

SG6311A PSG

XG7-Class Analog Signal Generator

Introduction

This data sheet provides key features and specifications for the SG6311A PSG XG7-class analog signal generator.



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About the SG6311A PSG Signal Generator

The SG6311A PSG reveals true device-under-test performance with metrology-grade signal purity, exceptionally low noise, and high, calibrated output power. Its compact dual-channel design and compatibility with existing test environments help teams expand test capacity, accelerate deployment, and scale advanced test setups with greater confidence and efficiency. The result is trusted measurements, clearer insight, and faster progress from initial evaluation through deployment.



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 55°C, unless otherwise stated, and after a 45-minute 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.

Channels

Frequency Option	Configurable Number of Channels
Option 520	One (option 001) or two (option 001 and 002)

Frequency

Frequency Range

Option	Specified Frequency Range	Tunable Frequency Range
Option 520	9 kHz to 20 GHz	9 kHz to 20 GHz

Frequency Resolution

CW Resolution of Setting		≤ 0.00004 Hz
Resolution of synthesis	Band N = 1 (YIG mode)	10 μ Hz (nom)
	Band N = 1 (DDS mode)	20 μ Hz (nom)
Sweep		0.001 Hz

Frequency Switching Speed¹, () = typ

Mode	Settling Time ^{2, 3, 4}	
	SCPI Mode	List / step sweep mode
Option EP5 or EP6 in YIG mode	(≤ 12 ms)	(≤ 8 ms)
Option EP5 or EP6 in DDS mode	(≤ 11 ms)	(≤ 7 ms)

Phase adjustments (nom)

Phase offset range	$\pm 180^\circ$
Phase offset resolution	0.001°

- 1 Applies when display refresh is off. Transitions that cross a mechanical attenuator boundary (46.875 MHz or 3.2 GHz) are expected to take approximately 25 ms to switch.
- 2 Time from receipt of SCPI command or trigger signal to within 0.1 ppm of final frequency or within 100 Hz, whichever is greater.
- 3 Performance applies when status register updates are off.
- 4 Switching to frequencies < 180 MHz will require an additional 20 ms.

Frequency Reference

Frequency accuracy (nom)

	Option EP5	Option EP6
Frequency accuracy calculation	$\pm [(time\ since\ last\ adjustment \times aging\ rate) + temperature\ effects + calibration\ accuracy]$	
Aging rate (after 30 days operation) ⁵	$\leq 2 \times 10^{-10}$ per day $\leq 2 \times 10^{-8}$ per year	$\leq 2 \times 10^{-10}$ per day $\leq 2 \times 10^{-8}$ per year
Initial achievable calibration accuracy (at time of shipment)	$< 1 \times 10^{-8}$	$< 5 \times 10^{-9}$
Adjustment resolution (nom)	$< 1 \times 10^{-10}$	$< 1 \times 10^{-10}$
Temperature effects (nom)	$\pm 2 \times 10^{-9}$	$\pm 2 \times 10^{-9}$
Warm up time 5 minutes	$< \pm 0.1$ ppm	$< \pm 0.1$ ppm

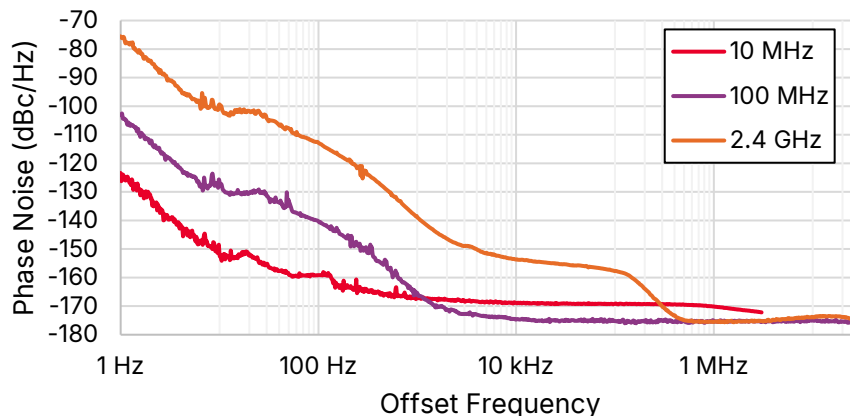
External reference input and output (nom)

Input frequency	Standard Option 1ER	10 MHz, 100 MHz 1 MHz to 110 MHz flexible reference
Input frequency resolution (Option 1ER)		0.1 Hz
Wide locking range		± 1.0 ppm (nom), optimized for best phase stability
Narrow locking range (Option EP5/EP6)		± 0.3 ppm (nom), optimized for best close-in phase noise
Output frequency		10 MHz, 100 MHz sine wave
	Input	Output
Amplitude	-3 dBm to +20 dBm	≥ 10 dBm (nom)
Connector type	BNC female	BNC female
Impedance	50 Ω	50 Ω

