc off, phase tracking on

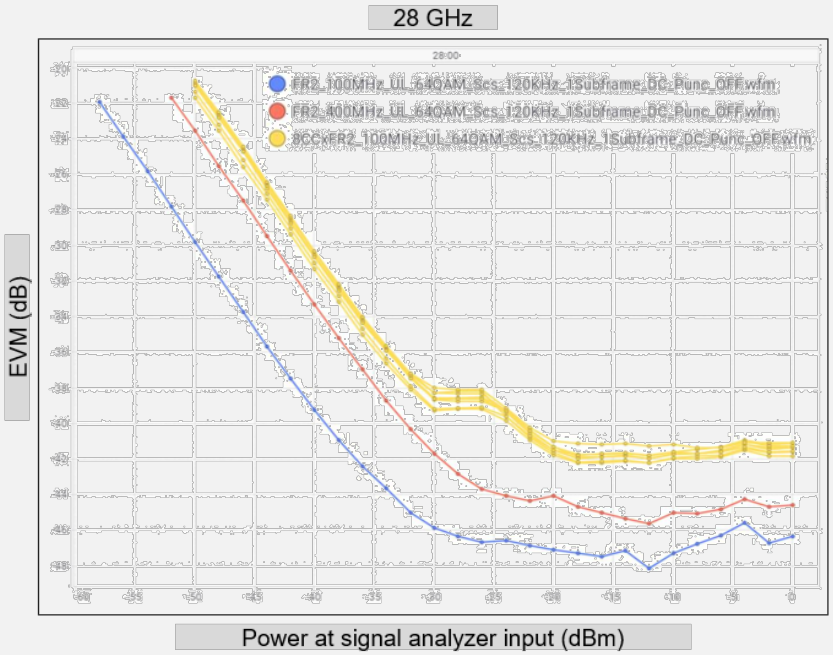

Figure 4. 5GNR FR2, 28 GHz carrier, CP-OFDM Uplink, 1x100 MHz (blue) and 1x400 MHz (red) and 8x100 MHz (yellow), 64 QAM, 120 kHz SCS, phase tracking on

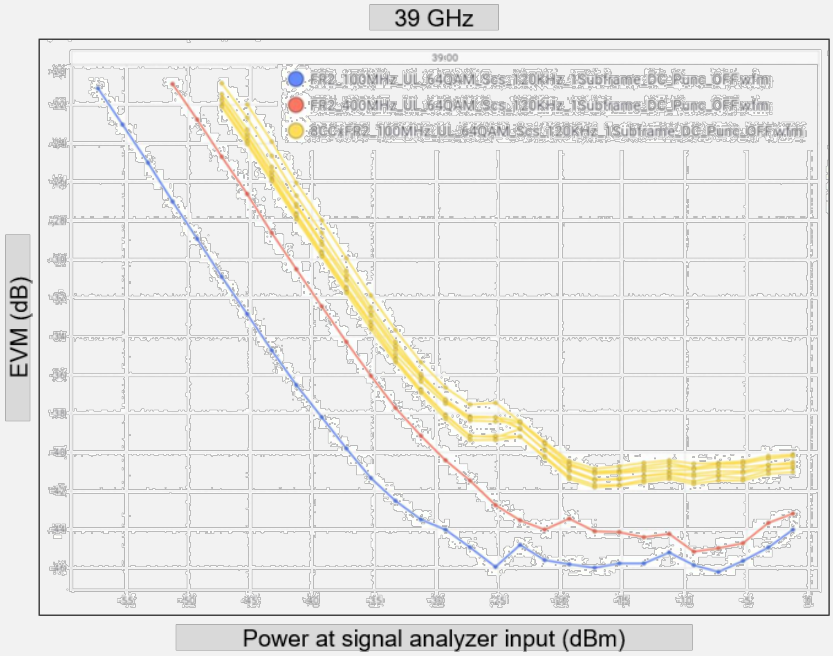

Figure 5. FR2, 39 GHz carrier, CP-OFDM Uplink, 1x100 MHz (blue) and 1x400 MHz (red) and 8x100 MHz (yellow), 64 QAM, 120 kHz SCS, phase tracking on

