DATA SHEET

N5194A and N5192A

UXG Agile Vector Adapter 50 MHz to 40 GHz

KEYSIGHT TECHNOLOGIES

Definitions and Conditions

Specification (spec): represents warranted performance of a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range of 0 to 50°C, unless otherwise stated, and after a 1 hour warm–up period. The specifications include measurement uncertainty. Data represented in this document are specifications unless otherwise noted.

Typical (typ): describes additional product performance information that is not covered by the product warranty. It is performance beyond specifications that 80% of the units exhibit with a 95% confidence level at room temperature (approximately 25°C). Typical performance does not include measurement uncertainty.

Nominal (nom): describes the expected mean or average performance, or an attribute whose performance is by design, such as the 50 Ω connector. This data is not warranted and is measured at room temperature (approximately 25°C).

Measured (meas): describes an attribute measured during the design phase for purposes of communicating expected performance, such as amplitude drift vs. time. This data is not warranted and is measured at room temperature (approximately 25°C).

All of the above apply when using the instrument in its default settings unless otherwise stated.

This data sheet provides a summary of the key performance parameters for UXG vector adapters. All options referenced in this data sheet are described in the UXG vector adapter configuration guide (5992–2332EN).

This is a combined data sheet for the N5194A UXG Vector Adapter and the N5192A [2] UXG Vector Adapter, Modified version. Unless otherwise stated, all specifications, typical, nominal and measured values described in this data sheet will be the same for the N5194A and N5192A and apply:

- When the N5194A UXG vector adapter is used together with the N5193A UXG agile signal generator with options EP1 enhanced phase noise, FR1 fine frequency resolution, SS2/SS4 switching speed, and CC1 LVDS I/O interface.
  Note:
  - The minimum options required for proper operation are SS2/SS4 switching speed and the CC1 LVDS I/O interface.
  - The N5194A UXG agile vector adapter 40 GHz model (option 540) only requires a 20 GHz N5193A UXG agile signal generator to operate over its full 40 GHz frequency range.
- When the N5192A UXG vector adapter is used together with the N5191A UXG agile signal generator with options FR1 fine frequency resolutions, SS3 switching speed and CC1 LVDS I/O interface.
  Note: The minimum options required for proper operation are SS3 switching speed and the CC1 LVDS I/O interface.

The N5193A and N5191A provide the 6 GHz reference and LO signals necessary for operating the N5194A and N5192A respectively.

1. Unless otherwise noted, this data sheet applies to units with serial numbers ending with xx6006xxxx or greater.
2. Because of the high-performance characteristics of the N5194A, a U.S. export license is required. The N5192A is a modified version of the UXG agile vector adapter that provides high performance without requiring an export license. Notable differences include maximum available frequency and switching speed.

Specifications

Frequency

Range

	Specified range	Tunable range
N5194A with option 520	50 MHz to 20 GHz	10 MHz to 20 GHz
N5194A with option 540	50 MHz to 40 GHz	10 MHz to 44 GHz
N5192A with option 52E	50 MHz to 20 GHz	10 MHz to 20 GHz

CW frequency resolution

0.001 Hz

Phase offset

Adjustable in 0.1° increments

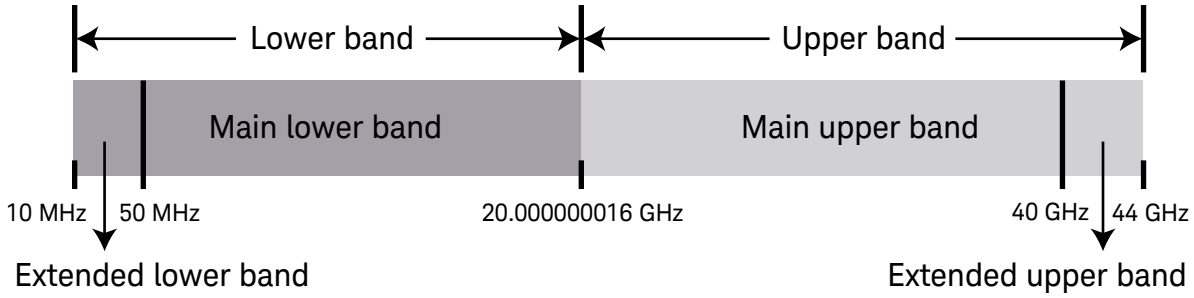
Accuracy

Accuracy is equivalent to the external frequency reference in use.

External 6 GHz reference input

Frequency	6 GHz
Input amplitude	+5 to +15 dBm (nom)
Input impedance	50 Ω (nom)

Switching speed for N5194A [1]



Lower band	10 MHz to < 20.000000016 GHz
– Main lower band	50 MHz to < 20.000000016 GHz
– Extended lower band	10 MHz to < 50 MHz
Upper band	20.000000016 GHz to 44 GHz
– Main upper band	20.000000016 GHz to < 40 GHz
– Extended upper band	40 GHz to 44 GHz

1. RF CW switching speed using an external hardware trigger. Speeds apply for any combination of frequency, amplitude ≤ max specified power and phase switching.

Update rate (Transition time) [1]

Frequency transitions	Transition details	External LO mode, narrowband, spec (typ)	External LO mode, wideband, spec (typ)	Internal LO mode, spec (typ)	Internal LO mode, *Optimized* [2], spec (typ)
Within lower band	Within Main Lower band	250 ns (190 ns)	220 ns (170 ns)	740 ns (470 ns)	(210 ns)
	Other transitions	(250 ns)	(220 ns)	(250 ns)	—
Within upper band	Within Main Upper Band	4.5 µs (2.5 µs)	4.5 µs (2.5 µs)	—	—
	Within upper sub–bands [3]	(250 ns)	(220 ns)	—	—
	Other transitions	(3.3 µs)	(3.3 µs)	—	—
Between lower and upper bands	Between Main Lower and Main Upper Bands	7 µs (4.3 µs)	7 µs (4.1 µs)	—	—
	Other transitions	(8 µs)	(8 µs)	—	—

Latency (Nominal values)

Frequency transitions	Transition details	External LO mode, narrowband, nominal (µs)	External LO mode, wideband, nominal (µs)	Internal LO mode, nominal (µs)	Internal LO mode, *Optimized* [2], nominal (µs)
Within lower band	Within main lower band	3	2.5	3.5	3.5
	Other transitions	3	2.5	3.5	—
Within upper band	Within main upper band	5	4.5	—	—
	Within upper sub–bands [3]	3	2.5	—	—
	Other transitions	5	4.5	—	—
Between lower and upper bands	Between main lower and main upper bands	5.5	5	—	—
	Other transitions	5.5	5	—	—

RF phase settling criteria

Final frequency	
10 MHz to < 2.85 GHz	Measured to phase settled within 0.1 radians of final phase
2.85 GHz to < 8.64 GHz	Measured to phase settled within 0.2 radians of final phase
8.64 GHz to < 17.3 GHz	Measured to phase settled within 0.3 radians of final phase
≥ 17.3 GHz	Measured to phase settled within 0.4 radians of final phase

1. Update Rate is determined by the transition time as measured from the start of the RF transition (where the frequency, amplitude and phase are undefined) to RF amplitude and phase settled. Latency is measured from the input trigger to RF amplitude and phase settled.
2. Optimized Mode applies when switching start frequency is not within any of the following 3 zones: (0 to 2.5 GHz) or (6.5 to 8 GHz) or (10 to 11.5 GHz), or stop frequency is not within any of the following 2 zones: (13 to 14 GHz) or (18.5 to 20 GHz).
3. Upper sub bands include: 20.000000016 GHz to < 24.0 GHz
   24.0 GHz to < 28.5 GHz
   28.5 GHz to < 32 GHz
   32 GHz to < 34 GHz
   34 GHz to < 36 GHz
   36 GHz to < 40.1 GHz
   40.1 GHz to < 42 GHz
   42 GHz to < 43.3 GHz
   43.3 GHz to 44 GHz

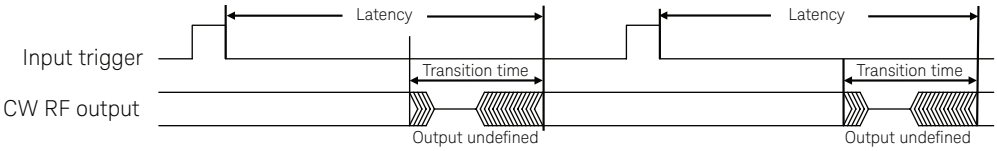


Figure 1. Switching speed definitions with input trigger

Switching speed for N5192A [1, 2]

	External LO mode, narrowband, nom	External LO mode, wideband, nom
Update rate (transition time between pulses in streaming)	101 µs	101 µs

1. For streaming mode only. Update rate refers to the transition time from the finishing of the leading pulse to the phase and amplitude settled in the following pulse. The diagram in N5194A section doesn't apply.
2. The N5192A does not have specified phase repeatability.