Ultra-low noise 2.4 GHz reference input and output (nom)

	2.4 GHz In (Option PCL)	2.4 GHz Out
Connector type	SMA female	SMA female
Frequency	2.4 GHz	2.4 GHz
Level range limits	-3 dBm to +20 dBm	+15 dBm to +17 dBm
Impedance	50 Ω	50 Ω
Frequency locking range	± 1.0 ppm	N/A
Wideband noise ⁶	N/A	-172 dBc/Hz (meas)

Measured Phase Noise of Reference Outputs (opt EP6)

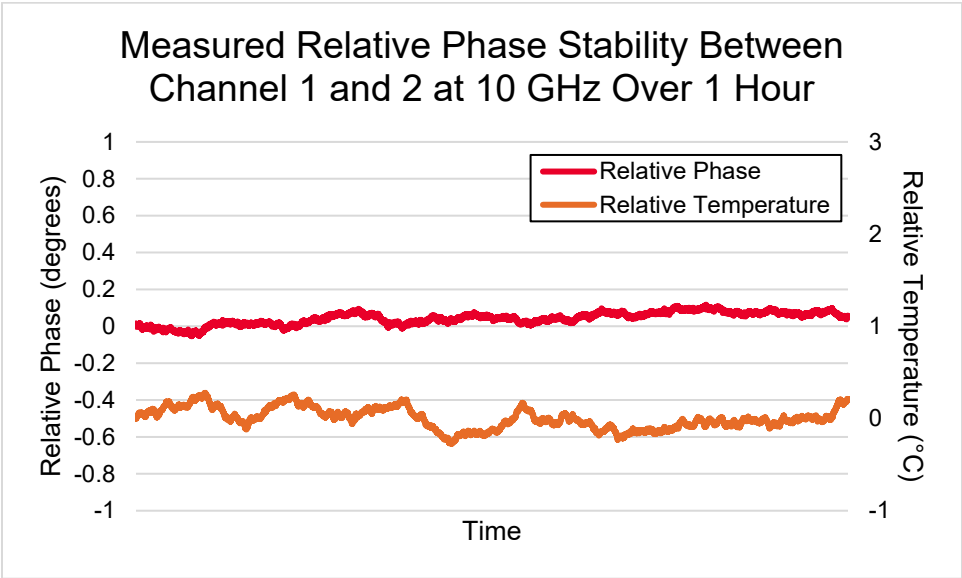
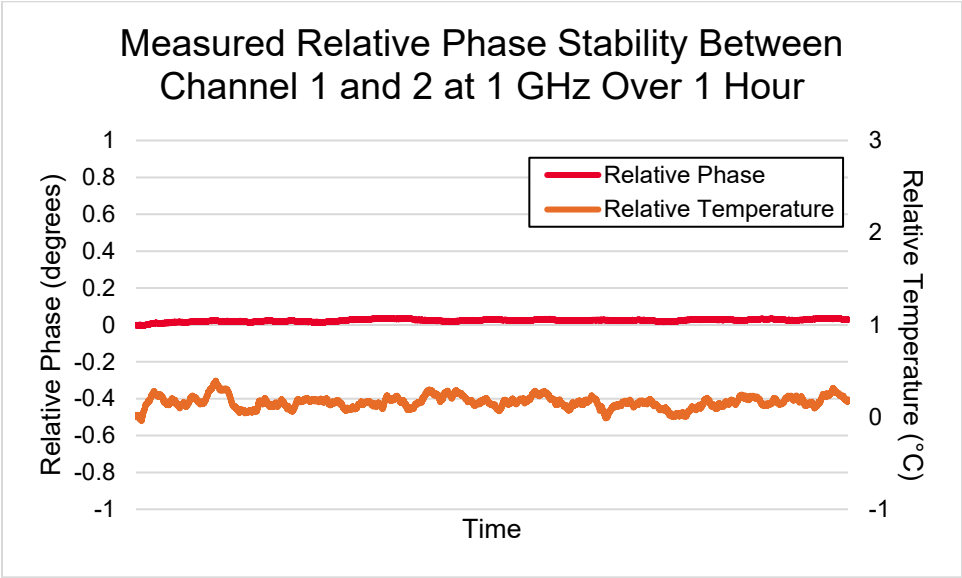


⁵ Not verified by Keysight N78000B ETMS FSE Calibration and Adjustment Software. Daily aging rate may be verified as a supplementary chargeable service, on request.

⁶ Measured at a 10 MHz offset from the 2.4 GHz carrier when instrument is locked to internal reference.