25 MHz Analysis Bandwidth (licensed as option B25)

25 MHz analysis bandwidth (licensed as option B25)			
Analysis bandwidth range	10 Hz to 25 MHz		
Tuning range	2 Hz to 50.0 GHz	In practice, low end of tuning range limited to < (½*BW), by image folding and LO feedthrough.	
	50.0 to 110 GHz w/ V3050A	Over-range tuning to 50.5 GHz allowed, but without corrections, performance not specified	
IF frequency (center)	322.5 MHz		
IF frequency response and phase linearity, demodulation and FFT response relative to the center frequency			
Center Frequency	Preselector	IF Freq response RMS (nom)	IF phase linearity RMS (nom)
20 MHz to 50 GHz	Off	0.03 dB	0.27
Full scale (ADC clipping)			
Description		**Supplemental information**	
2 Hz to 50 GHz		−7 dBm mixer level (nom)	
Data acquisition			
Description	**Data packing**		**Supplemental information**
	32-bit	**64-bit**	
Length (IQ sample pairs)	536 MSa (2^{29} Sa)	268 MSa (2^{28} Sa)	2 GB total memory
Maximum IQ Capture Time			Calculated by: Length of IQ sample pairs/Sample Rate (IQ Pairs)
10 MHz IFBW	42.94 s	21.47 s	
25 MHz IFBW	17.17 s	8.58 s	
Sample Rate (IQ Pairs)	1.25 × IFBW		
ADC Resolution	16 bits		

40 MHz Analysis Bandwidth (licensed as option B40)

Specifications on this bandwidth apply with center frequencies of 30 MHz and higher.

40 MHz analysis bandwidth (licensed as option B40)			
Analysis bandwidth range	10 Hz to 40 MHz		
Tuning range	2 Hz to 50.0 GHz	In practice, low end of tuning range limited to < (½*BW), by image folding and LO feedthrough.	
	50.0 to 110 GHz w/ V3050A	Over-range tuning to 50.5 GHz allowed, but without corrections, performance not specified	
IF frequency (center)	250 MHz		
IF frequency response and phase linearity, demodulation and FFT response relative to the center frequency			
Center Frequency	Preselector	IF Freq response RMS (nom)	IF phase linearity RMS (nom)
30 MHz to 50 GHz	Off	0.07 dB	0.24
Full scale (ADC clipping); preselector bypassed, LNA off PA off (nom) [1]			
Center frequency	**Mixer level for IF gain low**		**Mixer level for IF gain high**
< 3.6 GHz	-21 dBm		-21 dBm
3.6 to 26.5 GHz	-24 dBm		-24 dBm
> 26.5 GHz	-7 dBm		-11 dBm
Data acquisition			
Description	**Data packing**		**Supplemental information**
	32-bit	**64-bit**	
Length (IQ sample pairs)	536 MSa (2^{29} Sa)	268 MSa (2^{28} Sa)	2 GB total memory
Maximum IQ Capture Time			Calculated by: Length of IQ sample pairs/Sample Rate (IQ Pairs)
10 MHz IFBW	42.94 s	21.47 s	
25 MHz IFBW	17.17 s	8.58 s	
40 MHz IFBW	10.73 s	5.36 s	
Sample Rate (IQ Pairs)	1.25 × IFBW		
ADC Resolution	12 bits		
IF dynamic range			
SFDR (spurious-free dynamic range) (ADC related spurious)	-77 dBc (nom)	Signal at –6 dBFS, anywhere in full IF width	

1. Full scale (ADC clipping level) is a rough estimate of the signal level at which ADC overload occurs. Actual clipping levels vary significantly; this is only a guide. Mixer level is RF Input level less attenuation setting.

255 MHz Analysis Bandwidth (licensed as option B2X)

Specifications on this bandwidth apply with center frequencies of 400 MHz and higher.

255 MHz analysis bandwidth (licensed as option B2X)			
Analysis bandwidth range	10 Hz to 255 MHz		
Tuning range	2 Hz to 50.0 GHz	In practice, low end of tuning range limited to < (½*BW), by image folding and LO feedthrough.	
	50.0 to 110 GHz w/ V3050A	Over-range tuning to 50.5 GHz allowed, but without corrections, performance not specified	
IF frequency (center)	690 MHz		
IF frequency response and phase linearity, demodulation and FFT response relative to the center frequency			
Center Frequency	Preselector	IF Freq response RMS (nom)	IF phase linearity RMS (nom)
400 MHz to 50 GHz	Off	0.2 dB	0.8

Full scale (ADC clipping); preselector bypassed, LNA off PA off (nom) [1]		
Center frequency	**Mixer level for IF gain low**	**Mixer level for IF gain high**
< 3.3 GHz	-7 dBm	-8 dBm
3.3 to 13.3 GHz	-6 dBm	-12 dBm
> 13.3 GHz	-7 dBm	-13 dBm