Additional contributors to switching speed

With LAN or USB control	Add 900 µs (nom) from receipt of SCPI command

RF phase settling criteria

Final frequency	
10 MHz to < 2.85 GHz	Measured to phase settled within 0.1 radians of final phase
2.85 GHz to < 8.64 GHz	Measured to phase settled within 0.2 radians of final phase
8.64 GHz to < 17.3 GHz	Measured to phase settled within 0.3 radians of final phase
≥ 17.3 GHz	Measured to phase settled within 0.4 radians of final phase

RF amplitude settling criteria

50 MHz to 40 GHz	Measured to amplitude settled to within 1 dB of final amplitude

Amplitude

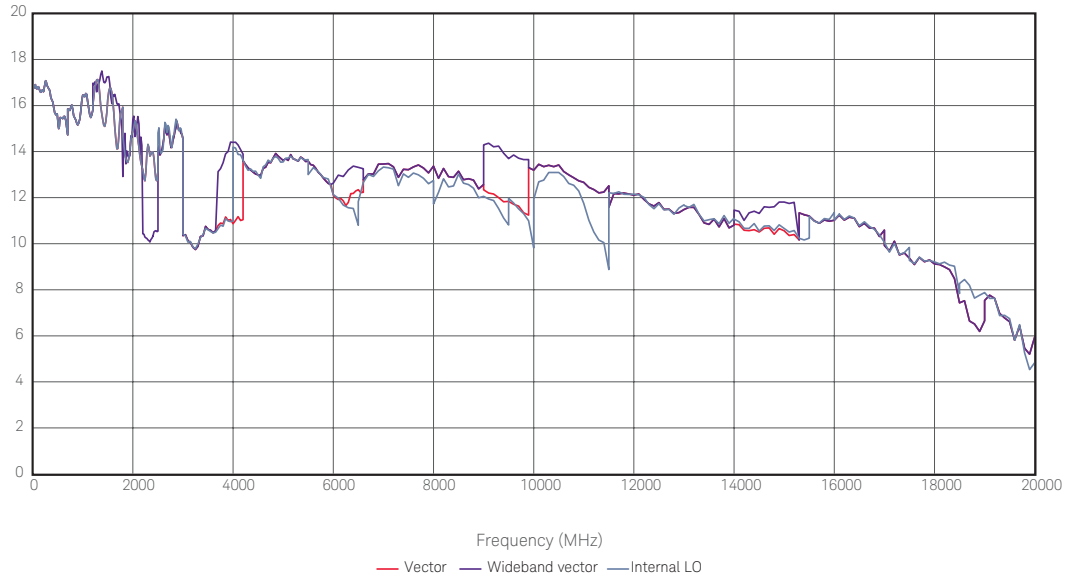
Maximum CW power [1, 2]

Option 520 or 52E	Max available power		Max specified power	
Frequency	External LO mode, dBm spec (typ)	Internal LO mode, dBm spec (typ)	External LO mode, dBm spec	Internal LO mode, dBm spec
10 MHz to < 2.5 GHz	+6 (+7)	+6 (+7)	+3	+3
2.5 GHz to 4 GHz	+7 (+8)	+6 (+9)	+3	+3
> 4 GHz to 14 GHz	+7 (+10)	+4 (+7)	+3	+3
> 14 GHz to 18 GHz	+6 (+8)	+6 (+8)	+3	+3
> 18 GHz to 20 GHz	+1 (+4)	–1 (+3)	+1	–2

Option 540	Max available power		Max specified power	
Frequency	External LO mode, dBm spec (typ)	Internal LO mode, dBm spec (typ)	External LO mode, dBm spec	Internal LO mode, dBm spec
10 MHz to < 2.5 GHz	+5 (+7)	+5 (+7)	+3	+3
2.5 GHz to 4 GHz	+5 (+8)	+5 (+7)	+3	+3
> 4 GHz to 14 GHz	+5 (+7)	+4 (+6)	+3	+3
> 14 GHz to 18 GHz	0 (+3)	0 (+3)	0	0
> 18 GHz to 20 GHz	–4 (0)	–4 (0)	–4	–4
> 20 GHz to 35 GHz	–2 (+1)	N/A	–2	N/A
> 35 GHz to 40 GHz	–5 (–1)	N/A	–5	N/A

1. Maximum CW power specifications are warranted from 15 to 40 °C. Maximum power in the 40 to 50 °C temperature range typically degrades less than 1 dB.
2. Instrument specifications are based on max specified power, unless otherwise stated. When operating at max available power, spectral purity will be degraded.

Maximum power, Option 520 or 52E



Maximum power, Option 540

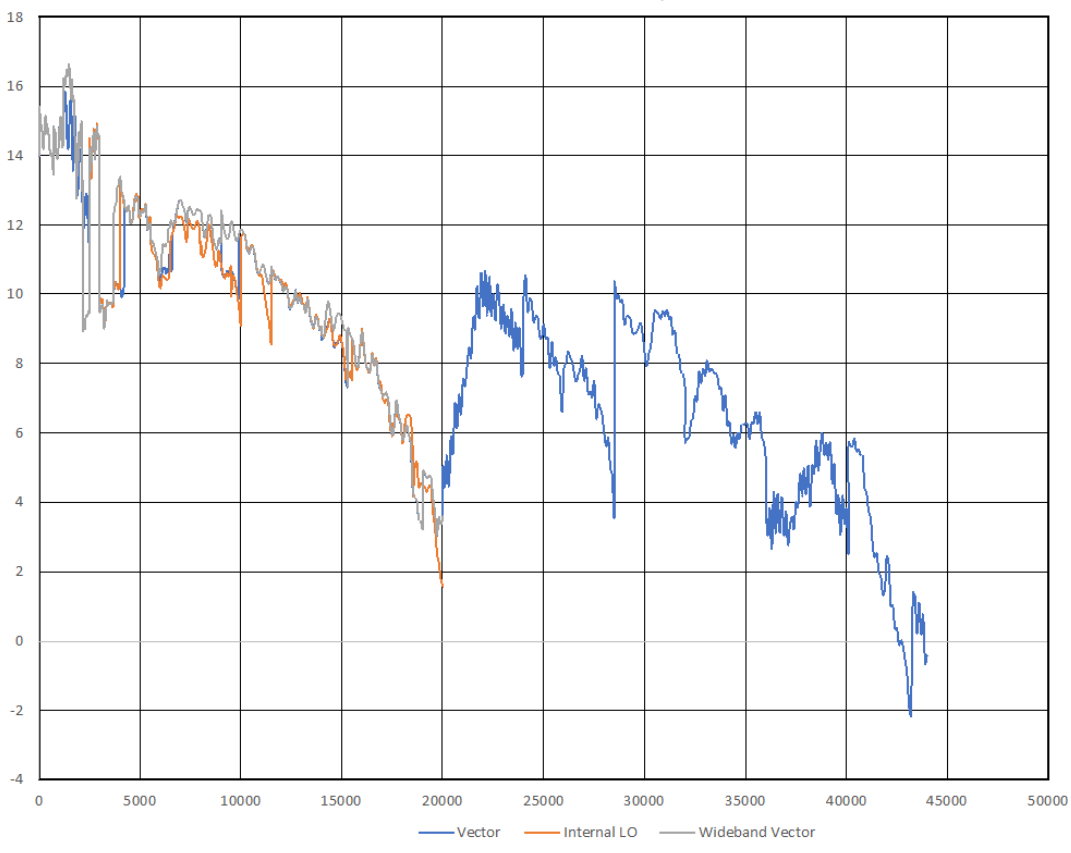


Figure 2: Maximum CW power (measured).

Minimum settable CW power

–120 dBm

Attenuator range

0 to 65 dB in 5 dB steps

Agile power linearity

Frequency	Output power, dBm	External LO mode, dB spec (typ)	Internal LO mode, dB spec (typ)
50 MHz to 14 GHz	Max specified power to –90 dBm	± 1.00 (± 0.33)	± 1.00 (± 0.34)
	0 to –120 dBm	± 1.65 (± 0.41)	± 1.65 (± 0.45)
> 14 GHz to 20 GHz	Max specified power to –10 dBm	± 0.80 (± 0.20)	± 0.65 (± 0.2)
	–10 to –90 dBm	± 1.05 (± 0.33)	± 1.00 (± 0.27)
	–10 to –120 dBm	± 1.75 (± 0.50)	± 1.85 (± 0.47)
> 20 GHz to 40 GHz	Max specified power to –50 dBm	± 1.00 (± 0.50)	N/A
	–50 to –80 dBm	± 1.20 (± 0.60)	N/A

CW power accuracy [1]

Frequency	Output power, dBm	External LO, dB spec (typ)	Internal LO, dB spec (typ)
50 MHz to 18 GHz	+3 to –25	± 2.5 (± 0.4)	± 2.5 (± 0.4)
200 MHz to 18 GHz	< –25 to –75	± 2.5 (± 0.4)	± 2.5 (± 0.4)
700 MHz to 18 GHz	< –75 to –90	± 2.5 (± 0.5)	± 2.5 (± 0.5)
> 18 GHz to 20 GHz	+1 to –25	± 2.5 (± 0.5)	N/A
	–2 to –25	N/A	± 3.0 (± 0.5)
	< –25 to –75	± 2.5 (± 0.5)	± 2.5 (± 0.5)
	< –75 to –90	± 2.5 (± 0.5)	± 3.0 (± 0.6)
> 20 GHz to 40 GHz	Max specified power to –50 dBm	± 2.5 (+0.5)	N/A

Resolution

0.01 dB

Maximum reverse power

½ Watt, 0 VDC

VSWR (nom)

Frequency	0 dB atten	≥ 5 dB atten
50 MHz to 18 GHz	1.6:1	1.6:1
> 18 GHz to 20 GHz	1.9:1	1.6:1
> 20 GHz to 40 GHz	2.0:1	2.0:1

Phase linearity vs. power [2]

Frequency	
50 MHz to 16 GHz	1.0 deg RMS (nom)
> 16 GHz to 40 GHz	2.0 deg RMS (nom)

1. CW power accuracy specifications are warranted from 0 to 50 ˚C. Specifications apply within ± 3 ˚C of last power alignment. Temperature compensation is ON. If temp comp is OFF, amplitude drift will be ≤ 0.2 dB/˚C. For instruments with Option 1ED Type–N connectors, specifications apply below 18 GHz and performance is typically degraded 0.2 dB above 18 GHz.
2. Specifications apply in vector mode only, over a power range of –5 to –85 dBm.