External reference input PLL synchronization bandwidths (nom)

External reference frequency	Loop bandwidth	
	Narrow	Wide
10 MHz	0.015 Hz	100 Hz
100 MHz	0.015 Hz	100 Hz
Flexible reference (Option 1ER), 1-110 MHz	0.015 Hz	100 Hz
2.4 GHz reference (Option PCL)	Not applicable, follows external 2.4 GHz directly	



Step/List Sweep

Frequency and amplitude step/list sweep (nom)

Operating modes	Step sweep	Equally spaced frequency and amplitude or logarithmically spaced frequency steps
	List sweep	Arbitrary list of frequency and amplitude steps
Sweep range	Frequency sweep	Within instrument frequency range
	Amplitude sweep	Within attenuator hold range, see Attenuator hold range section (Option 1E1)
Dwell time		100 μ s to 100 s
Number of points	Step sweep	2 to 65535
	List sweep	1 to 3201
Step change		Linear or logarithmic
Triggering		Free run, trigger key, external, bus (GPIB, LAN, USB)

Power

Output parameters

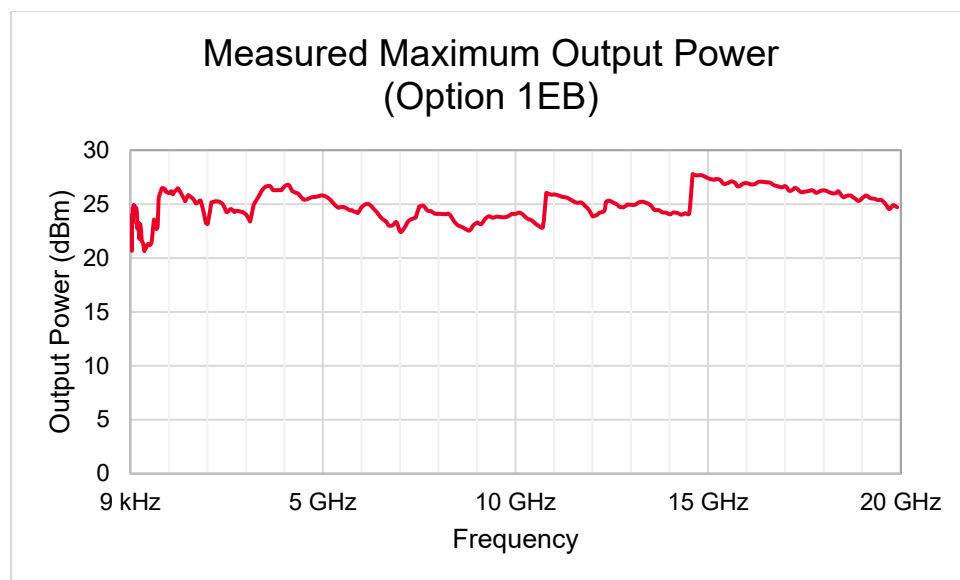
Settable range	Standard	-135 dBm to +20 dBm
	Option 1EB	-135 dBm to +30 dBm
Resolution		0.01 dB
Output impedance		50 Ω (nom)
Maximum reverse power		+27 dBm, 0 VDC
Attenuator type	Option 1E1	Mechanical step attenuator 0 dB to 25 dB in 5 dB steps, 25 dB to 115 dB in 10 dB steps
Attenuator hold range		Power levels of -20 dBm to maximum specified output power with step attenuator in 0 dB position. Can be offset using Option 1E1 attenuator.

Specified Maximum Output Power⁷

Frequency Option 520	Standard	Option 1EB
9 kHz to 750 MHz ⁸	+18 dBm	+19 dBm
> 750 MHz to 10.8 GHz	+18 dBm	+21 dBm
> 10.8 GHz to 20 GHz	+18 dBm	+22 dBm

⁷ Quoted specifications between 20 and 30°C with ALC auto. With Option 1EM rear panel connectors, the level is reduced by [0.2 dB + 0.075 dB/GHz].

⁸ Specification degrades by 2 dB between 39 MHz and 45 MHz.



Absolute level accuracy⁹ with Option 1E1, () = typical

Frequency	Measured at 0 dBm
9 kHz to 15 GHz ¹⁰	± 0.3 dB (±0.1 dB)
> 15 GHz to 20 GHz	± 0.4 dB (±0.1 dB)

Relative level accuracy / linearity (dB) ¹¹, () = typical, [] = meas

Frequency	> +10 dBm	+10 to > -40 dBm	-40 to > -70 dBm	-70 to -90 dBm	<-90 to -120 dBm
9 kHz to 350 MHz ¹²	± 0.4 (± 0.1)	± 0.4 (± 0.1)	± 0.5 (± 0.2)	± 0.5 (± 0.2) ¹³	[± 0.2]
> 350 MHz to 3.2 GHz	± 0.4 (± 0.1)	± 0.3 (± 0.1)	± 0.4 (± 0.1)	± 0.5 (± 0.1)	[± 0.2]
> 3.2 to 15 GHz	± 0.4 (± 0.1)	± 0.4 (± 0.1)	± 0.5 (± 0.1)	± 0.6 (± 0.2)	[± 0.2]
> 15 GHz to 20 GHz	± 0.5 (± 0.2)	± 0.4 (± 0.1)	± 0.5 (± 0.2)	± 0.6 (± 0.2)	[± 0.2]

9 Specifications apply in CW and list/step sweep modes from 20 to 30°C with the ALC on, attenuator hold off. For temperatures outside this range, absolute level accuracy degrades by 0.01 dB/degree C.