Data acquisition			
Description	**Data packing**		**Supplemental information**
	32-bit	**64-bit**	
Length (IQ sample pairs)	1073 MSa (2^{29} Sa)	536 MSa (2^{28} Sa)	4 GB total memory
Maximum IQ Capture Time			Calculated by: Length of IQ sample pairs/Sample Rate (IQ Pairs)
10 MHz IFBW	85.89 s	42.94 s	
25 MHz IFBW	34.34 s	17.17 s	
40 MHz IFBW	21.47 s	10.73 s	
240 MHz IFBW	3.57 s	1.78 s	
255 MHz IFBW	3.57 s	1.78 s	
Sample Rate (IQ Pairs)	Minimum of (1.25 × IFBW, 300 MSa/s)		
ADC Resolution	14 bits		
IF dynamic range			
SFDR (spurious-free dynamic range) (ADC related spurious)	-78 dBc (nom)	Signal at –21 dBFS, anywhere in full IF width	

1. Full scale (ADC clipping level) is a rough estimate of the signal level at which ADC overload occurs. Actual clipping levels vary significantly; this is only a guide. Mixer level is RF Input level less attenuation setting.

1 GHz Analysis Bandwidth (option R10)

Specifications on this bandwidth apply with center frequencies of 700 MHz and higher.

1 GHz analysis bandwidth (option R10)		
Analysis bandwidth range	10 Hz to 1.0 GHz	
Tuning range	2 Hz to 50.0 GHz	In practice, low end of tuning range limited to < (½*BW), by image folding and LO feedthrough.
	50.0 to 110 GHz w/ V3050A	Over-range tuning to 50.5 GHz allowed, but without corrections, performance not specified
IF frequency (center)	690 MHz	
ADC sample rate	4.8 GSa/sec	
ADC resolution	14 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	
IQ-pair sample rate	1.25*BW	
Capture memory	16 GB	
Capture time (time record length)	1660 msec at full 1.0 GHz BW	Capture time increases with each full power-of-2 decrease in BW
IF frequency response		
< 3.5 GHz	± 0.75 dB (nom)	
≥ 3.5 GHZ	Similar to 2 GHz analysis bandwidth see section below	

IF dynamic range		
SFDR (spurious-free dynamic range) (ADC related spurious)	-65 dBc (nom)	Signal at –27 dBFS, anywhere in full IF width
Full scale (ADC clipping); preselector bypassed, LNA off, PA off (nom) [1]		
Center frequency	**Mixer level for IF gain low**	**Mixer level for IF gain high**
< 3.3 GHz	-6 dBm	-7 dBm
3.3 to 13.3 GHz	-6 dBm	-12 dBm
> 13.3 to 50 GHz	-7 dBm	-13 dBm
TOI (3rd-order intermodulation distortion, in the IF; 2 tones of equal level, -27dBFS, 10 MHz tone separation; preselector bypass, IF Gain high) (nom)		
< 3.3 GHz	-74 dBc	
3.3 to 13.3 GHz	-74 dBc	
> 13.3 to 50 GHz	-69 dBc	
IF residual responses (relative to Full Scale; input terminated; IF Gain = High) (nom)		
< 13.3 GHz	-99 dBFS	
13.3 to 50 GHz	-95 dBFS	
RF residual responses (input terminated, but varies with tuning, generally LO-related) (nom)		
	-84 dBm	
Noise density in IF (characterized at center of RF band, and center of IF [2]) (nom)		
Center frequency	**IF gain low**	**IF gain high**
< 3.3 GHz	-151 dBm/Hz	-151 dBm/Hz
3.3 to 8.6 GHz	-155 dBm/Hz	-155 dBm/Hz
> 8.6 to 13.3 GHz	-153 dBm/Hz	-153 dBm/Hz
> 13.3 to 24.5 GHz	-150 dBm/Hz	-150 dBm/Hz
> 24.5 to 50 GHz	-144 dBm/Hz	-144 dBm/Hz

1. Full scale (ADC clipping level) is a rough estimate of the signal level at which ADC overload occurs. Actual clipping levels vary significantly; this is only a guide. Mixer level is RF Input level less attenuation setting.
2. IF noise up to 5.5 dB worse to either side of IF center.

