N9042B UXA X-Series Signal Analyzer, Multi-touch

2 Hz to 26.5, 44 or 50 GHz

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Definitions and Conditions

This data sheet provides performance information for Keysight N9042B Signal Analyzers.

Specifications describe the performance of parameters covered by the product warranty and apply to temperature ranges 15 to 40 °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
- For signal frequencies < 10 MHz, DC coupling applied.
- 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	Frequency range
526	2 Hz to 26.5 GHz
544	2 Hz to 44 GHz
550	2 Hz to 50 GHz
Minimal frequency	
PA off, LNA off	2 Hz
PA on	9 kHz
LNA on	30 MHz

Swept spectrum analysis (these bands 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

Frequency reference	
Accuracy (total)	± [(Initial accuracy) + (aging rate x time since last adjustment) + (temperature stability)]
Aging rate	± 3 x 10^{-8} / year
Temperature stability, full temperature range	± 4.5 x 10^{-9}
Achievable initial calibration accuracy	± 3.1 x 10^{-8}
Example frequency reference accuracy 1 year after last adjustment	= ± (3 x 10^{-8} + 4.5 x 10^{-9} + 3.1 x 10^{-8}) = ± 6.6 x 10^{-8}
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 above)

Frequency readout accuracy (start, stop, center, marker)

± (marker frequency x frequency reference accuracy + 0.10 % x span + 5 % x RBW + 2 Hz + 0.5 x horizontal resolution) where horizontal resolution is Span/(SweepPoints-1)

Marker frequency counter	
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	
Stepped/Swept	± (0.1 % x span + horizontal resolution) where horizontal resolution is span/(sweep points –1)
FFT	± (0.1 % x span + horizontal resolution) where horizontal resolution is span/(sweep points –1)

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
Sweep (trace) point range	
All spans	3 to 100,001
Resolution bandwidth (RBW) (see also IQ Analysis section)	
Range (with –3 dB bandwidth, standard)	1 Hz to 3 MHz (10% steps), 4, 5, 6, 8, 10 MHz

Bandwidth accuracy (power)

RBW range	Accuracy
1 Hz to 100 kHz	± 0.5% (± 0.022 dB)
110 kHz to 1.0 MHz (< 3.6 GHz center frequency)	± 1.0% (± 0.044 dB)
1.1 to 2 MHz (< 3.6 GHz center frequency)	± 0.07 dB (nominal)
2.2 to 3 MHz (< 3.6 GHz center frequency)	± 0.10 dB (nominal)
4 to 10 MHz (< 3.6 GHz center frequency)	± 0.20 dB (nominal)

Bandwidth accuracy (-3 dB)

RBW range	Accuracy
1 Hz to 1.3 MHz	± 2% (nominal)
1.5 MHz to 3 MHz	
• (≤ 3.6 GHz center frequency)	± 7% (nominal)
• (> 3.6 GHz center frequency)	± 8% (nominal)
4 MHz to 10 MHz	
• (≤ 3.6 GHz center frequency)	± 15% (nominal)
• (> 3.6 GHz center frequency)	± 20% (nominal)
Selectivity (-60 dB/-3 dB)	4.1: 1 (nominal)
EMI bandwidths (CISPR 16-1-1; requires N90EMEMCB or N6141EM0E)	200 Hz, 9 kHz, 120 kHz, 1 MHz
EMI bandwidths (MIL-STD-461; requires N90EMEMCB or N6141EM0E)	10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz

Preselector bandwidth

The preselector can have a significant passband ripple. To avoid ambiguous results, the -4 dB bandwidth is characterized

Center frequency	Mean bandwidth (- 4 dB)
5 GHz	46 MHz
10 GHz	52 MHz
15 GHz	53 MHz
20 GHz	55 MHz
25 GHz	56 MHz
35 GHz	62 MHz
44 GHz	70 MHz
50 GHz	76 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	
With Option N90EMEMCB or N6141EM0E	Add quasi-peak and EMI average to above

Triggers and Gating

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 (nominal)
External 2	Y	Y	Y	
External 3			Y	Jitter < 20 ps (nominal)
RF Burst	Y	Y		IF path ≤ 40 MHz only
Video (IF Mag)	Y		Y	In 255 MHz IF path only; at greater bandwidths, ADC trigger is similar
ADC			Y	Similar to Video, but operates digitally on mag[I,Q], prior to decimation, filtering, and corrections. Available for bandwidth > 255 MHz.
Line	Y	Y	Y	
Periodic	Y	Y	Y	Repetitive "frame" trigger, at precise interval, following an External or RF Burst trigger
TV	Y	Y		

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 (the highest allowed mixer level depends on the IF gain. It is nominally –10 dBm for preamp off and IF gain = low) + 2 dB (nominal)

Detector and sweep type relationships

	Supplemental information
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)	Noise will limit trigger level range at high frequencies, such as above 15 GHz
Level accuracy		
With positive slope trigger. Trigger level with negative slope is nominally 1 to 4 dB lower than positive slope.		
Absolute	± 2 dB + absolute amplitude accuracy (nominal)	
Relative	± 2 dB (nominal)	
Bandwidth (-10 dB)		
Most cases (including RF Burst Level Type = Relative)	> 80 MHz (nominal)	
Start Freq < 650 MHz RF Burst Level Type = Absolute		
• Sweep Type = Swept	16 MHz (nominal)	
• Sweep Type = FFT		
• 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

Amplitude Accuracy and Range Specifications

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	Bypasses the preamplifier. 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	Bypasses the preamplifier. Requires P26, P44, P4L, P50, or P5L. 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	Bypasses preselector. 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	Bypasses preselector. Requires P26, P44, P4L, P50, or P5L. 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	Bypasses preselector. 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. Not generally recommended for digital demodulation.
3d		LNA on, PA on	Bypasses preselector. Requires P26, P44, P4L, P50, or P5L. Good sensitivity for narrowband swept measurements only. Not generally recommended for digital demodulation.
4a	Full bypass path (FBP)	LNP, MPB	Bypasses both preamplifier and preselector. 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	Bypasses both preamplifier and preselector. Requires P26, P44, P4L, P50, or P5L. 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.

Amplitude range		
Measurement range	Displayed average noise level (DANL) to +30 dBm (for preamp off)	
	DANL to +24 dBm (for frequency opts ≤ 526 with preamp on)	
	DANL to +20 dBm (for frequency opts > 526 with preamp on)	
Input mechanical attenuator range (2 Hz to 50 GHz)	0 to 70 dB in 2 dB steps	
Electronic attenuator (option EA3)		
Frequency range	2 Hz to 3.6 GHz	
Attenuation range		
Electronic attenuator range	0 to 24 dB, 1 dB steps	
Full attenuation range (mechanical + electronic)	0 to 94 dB, 1 dB steps	
Maximum safe input level (max applied to RF input connector)		
Average total power (with and without preamp)	+30 dBm (1 W)	
Peak pulse power (< 10 μs pulse width, < 1% duty cycle, and input attenuation ≥ 30 dB)	+50 dBm (100 W)	
DC Bias at RF Input	0 VDC max (DC coupled)	Use external DC block as needed
	0.2 VDC max in full bypass path	
DC volts		
DC coupled	± 0.2 Vdc	
Display range		
Log scale	0.1 to 1 dB/division in 0.1 dB steps 1 to 20 dB/division in 1 dB steps (10 display)	
Linear scale	10 divisions	
Scale units	dBm, dBmV, dBμV, dBmA, dBμA, V, W, A	

Frequency Response

1a. Standard path frequency response (swept, preselector on, LNA off, PA off)
10 dB input attenuation, relative to reference conditions (50 MHz), preselector centering applied above 3.6 GHz

Frequency	Full range	20 to 30 °C	Typical, unless stated otherwise
9 kHz to 20 MHz	± 0.54 dB	± 0.50 dB	± 0.15 dB
> 20 MHz to 50 MHz	± 0.44 dB	± 0.40 dB	± 0.12 dB
> 50 MHz to 3.6 GHz	± 0.58 dB	± 0.52 dB	± 0.22 dB
> 3.6 to 5.2 GHz	± 2.70 dB	± 1.90 dB	± 0.98 dB
> 5.2 GHz to 8.4 GHz	± 2.50 dB	± 1.40 dB	± 0.58 dB
> 8.4 to 13.6 GHz	± 2.00 dB	± 1.50 dB	± 0.54 dB
> 13.6 to 17.1 GHz	± 2.00 dB	± 1.70 dB	± 0.68 dB
> 17.1 to 26.5 GHz	± 2.32 dB	± 1.90 dB	± 0.74 dB
> 26.5 to 34.5 GHz	± 2.70 dB	± 2.30 dB	± 0.94 dB
> 34.5 to 50 GHz	± 4.35 dB	± 3.00 dB	± 1.22 dB

1b. Standard path, LNA on frequency response (swept, preselector on, LNA on, PA off)
10 dB input attenuation, relative to reference conditions (50 MHz), preselector centering applied above 3.6 GHz

Frequency	Full range	20 to 30 °C	Typical, unless stated otherwise
30 MHz to 3.6 GHz	± 0.68 dB	± 0.54 dB	± 0.25 dB
> 3.6 to 5.2 GHz	± 2.90 dB	± 2.28 dB	± 1.14 dB
> 5.2 to 8.4 GHz	± 2.80 dB	± 2.06 dB	± 0.98 dB
> 8.4 to 13.6 GHz	± 2.40 dB	± 2.02 dB	± 0.88 dB
> 13.6 to 17.1 GHz	± 2.40 dB	± 2.16 dB	± 0.88 dB
> 17.1 to 26.5 GHz	± 2.86 dB	± 2.42 dB	± 0.98 dB
> 26.5 to 34.5 GHz	± 3.10 dB	± 2.60 dB	± 1.18 dB
> 34.5 to 50 GHz	± 5.25 dB	± 4.30 dB	± 2.04 dB

- **1c. Standard path, PA on frequency response (swept, preselector on, LNA off, PA on)**
- **10 dB input attenuation, relative to reference conditions (50 MHz), preselector centering applied above 3.6 GHz**

Frequency	Full range	20 to 30 °C	Typical, unless stated otherwise
9 kHz to 1 MHz	N/A	N/A	± 0.82 dB
> 1 to 50 MHz	± 0.80 dB	± 0.78 dB	± 0.25 dB
> 50 MHz to 3.6 GHz	± 0.68 dB	± 0.50 dB	± 0.18 dB
> 3.6 to 5.2 GHz	± 2.80 dB	± 2.30 dB	± 1.20 dB
> 5.2 GHz to 8.4 GHz	± 2.60 dB	± 1.64 dB	± 0.64 dB
> 8.4 to 13.6 GHz	± 2.30 dB	± 1.80 dB	± 0.60 dB
> 13.6 to 17.1 GHz	± 2.30 dB	± 2.00 dB	± 0.70 dB
> 17.1 to 26.5 GHz	± 2.86 dB	± 2.22 dB	± 0.72 dB
> 26.5 to 34.5 GHz	± 3.10 dB	± 2.44 dB	± 1.02 dB
> 34.5 to 50 GHz	± 5.06 dB	± 3.85 dB	± 1.78 dB

1d. Standard path, LNA on, PA on frequency response (swept, preselector on, LNA on, PA on)
10 dB input attenuation, relative to reference conditions (50 MHz), preselector centering applied above 3.6 GHz

Frequency	Full range	20 to 30 °C	Typical, unless stated otherwise
< 3.6 GHz	If tuning < 3.6 GHz, then standard path with LNA on is used.		
3.6 GHz to 8.4 GHz	± 3.00 dB	± 2.50 dB	± 1.36 dB
> 8.4 to 13.6 GHz	± 2.50 dB	± 2.20 dB	± 0.96 dB
> 13.6 to 17.1 GHz	± 2.30 dB	± 2.20 dB	± 0.94 dB
> 17.1 to 26.5 GHz	± 2.85 dB	± 2.40 dB	± 1.00 dB
> 26.5 to 34.5 GHz	± 3.20 dB	± 2.80 dB	± 1.32 dB
> 34.5 to 50 GHz	± 5.30 dB	± 4.50 dB	± 2.26 dB

2a. Low-noise path (LNP) frequency response (low-noise path enabled, preselector on, LNA off, PA off)
10 dB input attenuation, relative to reference conditions (50 MHz), preselector centering applied above 3.6 GHz

Frequency	Full range	20 to 30 °C	Typical, unless stated otherwise
3.6 GHz to 8.4 GHz	± 3.10 dB	± 2.30 dB	± 1.00 dB
> 8.4 to 13.6 GHz	± 2.12 dB	± 1.72 dB	± 0.56 dB
> 13.6 to 17.1 GHz	± 2.00 dB	± 1.78 dB	± 0.66 dB
> 17.1 to 26.5 GHz	± 2.52 dB	± 1.92 dB	± 0.64 dB
> 26.5 to 34.5 GHz	± 2.80 dB	± 2.45 dB	± 0.94 dB
> 34.5 to 50 GHz	± 3.58 dB	± 2.84 dB	± 1.20 dB

2b. Low-noise path (LNP) frequency response (low-noise path enabled, preselector on, LNA on, PA off)
10 dB input attenuation, relative to reference conditions (50 MHz), preselector centering applied above 3.6 GHz

Frequency	Frequency response (nominal)
3.6 to 8.4 GHz	± 0.80 dB
> 8.4 to 13.6 GHz	± 0.70 dB
> 13.6 to 17.1 GHz	± 0.70 dB
> 17.1 to 26.5 GHz	± 0.70 dB
> 26.5 to 34.5 GHz	± 1.00 dB
> 34.5 to 50 GHz	± 1.40 dB

3a. Microwave preselector bypass (MPB) path frequency response (MPB enabled, LNA off, PA off)
10 dB input attenuation, relative to reference conditions (50 MHz)

Frequency	Full range	20 to 30 °C	Typical, unless stated otherwise
3.6 GHz to 8.4 GHz	± 1.50 dB	± 1.44 dB	± 0.40 dB
> 8.4 to 13.6 GHz	± 1.66 dB	± 1.50 dB	± 0.50 dB
> 13.6 to 17.1 GHz	± 2.00 dB	± 1.62 dB	± 0.56 dB
> 17.1 to 26.5 GHz	± 2.52 dB	± 1.80 dB	± 0.56 dB
> 26.5 to 34.5 GHz	± 2.55 dB	± 2.10 dB	± 0.78 dB
> 34.5 to 50 GHz	± 4.20 dB	± 2.90 dB	± 1.12 dB

3b, 3c, 3d. Microwave preselector bypass (MPB) path frequency response (MPB path enabled)

	3b. MPB, LNA on (10 dB input attenuation) (nominal)	3c. MPB, PA on (10 dB input attenuation) (nominal)	3d. MPB, LNA on, PA on (10 dB input attenuation) (nominal)
3.6 GHz to 8.4 GHz	± 0.40 dB	± 0.30 dB	± 0.40 dB
> 8.4 to 13.6 GHz	± 0.50 dB	± 0.30 dB	± 0.45 dB
> 13.6 to 17.1 GHz	± 0.50 dB	± 0.40 dB	± 0.45 dB
> 17.1 to 26.5 GHz	± 0.50 dB	± 0.40 dB	± 0.50 dB
> 26.5 to 34.5 GHz	± 0.50 dB	± 0.50 dB	± 0.60 dB
> 34.5 to 50 GHz	± 0.90 dB	± 1.20 dB	± 1.00 dB

4a, 4b. Full bypass (FBP) path frequency response (full bypass path enabled)

	4a. FBP (10 dB input attenuation) (nominal)	4b. FBP, LNA on (10 dB input attenuation) (nominal)
3.6 GHz to 8.4 GHz	± 0.20 dB	± 0.30 dB
> 8.4 to 13.6 GHz	± 0.25 dB	± 0.50 dB
> 13.6 to 17.1 GHz	± 0.30 dB	± 0.50 dB
> 17.1 to 26.5 GHz	± 0.30 dB	± 0.50 dB
> 26.5 to 34.5 GHz	± 0.40 dB	± 0.50 dB
> 34.5 to 50 GHz	± 0.60 dB	± 1.00 dB

Electronic attenuator frequency response (10 dB mechanical input attenuation, relative to reference conditions (50 MHz)

Maximum error relative to reference conditions (50 MHz). Mechanical attenuation set to default/calibrated setting of 10 dB.

EA3 frequency	Full range	20 to 30 °C	Typical, unless stated otherwise
Attenuation = 4 to 24 dB, even steps			
9 kHz to 50 MHz	± 0.80 dB	± 0.65 dB	± 0.18 dB
50 MHz to 3.6 GHz	± 0.50 dB	± 0.48 dB	± 0.22 dB
Attenuation = 0,1,2 and odd steps, 3 to 23 dB			
10 MHz to 3.6 GHz	N/A	N/A	± 0.22 dB

Attenuator switching uncertainty (50 MHz reference frequency, relative to 10 dB reference setting, LNA off, PA off)

	1a. Std (10 dB input attenuation)
Attenuation 12 to 40 dB	± 0.14 dB ± 0.04 dB (typical)
Attenuation 2 to 8 dB, or > 40 dB	± 0.18 dB ± 0.06 dB (typical)
Attenuation 0 dB	± 0.05 dB (nominal)
Attenuation >2 dB at other frequencies (nominal)	
2 Hz to 3.6 GHz	± 0.3 dB
> 3.6 to 8.4 GHz	± 0.5 dB
> 8.4 to 26.5 GHz	± 0.7 dB
> 26.5 to 50 GHz	± 1.0 dB

Total absolute amplitude accuracy (at 50 MHz)

At 50 MHz, 10 dB attenuation, RBW ≤ 1 MHz, input signal -10 to -50 dBm, for Path 1a or -40 to -70 dBm for Path 1b and 1c, all settings auto-coupled except Auto Swp Time = Accy, any reference revel, any vertical scale.