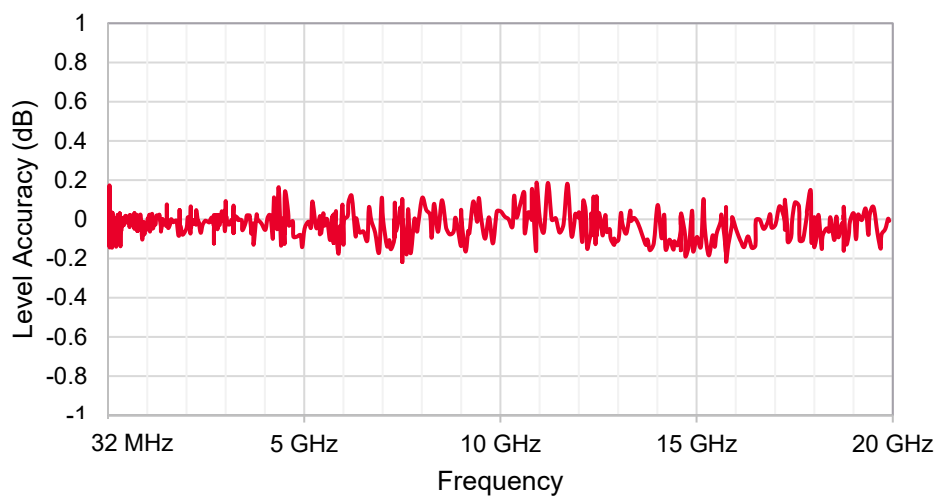
10 Below 20 MHz, absolute accuracy is degraded by 0.1 dB relative to the values shown.

11 Measured relative to 0 dBm for Option 520 with the mechanical step attenuator set to 0 dB or bypass. ALC auto mode.

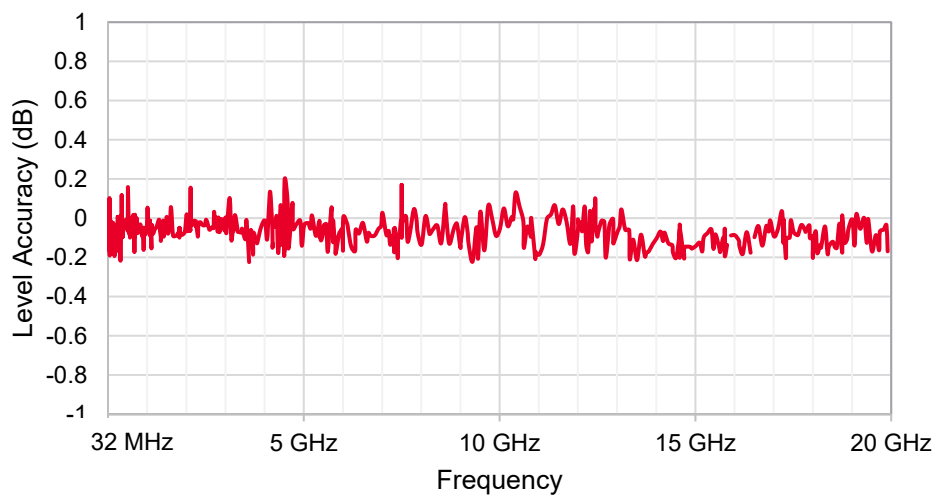
12 Below 20 MHz, relative accuracy specification is degraded by 0.5 dB and typical is degraded by 0.2 dB relative to the values shown.