Amplitude accuracy, absolute, 1 GHz IF path (nom) Microwave preselector bypass path (10 dB attenuation)				
Frequency	**3a. MPB**	**3b. LNA on**	**3c. PA on**	**3d. LNA on, PA on**
< 3.3 GHz	± 0.8 dB	± 0.5 dB [1]	± 0.5 dB [1]	-
3.3 to 8.6 GHz	± 0.6 dB	± 0.6 dB	± 0.5 dB	± 0.6 dB
> 8.6 to 13.3 GHz	± 0.8 dB	± 0.6 dB	± 0.7 dB	± 0.6 dB
> 13.3 to 24.5 GHz	± 1.0 dB	± 1.0 dB	± 1.0 dB	± 1.0 dB
> 24.5 to 50 GHz	± 1.0 dB	± 1.3 dB	± 1.2 dB	± 1.3 dB

1. Degraded by factor of ~2 in region < 600 MHz.

Amplitude accuracy, absolute, 1 GHz IF path (nom) Full bypass path (10 dB attenuation)		
Frequency	**4a. FBP**	**4b. FBP, LNA on**
3.3 to 8.6 GHz	± 0.8 dB	± 0.8 dB
> 8.6 to 13.3 GHz	± 1.0 dB	± 0.7 dB
> 13.3 to 24 GHz	± 1.0 dB	± 1.0 dB
> 24.5 to 50 GHz	± 1.0 dB	± 1.2 dB

1.5 GHz Analysis Bandwidth (option R15)

Specifications on this bandwidth apply with center frequencies of 900 MHz and higher.

1.5 GHz analysis bandwidth (option R15)		
Analysis bandwidth range	10 Hz to 1.5 GHz	
Tuning range	2 Hz to 50.0 GHz	In practice, low end of tuning range limited to < (½*BW), by image folding and LO feedthrough.
	50.0 to 110 GHz w/ V3050A	
IF frequency (center)	950 MHz (Band 0) or 1200 MHz (except for Band 0)	
ADC sample rate	4.8 GSa/sec	
ADC resolution	14 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	
IQ-pair sample rate	1.25*BW	
Capture memory	16 GB	
Capture time (time record length)	830 msec at full 1.0 GHz BW	Capture time increases with each full power-of-2 decrease in bandwidth
IF dynamic range	Similar to 2 GHz analysis bandwidth see section below	
IF frequency response		
< 3.5 GHz	± 0.75 dB (nom)	
≥ 3.5 GHZ	Similar to 2 GHz analysis bandwidth see section below	

Amplitude accuracy, absolute, 1.5 GHz IF path (nom) Microwave preselector bypass path (10 dB attenuation)				
Frequency	**3a. MPB**	**3b. LNA on**	**3c. PA on**	**3d. LNA on, PA on**
< 3.5 GHz	± 0.8 dB	± 0.6 dB [1]	± 0.7 dB [1]	-
3.5 to 8.9 GHz	± 0.7 dB	± 0.6 dB	± 0.6 dB	± 0.7 dB
> 8.9 to 24 GHz	± 1.0 dB	± 1.1 dB	± 1.1 dB	± 1.1 dB
> 24 to 50 GHz	± 1.2 dB	± 1.4 dB	± 1.2 dB	± 1.5 dB

1. Degraded by factor of ~2 in region < 600 MHz.

Amplitude accuracy, absolute, 1.5 GHz IF path (nom) Full bypass path (10 dB attenuation)		
Frequency	**4a. FBP**	**4b. FBP, LNA on**
3.5 to 8.9 GHz	± 0.8 dB	± 0.8 dB
> 8.9 to 24 GHz	± 1.0 dB	± 1.1 dB
> 24 to 50 GHz	± 1.2 dB	± 1.5 dB

2 GHz Analysis Bandwidth (opt R20)

Assumes Microwave Preselector Bypass Path, unless otherwise stated.

2 GHz Analysis Bandwidth (option R20)		
Analysis bandwidth range	10 Hz to 2.0 GHz	
Tuning range	3.3 to 50 GHz	
	50.0 to 110 GHz with V3050A	
IF frequency (center)	1200 MHz	
ADC sample rate	4.8 GSa/sec	
ADC resolution	14 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	
IQ-pair sample rate	1.25*bandwidth	
Capture memory	16 GB	
Capture time (time record length)	830 msec at full 2.0 GHz BW	Capture time increases with each full power-of-2 decrease in bandwidth