Synchronization

Multiple UXG agile vector adapters can be synchronized together with one UXG agile signal generator to have coherent outputs. This is useful for simulating angle–of–arrival (AoA) and phased array antenna wavefronts. One of the UXG vector adapter units must be configured as the LO controller and it is typically connected to the N5193A via a 100 pin LVDS cable.

Synchronization input connections

System Sync input	Recommended external reference input for use in system environments where trigger jitter and phase stability are important. Accepts a wide variety of input frequencies. See the Rear Panel Connectors section for connection details.
System Sync output	Provides a buffered version of the signal provided to the System Sync input for use in multi–instrument systems. See the Rear Panel Connectors section for connection details.
6 GHz input	Provides high stability synchronization between multiple signal generators. This is not a general 6 GHz connection. Only the 6 GHz synchronization output from another compatible signal generator should be connected. See the Rear Panel Connectors section for connection details.
6 GHz output	Provides high stability synchronization between multiple N519xA UXG signal generators. See the Rear Panel Connectors section for connection details.
LO input	Input port for external LO signal when operating in External LO mode. Normal input range is 8 to 20 GHz with ≥ +5 dBm (nom) power. 50 Ω (nom) impedance.

Local oscillator modes

Internal LO mode (N5194A only)	Frequency tuning is accomplished with an internal LO signal. No external LO signal is needed in this mode, but an external 6 GHz reference signal is still required. When using the Internal LO, the N5194A will only operate in standard vector mode and cannot be operated in wideband vector mode. Note that performance characteristics in this data sheet are based on using the Keysight N5193A UXG agile signal generator to provide the 6 GHz reference signal. Other signal generators can be used to provide the reference signal, but system performance will be unspecified. Internal LO mode operation is available up to 20 GHz only. This can only be done in vector mode, not enhanced vector mode or wideband vector mode.
External LO mode (N5194A and N5192A)	The LO signal is provided by an external source. An external 6 GHz reference signal is also required. Note that performance characteristics in this data sheet are based on using the Keysight UXG agile signal generator to provide both the external LO as well as the 6 GHz reference signals. Other signal generators can be used to provide the LO and reference signals, but system performance will be unspecified. External LO mode operates over the full frequency range of the instrument. The N5194A can be used as an External LO for the N5193A, and the N5192A can be used as an External LO for the N5191A.

Vector operating modes

The UXG agile vector adapters can be operated in three different vector modes.

Vector mode	Provides 200 MHz bandwidth operating at a 250 MSa/s rate, and is available as a standard capability in all UXG vector adapter units.
Enhanced vector mode	Provides 400 MHz bandwidth operating at a 2 GSa/s rate, and is available as an optional capability on units with option BB2 installed.
Wideband vector mode	Provides 1.6 GHz bandwidth operating at a 2 GSa/s rate, and is available as an optional capability on units with option BB1 installed.

Operating features

PDW streaming	
– N5194A	PDW streaming is a standard feature that provides agile control of most of the instrument settings with a continuous stream of PDWs transferred from the internal SSD or an external source, such as a LAN. Each PDW has a Pulse Start Time. The scenario starts playing at time 0 (or a specified offset time). The scenario runs until the end of the simulation (either the end of an internal file or when the external connection is closed with LAN). The simulation can run forever from LAN if the Scenario Time reset feature is used. The streaming PDW parameters are executed asynchronously, based on the time stamp information contained within the PDW.
– N5192A	PDW streaming is an optional feature enabled by adding the N5192ST1A PDW streaming capability. The N5192ST1A enables the same PDW streaming capabilities as described above for the N5194A.
Dual Arb	This feature plays arbitrary I/Q waveforms. Four markers are associated with each I/Q sample consisting of a pair of 16-bit words.
Real-time PDW streaming (N5194A only)	By adding the optional N5194326A [1] real-time pulse generation capability, the following can be coded in the PDW and generated in real time: unmodulated rectangular CW pulses, PSK/FSK modulated pulses, and pulses with linear chirp (up/down/triangle). This makes it possible to continuously stream PDWs without the need to reference waveform segments in baseband generator memory. The minimum time between real-time pulses is 240 ns.

1. N5194326A real–time pulse generation is subject to US ITAR export controls. For more information, please contact your Keysight representative.

Spectral Purity

Harmonics [1, 2]

External LO mode, vector mode

Fundamental frequency	Harmonic level (dBc) at ≤ –10 dBm	Harmonic level (dBc) at 0 dBm or max available power, whichever is lower
10 MHz to < 50 MHz	(–32)	(–32)
50 MHz to 500 MHz	–30 (–33)	–30 (–33)
> 500 MHz to 800 MHz	–51 (–56)	–52 (–56)
> 800 MHz to 4 GHz	–60 (–65)	–56 (–62)
> 4 GHz to 8 GHz	–64 (–69)	–58 (–63)
> 8 GHz to 12.5 GHz	–66 (–72)	–61 (–66)
> 12.5 GHz to 20 GHz	–59 (–65)	–53 (–58)
> 20 GHz to 22 GHz	(–68)	(–59)

External LO mode, wideband or enhanced vector mode (Opt BB1 or BB2)

Fundamental frequency	Harmonic level (dBc) at ≤ –10 dBm	Harmonic level (dBc) at 0 dBm or max available power, whichever is lower
10 MHz to < 50 MHz	(–32)	(–32)
50 MHz to 2 GHz	–30 (–33)	–30 (–33)
> 2 GHz to 3 GHz	–24 (–28)	–20 (–24)
> 3 GHz to 4 GHz	–31 (–35)	–29 (–33)
> 4 GHz to 8 GHz	–63 (–69)	–58 (–63)
> 8 GHz to 12.5 GHz	–63 (–68)	–61 (–66)
> 12.5 GHz to 20 GHz	–61 (–67)	–53 (–59)
> 20 GHz to 22 GHz	(–68)	(–59)

Internal LO mode [3], vector mode

Fundamental frequency	Harmonic level (dBc) at ≤ –10 dBm	Harmonic Level (dBc) at 0 dBm or max available power, whichever is lower
10 MHz to < 50 MHz	(–32)	(–32)
50 MHz to 500 MHz	–30 (–33)	–30 (–33)
> 500 MHz to 800 MHz	–51 (–56)	–52 (–56)
> 800 MHz to 4 GHz	–60 (–65)	–56 (–62)
> 4 GHz to 8 GHz	–63 (–68)	–58 (–63)
> 8 GHz to 12.5 GHz	–67 (–72)	–61 (–66)
> 12.5 GHz to 20 GHz	–58 (–64)	–53 (–58)

1. Measured using a CW signal with power set to –10 dBm and 0 dBm or max specified power, whichever is lower. Performance is unspecified for harmonics beyond the specified frequency range. Harmonic specifications are warranted from 15 to 40 ˚C.
2. The –10 dBm harmonic specifications are applicable over a 110 dB agile dynamic range.
3. Does not apply to N5192A UXG vector adapter, modified version.