13 Specification does not apply below 60 kHz and below -70 dBm.

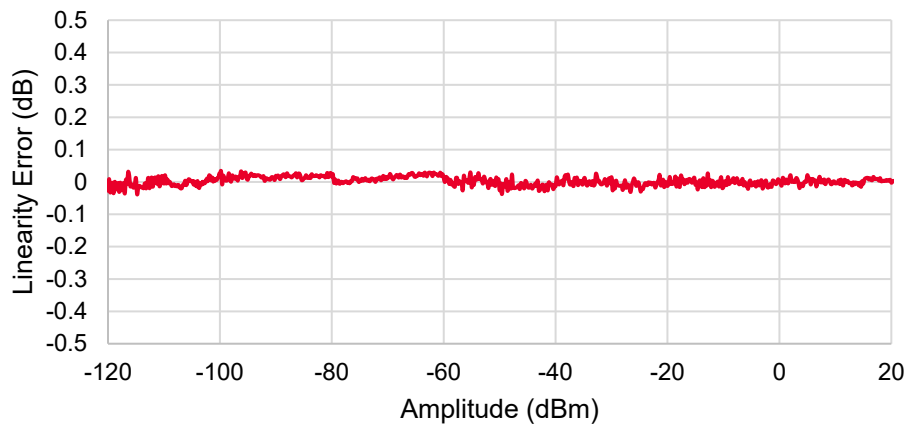
Measured Level Accuracy at -112.5 dBm



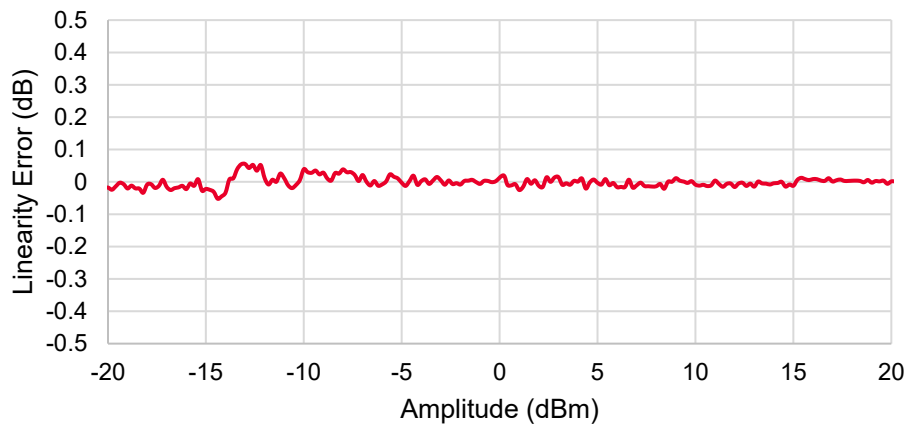
Measured Level Accuracy at -120 dBm



Measured Linearity at 10 GHz, CW,
Relative to 0 dBm



Measured Linearity at 10 GHz, CW,
Relative to 0 dBm, attenuator state held



VSWR (meas)

Frequency	Attenuator State	
	0 dB ¹⁴	All other attenuator states
9 kHz to 3.2 GHz	1.7: 1	1.3: 1
> 3.2 GHz to 20 GHz	1.9: 1	1.5: 1

¹⁴ Does not apply at $f = 1965, 3210, 6730, 12770, \text{ and } 19690 \text{ MHz} \pm 37.5 \text{ MHz}$ each, 75 MHz bandwidth, where f is the center frequency. VSWR degrades to 2.1:1 in these regions.

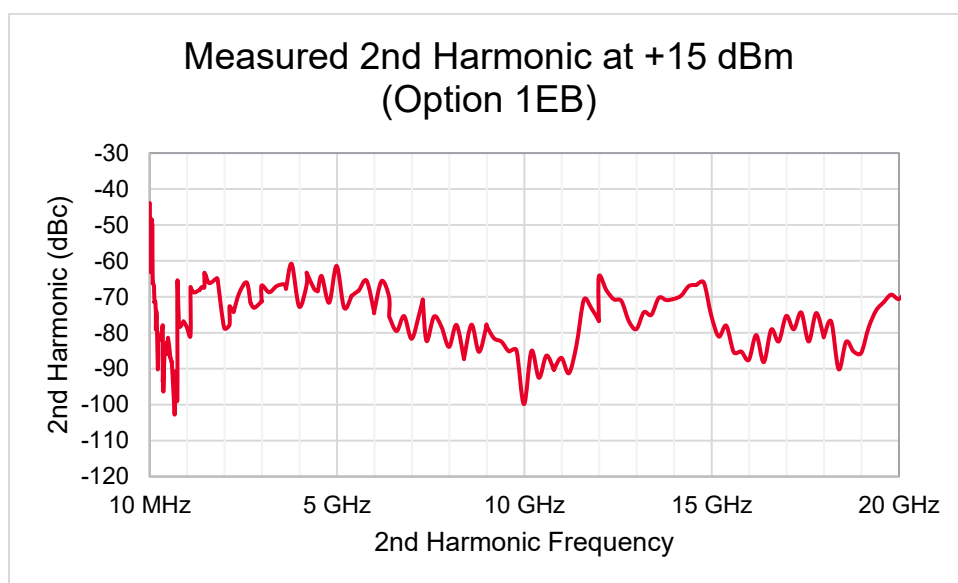
Amplitude switching speed¹⁵, () = typ

Mode	SCPI mode	Settling time
		List / step sweep mode
Standard	(< 9 ms)	(< 4 ms)
Mechanical attenuator (Option 1E1)	(< 25 ms)	(< 25 ms)