IF frequency response		
IF frequency response (amplitude flatness); across 2.0 GHz span; relative to amplitude at center of span; for microwave preselector bypass and full bypass paths, with LNA off or LNA on		
	Microwave preselector bypass	**Full bypass**
3.5 to 8.9 GHz	± 0.5 dB (nom), LNA off	± 0.4 dB (nom), LNA off [1]
	± 0.5 dB (nom), LNA on [1, 2]	± 0.4 dB (nom), LNA on [1, 2]
> 8.9 to 24 GHz	± 0.4 dB (nom), LNA off	± 0.4 dB (nom), LNA off [3]
	± 0.45 dB (nom), LNA on [3, 4]	± 0.5 dB (nom), LNA on [3, 4]
> 24 to 50 GHz	± 0.6 dB (nom), LNA off	± 0.6 dB (nom), LNA off
	± 0.6 dB (nom), LNA on [5]	± 0.6 dB (nom), LNA on [5]

1. ± 2.5 dB at 3.75 GHz ± 250 MHz.
2. ± 0.6 dB at 8.4 GHz ± 500 MHz.
3. ± 1.2 dB at 23.7 GHz ± 300 MHz.
4. ± 1.5 dB at 9.2 GHz ± 300 MHz.
5. ± 1.5 dB at 24.05 GHz ± 50 MHz.

IF dynamic range		
SFDR (spurious-free dynamic range) (ADC related spurious)	-60 dBc (nom)	Signal at –22 dBFS, anywhere in full IF width
Full scale (ADC clipping, signal at center frequency); preselector bypassed, LNA off, PA off (nom) [1]		
Center frequency	**Mixer level for IF gain low**	**Mixer level for IF gain high**
< 3.5 GHz	-10 dBm	-10 dBm
3.5 to 8.9 GHz	-4 dBm	-15 dBm
> 8.9 to 24 GHz	-7 dBm	-17 dBm
> 24 to 50 GHz	-7 dBm	-13 dBm
TOI (3rd-order intermodulation distortion, in the IF; 2 tones of equal level, -19dBFS, 10 MHz tone separation; preselector bypass, IF gain high) (nom)		
< 3.5 GHz	-83 dBc	
3.5 to 8.9 GHz	-75 dBc	
> 8.9 to 50 GHz	-69 dBc	
IF residual responses (input terminated; IF Gain = High) (nom)		
< 3.5 GHz	-97 dBFS	
3.5 to 50 GHz	-91 dBFS	
RF residual responses (input terminated, but varies with tuning, generally LO-related) (nom)		
	-80 dBm	
Noise density in IF (characterized at center of RF band, and center of IF [2]) (nom)		
Center frequency	**IF gain low**	**IF gain high**
< 3.5 GHz	-151 dBm/Hz	-151 dBm/Hz
3.5 to 8.9 GHz	-153 dBm/Hz	-155 dBm/Hz
> 8.9 to 24 GHz	-152 dBm/Hz	-153 dBm/Hz
> 24 to 50 GHz	-144 dBm/Hz	-144 dBm/Hz

1. Full scale (ADC clipping level) is a rough estimate of the signal level at which ADC overload occurs. Actual clipping levels vary significantly; this is only a guide. Mixer level is RF Input level less attenuation setting.
2. IF noise up to 5.5 dB worse to either side of IF center.

Amplitude accuracy, absolute, 2 GHz IF path (nom) Microwave preselector bypass path (10 dB attenuation)				
Frequency	**3a. MPB**	**3b. LNA on**	**3c. PA on**	**3d. LNA on, PA on**
3.5 to 8.9 GHz	± 0.5 dB	± 0.5 dB	± 0.5 dB	± 0.5 dB
> 8.9 to 24 GHz	± 0.8 dB	± 1.0 dB	± 0.9 dB	± 0.6 dB
> 24 to 50 GHz	± 1.1 dB	± 1.2 dB	± 1.3 dB	± 1.5 dB

Amplitude accuracy, absolute, 2 GHz IF path (nom) Full bypass path (10 dB attenuation)		
Frequency	**4a. FBP**	**4b. FBP, LNA on**
3.5 to 8.9 GHz	± 0.5 dB	± 0.5 dB
> 8.9 to 24 GHz	± 0.8 dB	± 0.8 dB
> 24 to 50 GHz	± 1.1 dB	± 1.5 dB

4 GHz Analysis Bandwidth (opt R40)

Assumes Microwave Preselector Bypass Path, unless otherwise stated.