Non–harmonics [1]

External LO mode, vector mode

		Non–harmonic level (dBc) (typ)	
Frequency	Line–related spurs at offsets ≤ 300 Hz	Offsets > 300 Hz excluding line–related spurs	Offsets > 10 kHz
10 MHz to < 50 MHz	N/A	N/A	N/A
50 MHz to < 2.5 GHz	(–68)	(–69)	(–67)
2.5 GHz to < 9 GHz	(–55)	(–62)	(–68)
9 GHz to < 12.5 GHz	(–53)	(–59)	(–70)
12.5 GHz to < 18 GHz	(–50)	(–55)	(–67)
18 GHz to 20 GHz	(–50)	(–55)	(–64)
> 20 GHz to 40 GHz	(–44)	(–52)	(–52)
> 40 GHz to 44 GHz	(–43)	(–51)	(–56)

External LO mode, wideband or enhanced vector mode (Opt BB1 or BB2)

		Non–harmonic level (dBc) (typ)	
Frequency	Line–related spurs at offsets ≤ 300 Hz	Offsets > 300 Hz excluding line–related spurs	Offsets > 10 kHz
10 MHz to < 50 MHz	N/A	N/A	N/A
50 MHz to < 1.2 GHz	(–72)	(–72)	(–72)
1.2 GHz to < 9 GHz	(–56)	(–62)	(–64)
9 GHz to < 12.5 GHz	(–53)	(–60)	(–70)
12.5 GHz to 20 GHz	(–49)	(–55)	(–64)
> 20 GHz to 40 GHz	(–44)	(–52)	(–52)
> 40 GHz to 44 GHz	(–43)	(–51)	(–56)

Internal LO mode [5], vector mode

		Non–harmonic level (dBc) (typ)	
Frequency	Line–related spurs at offsets ≤ 300 Hz	Offsets > 300 Hz excluding line–related spurs	Offsets > 10 kHz
10 MHz to < 50 MHz	N/A	N/A	N/A
50 MHz to < 2.5 GHz	(–69)	(–69)	(–67)
2.5 GHz to < 18 GHz	(–45)	(–45)	(–45)
18 GHz to 20 GHz	(–49)	(–48)	(–48)

Broadband noise [2]

Internal LO mode [5]

Fundamental frequency	Broadband noise [3]
50 MHz to 10 GHz	–140 dBc/Hz (typ)
> 10 GHz to 20 GHz	–134 dBc/Hz (typ)

External LO mode

Fundamental frequency	Broadband noise [4]
50 MHz to 1 GHz	–140 dBc/Hz (typ)
> 1 GHz to 20 GHz	–125 dBc/Hz (typ)
> 20 GHz to 40 GHz	–119 dBc/Hz (typ)

1. Measured using a CW signal with power set to –10 dBm. Performance is unspecified for non–harmonics beyond the specified frequency range. Non–harmonic specifications are warranted from 15 to 40 ˚C.
2. For large offsets > 4 GHz, broadband noise will drop.
3. CW signal measured with power set to +4 dBm.
4. CW signal Measured with power set to +5 dBm.
5. Does not apply to N5192A UXG vector adapter, modified version.

Phase Noise for N5194A

Internal LO mode for N5194A

Absolute SSB phase noise (dBc/Hz) [1]

	Offset from carrier				
Frequency	10 kHz spec (typ)	100 kHz spec (typ)	1 MHz spec (typ)	10 MHz spec (typ)	100 MHz spec (typ)
100 MHz	–144 (–148)	–143 (–148)	–142 (–148)	–143 (–148)	N/A
1 GHz	–132 (–144)	–132 (–143)	–145 (–151)	–142 (–153)	–142 (–155)
2 GHz	–130 (–140)	–120 (–138)	–142 (–149)	–143 (–150)	–143 (–150)
3 GHz	–122 (–128)	–126 (–132)	–132 (–137)	–133 (–141)	–131 (–140)
6 GHz	–124 (–131)	–128 (–134)	–138 (–145)	–141 (–148)	–138 (–146)
10 GHz	–121 (–127)	–125 (–131)	–133 (–140)	–138 (–145)	–135 (–143)
20 GHz	–113 (–119)	–116 (–124)	–125 (–132)	–127 (–135)	–124 (–133)

External LO mode for N5194A

Absolute SSB phase noise (dBc/Hz) [2]

	Offset from carrier				
Frequency	10 kHz spec (typ) [nom]	100 kHz spec (typ) [nom]	1 MHz spec (typ) [nom]	10 MHz spec (typ) [nom]	100 MHz spec (typ) [nom]
100 MHz	–144 (–148)	–143 (–148)	–142 (–148)	–143 (–148)	N/A
1 GHz	–132 (–144)	–132 (–143)	–145 (–151)	–142 (–153)	–142 (–155)
2 GHz	–130 (–140)	–120 (–138)	–142 (–149)	–143 (–150)	–143 (–150)
3 GHz	–115 (–121)	–120 (–126)	–125 (–129)	–123 (–131)	–121 (–129)
6 GHz	–114 (–121)	–117 (–124)	–124 (–128)	–124 (–130)	–122 (–129)
10 GHz	–109 (–117)	–111 (–120)	–119 (–124)	–118 (–126)	–118 (–128)
20 GHz	–106 (–115)	–108 (–118)	–117 (–123)	–120 (–127)	–118 (–126)
22 GHz	[–117]	[–121]	[–126]	[–129]	[–130]
26 GHz	[–116]	[–121]	[–126]	[–129]	[–131]
30 GHz	[–117]	[–121]	[–126]	[–129]	[–129]
34 GHz	[–115]	[–119]	[–125]	[–129]	[–130]
38 GHz	[–115]	[–119]	[–125]	[–127]	[–122]
42 GHz	[–114]	[–119]	[–126]	[–128]	[–125]

1. CW signal measured with power set to +4 dBm. Phase noise specifications are warranted from 0 to 50 °C.
2. CW signal Measured with power set to +5 dBm. Phase noise specifications are warranted from 0 to 50 °C

Measured internal LO absolute phase noise for N5194A

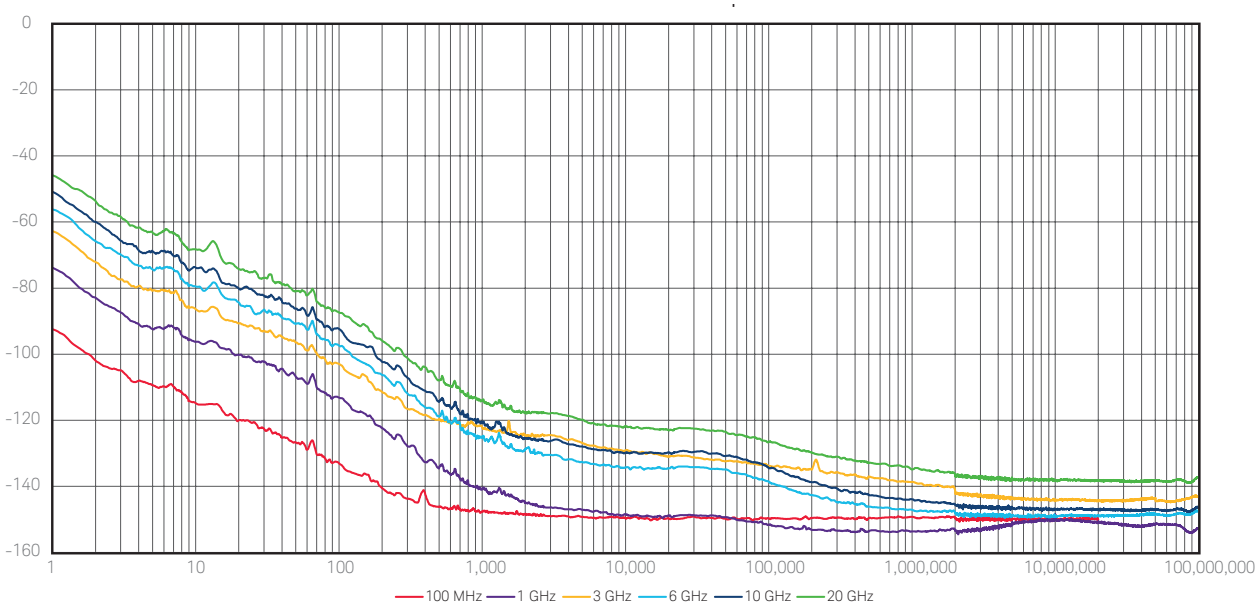


Figure 3. Measured absolute phase noise using the internal LO mode for the N5194A.

Measured external LO absolute phase noise for N5194A

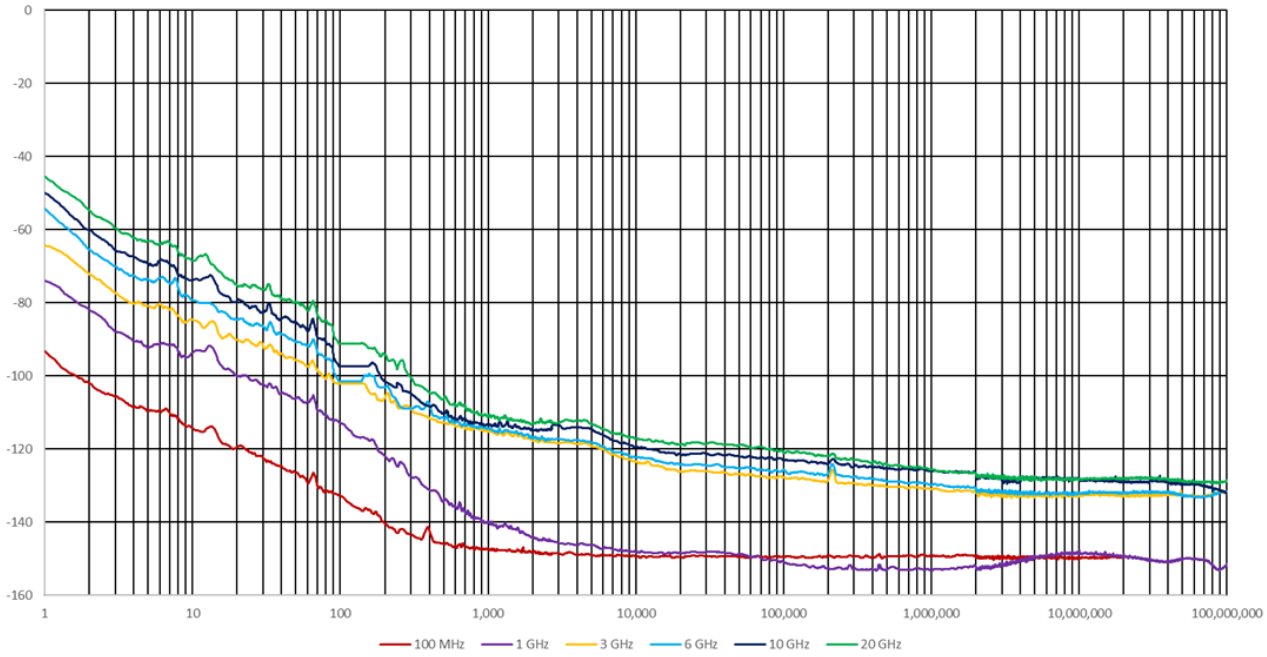


Figure 4a. Measured absolute phase noise using the external LO mode for the N5194A.