Spectral Purity

Harmonics¹⁶

Frequency	At +10 dBm (Standard)	At +15 dBm (Option 1EB)
9 kHz to < 100 MHz	-35 dBc	-35 dBc
100 MHz to 20 GHz	-55 dBc	-55 dBc



Non-harmonics¹⁷, () = typ, [] = meas

Frequency	Option EP5	Option EP6	Line-related (≤ 300 Hz) ¹⁸
9kHz to 8 MHz	-65 dBc	-75 dBc (-90 dBc)	[-90 dBc]
8 MHz to 750 MHz	-96 dBc	-100 dBc (-105 dBc)	[-80 dBc]
> 750 MHz to 1.5 GHz	-92 dBc	-100 dBc (-108 dBc)	[-80 dBc]
> 1.5 GHz to 3 GHz	-86 dBc	-94 dBc (-100 dBc)	[-75 dBc]
> 3 GHz to 6 GHz	-80 dBc	-88 dBc (-95 dBc)	[-70 dBc]
> 6 GHz to 12 GHz	-74 dBc	-82 dBc (-89 dBc)	[-65 dBc]
> 12 GHz to 20 GHz	-68 dBc	-76 dBc (-90 dBc)	[-60 dBc]

¹⁵ Time from receipt of SCPI command or trigger signal to amplitude settled within 0.1 db. Applies when display refresh is off.

¹⁶ Specifications apply from +20 to +30 °C with ALC auto and are nominal for harmonics beyond specified frequency range.

¹⁷ Specifications apply with ALC auto at offsets > 10 kHz, +10 dBm CW or maximum specified power, whichever is lower excluding external mechanical vibration. Performance is unspecified for non-harmonics beyond the specified frequency range.

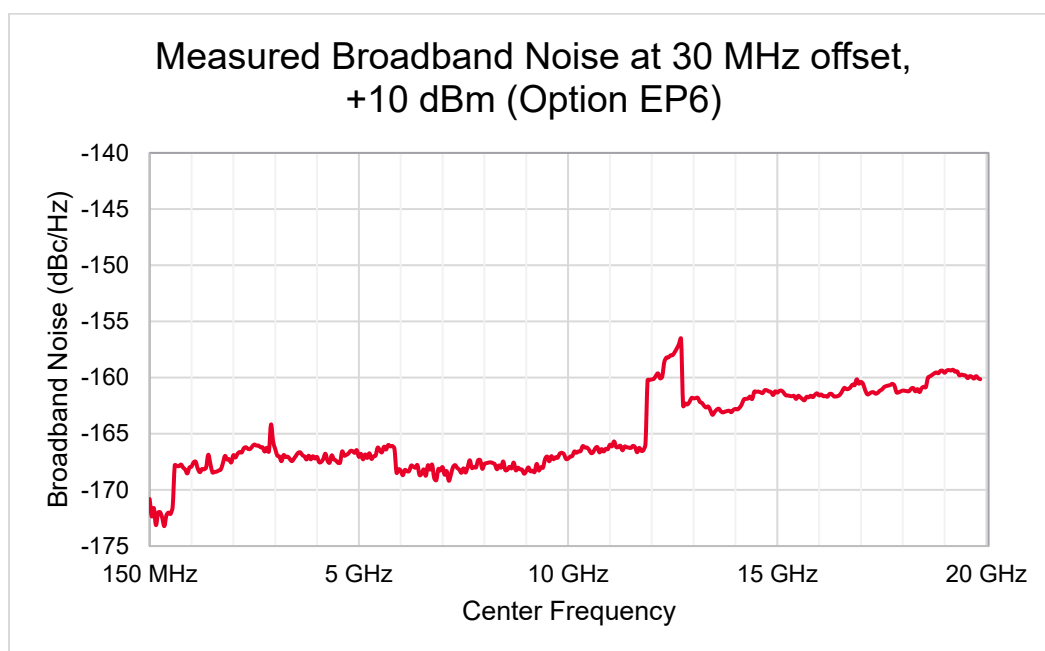
¹⁸ Power line related non-harmonics: 60 Hz to 300 Hz, measured from 1 MHz to 20 GHz.