4 GHz Analysis Bandwidth (option R40)		
Analysis bandwidth range	40 MHz to 4.0 GHz	
Tuning range	10 to 50 GHz	
	50.0 to 108 GHz with V3050A	
IF frequency (center)	2.55 GHz	
ADC sample rate	10.2 GSa/sec	
ADC resolution	12 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	
IQ-pair sample rate	1.2*BW	
Capture memory	16 GB	
Capture time (time record length)	429 msec at full 4.0 GHz BW	Capture time increases with each full power-of-2 decrease in bandwidth

IF frequency response		
IF frequency response (amplitude flatness); across 4.0 GHz span; relative to amplitude at center of span; for microwave preselector bypass and full bypass paths, with LNA off or LNA on		
	Microwave preselector bypass	**Full bypass**
10 to 22.7 GHz	± 0.5 dB (nom), LNA off	± 0.5 dB (nom), LNA off [2]
	± 0.5 dB (nom), LNA on [1, 2]	± 0.5 dB (nom), LNA on [1, 2]
> 22.7 to 47 GHz	± 0.7 dB (nom), LNA off	± 0.7 dB (nom), LNA off [3]
	± 0.7 dB (nom), LNA on [3]	± 0.7 dB (nom), LNA on [3]
> 47 to 50 GHz	± 1.0 dB (nom), LNA off	± 1.5 dB (nom), LNA off
	± 2.0 dB (nom), LNA on [3]	± 2.5 dB (nom), LNA on [3]

1. ± 1 dB at center frequency of 22.05 GHz ± 650 MHz.
2. ± 1 dB at center frequency of 11 GHz ± 1 GHz.
3. ± 1 dB at center frequency of 23.75 GHz ± 1 GHz.

IF dynamic range		
SFDR (spurious-free dynamic range) (ADC related spurious)	-62 dBc (nom)	Signal at –16 dBFS, anywhere in full IF width
Full scale (ADC clipping); preselector bypassed, LNA off, PA off) (nom) [1]		
Center frequency	**Mixer level for IF gain low**	**Mixer level for IF gain high**
10.0 to 22.7 GHz	-6 dBm	-16 dBm
> 22.7 to 50 GHz	-7 dBm	-13 dBm
TOI (3rd-order intermodulation distortion, in the IF; 2 tones of equal level, -19 dBFS, 10 MHz tone separation; preselector bypass, IF gain high) (nom)		
10.0 to 50 GHz	-66 dBc	
IF residual responses (input terminated; IF gain high) (nom)		
10.0 to 50 GHz	-80 dBFS	There are no actual discernable/observable IF Residuals in this IF path.
RF residual responses (input terminated, but varies with tuning, generally LO-related) (nom)		
10.0 to 20.0 GHz	-75 dBm	
> 20.0 to 22.7 GHz	-60 dBm	
> 22.7 to 50 GHz	-83 dBm	
Noise density in IF (characterized at center of RF band, and center of IF [2]) (nom)		
Center frequency	**IF gain low**	**IF gain high**
10.0 to 22.7 GHz	-148 dBm/Hz	-150 dBm/Hz
22.7 to 50 GHz	-142 dBm/Hz	-143 dBm/Hz

1. Full scale (ADC clipping level) is a rough estimate of the signal level at which ADC overload occurs. Actual clipping levels vary significantly; this is only a guide. Mixer level is RF Input level less attenuation setting.
2. IF noise up to 5.5 dB worse to either side of IF center.

Amplitude accuracy, absolute, 4 GHz IF path (nom) Microwave preselector bypass path (10 dB attenuation)				
Frequency	**3a. MPB**	**3b. LNA on**	**3c. PA on**	**3d. LNA on, PA on**
10 to 22.7 GHz	± 0.5 dB	± 0.7 dB	± 0.6 dB	± 0.8 dB
> 22.7 to 50 GHz	± 1.1 dB	± 1.2 dB	± 1.3 dB	± 1.3 dB

Amplitude accuracy, absolute, 4 GHz IF path (nom) Full bypass path (10 dB attenuation)		
Frequency	**4a. FBP**	**4b. FBP, LNA on**
10 to 22.7 GHz	± 0.5 dB	± 0.8 dB
> 22.7 to 50 GHz	± 1.1 dB	± 1.3 dB

Inputs and Outputs

Front Panel

RF input	
Option 526, 544, 550	2.4 mm male, 50 Ω (nominal) (standard)
	Adapter 2.4 mm to 3.5 mm included with Option 526
External frequency extender, wide-bandwidth (option EXW), interface for use with V3050A	
High LO Out	2.4 mm female; option EXW connection to V3050A signal analyzer frequency extender
High IF In	SMA, female; option EXW connection to V3050A signal analyzer frequency extender
External mixing (option EXM)	
Connector	SMA, female, 50 Ω, nominal
Functions	Triplexed for LO output, IF input, and mixer bias
Mixer bias range	± 10 mA in 10 µA step
IF frequency	322.5 MHz, for IF bandwidth path < = 25 MHz
	250.0 MHz (center), for IF bandwidth path = 40 MHz
LO output frequency range	3.75 to 14.0 GHz
Internal calibrator output	
Cal Out	2.4 mm female, 10 MHz to 50 GHz internal calibrator output