Measured external LO absolute phase noise above 20 GHz for N5194A

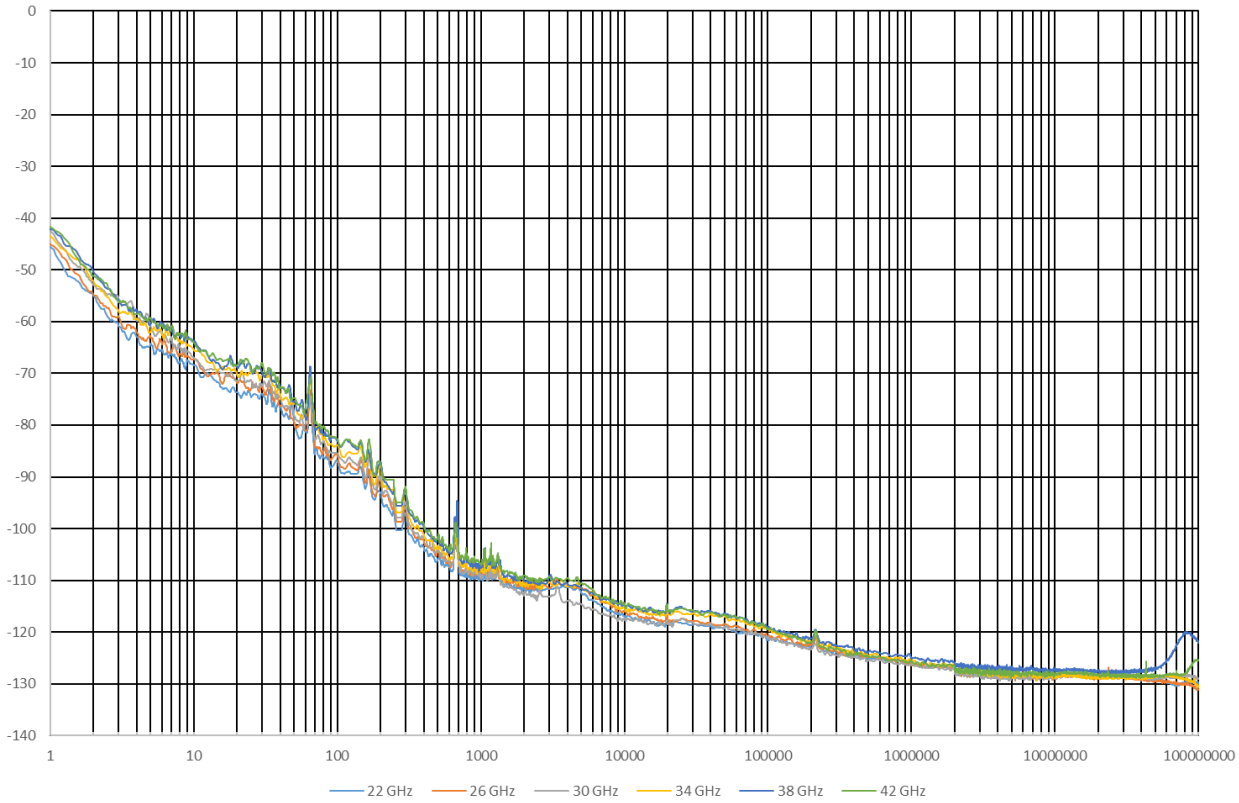


Figure 4b. Measured absolute phase noise above 20 GHz using the external LO mode for the N5194A.

Measured internal LO residual phase noise for N5194A

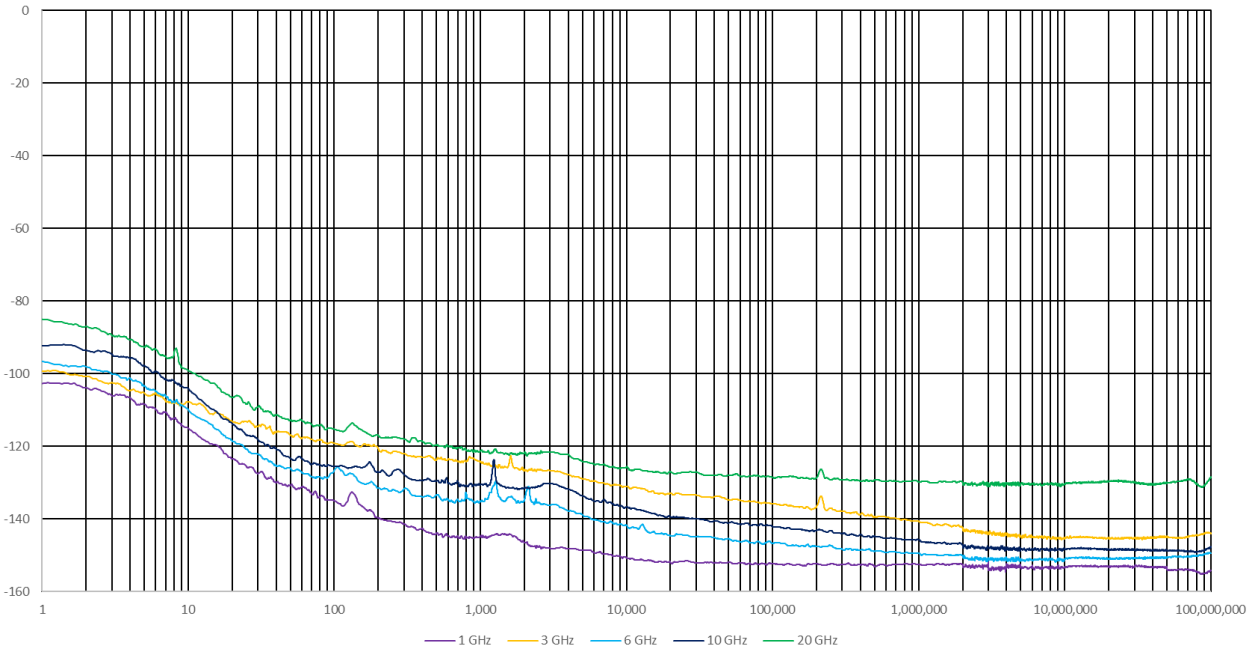


Figure 5. Measured residual phase noise using the internal LO mode for the N5194A.

Measured external LO residual phase noise for N5194A

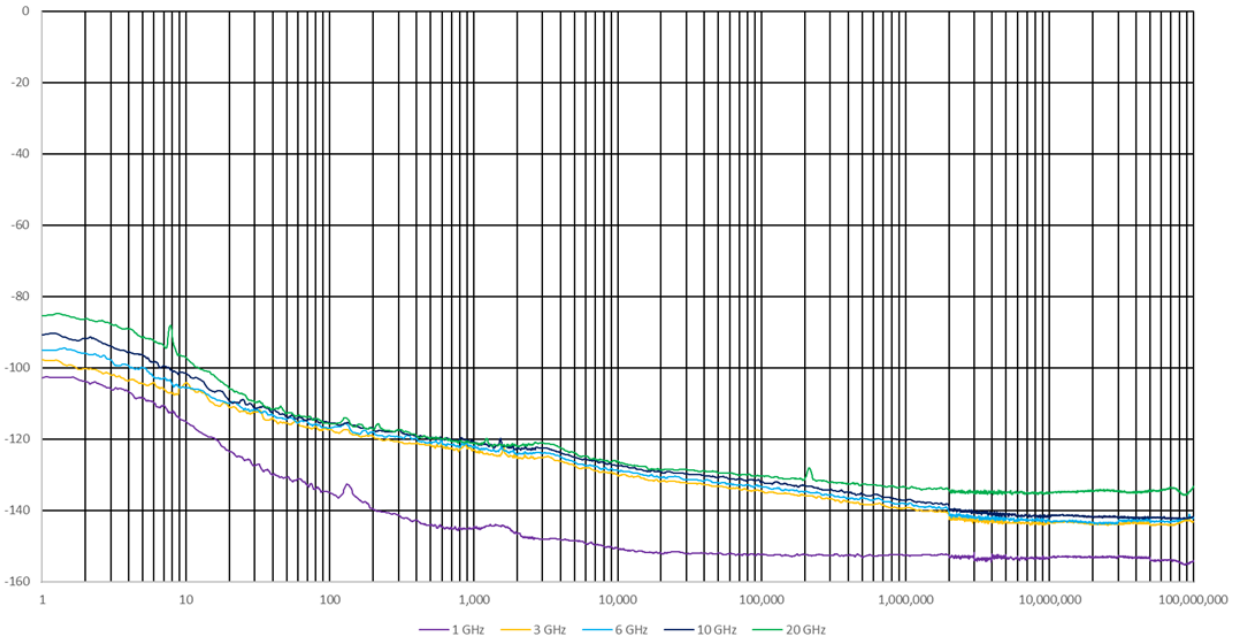


Figure 6. Measured residual phase noise using the external LO mode for the N5194A.