Sub-harmonics¹⁹

Fundamental frequency	Sub-harmonic level
9 GHz to 12 GHz	None
>12 GHz to 20 GHz ²⁰	< -60 dBc

Broadband noise, (l) = typ

Frequency	Option EP5 / EP6	Option EP5 / EP6 in high SNR mode ²¹
Carrier offset: 10 MHz		
50 MHz to < 1 GHz	(-165 dBc)	(-167 dBc)
1 GHz to 6 GHz	(-163 dBc)	(-165 dBc)
Carrier offset: 30 MHz		
> 6 GHz to 12 GHz	(-163 dBc)	(-166 dBc)
> 12 GHz to < 13 GHz	(-157 dBc)	(-157 dBc)
13 GHz to < 19 GHz	(-158 dBc)	(-160 dBc)
19 GHz to 20 GHz	(-157 dBc)	(-159 dBc)



¹⁹ Specifications apply with ALC auto at +10 dBm or maximum specified power, whichever is lower. Sub-harmonics are defined as carrier freq*(x/y), where x and y are integers, and x is not an integer multiple of y, but excluding harmonics. Does not apply to non-harmonic spurs which may overlap sub-harmonic spurs. Specifications are nominal for sub-harmonics beyond specified frequency range.

²⁰ From >12 GHz to 12.5 GHz, sub-harmonic degrades by 5 dB.

²¹ High SNR mode may degrade harmonic performance.

Absolute SSB phase noise (dBc/Hz)²², Option EP5, ()=typ, [] = meas

Carrier	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
10 MHz	-128 (-130)	-134 (-138)	-147 (-152)	-158 (-162)	-163 (-166)	-162 (-164)	n/a
100 MHz	-121 (-122)	-127 (-133)	-146 (-150)	-156 (-160)	-165 (-166)	-163 (-165)	-167 (-171)
1 GHz	-101 (-104)	-109 (-114)	-135 (-137)	-148 (-150)	-151 (-153)	-158 (-161)	-166 (-169)
2 GHz	-95 (-97)	-103 (-108)	-129 (-131)	-142 (-144)	-144 (-147)	-153 (-155)	-166 (-169)
4 GHz	-89 (-92)	-97 (-102)	-122 (-125)	-135 (-138)	-138 (-141)	-147 (-150)	-165 (-169)
8 GHz	-83 (-85)	-90 (-95)	-116 (-119)	-129 (-132)	-132 (-135)	-141 (-144)	-165 (-169)
10 GHz	-80 (-83)	-88 (-93)	-113 (-117)	-128 (-131)	-130 (-133)	-140 (-143)	-164 (-168)
20 GHz	-75 (-77)	-83 (-88)	-109 (-112)	-123 (-125)	-125 (-128)	-135 (-138)	-156 (-160)

Absolute SSB phase noise (dBc/Hz)²², Option EP6, YIG mode, ()=typ, [] = meas

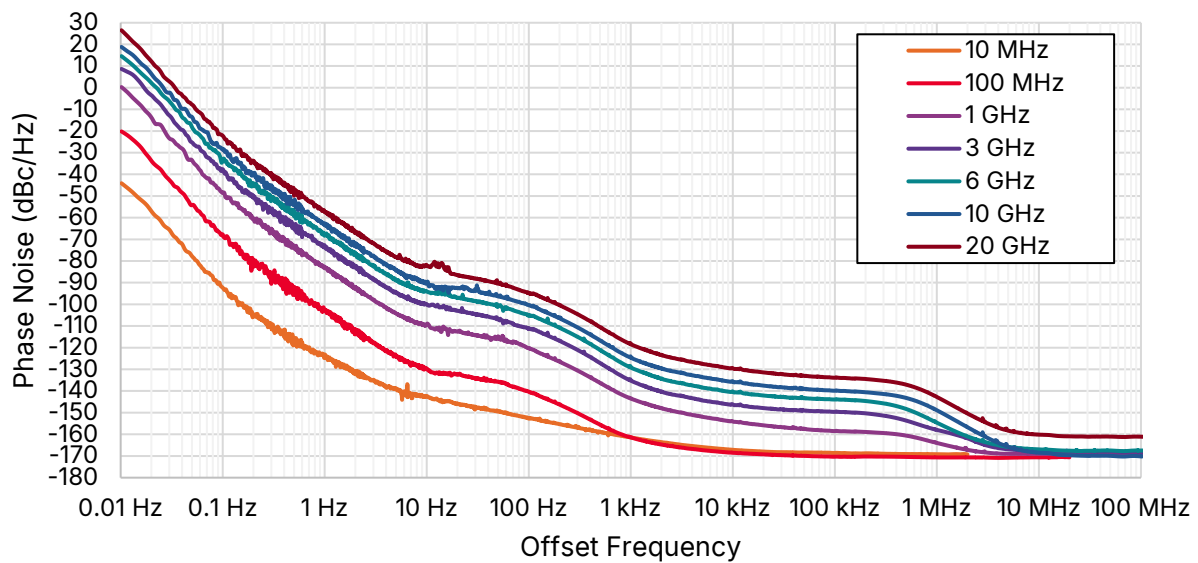
Carrier	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	100 MHz
10 MHz	[-123]	(-140)	-146 (-150)	-156 (-160)	-163 (-166)	-164 (-167)	-167 (-169)	n/a	n/a
100 MHz	[-102]	-123 (-127)	-130 (-135)	-157 (-160)	-166 (-168)	-168 (-170)	-169 (-171)	-168 (-171)	n/a
1 GHz	[-83]	-104 (-107)	-110 (-116)	-137 (-141)	-150 (-153)	-155 (-158)	-161 (-164)	-166 (-169)	-166 (-169)
2 GHz	[-77]	-96 (-101)	-103 (-109)	-131 (-135)	-145 (-148)	-149 (-152)	-156 (-159)	-166 (-170)	-165 (-169)
4 GHz	[-71]	-90 (-95)	-96 (-103)	-125 (-130)	-139 (-142)	-143 (-146)	-151 (-154)	-165 (-169)	-165 (-170)
8 GHz	[-66]	-83 (-88)	-91 (-97)	-119 (-124)	-133 (-136)	-137 (-140)	-145 (-148)	-166 (-170)	-169 (-173)
10 GHz	[-63]	-83 (-87)	-90 (-95)	-118 (-122)	-132 (-135)	-136 (-139)	-145 (-148)	-165 (-169)	-166 (-170)
20 GHz	[-57]	-77 (-81)	-81 (-88)	-110 (-116)	-126 (-129)	-130 (-133)	-138 (-142)	-156 (-160)	-158 (-162)