Path	Full range	20 to 30 °C	Typical	AutoAlign = Light, nominal
1a. Std	± 0.34 dB	± 0.32 dB	± 0.12 dB	± 0.18 dB
1b. Std (LNA on, preamp off)	± 0.44 dB	± 0.40 dB	± 0.16 dB	± 0.19 dB
1c. Std (LNA off, preamp on)	± 0.42 dB	± 0.38 dB	± 0.12 dB	± 0.17 dB
With electronic attenuator				
(at 50 MHz, 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)				
1a. Std	± 0.37 dB	± 0.32 dB	± 0.12 dB	± 0.17 dB
For absolute amplitude accuracy at any frequency in the 1a. Std Path, use the following formulas:				
At any frequency	± (abs amp at 50 MHz + frequency response)			
Wide range of signal levels, resolution bandwidths, reference levels, attenuation = 10 dB, 10 Hz to 3.6 GHz	± 0.25 dB, 95th percentile			

Note1: Absolute amplitude accuracy is the total of all amplitude measurement errors, and applies over the following subset of settings and conditions:

- 1 Hz ≤ RBW ≤ 1 MHz
- Input signal −10 to −50 dBm (details below)
- Input attenuation 10 dB
- Span < 5 MHz (nominal additional error for span ≥ 5 MHz is is 0.02 dB)
- All settings auto-coupled except Swp Time Rules = Accuracy
- Combinations of low signal level and wide RBW use VBW ≤ 30 kHz to reduce noise
- When using FFT sweeps, the signal must be at the center frequency.

This absolute amplitude accuracy specification includes the sum of the following individual specifications under the conditions listed above: Scale Fidelity, Reference Level Accuracy, Display Scale Switching Uncertainty, Resolution Bandwidth Switching Uncertainty, 50 MHz Amplitude Reference Accuracy, and the accuracy with which the instrument aligns its internal gains to the 50 MHz Amplitude Reference. The only difference between signals within the range above –50 dBm and those signals below that level is the scale fidelity. Our specifications and experience show no difference between signals above and below this level. The only reason our Absolute Amplitude Uncertainty specification does not go below this level is that noise detracts from our ability to verify the performance at all levels with acceptable test times and yields. So, the performance is not warranted at lower levels, but we fully expect it to be the same.

Note 2: Absolute amplitude accuracy for a wide range of signal and measurement settings, covers the 95th percentile proportion with 95% confidence. Here are the details of what is covered and how the computation is made:

- The wide range of conditions of RBW, signal level, VBW, reference level and display scale are described above.
- There are 44 quasi-random combinations used, tested at a 50 MHz signal frequency.
- We compute the 95th percentile proportion with 95% confidence for this set observed over a statistically significant number of instruments.
- Also, the frequency response relative to the 50 MHz response is characterized by varying the signal across a large number of quasi-random verification frequencies that are chosen to not correspond with the frequency response adjustment frequencies.
- We again compute the 95th percentile proportion with 95% confidence for this set observed over a statistically significant number of instruments.
- We also compute the 95th percentile accuracy of tracing the calibration of the 50 MHz absolute amplitude accuracy to a national standards organization.
- We also compute the 95th percentile accuracy of tracing the calibration of the relative frequency response to a national standards organization
- We take the root-sum-square of these four independent Gaussian parameters
- To that RSS we add the environmental effects of temperature variations across the 20 to 30°C range.
- These computations and measurements are made with the mechanical attenuator only in circuit, set to the reference state of 10 dB.

A similar process is used for computing the result when using the electronic attenuator under a wide range of settings: all even settings from 4 through 24 dB inclusive, with the mechanical attenuator set to 10 dB. The 95th percentile result was 0.21 dB.

VSWR (voltage standing wave ratio) at RF Input (95th Percentile)

Standard path, 10 dB input attenuation, 50 MHz (reference condition)		1.07:1 (nominal)	
Standard path, 0 dB input attenuation, 0.01 to 3.6 GHz		2.2:1 (nominal)	
Center frequency	**1a. Std, IF path ≤ 40 MHz (10 dB input attenuation)**	**1b. Std, LNA on and 1d. Std, LNA on, PA on IF path ≤ 40 MHz (0 dB input attenuation)**	**1c. Std, PA on IF path ≤ 40 MHz (0 dB input attenuation)**
10 MHz to 3.6 GHz	1.18	1.23 (path 1b. only)	1.66
> 3.6 to 8.4 GHz	1.20	1.39	1.57
> 8.4 to 13.6 GHz	1.20	1.28	1.42
> 13.6 to 17.1 GHz	1.28	1.38	1.39
> 17.1 to 26.5 GHz	1.32	1.36	1.40
> 26.5 to 34.5 GHz	1.50	1.60	1.63
> 34.5 to 50 GHz	1.65	1.73	1.79
Center frequency	**3a. MPB, IF path ≥ 255 MHz (10 dB input attenuation)**		
8.9 to 20 GHz	1.25		
> 20 to 30 GHz	1.45		
> 30 to 40 GHz	1.43		
> 40 to 50 GHz	1.70		
The magnitude of the mismatch over the range of frequencies will be very similar between MPB and non-MPB operation, between LNP and non-LNP operation, and between FBP and non-FBP operation, but the details, such as the frequencies of the peaks and valleys, will shift.			

VSWR plots

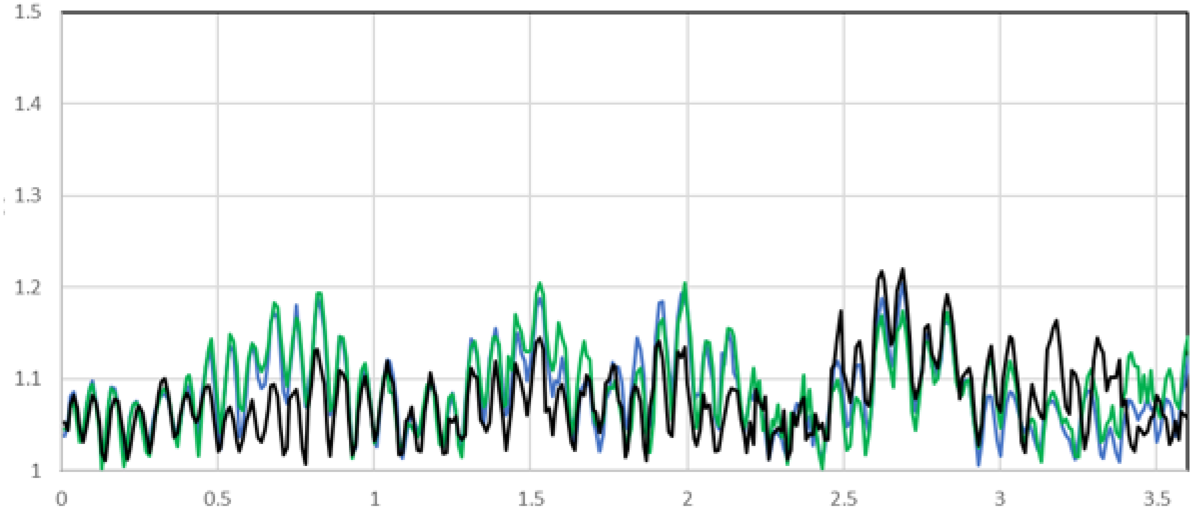

Figure 1. VSWR vs. frequency (0 to 3.5 GHz), 1a. Standard Path, 10 dB attenuation, measured on 3 units

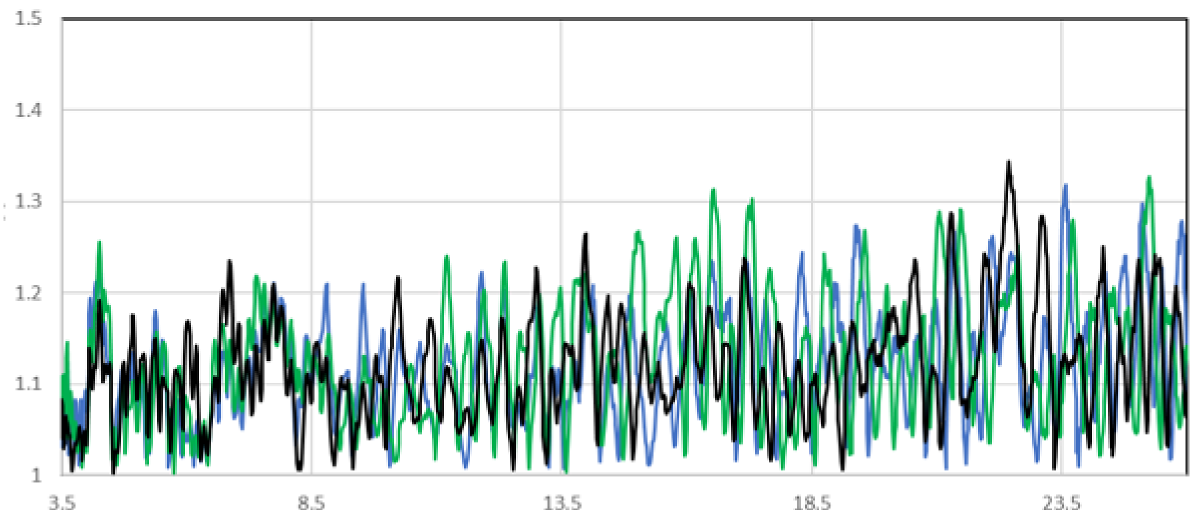

Figure 2. VSWR vs. frequency (3.5 to 26 GHz), 1a. Standard Path, 10 dB attenuation, measured on 3 units

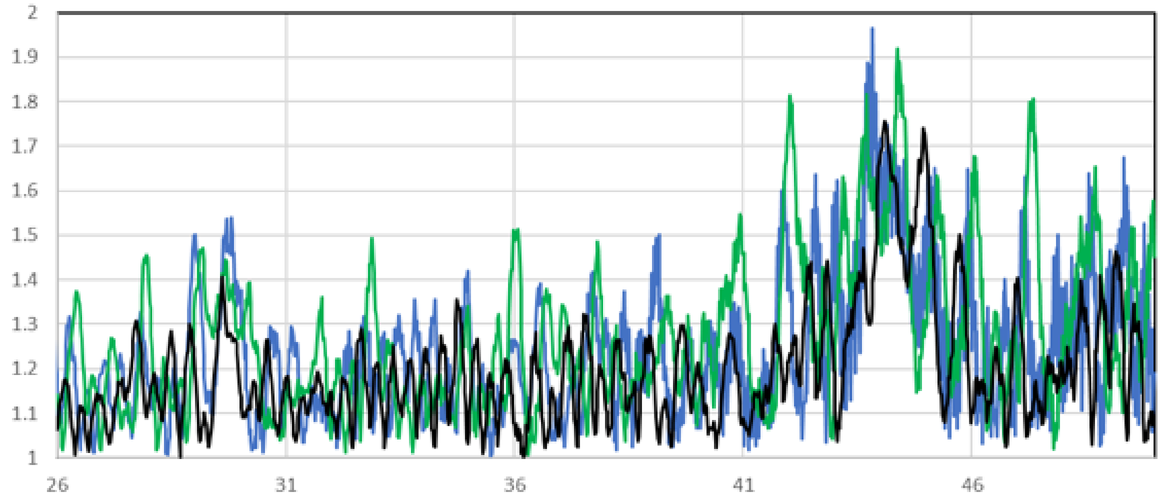

Figure 3. VSWR vs. frequency (26 to 50 GHz), 1a. standard path, 10 dB attenuation, measured on 3 units

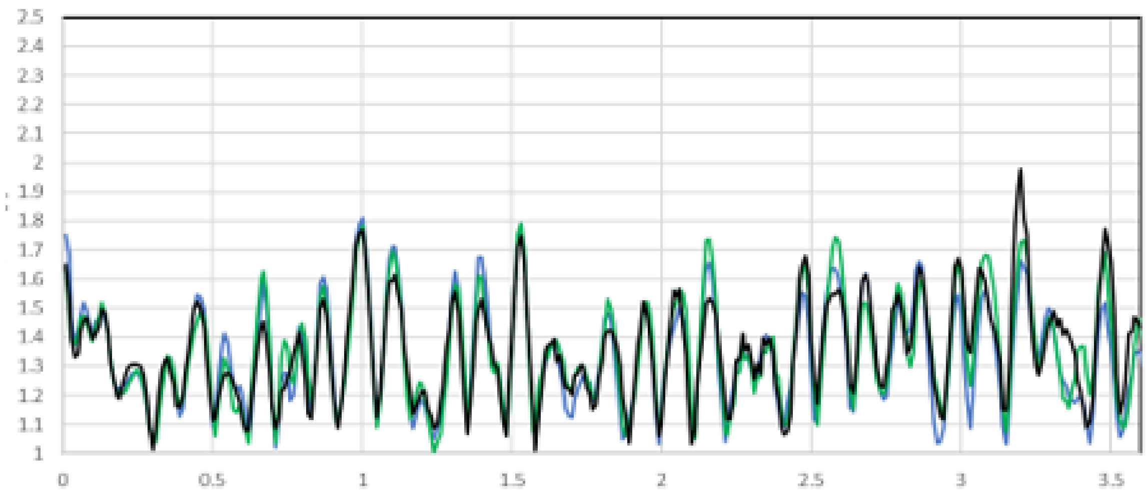

Figure 4. VSWR vs. frequency (0 to 3.5 GHz), 1c. preamp on, 0 dB attenuation, measured on 3 units

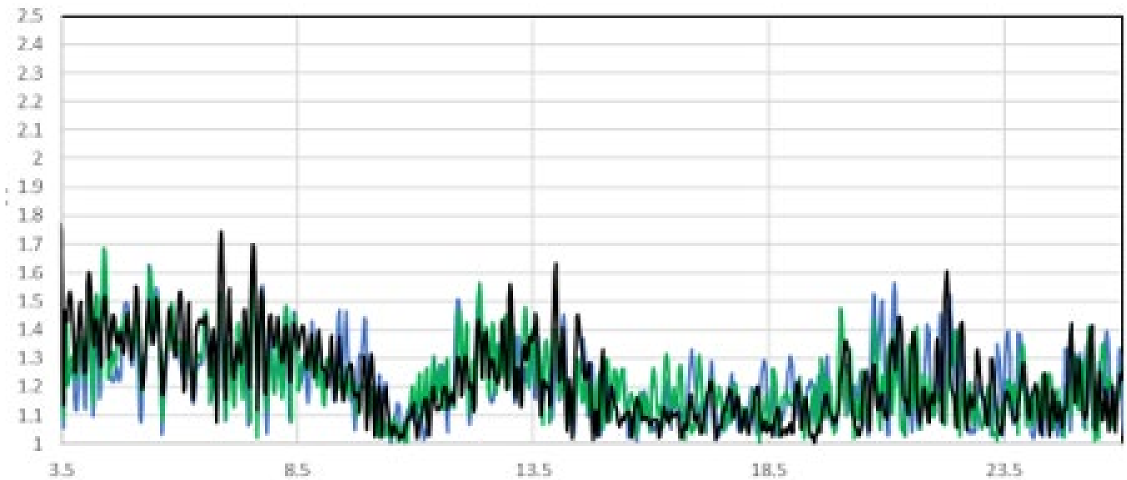

Figure 5. VSWR vs. frequency (3.5 to 26 GHz), 1c. preamp on, 0 dB attenuation, measured on 3 units

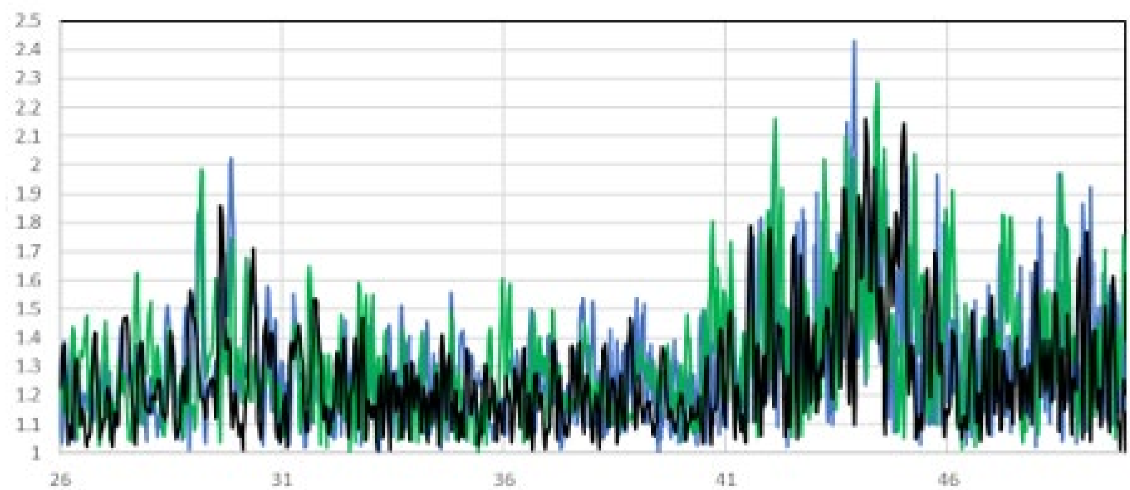

Figure 6. VSWR vs. frequency (26 to 50 GHz), 1c. preamp on, 0 dB attenuation, measured on 3 units

Resolution bandwidth switching uncertainty (relative to 30 kHz RBW)

1 Hz to 1.5 MHz RBW	< ± 0.03 dB
1.6 MHz to 2.7 MHz RBW	< ± 0.05 dB
3 MHz RBW	± 0.1 dB
4, 5, 6, 8, 10 MHz RBW	± 0.3 dB

Reference level

Range	
Log scale	–170 to +30 dBm in 0.01 dB steps
Linear scale	707 pV to 7.07 V with 0.11% (0.01 dB) resolution
Accuracy (Only affects the display, not the measurement, so it causes no additional error in measurement results from trace data or markers.)	0 dB
Display scale switching uncertainty	
Switching between linear and log (Only affects the display, not the measurement, so it causes no additional error in measurement results from trace data or markers.)	0 dB
Log scale/div switching (Only affects the display, not the measurement, so it causes no additional error in measurement results from trace data or markers.)	0 dB