Measured internal LO AM noise for N5194A

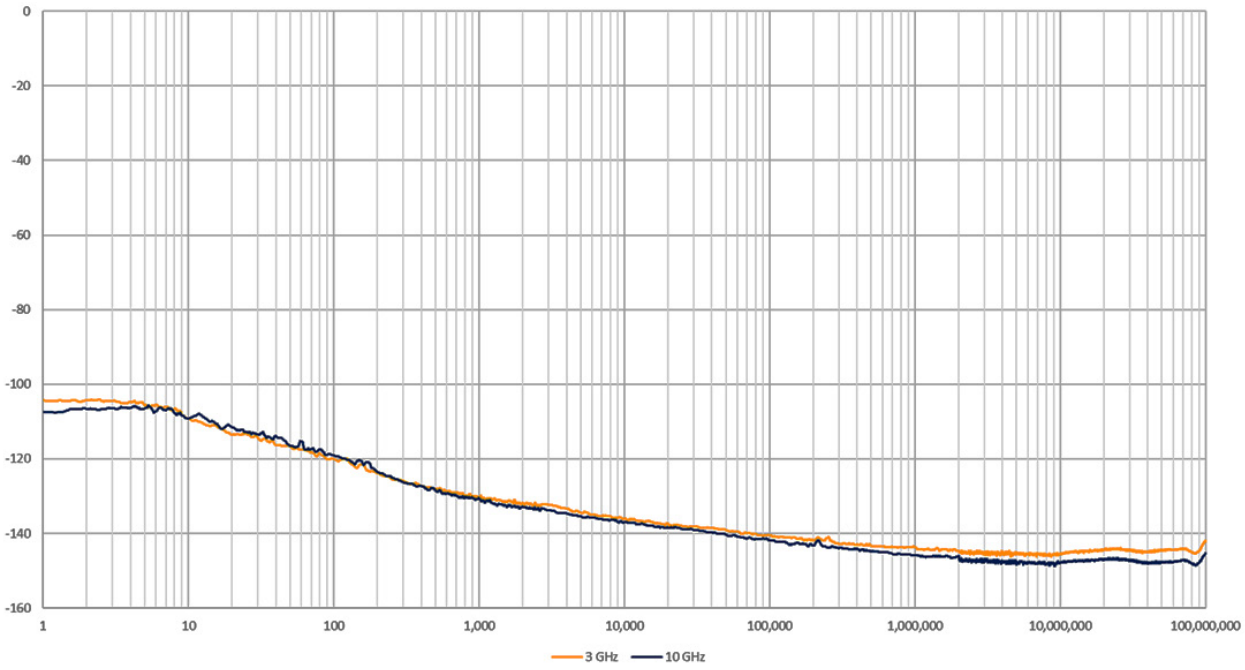


Figure 7. Measured AM noise using the internal LO mode for the N5194A.

Measured external LO AM noise for N5194A

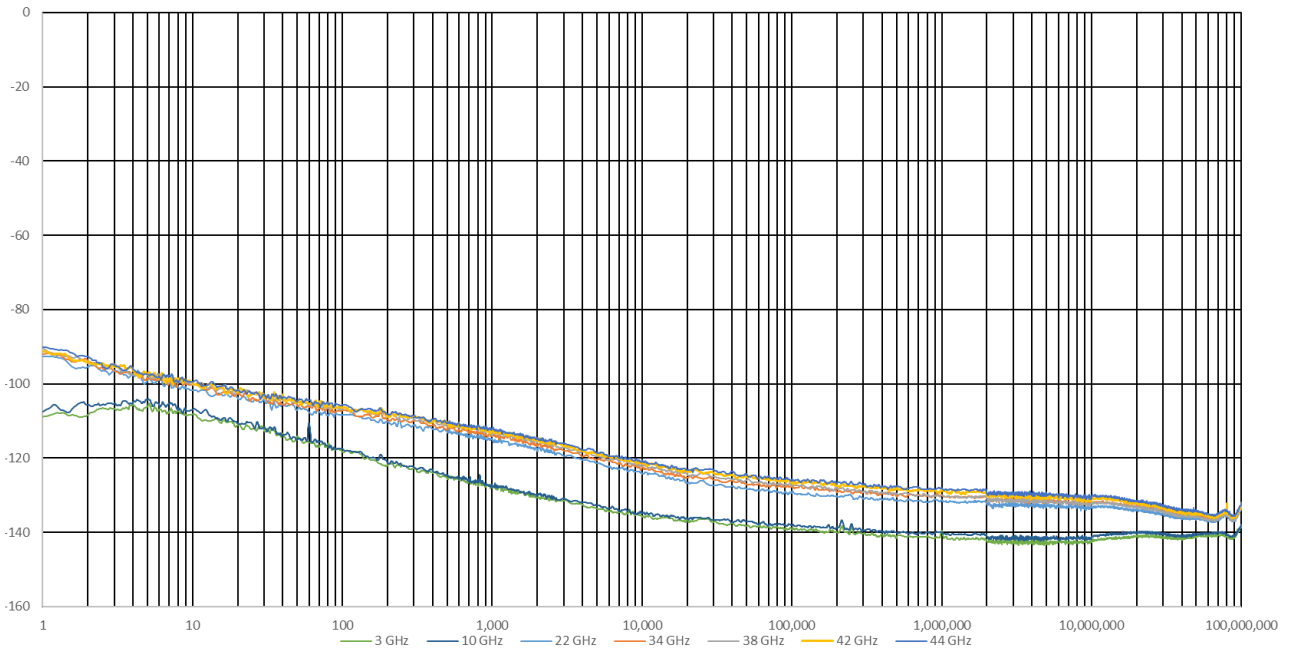


Figure 8. Measured AM noise using the external LO mode for the N5194A.

Phase Noise for N5192A

Absolute SSB phase noise (dBc/Hz), nominal [1]

	Offset from carrier
Frequency	20 kHz, nom
100 MHz	–150
1 GHz	–150
3 GHz	–126
6 GHz	–125
10 GHz	–122
20 GHz	–120

1. CW signal measured with power set to +5 dBm.

Measured external LO absolute phase noise for N5192A

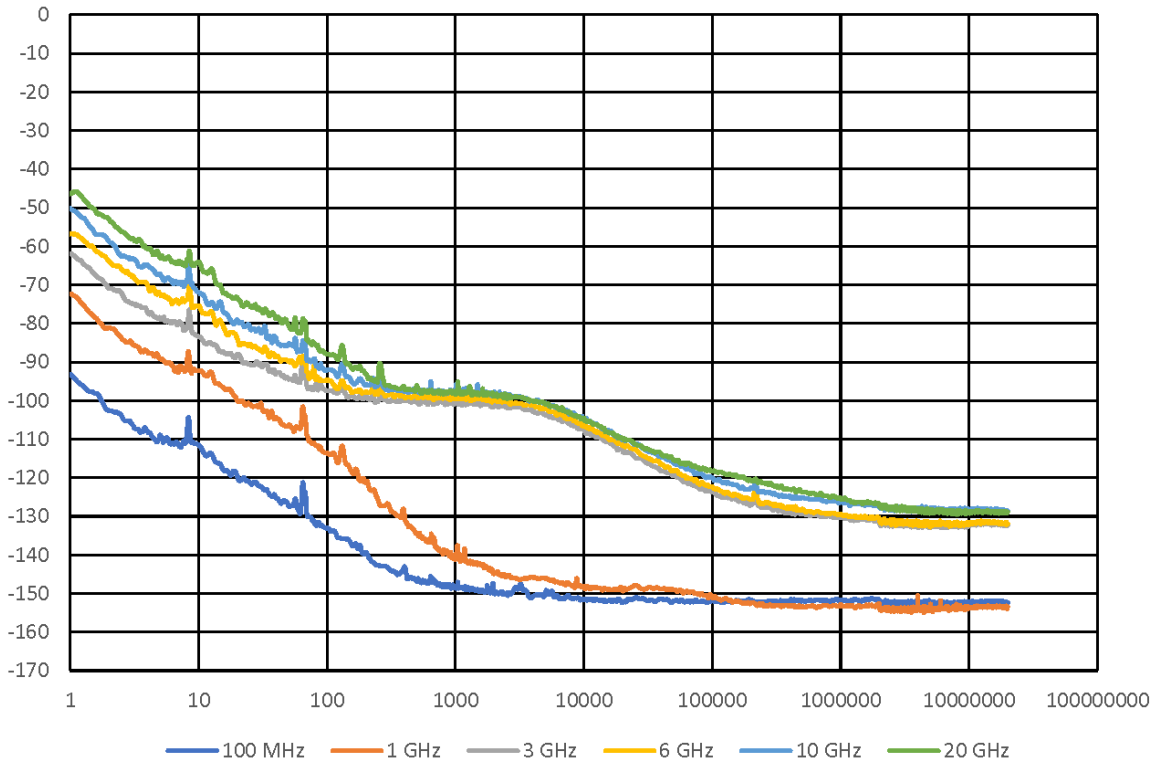


Figure 9. Measured absolute phase noise using the external LO mode for N5192A.