USB ports			
Type	**Description**	**Connector**	**Output Current**
Standard (2)	Compatible with USB 2.0	USB Type-A female	0.5 A (nom) for ports not marked
USB 3.0 (2)	Compatible with USB 3.0	USB Type-A female (blue)	1.2 A (nom) for ports
USB C (1)	Compatible with USB Type-C	USB Type-C female	3.0 A at 15 V

Wide IF out (enabled by option CRW)	
Connector	SMA, female, 50 Ω nominal

Rear Panel

10 MHz out	
Connector	BNC female, 50 Ω (nominal)
Output amplitude	≥ 0 dBm (nominal)
Frequency	10 MHz × (1+ frequency reference accuracy)
Ext ref in	
Connector	BNC female, 50 Ω (nominal)
Input amplitude range	–5 to 10 dBm (nominal)
Input frequency	1 to 50 MHz (nominal)
Frequency lock range	± 2 x 10^{-6} of specified external reference input frequency
Trigger 1 and 2 inputs	
Connector	BNC female,10 kΩ (nominal)
Trigger level range	–5 to 5 V
Trigger 3 input (precision, for wide-bandwidth measurements only)	
Connector	SMA, female, 50 Ω (nominal)
Trigger level range	–5 to 5 V
Trigger 1 and 2 outputs	
Connector	BNC female, 50 Ω (nominal)
Trigger level range	0 to 5 V (CMOS) (nominal)
VGA (monitor output 1)	
Connector	VGA compatible, 15-pin mini D-SUB
Format	XGA (60 Hz vertical sync rates, non-interlaced) Analog RGB
Resolution	1280 x 800
DisplayPort (monitor output 2)	
Connector	Mini DisplayPort
Resolution	1280 x 800
Noise source drive +28 V (pulsed)	
Connector	BNC female
SNS series noise source	**For use with Keysight Technologies' SNS series noise sources**
Connector	12 pin circular
Analog out	
Connector	BNC female
USB ports	
USB 3.0 (2 ports)	
Standard	Compatible with USB 3.0
Connector	USB Type-A female
Output current	1.2 A (nominal)
USB 2.0 (1 port)	
Standard	Compatible with USB 2.0
Connector	USB Type-A female
Output current	0.5 A (nominal)

GPIB interface	
Connector	IEEE-488 bus connector
GPIB codes	SH1, AH1, T6, SR1, RL1, PP0, DC1, C1, C2, C3, C28, DT1, L4, C0
GPIB mode	Controller or device
PCIe X4 interface	
Connector	PCIe X4, female
Digital Bus interface	
Connector	MDR-80
LAN TCP/IP interface	
Standard	1000Base-T
Connector	RJ45 Ethertwist
AUX IF output	
Connector	SMA female, shared by CR3, CRP and ALV
Impedance	50 Ω nominal
AUX IF output, second IF output, licensed as option CR3 (included as standard)	
SA mode	322.5 MHz center frequency
IQ analyzer with IF bandwidth ≤ 25 MHz	322.5 MHz center frequency
IQ analyzer with IF path 40 MHz	250 MHz center frequency
IQ analyzer with IF path 255 MHz/1 GHz Requires SW ≥ A.32	690 MHz center frequency
IQ analyzer with IF path 1.5 GHz	950 MHz (Band 0) or 1200 MHz (except Band 0) center frequency
IQ analyzer with IF path 2 GHz	1200 MHz center frequency
Conversion gain (SA mode and up to 40 MHz bandwidth)	-1 to +4 dB (nominal) plus RF frequency response
Bandwidth (-6 dB)	
< 3.6 GHz	Up to 1 GHz nominal
> 3.6 GHz, with preselector	Depends on RF center frequency
> 3.6 GHz, with preselector bypass	100 - 800 MHz ± 3 dB (nominal)
AUX IF output, programmable, licensed as option CRP (included as standard); only available in swept spectrum analysis	
Range	10 to 75 MHz (user selectable)
Resolution	0.5 MHz
Conversion gain at RF center frequency with 0 dB attenuation	-1 to +4 dB (nominal) plus RF frequency response
Lower output frequencies	Subject to folding
Bandwidth	
Highpass corner frequency	5 MHz (nominal) at -3 dB
Lowpass corner frequency	120 MHz (nominal) at -3 dB
Output at 70 MHz	
< 3.6 GHz or > 3.6 GHz with preselector bypassed	100 MHz nominal
Preselected band	Depends on RF center frequency