Display scale fidelity (log-linear fidelity, relative to the reference condition -25 dBm input thrqough 10 dB attenuation, thus -35 dBm at the input mixer)

Input mixer level	Full range	Typical
-18 dBm ≤ ML ≤ -10 dBm	± 0.10 dB total	± 0.04 dB
ML < -18 dBm input mixer level	± 0.07 dB	± 0.02 dB

Preamplifiers (2 stages: Low-Noise Amplifier LNA, Pre-Amplifier PA)

	Low-Noise Amplifier (LNA)	Pre-Amplifier (PA)
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
	For options P4L/P5L: ≥ 43.5 GHz both LNA and PA cannot be used simultaneously	
Noise figure	4 to 8 dB (nominal) (see DANL)	10 dB (nominal)
Gain	20 dB (nominal)	30 dB (nominal)
	When LNA and PA are used simultaneously, gain = 40 dB (nominal)	

Dynamic Range Specifications

1 dB Gain compression

Notes:

- 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.
- Specified at 1 kHz RBW with 100 kHz tone spacing. The compression point will nominally equal the specification for tone spacing greater than 5 times the prefilter bandwidth. At smaller spacings, ADC clipping may occur at a level lower than the 1 dB compression point.
- Reference level and off-screen performance: The reference level (RL) behavior differs from some earlier analyzers in a way that makes this analyzer more flexible. In other analyzers, the RL controlled how the measurement was performed as well as how it was displayed. Because the logarithmic amplifier in these analyzers had both range and resolution limitations, this behavior was necessary for optimum measurement accuracy. The logarithmic amplifier in this signal analyzer, however, is implemented digitally such that the range and resolution greatly exceed other instrument limitations. Because of this, the analyzer can make measurements largely independent of the setting of the RL without compromising accuracy. Because the RL becomes a display function, not a measurement function, a marker can read out results that are off-screen, either above or below, without any change in accuracy. The only exception to the independence of RL and the way in which the measurement is performed is in the input attenuation setting: When the input attenuation is set to auto, the rules for the determination of the input attenuation include dependence on the reference level. Because the input attenuation setting controls the tradeoff between large signal behaviors (third-order intermodulation, compression, and display scale fidelity) and small signal effects (noise), the measurement results can change with RL changes when the input attenuation is set to auto.
- Mixer power level (dBm) = total power at the input (dBm) − input attenuation (dB).
- Total power at the preamp (dBm) = total power at the input (dBm) − input attenuation (dB).
- The low noise path, when in use, does not substantially change the compression-to-noise dynamic range or the TOI-to-noise dynamic range because it mostly just reduces losses in the signal path in front of all significant noise, TOI and compression-affecting circuits. In other words, the compression threshold and the third-order intercept both decrease and to the same extent as that to which the DANL decreases.

Standard path: 1 dB gain compression (swept, standard, preselector on)

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).

Center frequency	Gain compression (nominal)			
	1a. PA off	1b. LNA	1c. PA	1d. LNA PA
20 to 40 MHz	+2 dBm	-14 dBm	-14 dBm	-14 dBm
> 40 MHz to 3.6 GHz	+5 dBm	-14 dBm	-14 dBm	-14 dBm
> 3.6 to 13.5 GHz	+8 dBm	-14 dBm	-22 dBm	-28 dBm
> 13.5 to 26.5 GHz	+3 dBm	-14 dBm	-24 dBm	-32 dBm
> 26.5 to 50 GHz	+6 dBm	-10 dBm	-23 dBm	-33 dBm

Low-Noise Path (LNP): 1 dB gain compression (swept, LNP, preselector on)

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).

Center frequency	Gain compression (nominal)	
	2a. Preselector LNP	2b. Preselector LNP LNA
> 3.6 to 13.5 GHz	+2 dBm	-14 dBm
> 13.5 to 26.5 GHz	+0 dBm	-18 dBm
>26.5 to 50 GHz	+3 dBm	-16 dBm

Microwave preselector bypass path (MPB): 1 dB gain compression (swept, preselector bypass)

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).

Frequency	Gain compression (nominal)	
	3a. MPB	3b. MPB LNA
20 to 40 MHz	+2 dBm	-14 dBm
> 40 MHz to 3.6 GHz	+5 dBm	-14 dBm
> 3.6 to 13.5 GHz	+2 dBm	-17 dBm
> 13.5 to 26.5 GHz	+0 dBm	-17 dBm
>26.5 to 50 GHz	+0 dBm	-15 dBm

Full bypass path (FBP): 1 dB gain compression (swept, full bypass)

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).

Frequency	Gain compression (nominal)	
	4a. FBP	4b. FBP LNA
> 3.6 to 13.5 GHz	-4 dBm	-20 dBm
> 13.5 to 26.5 GHz	-5 dBm	-23 dBm
>26.5 to 50 GHz	-5 dBm	-22 dBm

IF prefilter bandwidth

This table applies without Option FS1 or FS2, fast sweep. With Option FS1 or FS2, which is a standard option in the UXA, this table applies for sweep rates that are manually chosen to be the same as or slower than "traditional" sweep rates, instead of the much faster sweep rates, such as autocoupled sweep rates, available with FS1 or FS2. Sweep rate is defined to be span divided by sweep time. If the sweep rate is ≤ 1.1 times RBW-squared, the table applies. Otherwise, compute an "effective RBW" = span / (sweeptime × RBW). To determine the IF Prefilter bandwidth, look up this effective RBW in the table instead of the actual RBW. For example, for RBW = 3 kHz, Span = 300 kHz, and sweep time = 42 ms, we compute that sweep rate = 7.1 MHz/s, while RBW-squared is 9 MHz/s. So the sweep rate is < 1.1 times RBW-squared and the table applies; row 1 shows the IF prefilter bandwidth is nominally 8.9 kHz. If the sweep time is 1 ms, then the effective RBW computes to 100 kHz. This would result in an IF prefilter bandwidth from the third row, nominally 303 kHz.

Zero span or swept, RBW=	Sweep type = FFT, FFT width =	–3 dB bandwidth (nominal)
≤ 3.9 kHz	< 4.01 kHz	8.9 kHz
4.3 to 27 kHz	< 28.81 kHz	79 kHz
30 to 160 kHz	< 167.4 kHz	303 kHz
180 to 390 kHz	< 411.9 kHz	966 kHz
430 kHz to 10 MHz	< 7.99 MHz	10.9 MHz

Displayed Average Noise Level (DANL)

Input terminated, Sample or Average detector, Averaging type set to Log, IF Gain = High, 1 Hz Resolution Bandwidth, 0 dB input attenuation.

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	Full range	20 to 30 °C	Typical, unless otherwise stated
2 to 10 Hz	N/A		-90 dBm (nominal)
> 10 to 100 Hz			-115 dBm (nominal)
> 100 Hz to 1 kHz			-128 dBm (nominal)
> 1 to 9 kHz			-138 dBm (nominal)
> 9 to 100 kHz	-138 dBm	-140 dBm	-146 dBm
> 100 kHz to 1 MHz	-151 dBm	-152 dBm	-155 dBm
> 1 to 10 MHz	-152 dBm	-153 dBm	-156 dBm
> 10 MHz to 1.2 GHz	-150 dBm	-152 dBm	-155 dBm
> 1.2 to 2.1 GHz	-148 dBm	-150 dBm	-154 dBm
> 2.1 to 3.6 GHz	-146 dBm	-148 dBm	-152 dBm
> 3.6 to 6.6 GHz	-144 dBm	-146 dBm	-150 dBm
> 6.6 to 8.4 GHz	-144 dBm	-146 dBm	-151 dBm
> 8.4 to 13.6 GHz	-144 dBm	-146 dBm	-149 dBm
> 13.6 to 17.1 GHz	-142 dBm	-145 dBm	-149 dBm
> 17.1 to 22.5 GHz	-139 dBm	-141 dBm	-146 dBm
> 22.5 to 26.5 GHz	-136 dBm	-138 dBm	-143 dBm
> 26.5 to 30 GHz	-134 dBm	-136 dBm	-140 dBm
> 30 to 34.5 GHz	-132 dBm	-134 dBm	-139 dBm
> 34.5 to 37 GHz	-127 dBm	-129 dBm	-135 dBm
> 37 to 40 GHz	-125 dBm	-127 dBm	-134 dBm
> 40 to 45 GHz	-125 dBm	-127 dBm	-132 dBm
> 45 to 50 GHz	-120 dBm	-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 10 to 11 dB, for standard path, LNA on

Frequency	Full range	20 to 30 °C	Typical, unless otherwise stated
< 20 MHz	Not permitted with LNA on		
20 to 40 MHz	-152 dBm	-153 dBm	-158 dBm
> 40 to 500 MHz	-162 dBm	-163 dBm	-166 dBm
> 500 MHz to 2.5 GHz	-163 dBm	-164 dBm	-168 dBm
> 2.5 to 3.6 GHz	-162 dBm	-163 dBm	-167 dBm
> 3.6 to 4.7 GHz	-161 dBm	-162 dBm	-166 dBm
> 4.7 to 17.1 GHz	-160 dBm	-161 dBm	-165 dBm
> 17.1 to 22 GHz	-155 dBm	-157 dBm	-162 dBm
> 22 to 26.5 GHz	-152 dBm	-154 dBm	-159 dBm
> 26.5 to 27 GHz	-152 dBm	-154 dBm	-158 dBm
> 27 to 34.5 GHz	-147 dBm	-149 dBm	-154 dBm
> 34.5 to 42.5 GHz	-139 dBm	-141 dBm	-148 dBm
> 42.5 to 47 GHz	-136 dBm	-138 dBm	-144 dBm
> 47 to 50 GHz	-132 dBm	-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	Full range	20 to 30 °C	Typical, unless otherwise stated
> 100 to 200 kHz	-155 dBm	-156 dBm	-160 dBm
> 200 to 500 kHz	-157 dBm	-158 dBm	-162 dBm
> 500 kHz to 1 MHz	-160 dBm	-161 dBm	-165 dBm
> 1 MHz to 2.1 GHz	-162 dBm	-163 dBm	-166 dBm
> 2.1 to 3.6 GHz	-160 dBm	-161 dBm	-164 dBm
> 3.6 to 17.1 GHz	-161 dBm	-162 dBm	-166 dBm
> 17.1 to 20 GHz	-161 dBm	-162 dBm	-165 dBm
> 20 to 26.5 GHz	-159 dBm	-160 dBm	-163 dBm
> 26.5 to 30 GHz	-157 dBm	-158 dBm	-162 dBm
> 30 to 34.5 GHz	-156 dBm	-157 dBm	-160 dBm
> 34.5 to 37 GHz	-153 dBm	-155 dBm	-159 dBm
> 37 to 41 GHz	-150 dBm	-153 dBm	-157 dBm
> 41 to 46 GHz	-147 dBm	-150 dBm	-155 dBm
> 46 to 50 GHz	-145 dBm	-148 dBm	-152 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	Full range	20 to 30 °C	Typical, unless otherwise stated
< 20 MHz	Not permitted with LNA on		
20 to 40 MHz	-152 dBm	-153 dBm	-158 dBm
> 40 to 500 MHz	-162 dBm	-163 dBm	-166 dBm
> 500 MHz to 2.5 GHz	-163 dBm	-164 dBm	-168 dBm
> 2.5 to 3.6 GHz	-162 dBm	-163 dBm	-167 dBm
> 3.6 to 8.4 GHz	-161 dBm	-163 dBm	-168 dBm
> 8.4 to 13.6 GHz	-164 dBm	-165 dBm	-169 dBm
> 13.6 to 17.1 GHz	-163 dBm	-164 dBm	-168 dBm
> 17.1 to 23 GHz	-162 dBm	-163 dBm	-167 dBm
> 23 to 26.5 GHz	-161 dBm	-162 dBm	-166 dBm
> 26.5 to 34.5 GHz	-159 dBm	-160 dBm	-164 dBm
> 34.5 to 36.5 GHz	-157 dBm	-159 dBm	-163 dBm
> 36.5 to 43 GHz	-155 dBm	-157 dBm	-162 dBm
> 43 to 43.5 GHz	-153 dBm	-155 dBm	-160 dBm
> 43.5 to 47 GHz (for option P44 and P50)	-153 dBm	-155 dBm	-160 dBm
> 47 to 50 GHz (for option P50)	-150 dBm	-152 dBm	-158 dBm
> 43.5 to 47 GHz (for option P4L and P5L)	-136 dBm	-138 dBm	-144 dBm
> 47 to 50 GHz (for option P5L)	-132 dBm	-134 dBm	-141 dBm

2a. Low-noise path DANL (low-noise path enabled, preselector on, LNA off, PA off)

Noise Floor Extension (Option NF2) improves DANL by 9 to 11 dB, for low-noise path.

Frequency	Full range	20 to 30 °C	Typical, unless otherwise stated
< 3.6 GHz	Not permitted with low noise path		
3.6 to 6 GHz	-149 dBm	-151 dBm	-154 dBm
> 6 to 8.4 GHz	-150 dBm	-152 dBm	-155 dBm
> 8.4 to 17.1 GHz	-149 dBm	-151 dBm	-154 dBm
> 17.1 to 23 GHz	-147 dBm	-149 dBm	-152 dBm
> 23 to 26.5 GHz	-144 dBm	-146 dBm	-150 dBm
> 26.5 to 29 GHz	-143 dBm	-145 dBm	-149 dBm
> 29 to 34.5 GHz	-141 dBm	-143 dBm	-147 dBm
> 34.5 to 45 GHz	-134 dBm	-137 dBm	-142 dBm
> 45 to 50 GHz	-131 dBm	-134 dBm	-140 dBm

2b. Low-noise path DANL (low-noise path enabled, preselector on, LNA on, PA off)

Frequency	2b. LNP path, LNA on (nominal)
< 3.6 GHz	Not permitted with low noise path
3.6 to 6 GHz	-168 dBm
> 6 to 8.4 GHz	-168 dBm
> 8.4 to 17.1 GHz	-167 dBm
> 17.1 to 23 GHz	-165 dBm
> 23 to 26.5 GHz	-163 dBm
> 26.5 to 29 GHz	-162 dBm
> 29 to 34.5 GHz	-161 dBm
> 34.5 to 45 GHz	-157 dBm
> 45 to 50 GHz	-154 dBm

3a, 3b. Microwave preselector bypass (MPB) path DANL (MPB path enabled)

Frequency	3a. MPB path (nominal)	3b. MPB, LNA on (nominal)
3.6 to 8.4 GHz	-156 dBm	-165 dBm
> 8.4 to 17.1 GHz	-154 dBm	-165 dBm
> 17.1 to 22 GHz	-151 dBm	-164 dBm
> 22 to 22.5 GHz	-151 dBm	-161 dBm
> 22.5 to 26.5 GHz	-149 dBm	-161 dBm
> 26.5 to 30 GHz	-147 dBm	-159 dBm
> 30 to 34.5 GHz	-146 dBm	-159 dBm
> 34.5 to 41 GHz	-140 dBm	-154 dBm
> 41 to 44 GHz	-140 dBm	-152 dBm
> 44 to 49 GHz	-136 dBm	-151 dBm
> 49 to 50 GHz	-135 dBm	-150 dBm

If using microwave preselector bypass path (MPB) use path 3b for digital demodulation.

4a. Full bypass (FBP) path DANL (low-noise path enable, preselector bypass on, LNA off, PA off)

Frequency	Full range	20 to 30 °C	Typical, unless otherwise stated
3.6 to 8.4 GHz	-154 dBm	-155 dBm	-158 dBm
> 8.4 to 13.6 GHz	-154 dBm	-155 dBm	-158 dBm
> 13.6 to 17.1 GHz	-153 dBm	-155 dBm	-157 dBm
> 17.1 to 22 GHz	-152 dBm	-153 dBm	-156 dBm
> 22 to 26.5 GHz	-150 dBm	-151 dBm	-155 dBm
> 26.5 to 29 GHz	-150 dBm	-151 dBm	-154 dBm
> 29 to 34.5 GHz	-148 dBm	-149 dBm	-153 dBm
> 34.5 to 45 GHz	-142 dBm	-144 dBm	-149 dBm
> 45 to 50 GHz	-140 dBm	-142 dBm	-148 dBm

4b. Full bypass (FBP) path DANL (low-noise path enable, preselector bypass on, LNA on) (nominal)

Frequency	4b. FBP, LNA on
3.6 to 8.4 GHz	-165 dBm
> 8.4 to 13.6 GHz	-164 dBm
> 13.6 to 17.1 GHz	-164 dBm
> 17.1 to 22 GHz	-163 dBm
> 22 to 26.5 GHz	-161 dBm
> 26.5 to 29 GHz	-161 dBm
> 29 to 34.5 GHz	-160 dBm
> 34.5 to 45 GHz	-157 dBm
> 45 to 50 GHz	-155 dBm

Residuals, Images, and Spurious Responses

Residual responses (input terminated, 0 dB attenuation)

200 kHz to 8.4 GHz (swept)	-100 dBm
Zero span or FFT or other frequencies	-100 dBm (nominal)

Image responses (standard path, LNA off, PA off)

Mixer level	Tuned frequency (f)	Excitation frequency	Full range
-10 dBm	10 MHz to 26.5 GHz	f+45 MHz	-80 dBc
	10 MHz to 3.6 GHz	f+10,245 MHz	-80 dBc
	10 MHz to 22 GHz	f+645 MHz	-80 dBc
	> 22 to 26.5 GHz	f+645 MHz	-70 dBc
-30 dBm	> 26.5 to 50 GHz	f+45 MHz	-90 dBc (nominal)
	> 26.5 to 34.5 GHz	f+645 MHz	-70 dBc
	> 34.5 to 42 GHz	f+645 MHz	-55 dBc
	> 42 to 50 GHz	f+645 MHz	-70 dBc (nominal)

Other spurious responses (input-related, standard path, LNA off, PA off)

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).