Measured external LO residual phase noise for N5192A

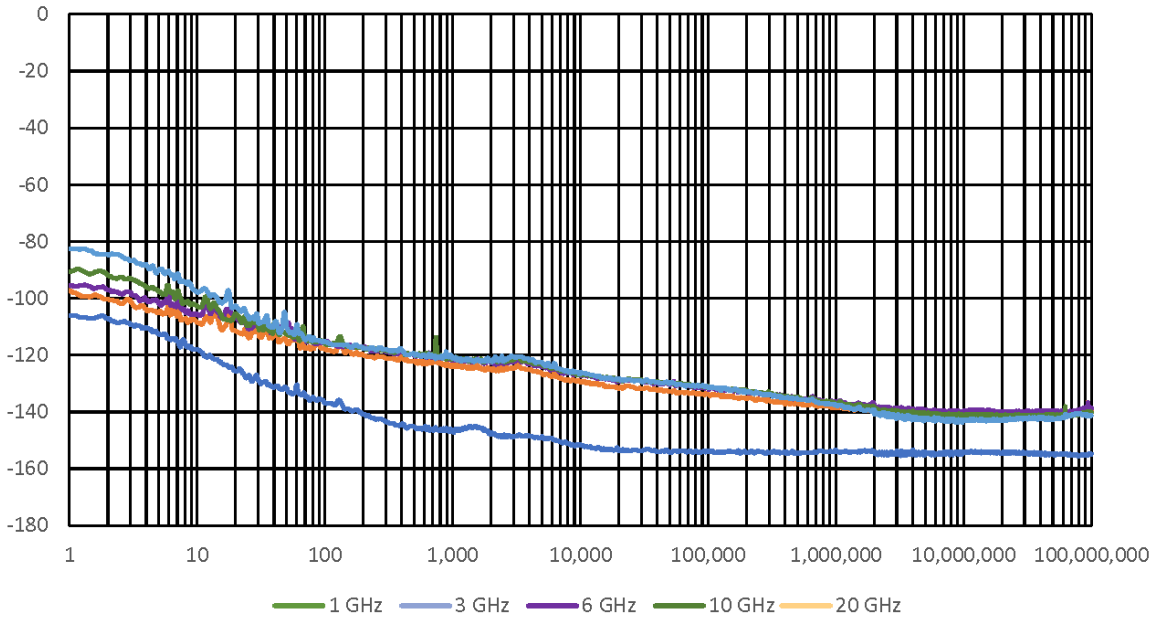


Figure 10. Measured residual phase noise using the external LO mode for N5192A.

Pulse Modulation

Pulse types

Defined by waveform
Pulse Waveform Maker – a built-in feature to define simple IQ pulse types. These can be called by the PDW. However, it does not have marker capability.

On/Off ratio

Integrated over 100 Hz bandwidth

External LO mode	100 dB
Internal LO mode	105 dB

Rise/fall times [1]

Defined by IQ waveform. Minimum rise/fall time

Vector mode	4.0 ns (nom)
Enhanced vector mode (opt BB2)	2.0 ns (nom)
Wideband vector mode (opt BB1)	0.5 ns (nom)

Figure 11. 100 ns pulse with 16 ns rise/fall times.

Figure 12. 20 ns pulse with 2 ns rise/fall times.

Overshoot

Vector mode	4 % (typ) up to 32 GHz
Enhanced vector mode (opt BB2) or Wideband vector mode (opt BB1)	10 % (typ) up to 32 GHz [3]

Pulse Width [2]

	Maximum	Minimum
Vector mode	8 ns (nom)	8 ns (nom)
Enhanced vector mode	4 ns (nom)	2 s (nom)
Wideband vector mode	1 ns (nom)	2 s (nom)
Pulse repetition interval		250 ns (nom)

1. Rise/fall times are determined by the sample rate, but may experience degradation of pulse shape with extremely short rise/fall times. A minimum of 4 or more samples is recommended for better rise/fall shape quality.
2. Minimum pulse width is determined by the sample rate, but may experience degradation of pulse shape with extremely short rise/fall times. A minimum of 8 or more samples is recommended for better pulse shape quality. Maximum pulse width is determined by the available baseband generator memory and sample rate.
3. Except at 2.199 GHz, where overshoot is 12% (nom).

Level accuracy

Relative to CW signal	
Test conditions: ALC off, with power alignment performed	
Frequency [1]	
50 MHz to 15 GHz	± 0.75 dB
> 15 GHz to 20 GHz	± 1.0 dB
> 20 GHz to 32 GHz	± 0.75 dB

Video feed through

Frequency	Vector mode, spec (typ)	Wideband or enhanced vector mode
< 1.8 GHz	250 mV p–p (100)	—
≥ 1.8 GHz	25 mV p–p (20)	—
< 1.2 GHz	—	250 mV p–p (100)
≥ 1.2 GHz	—	25 mV p–p (20)

Pulse compression

Mode	Vector mode [2]	Wideband or enhanced vector mode [3]
External LO	± 5 ns	± 2.5 ns
Internal LO [4]	± 5 ns	

1. Measured at the RF center frequency of the pulse.
2. Measurement conditions: pulse rise/fall times are 16 ns each, pulse width = 100 ns, pulse period = 1 us.
3. Measurement conditions: pulse rise/fall times are 5 ns each, pulse width = 20 ns, pulse period = 500 ns.
4. Internal LO specifcation only applies up to 20 GHz.

Internal Baseband Generator

Channels

2 digital channels, I and Q. (no analog inputs or outputs)

Resolution

16 bits (1/65,536)

Baseband waveform memory (playback)

Sample rate	Standard memory size	Option BBM
250 MSa/s	512 MSa per channel	6 GSa per channel
2 GSa/s (opt BB1 or BB2 only)	512 MSa per channel	4 GSa per channel

Waveform memory (non–volatile storage on removable SSD drive)

512 GBytes

Waveform segments

		Vector mode	Wideband or enhanced vector mode
Minimum segment length		64 samples (256 ns)	256 samples (128 ns)
Maximum segment length	Standard memory size	512 MSa	512 MSa
	Option BBM	2 GSa	4 GSa
Maximum number of segments		65,536	65,536
Minimum memory allocation		256 samples or 1 kbyte blocks	256 samples or 1 kbyte blocks
Minimum quantums [1]		1 sample	32 samples

Sample clock

	Standard clock rate	Option BB1 or BB2
Sample rate	250 MSa/s	250 MSa/s and 2 GSa/s

RF modulation bandwidth

Clock rate	Bandwidth
250 MSa/s (standard)	200 MHz
2 GSa/s (Opt BB1)	1.6 GHz [2, 3]
2 GSa/s (Opt BB2)	400 MHz [3]

Triggers

Source	External, trigger key, external, remote SCPI trigger over LAN or USB
External trigger inputs	**Triggers 1–2:** SMA rear–panel connectors
	Triggers 3–10: SMB rear–panel connectors
	Trigger In: SMB rear–panel connector
	All trigger ports have 4 ns input delay resolution
External polarity	Negative, positive
Types	Single, Continuous free run, Continuous trigger and run

1. A quantum is the minimum number of samples needed to describe a waveform segment.
2. At band crossings at 24, 28.5, 32, 36, and 40 GHz, bandwidth is limited to 800 MHz.
3. Full bandwidth applies for center frequencies > 1.2 GHz.

Internal Baseband Generator (Continued)

Markers

Number of markers	**Markers 1–2:** SMA rear–panel connectors with 78.125 ps output delay resolution
	Markers 3–10: SMB rear–panel connectors with 78.125 ps output delay resolution
	PRCN Marker Out: SMB rear–panel connector with 10 ps output delay resolution
	Marker Out: SMB rear–panel connector with 4 ns output delay resolution
Connector polarity	Negative, positive

Remote Programming

Interfaces	USB 2.0, 1000BaseT LAN, 10GB Ethernet
Keysight I/O libraries	Keysight's IO Library Suite helps you quickly establish an error–free connection between your PC and instruments, regardless of the vendor. It provides robust instrument control and works with the software development environment you choose.