AUX IF output, Fast Log Video, licensed as option ALV		
General port specifications		
Connector	SMA female	Shared with other options
Impedance	50 Ω nominal	
Fast Log video output		
Output voltage	Open-circuit voltages shown	
Maximum	1.6 V at –10 dBm nominal	
Slope	25 ± 1 mV/dB nominal	
Rise Time	15 ns nominal	
Fall Time	40 ns nominal (for frequencies between 3.6-26.5 GHz, with MPB path)	
	Other cases, depends on bandwidth.	
Option YAV Y-axis video output		
General port specifications		
Connector	BNC female	Shared with other options
Impedance	50 Ω nominal	
Screen video		
Operating conditions		
Display scale types	Log or Lin	“Lin” is linear in voltage
Log scales	All (0.1 to 20 dB/div)	
Modes	Spectrum analyzer only	
Gating	Gating must be off	
Output scaling	0 to 1.0 V open circuit, representing bottom to top of screen	
Offset	± 1% of full scale nominal	
Gain accuracy	± 1% of output voltage nominal	
Log video (Log envelope) output		
Amplitude range (terminated with 50 Ω)		
Maximum	1.0 V nominal for –10 dBm at the mixer	
Scale factor	Output changes 1 V per 192.66 dB change in the signal envelope	
Bandwidth	Set by RBW	
Operating conditions	Select Sweep Type = Swept	
Linear video (AM demod) output		
Amplitude range (terminated with 50 Ω)		
Maximum	1.0 V nominal for signal envelope at the reference level	
Minimum	0 V	
Scale factor	If carrier level is set to half the reference level in volts, the scale factor is 200% of carrier level per volt. Regardless of the carrier level, the scale factor is 100% of reference level per volt.	
Bandwidth	Set by RBW	
Operating conditions	Select Sweep Type = Swept	

General Specifications

Temperature range		
Operating	0 to 40 °C	
Altitude	4,600 m (approx. 15,000 feet)	
Maximum relative humidity	95% non-condensing	
Environment		
	Indoor use	
Power requirements		
Voltage and frequency (nominal)	100/120 V, 50/60/400 Hz	The instruments can operate with mains supply voltage fluctuations up to ± 10% of the nominal voltage
	220/240 V, 50/60 Hz	
Rated output power	850W	
Display		
Resolution	1280 x 800	
Size	357 mm (14.1 in.) diagonal (nominal) capacitive multi-touch screen	
Data storage		
Internal	Removable solid-state drive (≥ 256 GB)	
External	Supports USB 3.0/2.0 compatible memory devices	
Weight (without options)		
Net	38.6 kg (nominal)	
Shipping	53.9 kg (119 lbs) (nominal)	
Dimensions		
Height	281 mm (11 in)	
Width	459 mm (18 in)	
Length	575 mm (22.6 in)	
CPU	Modular, upgradeable; Intel i7, 6-core, 1.9 GHz clock, 8 GB DDR4 DRAM; includes secure memory for instrument cal data	
SSD (solid-state drive)	256 GB, removeable	
Operating system	Windows-10, Enterprise	
Calibration cycle		
The recommended calibration cycle is one year; calibration services are available through Keysight service centers.		

Additional Resources

The N9042B UXA X-Series signal analyzer isn't the only thing that will bring you to RF breakthroughs. Powerful software drives your measurements while finely-tuned hardware takes them to new heights. In order to move the measurement plane to your device under test, reach even higher levels of measurement accuracy, and achieve 4 GHz of signal analysis and generation, the N9042B UXA partners with the:

- N9042B UXA X-Series signal analyzer
- PathWave X-Series measurement applications and PathWave Vector Signal Analysis (VSA)
- V3050A frequency extender for an unbanded, preselected frequency range to 110 GHz
- U9361 RCal receiver calibrator for improved receiver test system accuracy by 10X
- M9383B VXG signal generator for wideband stimulus and response testing
- N9042B UXA Signal Analyzer Configuration Guide (3121-1036.EN)

www.keysight.com/find/N9042B

Learn more at: www.keysight.com

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