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

Second-Harmonic Intercept (SHI)

1a. Standard path: SHI (swept, preselector on, LNA off, PA off)

Frequency of the fundamental	Mixer level	Distortion	SHI
10 MHz to 1.8 GHz	-15 dBm	-61 dBc	+46 dBm
> 1.8 to 3 GHz	-15 dBm	-67 dBc	+52 dBm
> 3 to 5.2 GHz	-15 dBm	-70 dBc	+55 dBm
> 5.2 to 13.25 GHz	-15 dBm	-79 dBc	+64 dBm
> 13.25 to 25.0 GHz	-15 dBm	-68 dBc	+53 dBm

1b. Standard path: SHI (swept, preselector on, LNA on, PA off)

Frequency of the fundamental	Preamp level	Distortion (nominal)	SHI (nominal)
10 MHz to 1.8 GHz	-45 dBm	-57 dBc	+12 dBm
> 1.8 to 13.25 GHz	-45 dBm	-60 dBc	+15 dBm

1c. Standard path: SHI (swept, preselector on, LNA off, PA on)

Frequency of the fundamental	Preamp level	Distortion (nominal)	SHI (nominal)
10 MHz to 1.8 GHz	-45 dBm	-73 dBc	+28 dBm
> 1.8 to 13.25 GHz	-45 dBm	-50 dBc	+5 dBm

2a. Low-noise path: SHI (swept, Low-noise path enabled, preselector on, LNA off, PA off)

Frequency of the fundamental	Mixer level	Distortion	SHI
1.75 to 2.5 GHz	-15 dBm	-92 dBc	+77 dBm
> 2.5 to < 5 GHz	-15 dBm	-97 dBc	+82 dBm
5 to 13.25 GHz	-15 dBm	-102 dBc	+87 dBm
> 13.25 to 25 GHz	-15 dBm	-92 dBc	+77 dBm

Third-Order Intercept (TOI)

1a. Standard path (swept, preselector on, LNA off, PA off)

Two –16 dBm (up to 26.5 GHz) or –20 dBm (> 26.5 GHz to 50 GHz) tones at input mixer with tone separation ≥ 100 kHz

Frequency	Full range	20 to 30 °C	Typical, unless otherwise stated
10 to 350 MHz	+14 dBm	+15 dBm	+18 dBm
> 350 MHz to 1.1 GHz	+15 dBm	+16 dBm	+19 dBm
> 1.1 GHz to 3.0 GHz	+17 dBm	+18 dBm	+21 dBm
> 3.0 to 3.6 GHz	+18 dBm	+19 dBm	+22 dBm
> 3.6 to 13.6 GHz	+14 dBm	+15 dBm	+19 dBm
> 13.6 to 21 GHz	+10 dBm	+11 dBm	+16 dBm
> 21 to 26.5 GHz	+12 dBm	+14 dBm	+18 dBm
> 26.5 to 34.5 GHz	+11 dBm	+13 dBm	+19 dBm
> 34.5 to 50 GHz	+7 dBm	+9 dBm	+14 dBm

1b. Standard path, (swept, preselector on, LNA on, PA off)

Two –34 dBm tones at preamp input with tone separation ≥ 100 kHz

Frequency	TOI (nominal)
10 to 350 MHz	-2 dBm
> 350 MHz to 1.1GHz	-1 dBm
> 1.1 to 2.6 GHz	0 dBm
> 2.6 to 3.6 GHz	+4 dBm
> 3.6 to 13.6 GHz	+1 dBm
> 13.6 to 21 GHz	-4 dBm
> 21 to 26.5 GHz	+3 dBm
> 26.5 to 34.5 GHz	+2 dBm
> 34.5 to 50 GHz	-2 dBm

1c. Standard path (swept, preselector on, LNA off, PA on)

Two –34 dBm tones at LNA input with tone separation ≥ 100 kHz

Frequency	TOI (nominal)
10 to 500 MHz	0 dBm
> 500 MHz to 1.6 GHz	+2 dBm
> 1.6 to 3.6 GHz	+3 dBm
> 3.6 to 13.6 GHz	-12 dBm
> 13.6 to 21 GHz	-14 dBm
> 21 to 26.5 GHz	-8 dBm
> 26.5 to 34.5 GHz	-10 dBm
> 34.5 to 41 GHz	-12 dBm
> 41 to 50 GHz	-6 dBm

1d. Standard path (swept, preselector on, LNA on, PA on)

Two –45 dBm tones at preamp level with tone separation ≥ 100 kHz

Frequency	TOI (nominal)
30 to 500 MHz	-2 dBm
> 500 MHz to 2 GHz	0 dBm
> 2 to 3.6 GHz	+4 dBm
> 3.6 to 13.6 GHz	-17 dBm
> 13.6 to 21 GHz	-22 dBm
> 21 to 34.5 GHz	-16 dBm
> 34.5 to 50 GHz	-20 dBm

2a. Low-noise path (swept, Low-noise path enable, preselector on, LNA off, PA off)

Two –16 dBm (3.6 GHz to 26.5 GHz) or –20 dBm (26.5 GHz to 50 GHz) tones at input mixer with tone separation ≥ 100 kHz

Frequency	TOI (nominal)
3.6 to 13.6 GHz	+15 dBm
> 13.6 to 23 GHz	+11 dBm
> 23 to 34.5 GHz	+14 dBm
> 34.5 to 50 GHz	+8 dBm

2b. Low-noise path (swept, Low-noise path enable, preselector on, LNA on, PA off)

Two –45 dBm tones at preamp level with tone separation ≥ 100 kHz

Frequency	TOI (nominal)
3.6 to 13.6 GHz	0 dBm
> 13.6 to 21 GHz	-9 dBm
> 21 to 34.5 GHz	-2 dBm
> 34.5 to 50 GHz	-5 dBm

Phase Noise (SSB)

Phase noise	Offset	Full range	20 to 30 °C	Typical, unless otherwise stated
Noise sidebands (CF = 1 GHz)	10 Hz Wide Ref Loop BW		The factory test line limit is consistent with a warranted specification of –89 dBc/Hz	−93 dBc/Hz
	10 Hz Narrow Ref Loop BW			−88 dBc/Hz (nominal)
	100 Hz	–107 dBc/Hz	–107 dBc/Hz	–112 dBc/Hz
	1 kHz	−123 dBc/Hz	−124 dBc/Hz	−127 dBc/Hz
	10 kHz	–132 dBc/Hz	–134 dBc/Hz	–135 dBc/Hz
	100 kHz	–138 dBc/Hz	–139 dBc/Hz	–141 dBc/Hz
	1 MHz	–144 dBc/Hz	–145 dBc/Hz	–146 dBc/Hz
	10 MHz	–154 dBc/Hzss	–155 dBc/Hz	–157 dBc/Hz

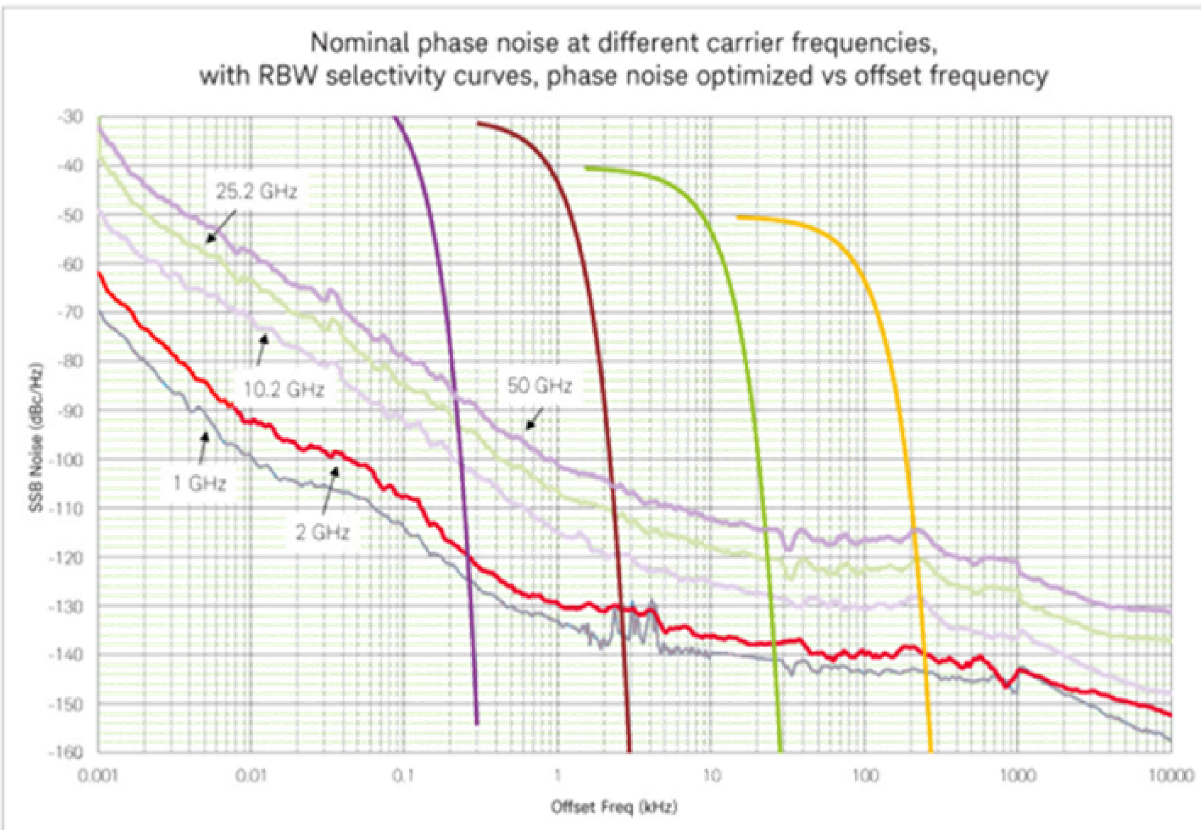

Figure 7. Nominal UXA phase noise at various center frequencies. 50 GHz curve is the predicted phase noise computed from the 25.2 GHz observation. RBW curves added to show impact of analyzer phase noise in resolving two closely spaced signals for various RBW filter choices.

IQ Analyzer

All specifications based on preselector by-passed (RF path either Microwave Preselector Bypass or Full Bypass) (except < 3.6 GHz), unless otherwise noted. 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; e.g. instruments with R20 also have R15 and R10 licenses, plus B2X, B40, and B25 paths.

10 MHz Analysis Bandwidth (Standard)

Specifications on this bandwidth apply with center frequencies of 10 MHz and higher. All specifications apply under the following settings unless otherwise specified: preselector bypassed, PA off, LNA off, IF gain = Auto, IF gain offset = 0 dB.

10 MHz analysis bandwidth (standard)

Analysis bandwidth range	10 Hz to 10 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	5122.5 MHz (1st IF, center freq ≤ 3.6 GHz)	
	322.5 MHz (Final IF)	
ADC sample rate	100 MSa/sec	
ADC resolution	16 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	
Capture memory	2 GB	
IQ Analyzer	32,000,001 sample pairs	
Length (IQ sample pairs)	536.8 MSa (2^{29} Sa) with 32-bit data packing	
	268.4 MSa (2^{28} Sa) with 64-bit data packing	
Maximum capture time (time record length)	35.8 sec at full 10 MHz BW with 32-bit data packing	Capture time increases linearly with decrease in bandwidth

IF frequency response

Center frequency	Span (MHz)	Preselector	Amplitude max error	Amplitude midwidth error (95%)	Slope (dB/MHz) (95%)	Amplitude RMS (nominal)
≤ 3.6 GHz	≤ 10 MHz	NA	± 0.20 dB	± 0.12 dB	± 0.10 dB	± 0.03 dB
> 3.6 to 26.5 GHz	≤ 10 MHz	Off	± 0.25 dB	± 0.12 dB	± 0.10 dB	± 0.02 dB
> 26.5 to 50 GHz	≤ 10 MHz	Off	± 0.35 dB	± 0.12 dB	± 0.10 dB	± 0.03 dB

IF phase linearity

Center frequency	Span (MHz)	Preselector	RMS (nominal)
≤ 3.6 GHz	≤ 10 MHz	NA	0.032
> 3.6 GHz	≤ 10 MHz	Off	0.057

25 MHz Analysis Bandwidth (Option B25)

Specifications on this bandwidth apply with center frequencies of 15 MHz and higher. All specifications apply under the following settings unless otherwise specified: preselector bypassed, PA off, LNA off, IF gain = Auto, IF gain offset = 0 dB.

25 MHz analysis bandwidth (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. • Over-range tuning to 50.5 GHz allowed, but without corrections, performance not specified
	50.0 to 110 GHz w/ V3050A	
IF frequency	5122.5 MHz (1st IF, center freq ≤ 3.6 GHz)	
	322.5 MHz (Final IF)	
ADC sample rate	100 MSa/sec	
ADC resolution	16 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	
Capture memory	2 GB	
IQ Analyzer	32,000,001 sample pairs	
Length (IQ sample pairs)	536.8 MSa (2^{29} Sa) with 32-bit data packing	
	268.4 MSa (2^{28} Sa) with 64-bit data packing	
Maximum capture time (time record length)	11.9 sec at full 25 MHz BW with 32-bit data packing	Capture time increases linearly with decrease in bandwidth

IF frequency response

Center frequency	Span (MHz)	Preselector	Amplitude max error	Amplitude RMS (nominal)
≤ 3.6 GHz	10 to ≤ 25	NA	± 0.30 dB	± 0.07 dB
> 3.6 to 26.5 GHz	10 to ≤ 25	Off	± 0.40 dB	± 0.04 dB
> 26.5 to 50 GHz	10 to ≤ 25	Off	± 0.60 dB	± 0.06 dB

IF phase linearity

Center frequency	Span (MHz)	Preselector	RMS (nominal)
≤ 3.6 GHz	≤ 25 MHz	NA	0.11
> 3.6 GHz	≤ 25 MHz	Off	0.27

Full scale (ADC clipping) (nominal)

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.

Center frequency	Mixer level for IF gain = low	Mixer level for IF gain = high
≤ 3.6 GHz	-8 dBm	-17 dBm
> 3.6 to 34.5	-7 dBm	-16 dBm
> 34.5 to 50	-1 dBm	-12 dBm
Effect of signal frequency ≠ CF	Up to ± 1 dB nominal	

40 MHz Analysis Bandwidth (Option B40)

Specifications on this bandwidth apply with center frequencies of 65 MHz and higher. All specifications apply under the following settings unless otherwise specified: preselector bypassed, PA off, LNA off, IF gain = Auto, IF gain offset = 0 dB.

40 MHz analysis bandwidth (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. • Over-range tuning to 50.5 GHz allowed, but without corrections, performance not specified.
	50.0 to 110 GHz w/ V3050A	
IF frequency	5050 MHz (1st IF, center frequency ≤ 3.6 GHz)	
	250 MHz (Final IF)	
ADC sample rate	200 MSa/sec	
ADC resolution	12 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	
Capture memory	2 GB	
IQ Analyzer	32,000,001 sample pairs	
Length (IQ sample pairs)	536,870,912 (2^{29} Sa) with 32-bit data packing	
	268,435,456 (2^{28} Sa) with 64-bit data packing	
Maximum capture time (time record length)	8.95 sec at full 40 MHz BW with 32-bit data packing	Capture time increases linearly with decrease in bandwidth
	4.47 sec at full 40 MHz BW with 64-bit data packing	

IF frequency response

Center frequency	Span (MHz)	Preselector	Amplitude Max Error	Amplitude RMS (nominal)
65 MHz to 3.6 GHz	≤ 40 MHz	N/A	± 0.37 dB	± 0.09 dB
> 3.6 to 26.5 GHz	≤ 40 MHz	Off	± 0.7 dB	± 0.06 dB
> 26.5 to 50 GHz	≤ 40 MHz	Off	± 1.0 dB	± 0.08 dB

IF phase linearity

Center frequency	Span (MHz)	Preselector	RMS (nominal)
65 MHz to 3.6 GHz	≤ 40 MHz	NA	0.08
> 3.6 GHz	≤ 40 MHz	Off	0.3

IF dynamic range (IF gain = low) (nominal)

SFDR (spurious-free dynamic range) (ADC related spurious)	-80 dBc	Signal at –12 dBFS, anywhere in full IF width

IF residual responses (relative to full scale, input terminated, IF gain = low) (nominal)

Center frequency	
65 MHz to 34.5 GHz	-112 dBFS
> 34.5 to 50 GHz	-107 dBFS

Full scale (ADC clipping) (nominal)

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.

Center frequency	Mixer level for IF gain = low	Mixer level for IF gain = high
65 MHz to 3.6 GHz	-7 dBm	-14 dBm
> 3.6 to 17.1 GHz	-6 dBm	-16 dBm
> 17.1 to 26.5 GHz	-6 dBm	-15 dBm
> 26.5 to 34.5 GHz	-7 dBm	-11 dBm
> 34.5 to 50 GHz	-4 dBm	-4 dBm
Effect of signal frequency ≠ CF	Up to ±1 dB nominal	

Signal to noise ratio (ratio of clipping level to noise level, log averaged, 1 Hz RBW, IF gain = low) (nominal)

Center frequency	
65 MHz to 17.1 GHz	144 dB
> 17.1 to 26.5 GHz	141 dB
> 26.5 to 50 GHz	134 dB

TOI (3rd-order intermodulation distortion in the IF, 2 tones of equal level @ -19 dBFS, 10 MHz tone separation, IF gain = high) (nominal)

Center frequency	
65 MHz to 34.5 GHz	-83 dBc
> 34.5 to 50 GHz	-81 dBc

Noise density in IF (characterized at center of RF band and center of IF, 0 dB attenuation)

The noise level in the IF will change for frequencies away from the center of the IF.
The IF part of the total noise is nominally ±1.5 dB worse at the worst frequency within the IF bandwidth.