General Specifications

Power requirements	350 W typical, 400 W maximum
Operating temperature range	0 to 50 ˚C
Storage temperature range	–40 to 70 ˚C; during storage below –20 ˚C, instrument states and waveform data may be lost.
Altitude	0 to 3000 m (10,000 ft)
Humidity	Type tested, 95% relative humidity at 40 °C decreasing linearly to 50% relative humidity at 50 °C.
Environmental testing	Samples of this product have been 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 MIL–PRF–28800F Class 3. Phase noise specifications are not warranted in a vibrating environment.
ISO compliant	This family of signal generators is manufactured in an ISO–9001 registered facility in concurrence with Keysight's commitment to quality.
EMC	Conforms to the immunity and emission requirements of IEC/EN 61326–1 including the conducted and radiated emission requirements of CISPR Pub 11/2009 Group 1, Class A.
Storage	Memory is shared by instrument states and waveform files.
	The solid–state drive initially holds at least 512 GB of free space.
Security	Display blanking
	Memory clearing functions (See Application Note, *Security Features of Keysight Technologies Signal Generators*, part number E4400–90621).
	Removable Solid State Drive (SSD) with all user data.
Self–test	Internal diagnostic routine tests most modules in a preset condition. If node voltages are within acceptable limits, then the module passes the test.
Weight	17.2 kg (38.0 lb) net
	24.0 kg (52.8 lb) shipping
Dimensions	103 mm H x 426 mm W x 559 mm D (4.05" H x 16.8" W x 22.0" D)
	Height and depth dimensions include bottom and rear panel feet.
	Rack mounting height: 2U (89 mm or 3.5")
Recommended calibration cycle	12 months

Input/Output Descriptions [1]

Front panel connectors

Option 1EM moves all connectors to the rear panel except the USB connectors.

RF output	Output impedance 50 Ω (nom).
– Option 520 or 52E	**Standard:** Precision APC–3.5 male; plus 3.5 to 3.5 mm female adapter **Option 1ED:** Type–N female; plus Type–N male to SMA female adapter
– Option 540	Precision APC–2.4 male; plus 2.4 to 2.4 mm and 2.4 to 2.92 mm female adapters
USB 2.0 primary (2 ports)	Allows control of USB devices. USB Type–A female connector. Nominal output current 0.5 A.

Rear panel connectors

Unless otherwise noted, digital outputs are 5 V CMOS, and digital inputs will accept 5 V CMOS, 3.3 V CMOS, or TTL voltage levels. Option 1EM moves all connectors to the rear panel except the USB connectors.

LAN (1000BaseT)	Allows LAN TCP/IP communication. RJ45 Ethertwist connector. The LAN connector provides SCPI remote programming functionality. The LAN connector is used to access the internal web server and FTP server. The LAN supports DHCP, HiSLIP, sockets SCIP, VXI–11 SCPI, connection monitoring, dynamic hostname services, and TCP keep alive. This interface is LXI class C compliant.
USB 2.0 primary (2 ports)	Allows control of USB devices. USB Type–A female connector. Nominal output current 0.5 A.
USB 2.0 secondary (1 port)	Receives control from USB host. USB Type–B female connector. Nominal output current 0.5A.
SFP 1	Accepts an SFP+ transceiver
SFP 2	Accepts an SFP+ transceiver
DisplayPort	Reserved for future use
Data Port 1	100–pin LVDS. This connector is used to provide agile LO control of the N519xA UXG agile signal generator.
System Sync In	SMA
System Sync Out	SMA
Triggers 1 through 10	Triggers 1 – 2 are SMA; Triggers 3 – 10 are SMB. High impedance inputs and 50 Ω outputs.
6 GHz In	SMA; +5.0 dBm minimum input power. Damage level > +15 dBm.
6 GHz Out	SMA; +10 dBm nominal output power.
LO In	SMA; +2.0 dBm minimum input power. Damage level > +20 dBm.
IF Ref In	SMA
IF Ref Out	SMA
IF In	SMA
IF Out	SMA
Trigger In 50 Ω	SMB
PRCN Marker Out 50 Ω	SMB
Marker Out 50 Ω	SMB

1. Please refer to the configuration guide for more details on configurations involving 2 vector UXGs.

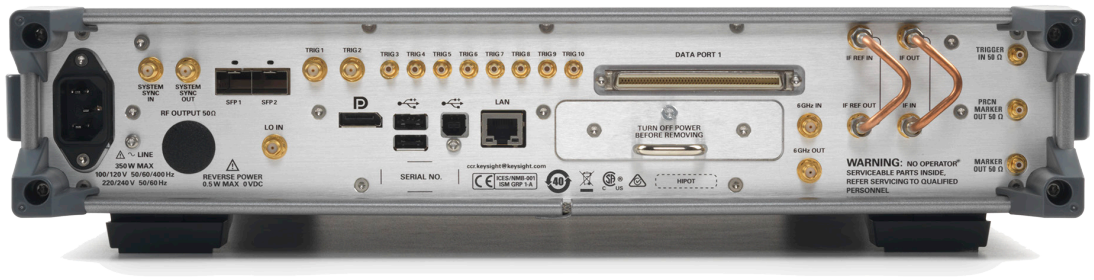


Figure 13. The UXG agile vector adapter rear panel.

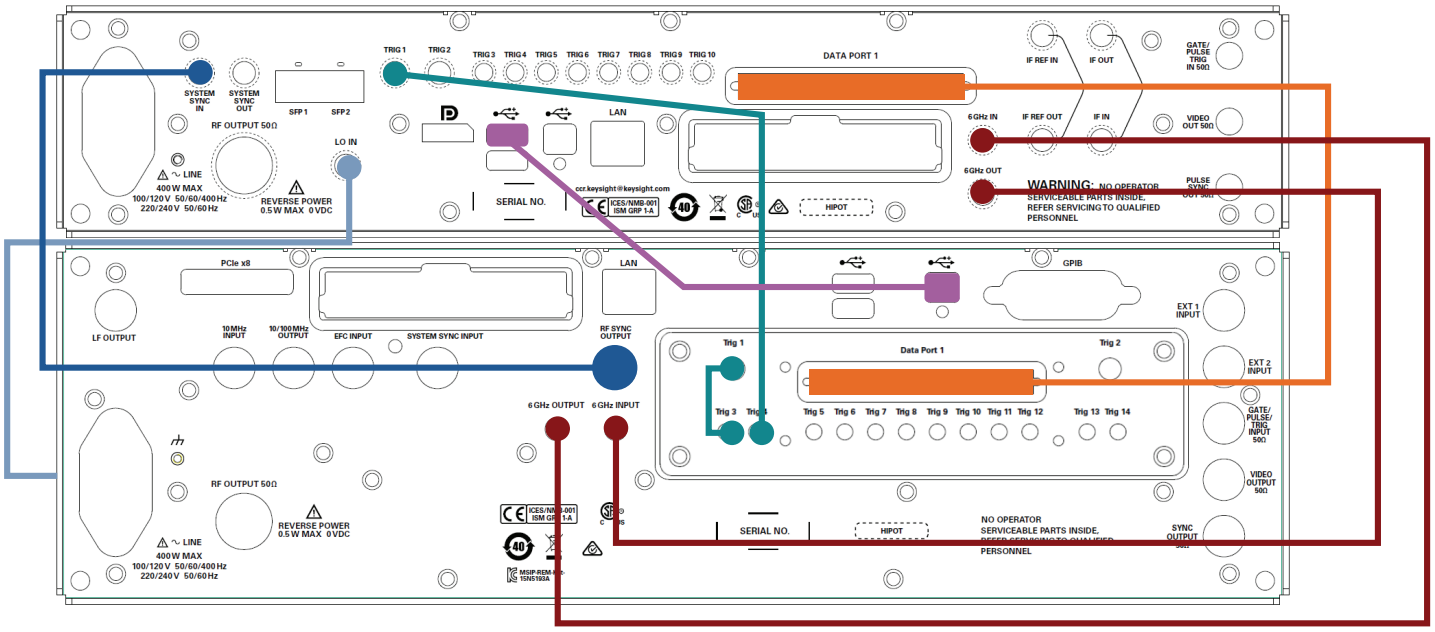


Figure 14. Connections between the UXG agile vector adapter and the UXG agile signal generator[1, 2].

1. An alternative approach is to take the 6 GHz from the Analog UXG, split it, and take the output to each of the 6 GHz inputs of both the UXGs. Please reference the configuration guide for more details.
2. For details on cables and accessories, please reference the configuration guide.

Performance Archive

Solid state drive (SSD) capacity was increased from 480 GB to 512 GB on instruments with s/n ≥ 5747xxxx, shipped after August 2017.

Related Literature

Publication title	Publication number
N5194A and N5192A UXG Agile Vector Adapter – Configuration Guide	5992–2332EN
N5193A UXG Agile Signal Generator – Data Sheet	5992–0092EN
UXG Agile Signal Generator (N5193A and N5191A) – Configuration Guide	5992–1116EN
N5191A UXG X–Series Agile Signal Generator, Modified Version – Data Sheet	5992–1095EN
TAKE YOUR LAB TO THE NEXT LEVEL WITH Keysight Technologies Electronic Warfare Test and Evaluation Solutions – Brochure	5992–3476EN

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