	3a. MPB		3b. LNA on		4a. FBP	
Center frequency	**IF gain = low**	**IF gain = high**	**IF gain = low**	**IF gain = high**	**IF gain = low**	**IF gain = high**
1.8 GHz	-146 dBm/Hz	-147 dBm/Hz	-161 dBm/Hz	-161 dBm/Hz	N/A	N/A
6 GHz	-148 dBm/Hz	-149 dBm/Hz	-158 dBm/Hz	-158 dBm/Hz	-150 dBm/Hz	-154 dBm/Hz
11 GHz	-146 dBm/Hz	-148 dBm/Hz	-158 dBm/Hz	-158 dBm/Hz	-150 dBm/Hz	-153 dBm/Hz
15.35 GHz	-146 dBm/Hz	-147 dBm/Hz	-158 dBm/Hz	-158 dBm/Hz	-149 dBm/Hz	-152 dBm/Hz
21.8 GHz	-143 dBm/Hz	-144 dBm/Hz	-156 dBm/Hz	-156 dBm/Hz	-148 dBm/Hz	-151 dBm/Hz
30.5 GHz	-138 dBm/Hz	-138 dBm/Hz	-151 dBm/Hz	-151 dBm/Hz	-145 dBm/Hz	-145 dBm/Hz
42.25 GHz	-128 dBm/Hz	-128 dBm/Hz	-143 dBm/Hz	-143 dBm/Hz	-140 dBm/Hz	-140 dBm/Hz

Spurious responses (preselector enabled for frequencies > 3.6 GHz) (nominal)

Residual responses (input terminated, 0 dB attenuation, IF gain = low)

Center frequency	
65 MHz to 19.0 GHz	-100 dBm
> 19.0 to 21.0 GHz	-98 dBm
> 21.0 to 40.0 GHz	-100 dBm
> 40.0 to 41.0 GHz	-87 dBm
> 41.0 to 50 GHz	-100 dBm

Image responses

Tuned frequency (f)	Excitation frequency
65 MHz to 3.6 GHz	f + 2 * 1st IF MHz
	f + 2 * Final IF MHz
> 3.6 to 50 GHz	f + 2 * Final IF MHz

255 MHz Analysis Bandwidth (Option B2X)

Specifications on this bandwidth apply with center frequencies of 400 MHz and higher. All specifications apply under the following settings unless otherwise specified: preselector bypassed, PA off, LNA off, IF gain = Auto, IF gain offset = 0 dB.

255 MHz analysis bandwidth (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. • Over-range tuning to 50.5 GHz allowed, but without corrections, performance not specified.
	50.0 to 110 GHz w/V3050A	
IF frequency	5490 MHz (1st IF, center freq ≤ 3.3 GHz)	
	690 MHz (Final IF)	
ADC sample rate	4.8 GSa/sec	
ADC resolution	14 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	64-bit data packing only
Capture memory	16 GB	
IQ Analyzer	32,000,001 sample pairs	
Length (IQ sample pairs)	2,147,483,640 samples with 64-bit data packing	With 89601C VSA software or Fast Capture (FETCH:FCAP?)
Maximum capture time (time record length)	7.16 sec at full 255 MHz BW with 64-bit data packing	Capture time increases linearly with decrease in bandwidth

IF frequency response (span ≤ 255 MHz), microwave preselector bypass path (MPB)

	3a. MPB (10 dB attenuation)			3b. LNA on (0 dB attenuation)		3c. PA on (0 dB attenuation)	
Center frequency	**Full range**	**20 to 30 °C**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**
600 MHz to 3.3 GHz	± 0.75 dB	± 0.55 dB	± 0.04 dB	± 0.2 dB	± 0.06 dB	± 0.35 dB	± 0.15 dB
> 3.3 to 8.6 GHz	± 0.85 dB	± 0.65 dB	± 0.04 dB	± 0.2 dB	± 0.08 dB	± 0.25 dB	± 0.15 dB
> 8.6 to 13.3 GHz	± 1.0 dB	± 0.75 dB	± 0.07 dB	± 0.3 dB	± 0.14 dB	± 0.2 dB	± 0.08 dB
> 13.3 to 24.5 GHz	± 1.3 dB	± 1.2 dB	± 0.09 dB	± 0.4 dB	± 0.17 dB	± 0.4 dB	± 0.18 dB
> 24.5 to 49.55 GHz	± 3.0 dB	± 2.5 dB	± 0.15 dB	± 0.45 dB	± 0.25 dB	± 0.75 dB	± 0.25 dB
> 49.55 to 50 GHz	± 0.8 dB (nominal)		± 0.25 dB	± 0.9 dB	± 0.3 dB	± 1.3 dB	± 0.38 dB

IF frequency response (span ≤ 255 MHz) full bypass path (FBP)

	4a. FBP (10 dB attenuation)			4b. LNA on (0 dB attenuation)	
Center frequency	**Full range**	**20 to 30 °C**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**
> 3.3 to 8.6 GHz	± 0.8 dB	± 0.7 dB	± 0.15 dB	± 0.2 dB	± 0.08dB
> 8.6 to 13.3 GHz	± 0.9 dB	± 0.75 dB	± 0.06 dB	± 0.25 dB	± 0.08 dB
> 13.3 to 24.5 GHz	± 1.25 dB	± 1.2 dB	± 0.1 dB	± 0.35 dB	± 0.18 dB
> 24.5 to 49.55 GHz	± 2.45 dB	± 2.2 dB	± 0.15 dB	± 0.6dB	± 0.28 dB
> 49.55 to 50 GHz	± 0.75 dB (nominal)		± 0.23 dB	± 0.95 dB	± 0.4 dB

IF phase linearity

Center frequency	Span (MHz)	Preselector	RMS (nominal)
400 MHz to 3.3 GHz	≤ 255 MHz	NA	1
> 3.3 to 6 GHz	≤ 255 MHz	Off	0.8
> 6 to 18 GHz	≤ 255 MHz	Off	0.5
> 18 to 20 GHz	≤ 255 MHz	Off	1.2
> 20 to 28 GHz	≤ 255 MHz	Off	0.8
> 28 to 31 GHz	≤ 255 MHz	Off	1.2
> 31 to 35 GHz	≤ 255 MHz	Off	0.8
> 35 to 38 GHz	≤ 255 MHz	Off	1.9
> 38 GHz	≤ 255 MHz	Off	0.8

IF dynamic range (IF gain = high) (nominal)

SFDR (spurious-free dynamic range) (ADC related spurious)	-78 dBc	Signal at –21 dBFS, anywhere in full IF width

IF residual responses (relative to full scale, input terminated, IF gain = low) (nominal)

Center frequency	
400 MHz to 3.3 GHz	-101 dBFS
> 3.3 to 24.5 GHz	-105 dBFS
> 24.5 to 50 GHz	-99 dBFS

Full scale (ADC clipping) (nominal)

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.

Center frequency	Mixer level for IF gain = low	Mixer level for IF gain = high
400 MHz to 3.3 GHz	-6 dBm	-9 dBm
> 3.3 to 8.6 GHz	-8 dBm	-14 dBm
> 8.6 to 13.3 GHz	-8 dBm	-11 dBm
> 13.3 to 24.5 GHz	-8 dBm	-16 dBm
> 24.5 to 50 GHz	-7 dBm	-10 dBm
Effect of signal frequency ≠ CF	Up to ± 2 dB nominal	

Signal to noise ratio (ratio of clipping level to noise level, log averaged, 1 Hz RBW, IF gain = low) (nominal)

Center frequency	
400 MHz to 3.3 GHz	147 dB
> 3.3 to 13.3 GHz	145 dB
> 13.3 to 24.5 GHz	140 dB
> 24.5 GHz	136 dB

TOI (3rd-order intermodulation distortion in the IF, 2 tones of equal level @ -25 dBFS, 10 MHz tone separation, IF gain = high) (nominal)

Center frequency	
400 MHz to 3.3 GHz	-82 dBc
> 3.3 to 13.3 GHz	-81 dBc
> 13.3 to 24.5 GHz	-77 dBc
> 24.5 GHz	-76 dBc

Noise density in IF (characterized at center of RF band and center of IF, 0 dB attenuation)

The noise level in the IF will change for frequencies away from the center of the IF.
The IF part of the total noise is nominally ±1.5 dB worse at the worst frequency within the IF bandwidth.

	3a. MPB		3b. LNA on		3b. FBP	
Center frequency	IF gain = low	IF gain = high	IF gain = low	IF gain = high	IF gain = low	IF gain = high
1.65 GHz	-148 dBm/Hz	-148 dBm/Hz	-162 dBm/Hz	-162 dBm/Hz	N/A	N/A
5.95 GHz	-149 dBm/Hz	-150 dBm/Hz	-158 dBm/Hz	-158 dBm/Hz	-152 dBm/Hz	-155 dBm/Hz
10.95 GHz	-148 dBm/Hz	-148 dBm/Hz	-158 dBm/Hz	-158 dBm/Hz	-152 dBm/Hz	-154 dBm/Hz
18.9 GHz	-143 dBm/Hz	-143 dBm/Hz	-156 dBm/Hz	-156 dBm/Hz	-149 dBm/Hz	-150 dBm/Hz
37.25 GHz	-137 dBm/Hz	-137 dBm/Hz	-149 dBm/Hz	-149 dBm/Hz	-146 dBm/Hz	-147 dBm/Hz

Spurious responses (preselector enabled for frequencies > 3.3 GHz) (nominal)

Residual responses (input terminated, 0 dB attenuation, IF gain = high)

Center frequency	
400 MHz to 50 GHz	-99 dBm

Image responses

Tuned frequency (f)	Excitation frequency
400 MHz to 3.3 GHz	f + 2 * 1st IF MHz
	f + 2 * Final IF MHz
> 3.3 to 50 GHz	f + 2 * Final IF MHz

Amplitude accuracy, absolute, microwave preselector bypass path (MPB)

	3a. MPB (10 dB attenuation)		3b. LNA on (0 dB attenuation)	3c. PA on (0 dB attenuation)
Center frequency	**Full range**	**20 to 30 °C**	**Nominal**	**Nominal**
400 MHz to 3.3 GHz	± 1.6 dB	± 1.5 dB	± 0.5 dB	± 0.6 dB
> 3.3 to 8.6 GHz	± 1.4 dB	± 1.3 dB	± 0.2 dB	± 0.2 dB
> 8.6 to 13.3 GHz	± 1.9 dB	± 1.7 dB	± 0.3 dB	± 0.3 dB
> 13.3 to 24.5 GHz	± 1.9 dB	± 1.7 dB	± 0.4 dB	± 0.4 dB
> 24.5 to 39 GHz	± 2.8 dB	± 2.4 dB	± 0.9 dB	± 0.8 dB
> 39 to 50 GHz	± 3.3 dB	± 2.8 dB	± 1.0 dB	± 1.3 dB

Amplitude accuracy, absolute, full bypass path (FBP)

	4a. FBP (10 dB attenuation)		4b. LNA on (0 dB attenuation)
Center frequency	**Full range**	**20 to 30 °C**	**Nominal**
> 3.3 to 8.6 GHz	± 1.4 dB	± 1.3 dB	± 0.2 dB
> 8.6 to 13.3 GHz	± 1.8 dB	± 1.6 dB	± 0.3 dB
> 13.3 to 24.5 GHz	± 2.1 dB	± 1.8 dB	± 0.4 dB
> 24.5 to 39 GHz	± 2.6 dB	± 2.3 dB	± 1.0 dB
> 39 to 50 GHz	± 2.9 dB	± 2.5 dB	± 1.2 dB

1 GHz Analysis Bandwidth (Option R10)

Specifications on this bandwidth apply with center frequencies of 700 MHz and higher. All specifications apply under the following settings unless otherwise specified: preselector bypassed, PA off, LNA off, IF gain = Auto, IF gain offset = 0 dB.

1.0 GHz analysis bandwidth (Option R10)

Analysis bandwidth range	10 Hz to 1 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. • Over-range tuning to 50.5 GHz allowed, but without corrections, performance not specified.
	50.0 to 110 GHz w/ V3050A	
IF frequency	5490 MHz (1st IF, center freq ≤ 3.3 GHz)	
	690 MHz (Final IF)	
ADC sample rate	4.8 GSa/sec	
ADC resolution	14 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	64-bit data packing only
Capture memory	16 GB	
IQ Analyzer	32,000,001 sample pairs	
Length (IQ sample pairs)	4,294,967,296 samples with 64-bit data packing	With 89601C VSA software or Fast Capture (FETCH:FCAP?)
Maximum capture time (time record length)	1.79 s at full 1.0 GHz BW with 64-bit data packing	Capture time increases with each full power-of-2 decrease in bandwidth

IF frequency response (span ≤ 1 GHz), microwave preselector bypass path (MPB)

	3a. MPB (10 dB attenuation)			3b. LNA on (0 dB attenuation)		3c. PA on (0 dB attenuation)	
Center frequency	**Full range**	**20 to 30 °C**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**
700 MHz to 3.3 GHz	± 1.8 dB	± 1.6 dB	± 0.08 dB	± 0.55 dB	± 0.12 dB	± 0.6 dB	± 0.13 dB
> 3.3 to 8.6 GHz	± 1.5 dB	± 1.2 dB	± 0.1 dB	± 0.3 dB	± 0.08 dB	± 0.4 dB	± 0.13 dB
> 8.6 to 13.3 GHz	± 1.25 dB	± 1 dB	± 0.08 dB	± 0.45 dB	± 0.13 dB	± 0.25 dB	± 0.07 dB
> 13.3 to 24.5 GHz	± 1.6 dB	± 1.25 dB	± 0.12 dB	± 0.6 dB	± 0.2 dB	± 0.5 dB	± 0.15 dB
> 24.5 to 48.55 GHz	± 2.95 dB	± 2.25 dB	± 0.16 dB	± 0.75 dB	± 0.3 dB	± 0.6 dB	± 0.25 dB
> 48.55 to 50 GHz	± 0.9 dB (nominal)		± 0.16 dB	± 0.9 dB	± 0.3 dB	± 1.2 dB	± 0.4 dB

IF frequency response (span ≤ 1 GHz) full bypass path (FBP)

	4a. FBP (10 dB attenuation)			4b. LNA on (0 dB attenuation)	
Center frequency	**Full range**	**20 to 30 °C**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**
> 3.3 to 8.6 GHz	± 1.5 dB	± 1.25 dB	± 0.13 dB	± 0.3 dB	± 0.09 dB
> 8.6 to 13.3 GHz	± 1.15 dB	± 0.9 dB	± 0.06 dB	± 0.4 dB	± 0.1 dB
> 13.3 to 24.5 GHz	± 1.7 dB	± 1.4 dB	± 0.16 dB	± 0.5 dB	± 0.16 dB
> 24.5 to 48.55 GHz	± 2.3 dB	± 1.85 dB	± 0.1 dB	± 1.0 dB	± 0.35 dB
> 48.55 to 50 GHz	± 0.9 dB (nominal)		± 0.18 dB	± 1.25 dB	± 0.35 dB

IF phase linearity

Center frequency	Span (MHz)	Preselector	RMS (nominal)
700 MHz to 3.3 GHz	≤ 1000 MHz	N/A	1.5
> 3.3 to 18 GHz	≤ 1000 MHz	Off	1
> 18 to 25GHz	≤ 1000 MHz	Off	1.5
> 25 GHz	≤ 1000 MHz	Off	2

IF dynamic range (IF gain = high) (nominal)

SFDR (spurious-free dynamic range) (ADC related spurious)	-66 dBc	Signal at –27 dBFS, anywhere in full IF width

IF residual responses (relative to Full Scale, input terminated, IF gain = high) (nominal)

Center frequency	
700 MHz to 13.3 GHz	-91 dBFS
> 13.3 to 24.5 GHz	-88 dBFS
> 24.5 to 50 GHz	-78 dBFS

Full scale (ADC clipping) (nominal)

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.

Center frequency	Mixer level for IF gain = low	Mixer level for IF gain = high
700 MHz to 3.3 GHz	-6 dBm	-8 dBm
> 3.3 to 8.6 GHz	-8 dBm	-14 dBm
> 8.6 to13.3 GHz	-8 dBm	-11 dBm
> 13.3 to 24.5 GHz	-8 dBm	-16 dBm
> 24.5 to 50 GHz	-7 dBm	-10 dBm
Effect of signal frequency ≠ CF	Up to ±3.5 dB nominal	

Signal to noise ratio (ratio of clipping level to noise level, log averaged, 1 Hz RBW, IF gain = low) (nominal)

Center frequency	
700 MHz to 3.3 GHz	147 dB
> 3.3 to 8.6 GHz	146 dB
> 8.6 to 13.3 GHz	144 dB
> 13.3 to 24.5 GHz	140 dB
> 24.5 to 50 GHz	135 dB

TOI (3rd-order intermodulation distortion in the IF, 2 tones of equal level @ -27 dBF-S, 10 MHz tone separation, IF gain = high) (nominal)

Center frequency	
700 MHz to 3.3 GHz	-77 dBc
> 3.3 to 13.3 GHz	-75 dBc
> 13.3 to 24.5 GHz	-72 dBc
> 24.5 to 50 GHz	-69 dBc

Noise density in IF (characterized at center of RF band and center of IF, 0 dB attenuation)

The noise level in the IF will change for frequencies away from the center of the IF.
The IF part of the total noise is nominally 4.0 dB worse at the worst frequency within the IF bandwidth.

Center frequency	3a. MPB		3b. LNA on		4a. FBP	
	IF gain = low	IF gain = high	IF gain = low	IF gain = high	IF gain = low	IF gain = high
1.65 GHz	-144 dBm/Hz	-145 dBm/Hz	-160 dBm/Hz	-161 dBm/Hz	N/A	N/A
5.95 GHz	-147 dBm/Hz	-150 dBm/Hz	-158 dBm/Hz	-159 dBm/Hz	-148 dBm/Hz	-154 dBm/Hz
10.95 GHz	-146 dBm/Hz	-148 dBm/Hz	-157 dBm/Hz	-157 dBm/Hz	-148 dBm/Hz	-153 dBm/Hz
18.9 GHz	-141 dBm/Hz	-141 dBm/Hz	-155 dBm/Hz	-155 dBm/Hz	-145 dBm/Hz	-147 dBm/Hz
37.25 GHz	-137 dBm/Hz	-137 dBm/Hz	-148 dBm/Hz	-148 dBm/Hz	-145 dBm/Hz	-147 dBm/Hz

Spurious responses (preselector enabled for frequencies > 3.3 GHz) (nominal)

Residual responses (input terminated, 0 dB attenuation, IF gain = high)

Center frequency	
700 MHz to 20.5 GHz	-90 dBm
> 20.5 to 21.5 GHz	-81 dBm
> 21.5 to 50 GHz	-90 dBm

Image responses

Tuned frequency (f)	Excitation frequency
700 MHz to 3.3 GHz	f + 2 * 1st IF MHz
	f + 2 * Final IF MHz
> 3.3 to 50 GHz	f + 2 * Final IF MHz

Amplitude accuracy, absolute, microwave preselector bypass path (MPB)

	3a. MPB (10 dB attenuation)		3b. LNA on (0 dB attenuation)	3c. PA on (0 dB attenuation)
Frequency	**Full range**	**20 to 30 °C**	**Nominal**	**Nominal**
700 MHz to 3.3 GHz	± 1.5 dB	± 1.4 dB	± 0.3 dB	± 0.3 dB
> 3.3 to 8.6 GHz	± 1.3 dB	± 1.2 dB	± 0.2 dB	± 0.3 dB
> 8.6 to 13.3 GHz	± 1.6 dB	± 1.4 dB	± 0.3 dB	± 0.4 dB
> 13.3 to 24.5 GHz	± 1.9 dB	± 1.7 dB	± 0.4 dB	± 0.3 dB
> 24.5 to 39 GHz	± 2.7 dB	± 2.3 dB	± 0.8 dB	± 0.7 dB
> 39 to 50 GHz	± 3.2 dB	± 2.6 dB	± 0.9 dB	± 1.1 dB

Amplitude accuracy, absolute, full bypass path (FBP)

	4a. FBP (10 dB attenuation)		4b. LNA on (0 dB attenuation)
Frequency	**Full range**	**20 to 30 °C**	**Nominal**
> 3.3 to 8.6 GHz	± 1.3 dB	± 1.2 dB	± 0.2 dB
> 8.6 to 13.3 GHz	± 1.6 dB	± 1.4 dB	± 0.4 dB
> 13.3 to 24.5 GHz	± 1.9dB	± 1.6 dB	± 0.3 dB
> 24.5 to 39 GHz	± 2.8 dB	± 2.5 dB	± 0.9 dB
> 39 to 50 GHz	± 3.0 dB	± 2.7 dB	± 1.0 dB

1.5 GHz Analysis Bandwidth (Option R15)

Specifications on this bandwidth apply with center frequencies of 950 MHz and higher. All specifications apply under the following settings unless otherwise specified: preselector bypassed, PA off, LNA off, IF gain = Auto, IF gain offset = 0 dB.

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. • Over-range tuning to 50.5 GHz allowed, but without corrections, performance not specified.
	50.0 to 110 GHz w/ V3050A	
IF frequency	5750 MHz (1st IF, center freq ≤ 3.5 GHz)	
	1200 MHz (Final IF: CF > 3.5 GHz)	
	950 MHz (Final IF: CF ≤ 3.5 GHz	
ADC sample rate	4.8 GSa/sec	
ADC resolution	14 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	64-bit data packing only
Capture memory	16 GB	
IQ Analyzer	32,000,001 sample pairs	
Length (IQ sample pairs)	3,355,443,186 samples with 64-bit data packing	With 89601C VSA software or Fast Capture (FETCH:FCAP?)
Capture time (time record length)	0.895 s at full 1.5 GHz BW with 64-bit data packing	Capture time increases with each full power-of-2 decrease in bandwidth

IF frequency response (span ≤ 1.5 GHz) microwave preselector bypass path (MPB)

	3a. MPB (10 dB attenuation)			3b. LNA on (0 dB attenuation)		3c. PA on (0 dB attenuation)	
Center frequency	**Full range**	**20 to 30 °C**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**
950 MHz to 3.5 GHz	± 2.0 dB	± 1.85 dB	± 0.13 dB	± 0.75 dB	± 0.13 dB	± 0.75 dB	± 0.16 dB
> 3.5 to 8.9 GHz	± 1.4 dB	± 1 dB	± 0.08 dB	± 0.3 dB	± 0.1 dB	± 0.35 dB	± 0.1 dB
> 8.9 to 24 GHz	± 1.6 dB	± 1.25 dB	± 0.08 dB	± 0.5 dB	± 0.14 dB	± 0.35 dB	± 0.1 dB
> 24 to 45 GHz	± 2.75 dB	± 2.25 dB	± 0.16 dB	± 0.5 dB	± 0.16 dB	± 0.5 dB	± 0.22 dB
> 45 to 50 GHz	± 0.8 dB (nominal)		± 0.16 dB	± 1 dB	± 0.16 dB	± 1 dB	± 0.22 dB

IF frequency response (span ≤ 1.5 GHz) full bypass path (FBP)

	4a. FBP (10 dB attenuation)			4b. LNA on (0 dB attenuation)	
Center frequency	**Full range**	**20 to 30 °C**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**
> 3.5 to 8.9 GHz	± 1.6 dB	± 1.25 dB	± 0.08 dB	± 0.3 dB	± 0.1 dB
> 8.9 to 24 GHz	± 1.65 dB	± 1.25 dB	± 0.08 dB	± 0.45 dB	± 0.14 dB
> 24 to 45 GHz	± 2.25 dB	± 1.85 dB	± 0.16 dB	± 0.75 dB	± 0.25 dB
> 45 to 50 GHz	± 0.85 dB (nominal)		± 0.16 dB	± 0.85 dB	± 0.25 dB

IF phase linearity

Center frequency	Span (MHz)	Preselector	RMS (nominal)
950 MHz to 3.5 GHz	≤ 1500 MHz	NA	1.5
> 3.5 to 16 GHz	≤ 1500 MHz	Off	0.5
> 16 to 29 GHz	≤ 1500 MHz	Off	1.5
> 29 to 35 GHz	≤ 1500 MHz	Off	2
> 35 GHz	≤ 1500 MHz	Off	3

IF dynamic range (IF gain = high) (nominal)

SFDR (spurious-free dynamic range) (ADC related spurious)	-60 dBc	Signal at –22 dBFS, anywhere in full IF width

IF residual responses (relative to Full Scale, input terminated, IF gain = high) (nominal)

Center frequency	
950 MHz to 50 GHz	-75 dBFS

Full scale (ADC clipping) (nominal)

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.

Center frequency	Mixer level for IF gain = low	Mixer level for IF gain = high
950 MHz to 3.5 GHz	-5 dBm	-6 dBm
> 3.5 to 8.9 GHz	-7 dBm	-15 dBm
> 8.9 to 24.0 GHz	-7 dBm	-16 dBm
> 24.0 to 50 GHz	-7 dBm	-10 dBm
Effect of signal frequency ≠ CF	Up to ± 4 dB nominal	

Signal to noise ratio (ratio of clipping level to noise level, log averaged, 1 Hz RBW, IF gain = low) (nominal)

Center frequency	
950 MHz to 8.9 GHz	147 dB
> 8.9 to 24.0 GHz	143 dB
> 24.0 to 50 GHz	137 dB

TOI (3rd-order intermodulation distortion in the IF, 2 tones of equal level @ -19 dBFS, 10 MHz tone separation, IF gain = high) (nominal)

Center frequency	
950 MHz to 3.5 GHz	-77 dBc
> 3.5 to 8.9 GHz	-75 dBc
> 8.9 to 50 GHz	-70 dBc

Noise density in IF (characterized at center of RF band and center of IF, 0 dB attenuation)

The noise level in the IF will change for frequencies away from the center of the IF.
The IF part of the total noise is nominally ± 4.0 dB worse at the worst frequency within the IF bandwidth.

	3a. MPB		3b. LNA on		4a. FBP	
Center frequency	IF gain = low	IF gain = high	IF gain = low	IF gain = high	IF gain = low	IF gain = high
1.75 GHz	-143 dBm/Hz	-144 dBm/Hz	-160 dBm/Hz	-160 dBm/Hz	NA	NA
6.2 GHz	-146 dBm/Hz	-150 dBm/Hz	-158 dBm/Hz	-158 dBm/Hz	-149 dBm/Hz	-154 dBm/Hz
16.45 GHz	-146 dBm/Hz	-147 dBm/Hz	-158 dBm/Hz	-158 dBm/Hz	-151 dBm/Hz	-153 dBm/Hz
37 GHz	-136 dBm/Hz	-136 dBm/Hz	-148 dBm/Hz	-148 dBm/Hz	-145 dBm/Hz	-145 dBm/Hz

Spurious responses (preselector enabled for frequencies > 3.5 GHz) (nominal)

Residual responses (input terminated, 0 dB attenuation, IF gain = high)

Center frequency	
950 MHz to 3.5 GHz	-87 dBm
> 3.5 to 8.9 GHz	-104 dBm
> 8.9 to 24.0 GHz	-81 dBm
> 24.0 to 50 GHz	-98 dBm

Image responses

Tuned frequency (f)	Excitation frequency
950 MHz to 3.5 GHz	f + 2 * 1st IF MHz
	f + 2 * Final IF MHz
> 3.5 to 50 GHz	f + 2 * Final IF MHz

Amplitude accuracy, absolute, microwave preselector bypass path (MPB)

	3a. MPB (10 dB attenuation)		3b. LNA on (0 dB attenuation)	3c. PA on (0 dB attenuation)
Frequency	**Full range**	**20 to 30 °C**	**Nominal**	**Nominal**
950 MHz to 3.5 GHz	± 1.3 dB	± 1.2 dB	± 0.3 dB	± 0.3 dB
> 3.5 to 8.9 GHz	± 1.5 dB	± 1.3 dB	± 0.3 dB	± 0.3 dB
> 8.9 to 24 GHz	± 1.9 dB	± 1.6 dB	± 0.5 dB	± 0.4 dB
> 24 to 39 GHz	± 2.9 dB	± 2.5 dB	± 1.0 dB	± 0.9 dB
> 39 to 50 GHz	± 3.5 dB	± 2.9 dB	± 1.0 dB	± 1.1 dB

Amplitude accuracy, absolute, full bypass path (FBP)

	4a. FBP (10 dB attenuation)		4b. LNA on (0 dB attenuation)
Frequency	**Full range**	**20 to 30 °C**	**Nominal**
> 3.5 to 8.9 GHz	± 1.4 dB	± 1.3 dB	± 0.3 dB
> 8.9 to 24 GHz	± 1.9 dB	± 1.7 dB	± 0.5 dB
> 24 to 39 GHz	± 2.7 dB	± 2.4 dB	± 1.0 dB
> 39 to 50 GHz	± 2.9 dB	± 2.5 dB	± 1.3 dB

2 GHz Analysis Bandwidth (Option R20)

All specifications apply under the following settings unless otherwise specified: preselector bypassed, PA off, LNA off, IF gain = Auto, IF gain offset = 0 dB.

2.0 GHz analysis bandwidth (Option R20)		
Analysis bandwidth range	10 Hz to 2 GHz	
Tuning range	3.5 GHz 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	1200 MHz (Final IF)	
ADC sample rate	4.8 GSa/sec	
ADC resolution	14 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	64-bit data packing only
Capture memory	16 GB	
IQ Analyzer	32,000,001 sample pairs	
Length (IQ sample pairs)	4,294,967,280 samples with 64-bit data packing	With 89601C VSA software or Fast Capture (FETCH:FCAP?)
Capture time (time record length)	0.895 s at full 2.0 GHz BW with 64-bit data packing	Capture time increases with each full power-of-2 decrease in bandwidth

IF frequency response (span ≤ 2 GHz) microwave preselector bypass path (MPB)

	3a. MPB (10 dB attenuation)			3b. LNA on (0 dB attenuation)		3c. PA on (0 dB attenuation)	
Center frequency	**Full range**	**20 to 30 °C**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**
3.5 to 8.9 GHz	± 1.6 dB	± 1.25 dB	± 0.06 dB	± 0.35 dB	± 0.1 dB	± 0.4 dB	± 0.1 dB
> 8.9 to 24 GHz	± 2.0 dB	± 1.4 dB	± 0.06 dB	± 0.5 dB	± 0.15 dB	± 0.5 dB	± 0.14 dB
> 24 to 48 GHz	± 3.2 dB	± 2.5 dB	± 0.16 dB	± 0.65 dB	± 0.25 dB	± 0.65 dB	± 0.25 dB
> 48 to 50 GHz	± 1.2 dB (nominal)	± 0.2 dB		± 1.1 dB	± 0.25 dB	± 1 dB	± 0.25 dB

IF frequency response (span ≤ 2 GHz) full bypass path (FBP)

	4a. FBP (10 dB attenuation)			4b. LNA on (0 dB attenuation)	
Center frequency	**Full range**	**20 to 30 °C**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**
3.5 to 8.9 GHz	± 2.1 dB	± 1.5 dB	± 0.1 dB	± 0.3 dB	± 0.1 dB
> 8.9 to 24 GHz	± 2.1 dB	± 1.5 dB	± 0.09 dB	± 0.5 dB	± 0.15 dB
> 24 to 48 GHz	± 2.6 dB	± 2 dB	± 0.1 dB	± 0.65 dB	± 0.25 dB
> 48 to 50 GHz	± 1 dB (nominal)		± 0.15 dB	± 1.1 dB	± 0.25 dB

IF phase linearity

Center frequency	**Span (MHz)**	**Preselector**	**RMS (nominal)**
3.5 to 8.9 GHz	≤ 2000 MHz	Off	0.6°
> 8.9 to 16 GHz	≤ 2000 MHz	Off	0.7°
> 16 to 25 GHz	≤ 2000 MHz	Off	1.2°
> 25 GHz	≤ 2000 MHz	Off	2.2°

IF dynamic range (IF gain = high) (nominal)

SFDR (spurious-free dynamic range) (ADC related spurious)	-65 dBc	Signal at –22 dBFS, anywhere in full IF width

IF residual responses (relative to full scale, input terminated, IF gain = high) (nominal)

Center frequency	
3.5 to 50 GHz	-75 dBFS

Full scale (ADC clipping) (nominal)

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.

Center frequency	Mixer level for IF gain = low	Mixer level for IF gain = high
3.5 to 8.9 GHz	-7 dBm	-15 dBm
> 8.9 to 24.0 GHz	-7 dBm	-16 dBm
> 24.0 to 50 GHz	-7 dBm	-10 dBm
Effect of signal frequency ≠ CF	Up to ± 4 dB nominal	

Signal to noise ratio (ratio of clipping level to noise level, log averaged, 1 Hz RBW, IF gain = low) (nominal)

Center frequency	
3.5 to 8.9 GHz	147 dB
> 8.9 to 24.0 GHz	143 dB
> 24.0 to 50 GHz	137 dB

TOI (3rd-order intermodulation distortion in the IF, 2 tones of equal level @ -19 dBFS, 10 MHz tone separation, IF gain = high) (nominal)

Center frequency	
3.5 to 8.9 GHz	-75 dBc
> 8.9 to 50 GHz	-70 dBc

Noise density in IF (characterized at center of RF band and center of IF, 0 dB attenuation)

The noise level in the IF will change for frequencies away from the center of the IF.
The IF part of the total noise is nominally ± 2.0 dB worse at the worst frequency within the IF bandwidth.

	3a. MPB		3b. LNA on		4a. FBP	
Center frequency	IF gain = low	IF gain = high	IF gain = low	IF gain = high	IF gain = low	IF gain = high
6.2 GHz	-147 dBm/Hz	-150 dBm/Hz	-158 dBm/Hz	-157 dBm/Hz	-149 dBm/Hz	-154 dBm/Hz
16.45 GHz	-147 dBm/Hz	-148 dBm/Hz	-158 dBm/Hz	-158 dBm/Hz	-151 dBm/Hz	-153 dBm/Hz
37 GHz	-137 dBm/Hz	-137 dBm/Hz	-149 dBm/Hz	-148 dBm/Hz	-145 dBm/Hz	-145 dBm/Hz

Spurious responses (preselector enabled) (nominal)

Residual responses (input terminated, 0 dB attenuation, IF gain = high)

Center frequency	
3.5 to 8.9 GHz	-104 dBm
> 8.9 to 20.5 GHz	-98 dBm
> 20.5 to 24.0 GHz	-81 dBm
> 24.0 to 50 GHz	-98 dBm

Image responses

Tuned frequency (f)	Excitation frequency
3.5 to 50 GHz	f + 2 * Final IF MHz

Amplitude accuracy, absolute, microwave preselector bypass path (MPB)

	3a. MPB (10 dB attenuation)		3b. LNA on (0 dB attenuation)	3c. PA on (0 dB attenuation)
Center frequency	Full range	20 to 30 °C	Nominal	Nominal
3.5 to 8.9 GHz	± 1.7 dB	± 1.6 dB	± 0.4 dB	± 0.4 dB
> 8.9 to 24 GHz	± 2.0 dB	± 1.7 dB	± 0.6 dB	± 0.4 dB
> 24 to 39 GHz	± 2.8 dB	± 2.5 dB	± 1.0 dB	± 0.9 dB
> 39 to 50 GHz	± 3.5 dB	± 2.9 dB	± 1.0 dB	± 1.0 dB

Amplitude accuracy, absolute, full bypass path (FBP)

	4a. FBP (10 dB attenuation)		4b. LNA on (0 dB attenuation)
Center frequency	Full range	20 to 30 °C	Nominal
3.5 to 8.9 GHz	± 1.6 dB	± 1.5 dB	± 0.4 dB
> 8.9 to 24 GHz	± 1.9 dB	± 1.7 dB	± 0.4 dB
> 24 to 39 GHz	± 2.6 dB	± 2.3 dB	± 0.9 dB
> 39 to 50 GHz	± 2.9 dB	± 2.5 dB	± 1.0 dB

4 GHz Analysis Bandwidth (Option R40)

All specifications apply under the following settings unless otherwise specified: preselector bypassed, PA off, LNA off, IF gain = Auto, IF gain offset = 0 dB.

4 GHz analysis bandwidth (Option R40)

Instrument analysis bandwidth range	10 Hz to 4.0 GHz	
Analysis bandwidth range (R40 path)	40 MHz to 4.0 GHz	
Tuning range	10 to 50 GHz	• In practice, low end of tuning range limited to < (½*BW), by image folding and LO feedthrough. • Over-range tuning to 50.5 GHz allowed, but without corrections, performance not specified
	> 50.0 to 108 GHz w/ V3050A	
IF frequency	2550 MHz (Final IF)	
ADC sample rate	10.2 GSa/sec	
ADC resolution	12 bits	
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa	64-bit data packing only
Capture memory	16 GB	
IQ Analyzer	32,000,001 sample pairs	
Length (IQ sample pairs)	4,210,752,234 samples with 64-bit data packing	With 89601C VSA software or Fast Capture (FETCH:FCAP?)
Maximum capture time (time record length)	0.42 s at full 4.0 GHz BW with 64-bit data packing	Capture time increases with each full power-of-2 decrease in bandwidth

IF frequency response (span ≤ 4 GHz) microwave preselector bypass path (MPB)

	3a. MPB (10 dB attenuation)			3b. LNA on (0 dB attenuation)		3c. PA on (0 dB attenuation)	
Center frequency	**Full range**	**20 to 30 °C**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**
10 to 22.7 GHz	± 2.2 dB	± 1.75 dB	± 0.13 dB	± 0.6 dB	± 0.15 dB	± 0.5 dB	± 0.35 dB
> 22.7 to 46.75 GHz	± 4.5 dB	± 3.7 dB	± 0.2 dB	± 0.7 dB	± 0.2 dB	± 0.9 dB	± 0.25 dB
> 46.75 to 49 GHz	± 1 dB (nominal)		± 0.2 dB	± 1.1 dB	± 0.2 dB	± 1 dB	± 0.25 dB

IF frequency response (span ≤ 4 GHz) full bypass path (FBP)

	4a. FBP (10 dB attenuation)			4b. LNA on (0 dB attenuation)	
Center frequency	**Full range**	**20 to 30 °C**	**RMS (nominal)**	**Nominal**	**RMS (nominal)**
10 to 22.7 GHz	± 2.3 dB	± 1.8 dB	± 0.12 dB	± 0.6 dB	± 0.15 dB
> 22.7 to 46.75 GHz	± 3.0 dB	± 2.5 dB	± 0.15 dB	± 0.7 dB	± 0.25 dB
> 46.75 to 49 GHz	± 1 dB (nominal)		± 0.15 dB	± 1.1 dB	± 0.25 dB

IF Phase linearity

Center frequency	Span (MHz)	Preselector	RMS (nominal)
10 to 17 GHz	≤ 4000 MHz	Off	0.8
> 17 to 26 GHz	≤ 4000 MHz	Off	1.3
> 26 to 34 GHz	≤ 4000 MHz	Off	2.2
> 34 GHz	≤ 4000 MHz	Off	2.7

IF dynamic range (IF gain = high) (nominal)

SFDR (spurious-free dynamic range) (ADC related spurious)	-69 dBc	Signal at –16 dB FS, anywhere in full IF width

IF residual responses (relative to full scale, input terminated, IF gain = high) (nominal)

Center frequency	
10 to 50 GHz	-87 dBFS

Full scale (ADC clipping) (nominal)

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.

Center frequency	Mixer level for IF gain = low	Mixer level for IF gain = high
10 to 22.7 GHz	-6 dBm	-16 dBm
> 22.7 to 50 GHz	-6 dBm	-13 dBm
Effect of signal frequency ≠ CF	Up to ± 4 dB nominal	

Signal to noise ratio (ratio of clipping level to noise level, log averaged, 1 Hz RBW, IF gain = low) (nominal)

Center frequency	
10 to 22.7 GHz	144 dB
> 22.7 to 50 GHz	139 dB

TOI (3rd-order intermodulation distortion in the IF, 2 tones of equal level @ -14 dBFS, 10 MHz tone separation, IF gain = high) (nominal)

Center frequency	
10 to 22.7 GHz	-66 dBc
> 22.7 to 50 GHz	-69 dBc

Noise density in IF (characterized at center of RF band and center of IF, 0 dB attenuation)

The noise level in the IF will change for frequencies away from the center of the IF.
The IF part of the total noise is nominally ± 5.0 dB worse at the worst frequency within the IF bandwidth.

	3a. MPB		3b. LNA on		4a. FBP	
Center frequency	IF gain = low	IF gain = high	IF gain = low	IF gain = high	IF gain = low	IF gain = high
16.35 GHz	-139 dBm/Hz	-142 dBm/Hz	-156 dBm/Hz	-155 dBm/Hz	-143 dBm/Hz	-147 dBm/Hz
36.35 GHz	-135 dBm/Hz	-135 dBm/Hz	-148 dBm/Hz	-149 dBm/Hz	-140 dBm/Hz	-144 dBm/Hz

Spurious responses (preselector enabled) (nominal)

Residual responses (input terminated, 0 dB attenuation, IF gain = high)

Center frequency	
10 to 21.0 GHz	-75 dBm
> 21.0 to 21.5 GHz	-65 dBm
> 21.5 to 50 GHz	-75 dBm

Image responses

Tuned frequency (f)	Excitation frequency
10 to 50 GHz	f + 2 * Final IF MHz

Amplitude accuracy, absolute, microwave preselector bypass path (MPB)

	3a. MPB (10 dB attenuation)		3b. LNA on (0 dB attenuation)	3c. PA on (0 dB attenuation)
Center frequency	Full range	20 to 30 °C	Nominal	Nominal
10 to 22.7 GHz	± 1.9 dB	± 1.7 dB	± 0.4 dB	± 0.3 dB
> 22.7 to 39 GHz	± 2.8 dB	± 2.5 dB	± 0.7 dB	± 0.6 dB
> 39 to 50 GHz	± 3.3 dB	± 2.8 dB	± 0.7 dB	± 0.8 dB

Amplitude accuracy, absolute, full bypass path (FBP)

	4a. FBP (10 dB attenuation)		4b. FBP, LNA on (0 dB attenuation)
Center frequency	Full range	20 to 30 °C	Nominal
10 to 22.7 GHz	± 2.0 dB	± 1.7 dB	± 0.4 dB
> 22.7 to 39 GHz	± 2.5 dB	± 2.2 dB	± 0.8 dB
> 39 to 50 GHz	± 3.1 dB	± 2.7 dB	± 0.8 dB

11 GHz Analysis Bandwidth (Option EDC; requires Option CRW)

Specifications on this bandwidth apply with center frequencies specified in table. All specifications apply under the following settings unless otherwise specified: preselector bypassed, PA off, LNA off, IF Gain = Auto, IF Gain Offset = 0 dB.

Requires options CRW and EDC; connected to Keysight M8131A 16/32 GSa/s Digitizer.

11 GHz analysis bandwidth (Option EDC; requires Option CRW)

Analysis bandwidth range	40 MHz to 11.0 GHz
Tuning range	20.5 to 46 GHz using RF Input connector
	55.5 to 104.5 GHz using V3050A
IF frequency	6200 MHz (Final IF)
ADC sample rate	32 GSa/sec
ADC resolution	10 bits
Final data format	I & Q pairs, 32 bits each, 64 bits/Sa
Capture memory	1 GB
Length (IQ sample pairs)	800 MSa (229 Sa)
Maximum capture time (time record length)	26 ms at full 11.0 GHz BW

Real-Time Spectrum Analyzer (RTSA)

General frequency domain characteristics

A/D converter sample rate	4.8 Gsa/s (2.4 GHz complex)			
Supported detectors	Peak, Negative Peak, Sample, Average Voltage, Average Power (RMS)			
Number of display traces	Up to 6			
Available types of traces	Clear Write, Max Hold, Min Hold			
Window types	Hanning, Blackman-Harris, Rectangular, Flattop, Kaiser, Gaussian			
Resolutions bandwidths (RBW) (Default window type = Kaiser)	6 RBWs available for each window type for spans Approximate Span: RBW ratio for windows (Note: not applicable for spans from 240 to 255 MHz, 960 MHz to 1 GHz and from 1.9 to 2 GHz) Flattop = 7 to 212 Gaussian, Blackman-Harris = 13 to 417 Kaiser = 13 to 418 Hanning = 17 to 551			
Span	**Min RBW**		**Max RBW**	
1 kHz	1.86 Hz		59.4 Hz	
255 MHz	447 kHz		14.3 MHz	
1 GHz	1.78 MHz		57.1 MHz	
2 GHz	3.57 MHz		114 MHz	
	N9042RTAB	**N9042RTBB**	**N9042RTEB**	**N9042RTFB**
Center frequency	Maximum real-time analysis bandwidth			
≥ 2 Hz to 670 MHz	(center frequency + 80 MHz) x 2, up to 1 GHz		(center frequency + 80 MHz) x 2	
> 670 MHz to 3.5 GHz	1 GHz		1.5 GHz	
> 3.5 GHz to 50 GHz	1 GHz		2 GHz	
> 50 GHz to 110 GHz (with V3050A)	1 GHz (maximum center frequency for full measurement bandwidth = 109.5 GHz)		2 GHz (maximum center frequency for full measurement bandwidth = 109 GHz)	
Minimum signal duration for 100% probability of intercept (POI) with full amplitude accuracy (with at least 50% overlap)	15.4 µs	227 ns	15.4 µs	227 ns
Histogram	Max 1 GHz BW (span)		Max 2 GHz BW (span)	
Maximum sample rate (Hz)	1.247259439e9	1.247259439e9	2.4e9	2.4e9
(Gap free) FFT processing rate	4,687,500 FFT/sec			
FFT Length	1024			

Supported triggers	Free Run, Line, External 1, External 2, External 3, RF Burst, Periodic, FMT, ADC
Number of markers	12

Supported markers	Normal, Delta, Noise, Band Power			
Filter Type	Gaussian, Flattop, Blackman-Harris, Rectangular, Hanning, Kaiser			
Amplitude resolution	.01 dB			
Frequency points	821		855	
RMS average	Yes			
Minimum acquisition time	8.55 μs @ 170 MHz 236.45 μs @ 1 GHz	8.55 μs	8.55 μs @ 170 MHz 239.4 μs @ 2 GHz	8.55 μs
Maximum acquisition time at widest bandwidth				
Spectrogram and Normal	3.58 sec			
Density view	3.58 sec			
Density and spectrogram	3.58 sec			

Density view

	N9042RTAB	N9042RTBB	N9042RTEB	N9042RTFB
Probability range	0 to 100%			
Minimum span	1 kHz	1 kHz	1 kHz	1 kHz
Maximum span	1 GHz	1 GHz	2 GHz	2 GHz
Persistence duration	Infinite, Finite			
Color palettes	Cool, Warm, Grayscale, Radar, Fire, Frost			

Spectrogram View

	N9042RTAB	N9042RTBB	N9042RTEB	N9042RTFB
Maximum number of acquisitions stored	250,000			
Dynamic range covered by colors	200 dB			
Minimum slice time	8.55 μs @ 170 MHz 232.45 μs @ 1 GHz	8.55 μs	8.55 μs @ 170MHz 239.4 μs @ 2 GHz	8.55 μs

Power vs. Time

	N9042RTAB	N9042RTBB	N9042RTEB	N9042RTFB
Supported detectors	Peak, Negative Peak, Sample, Average Voltage, Average Power (RMS)			
Supported triggers	Free Run, Line, External 1, External 2, External 3, RF Burst, Periodic, FMT, Level (PvT) ≤ 255 MHz, ADC			
Number of markers	12			
Maximum time viewable	13.77 s @ 1 GHz		7.27 s @ 2 GHz	
Minimum time viewable	13.96 μs @ 1 GHz		8.55 μs @ 2 GHz	
Maximum IF bandwidth	1 GHz		2 GHz	
Minimum detectable signal duration	Note: Signal must have > 60 dB signal to mask (StM) to maintain 100% POI. Does not include analog front-end effects.			
With Option B2X	3.33 ns			
With Option R10	802 ps			
With Option R15	n/a		535 ps	
With Option R20	n/a		418 ps	

Frequency Mask Trigger (FMT)

	N9042RTAB	N9042RTBB	N9042RTEB	N9042RTFB
Trigger views	Density, Spectrogram, Normal			
Trigger setting resolution	0.001dB			
Trigger conditions	Enter, Leave, Inside, Outside, Enter->Leave, Leave->Enter, TQT			
Minimum Time Qualified Trigger (TQT) duration	14.77 μs @ 1 GHz	231 ns @ 1 GHz	14.96 μs @ 2 GHz	214 ns @ 2 GHz
Minimum detectable signal duration with > 6 0 dB Signal to Mask (StM)	Note: Calculated with the length 1024 Blackman-Harris window			

• At 170 MHz	9.43 ns	9.43 ns	9.43 ns	9.43 ns
• With Option B2X (255 MHz)	9.32 µs	6.67 ns	10.98 µs	6.67 ns
• With Option R10 (1 GHz)	14.13 µs	1.60 ns	14.13 µs	1.60 ns
• With Option R15 (1.5 GHz)	n/a		14.34 µs	1.06 ns
• With Option R20 (2 GHz)	n/a		14.62 µs	1.25 ns

Minimum signal duration (in µs) for 100% probability of FMT triggering with various RBW

Span										
N9042RTAB/ N9042RTEB	**2 GHz**	**1.5 GHz**	**1 GHz**	**255 MHz**	**170 MHz**	**160 MHz**	**120 MHz**	**80 MHz**	**40 MHz**	**20 MHz**
RBW1	0.64	0.76	1.04	3.62	5.13	5.45	7.26	10.89	21.79	43.58
RBW2	0.43	0.49	0.63	1.92	2.71	2.88	3.84	5.76	11.53	23.05
RBW3	0.32	0.35	0.42	1.06	1.50	1.599	2.13	3.197	6.39	12.79
RBW4	0.27	0.28	0.32	0.64	0.90	0.96	1.28	1.91	3.83	7.66
RBW5	0.24	0.25	0.27	0.424	0.599	0.64	0.85	1.27	2.55	5.09
RBW6	0.23	0.23	0.24	0.32	0.45	0.48	0.64	0.95	1.90	3.81
N9042RTBB/ N9042RTFB	**2 GHz**	**1.5 GHz**	**1 GHz**	**255 MHz**	**170 MHz**	**160 MHz**	**120 MHz**	**80 MHz**	**40 MHz**	**20 MHz**
RBW1	16.24	16.42	17.24	23.91	5.13	5.45	7.26	10.89	21.79	43.58
RBW2	15.82	15.87	16.42	20.49	2.71	2.88	3.84	5.76	11.53	23.05
RBW3	15.50	15.74	16.21	19.64	1.50	1.599	2.13	3.197	6.39	12.79
RBW4	15.44	15.67	15.70	19.21	0.90	0.96	1.28	1.91	3.83	7.66
RBW5	15.42	15.36	15.65	17.29	0.599	0.64	0.85	1.27	2.55	5.09
RBW6	15.40	15.34	15.62	17.18	0.45	0.48	0.64	0.95	1.90	3.81

Minimum signal duration (in µs) for 100% probability of FMT triggering with various Signal to Mask (StM)
Note: Calculated with the length 1024 Blackman-Harris window

Span										
N9042RTAB/ N9042RTEB	**2 GHz**	**1.5 GHz**	**1 GHz**	**255 MHz**	**170 MHz**	**160 MHz**	**120 MHz**	**80 MHz**	**40 MHz**	**20 MHz**
0 dB offset	16.25	16.42	17.24	23.91	5.13	5.452	7.27	10.90	21.81	43.62
6 dB offset	15.82	15.87	16.42	20.51	0.96	1.017	1.36	2.03	4.07	8.14
12 dB offset	15.74	15.77	16.27	19.85	0.46	0.49	0.65	0.97	1.94	3.89
20 dB offset	15.66	15.68	16.13	19.27	0.18	0.195	0.26	0.39	0.78	1.56
40 dB offset	15.55	15.53	15.91	18.37	0.02	0.03	0.03	0.05	0.10	0.20
60 dB offset	15.48	15.44	15.78	17.81	0.01	0.01	0.01	0.02	0.04	0.08
N9042RTBB/ N9042RTFB	**2 GHz**	**1.5 GHz**	**1 GHz**	**255 MHz**	**170 MHz**	**160 MHz**	**120 MHz**	**80 MHz**	**40 MHz**	**20 MHz**
0 dB offset	0.64	0.76	1.04	3.63	5.13	5.45	7.27	10.90	21.81	43.62
6 dB offset	0.22	0.22	0.23	0.68	0.96	1.02	1.36	2.03	4.07	8.14
12 dB offset	0.13	0.12	0.11	0.32	0.46	0.49	0.65	0.97	1.94	3.89
20 dB offset	0.07	0.05	0.05	0.13	0.18	0.195	0.26	0.39	0.78	1.56
40 dB offset	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.05	0.10	0.20
60 dB offset	0.001	0.001	0.002	0.007	0.009	0.01	0.01	0.02	0.04	0.08

General Specifications

Temperature range		
Operating	0 to 40 °C	
Storage	-40 to +70 °C	
Altitude	Operating: Up to 3,000 meters (9,842 feet) De-rate maximum temperature (40 °C) by 1 °C for every 200 meters above 2,000 meters.	
	Non-operating: up to 4,600 m (approx. 15,091 feet)	
Maximum relative humidity	95% up to 40 °C, 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 input power	900W with C20 input connector (maximum)	
	850W with C14 input connector (maximum)	
Power consumption, on	811W (typical)	
Power consumption, standby	30 W	
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	
CPU	Modular, upgradeable; Intel i7, 6-core, 1.9 GHz clock, 32 GB DDR4 DRAM; includes secure memory for instrument calibration data	
Operating system	Windows-10, Enterprise	
Weight (without option R40)		
Net	38.6 kg (85 lbs) (nominal)	
Shipping	44.5 kg (98 lbs) (nominal)	
Dimensions		
Height	281 mm (11 in)	
Width	459 mm (18 in)	
Length	575 mm (22.6 in)	
Calibration cycle		
The recommended calibration cycle is one year; calibration services are available through Keysight Service Centers.		

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		
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
USB 3.0 (2)	Compatible with USB 3.0	USB Type-A female (blue)	0.9 A
USB C (1)	Compatible with USB Type-C	USB Type-C female	5 V, 3.0 A
			15 V, 3.0 A
Wide IF out (enabled by Option CRW)			
Connector	SMA, female, 50 Ω nominal		
External frequency extender, wide bandwidth (option EXW), interface for use with V3050A			
High LO Out	2.4 mm female; licensed as option EXW connection to V3050A signal analyzer frequency extender		
High LO out power			
Frequency range	**Full range**		
9.8 to 50 GHz	4.9 to 13.7 dBm		
External mixing (Option EXM)			
Connector	SMA, female, 50 Ω, (nominal) at IF and LO frequencies		
Functions	Diplexer, LO output and IF input		
IF input			
Maximum safe level	+7 dBm		
Center frequency	IF BW ≤ 25 MHz		322.5 MHz
	40 MHz IF path		250 MHz
	255 MHz IF path		690 MHz
	1 GHz IF path		690 MHz
Bandwidth	Supports all optional IFs up to and including R10		
ADC clipping level	25, 255, or 1 GHz IF paths		-15 dBm (nominal)
	40 MHz IF path		-20 dBm (nominal)
1 dB gain compression	-2 dB (nominal)		
Gain accuracy (The amplitude accuracy of a measurement includes this term and the accuracy with which the settings of corrections model the loss of the external mixer.)	IF BW	Full range	20 to 30 °C
	IF BW ≤ 25 MHz (swept and narrowband)	± 2.5 dB	± 1.2 dB
	Wider IF BW	± 1.2 dB (nominal)	
IF frequency response	**Center frequency**	**Width**	**RMS (nominal)**
	322.5 MHz	± 5 MHz	0.05 dB
	322.5 MHz	± 12.5 MHz	0.07 dB
	250 MHz	± 20 MHz	0.10 dB
	690 MHz	± 127.5 MHz	0.12 dB
	690 MHz	± 500 MHz	0.18 dB
Noise figure (322.5 MHz, swept operation high IF gain)	11 dB (nominal)		
VSWR	See plot below		

<table>
<tr><th colspan="4">LO output</th></tr>
<tr><td>Frequency range</td><td colspan="3">3.75 to 14.1 GHz</td></tr>
<tr><td rowspan="4">Output power</td><td colspan="3">The LO output port power is compatible with Keysight M1970 and 11970 Series mixers except for the 11970K.
The power is specified at the connector. Cable loss will affect the power available at the mixer.
With non-Keysight/Agilent mixer units, supplied loss calibration data may be valid only at a specified LO power that may differ from the power available at the mixer. In such cases, additional uncertainties apply.</td></tr>
<tr><td>Center frequency</td><td>Full range</td><td>20 to 30 °C</td></tr>
<tr><td>3.75 to 8.72 GHz
(LO Doubler = Off settings)</td><td>+13.5 to 19 dBm</td><td>+15 to 18 dBm</td></tr>
<tr><td>7.8 to 14.1 GHz
(LO Doubler = On setting. Fundamental frequency = 3.9 to 7.05 GHz)</td><td>N/A</td><td>+14 to 18.5 dBm</td></tr>
<tr><td>Second harmonic</td><td colspan="3">-20 dB (nominal)
(LO Doubler = Off settings)</td></tr>
<tr><td>Fundamental feedthrough and undesired harmonics</td><td colspan="3">-30 dB (nominal)
(LO Doubler = On setting. Fundamental frequency = 3.9 to 7.05 GHz)</td></tr>
<tr><td>VSWR (The reflection coefficient has a Rayleigh probability distribution from 3.75 GHz to 14.1 GHz with a median VSWR of 1.22:1.)</td><td colspan="3">1.8:1 (nominal)</td></tr>
</table>

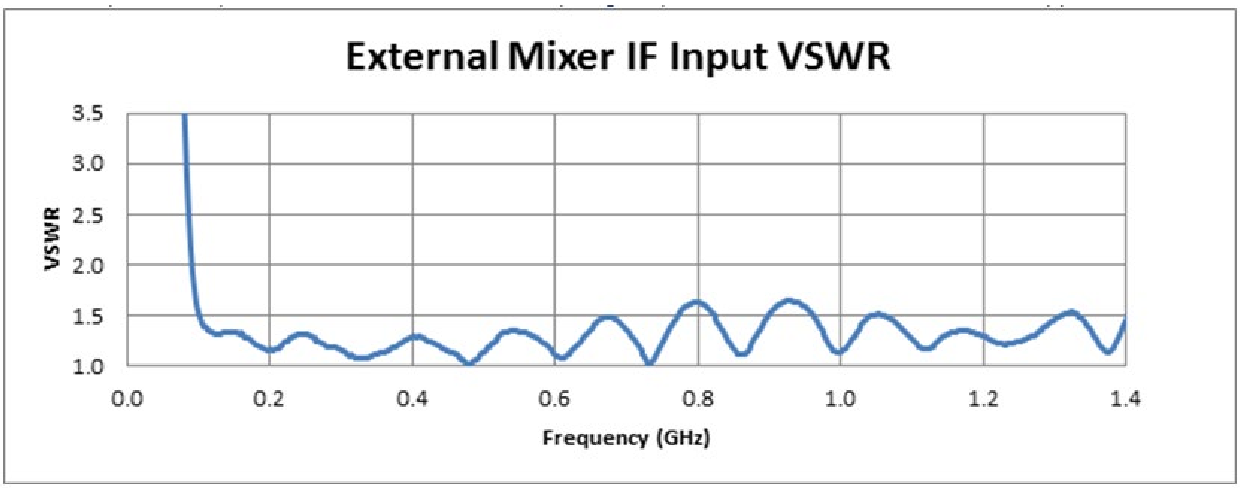

Figure 8. External mixer IF input VSWR

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)
Monitor output 1 (Option PC8 CPU)	
Connector	VGA compatible, 15-pin mini D-SUB
Format	XGA (60 Hz vertical sync rates, non-interlaced) analog RGB
Resolution	1024 x 768
Monitor output 2 (Option PC8 CPU)	
Connector	Mini DisplayPort
Resolution	1024 x 768
Monitor Output (Option PCA CPU)	
Connector	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 (Option PC8 CPU, host, superspeed; 2 ports)	
Standard	Compatible with USB 3.0
Connector	USB Type-A female
Output current	0.9 A (nominal)
USB 2.0 (Option PC8 CPU, 1 port)	
Standard	Compatible with USB 2.0
Connector	USB Type-A female
Output current	0.5 A (nominal)
USB 3.1 (Option PCA CPU, 4 ports)	
Standard	Compatible with USB 3.0
Connector	USB Type-A female
Output current	0.9 A (nominal)
USB 3.0 (Option PC8 and PCA CPUs; device; 1 port)	
Standard	Compatible with USB 3.0
Connector	USB Type-B female

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
Thunderbolt (Option PCA CPU)	
Connector	USB Type C, female (2 ports)
Output power	5 V, 1.0 A max
PCIe X4 interface (Option PC8 CPU)	
Connector	PCIe X4, female
Digital bus interface	
Connector	MDR-80
LAN TCP/IP interface	
Standard	Option PC8 and PCA CPUs: 1G Base-T
	Option PCA CPU: 10G Base-T
Connector	RJ45 Ethertwist

Optical Data Interface (ODI)

ODI physical interface characteristics	
Specification	ODI-1: Physical Layer Specification, Revision 3.0
Number of ODI ports	1
Connector	MPO style, 2 rows of 12 fiber positions
Lane rate	12.5 Gbit/s
Interlaken burst max	2048 byte
Flow control	In-band
Port directionality	Producer only
Port aggregation	Not applicable
Interlaken channels	1 channel (Ch 0)
Streaming data rate	Up to 9.6 GByte/s
ODI data format capability	
Specification	ODI-2: Transport Layer, Revision 3.0 ODI-2.1: High Speed Data Formats, Revision 3.0
Packet types supported	Data packets Context packets
Context packets	Signal context packets supported: Data includes bandwidth, IF frequency, RF frequency, reference level, sample rate, overrange count
Control packets	Not used
Timestamp support	Supported, time of day Typical accuracy: System clock ± 20 μs
Trailer bit support	Overrange Spectral inversion Incomplete packet
Data format class IDs supported	See table below
Signal data packet size	Data size 65,536 bytes 16,384 16-bit IQ samples per packet 8,192 32-bit IQ samples per packet

Supported data format and class ID table				
Item packing field width	Data item (signed)	Real or IQ	Data type identifier	Notes
32-bit	16-bit	IQ	0x18	16-bit I&Q for bandwidths > 255.176 MHz
64-bit	32-bit	IQ	0x20	32-bit I&Q for bandwidths ≤ 255.176MHz

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), IF path ≤ 40 MHz)	
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
Conversion gain (SA mode and up to 40 MHz bandwidth, 0 dB attenuation)	-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) IF frequency range

AUX IF output, programmable, licensed as option CRP (only available in swept spectrum analysis or IF path ≤ 40 MHz)	
IF 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	
Bandwidth with 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 (only available for IF path ≤ 40 MHz)

General port specifications		
Connector	SMA female	Shared with other options
Impedance	50 Ω nominal	
Fast Log Video output (preamp off, preselector bypass for > 3.6 GHz)		
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	
	Other cases, depends on bandwidth.	
Y-axis video output, licensed as option YAV		
General port specifications		
Connector	BNC female	Shared with other options
Impedance	50 Ω nominal	
Screen video		
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 ranger (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	

Regulatory Information

This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2 and MEASUREMENT CATEGORY NONE per IEC 61010-1, and 664 respectively.

This product has been designed and tested in accordance with accepted industry standards and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

This product is intended for indoor use.

Safety and regulatory markings which may be on the product

	The CE mark is a registered trademark of the European Community (if accompanied by a year, it is the year when the design was proven). This product complies with all relevant directives.
ccr.keysight@keysight.com	The Keysight email address is required by EU directives applicable to our product.
CAN ICES/NMB-001(A)	Canada EMC label. Interference-Causing Equipment Standard for industrial, scientific and medical (ISM) equipment. Matériel industriel, scientifique et médical (ISM)
ISM 1-A (GRP.1 CLASS A)	This is a symbol of an Industrial Scientific and Medical Group 1 Class A product. (CISPR 11, Clause 4)
	The CSA mark is a registered trademark of the CSA International.
	The RCM mark is a registered trademark of the Australian Communications and Media Authority.
	UK conformity mark is a UK government owned mark. Products showing this mark comply with all applicable UK regulations.
	This symbol indicates separate collection for electrical and electronic equipment mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive 2002/96/EC). The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation. Please refer to keysight.com/go/takeback to understand your Trade in options with Keysight in addition to product takeback instructions.
	China Restricted Substance Product Label. The EPUP (environmental protection use period) number in the center indicates the time period during which no hazardous or toxic substances or elements are expected to leak or deteriorate during normal use and generally reflects the expected useful life of the product.
	Universal recycling symbol. This symbol indicates compliance with the China standard GB 18455-2001 as required by the China RoHS regulations for paper/fiberboard packaging.
	More than one person is required to safely lift or carry this instrument. Alternately a mechanical lift can be used to eliminate the risk of personal injury.
	South Korean Certification (KC) mark; includes the marking's identifier code.
	This symbol indicates the presence of a class 1 Laser device

EMC	Complies with the essential requirements of the European EMC Directive and the UK Electromagnetic Compatibility Regulations 2016 as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity): IEC/EN 61326-1 CISPR 11 Group 1, Class A **Caution**: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.AS/NZS CISPR 11 ICES/NMB-001 This ISM device complies with Canadian ICES-001 Cet appareil ISM est conforme a la norme NMB-001 du Canada NOTE: This is a sensitive measurement apparatus by design and may have some performance loss (up to 25 dBm above the Spurious Responses, Residual specification of –100 dBm) when exposed to 3V/m ambient continuous electromagnetic phenomenon in the range of 80 MHz to 6 GHz (similar to those used in testing per IEC 61000-4-3).
South Korean Class A EMC declaration	This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference. This EMC statement applies to the equipment only for use in business environment. **사 용 자 안 내 문** 이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다. ※ 사용자 안내문은 "업무용 방송통신기자재"에만 적용한다.
Safety	Complies with the essential requirements of the European Low Voltage Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity): IEC/EN 61010-1 Canada: CSA C22.2 No. 61010-1 USA: UL std no. 61010-1 WARNING "WARNING: EMBEDDED CLASS 1 INVISIBLE LASER RADIATION. DO NOT EXPOSE USERS OR VIEW DIRECTLY WITH TELESCOPES"
Acoustic statement (European Machinery Directive)	Acoustic noise emission LpA < 70 dB Operator position Normal operation mode per ISO 7779 Acoustic noise - more information (Values given are per ISO 7779 standard in the "Operator Sitting" position) Ambient temperature (< 40 °C) Nominally under 55 dBA Sound Pressure. Ambient temperature (≥ 40 °C) Nominally under 65 dBA Sound Pressure.
Environmental stress	Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of storage, transportation, and end-use; those stresses include, but are not limited to, temperature, humidity, shock, vibration, altitude, and power line conditions; test methods are aligned with IEC 60068-2 and levels are similar to MILPRF-28800F Class 3.

To find a current Declaration of Conformity for a specific Keysight product, go to:
http://www.keysight.com/go/conformity

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:

- 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

Confidently Covered by Keysight Services

Prevent delays caused by technical questions and reduce system downtime due to instrument maintenance and repairs with Keysight Services. Keysight Services are here to support your test needs with expert technical support, instrument repair and calibration, software support, training, alternative acquisition program options, and more.

A KeysightCare agreement provides dedicated, proactive support through a single point of contact for instruments, software, and solutions. KeysightCare covers an extensive group of instruments, application software, and solutions and ensures optimal uptime, faster response, faster access to experts, and faster resolution.

Keysight services

Offering	Benefits
KeysightCare KEYSIGHTCARE	KeysightCare provides elevated support for Keysight instruments and software, with access to technical support experts that respond within a specified time and ensure committed repair and calibration turnaround times (TAT). KeysightCare offers multiple service agreement tiers, including KeysightCare Assured, Enhanced, and Application Software Support. See the KeysightCare data sheet for details.
KeysightCare Assured	KeysightCare Assured goes beyond basic warranty with repair services that include committed TAT and unlimited access to technical experts.
KeysightCare Enhanced	KeysightCare Enhanced includes all the benefits of KeysightCare Assured plus Keysight's accurate and reliable Calibration Services, accelerated, and committed TAT, and technical response.
Keysight Support Portal & Knowledge Center	All KeysightCare tiers include access to the Keysight Support Portal where you can manage support and service resources related to your assets such as service requests, and status, or browse the Knowledge Center.
Education Services	Build confidence and gain new skills to make accurate measurements, with flexible Education Services developed by Keysight experts. Including Start-up Assistance.
Alternative acquisition options	
KeysightAccess	Reduce budget challenges with a leased-based subscription service, that offers low monthly payments, enabling you to get the instruments, software, and technical support you want for your test needs.

Recommended services

Maximize your test system up-time by securing technical support, repair, and calibration services with committed response and turnaround times. 1-year KeysightCare Assured is included in every new instrument purchase. Obtain multi-year KeysightCare upfront to eliminate the need for lengthy and tedious paperwork and yearly requests for maintenance budget. Plus, you benefit from secured service for 2, 3, or 5 years.

Service	Function
KeysightCare Enhanced [1]	**Includes tech support, warranty and calibration**
R-55B-001-1	KeysightCare Enhanced – Upgrade 1 year
R-55B-001-2	KeysightCare Enhanced – Extend to 2 years
R-55B-001-3	KeysightCare Enhanced – Extend to 3 years (Recommended)
R-55B-001-5	KeysightCare Enhanced – Extend to 5 years (Recommended)
KeysightCare Assured	**Includes tech support and warranty**
R-55A-001-2	KeysightCare Assured – Extend to 2 years
R-55A-001-3	KeysightCare Assured – Extend to 3 years
R-55A-001-5	KeysightCare Assured – Extend to 5 years
Start-Up Assistance	
PS-S40-01	Included – instrument fundamentals and operations starter
PS-S40-04	Recommended – instrument fundamentals and operations starter
PS-S40-02	Optional, technology & measurement science standard learning

1. Available in select countries. For details, please view the datasheet. R-55B-001-2/3/5 must be ordered with R-55B-001-1.

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