Absolute SSB phase noise (dBc/Hz)²², Option EP6, DDS mode, ()=typ, [] = meas

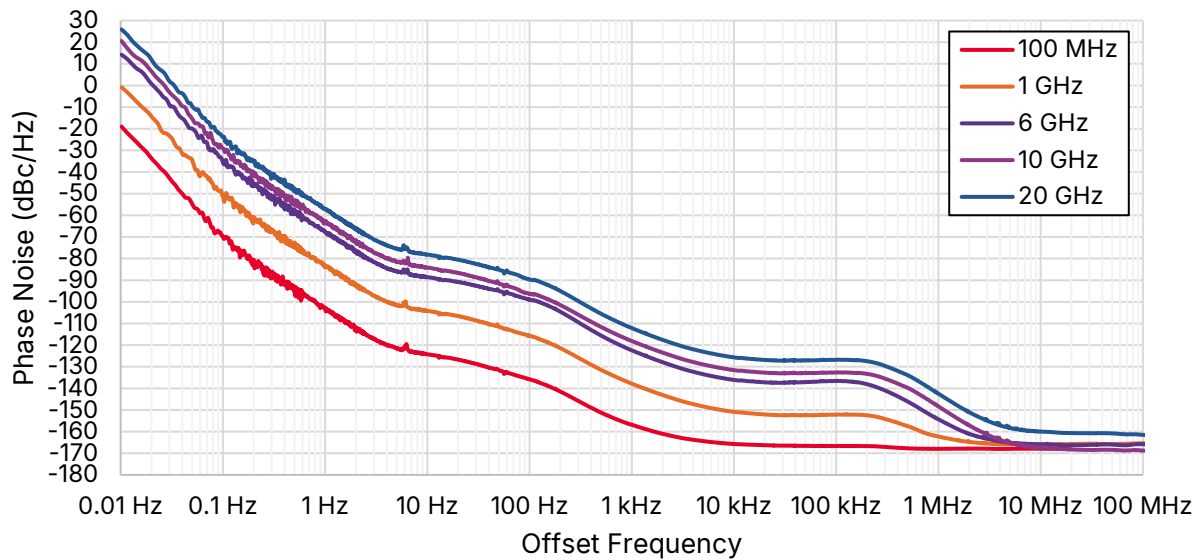
Carrier	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	100 MHz
10 MHz	[-123]	(-120)	-126 (-130)	-137 (-141)	-146 (-149)	-151 (-154)	-153 (-156)	n/a	n/a
100 MHz	[-102]	-117 (-121)	-127 (-130)	-138 (-142)	-147 (-150)	-152 (-154)	-152 (-156)	-152 (-156)	n/a
1 GHz	[-83]	-102 (-107)	-110 (-115)	-137 (-141)	-150 (-153)	-156 (-159)	-161 (-163)	-160 (-164)	-160 (-164)
2 GHz	[-77]	-95 (-100)	-103 (-109)	-131 (-135)	-144 (-147)	-150 (-153)	-157 (-159)	-158 (-162)	-157 (-161)
4 GHz	[-71]	-91 (-95)	-98 (-104)	-125 (-129)	-137 (-141)	-144 (-147)	-151 (-154)	-152 (-157)	-152 (-157)
8 GHz	[-66]	-85 (-89)	-91 (-97)	-119 (-123)	-131 (-135)	-138 (-141)	-145 (-149)	-147 (-151)	-147 (-153)
10 GHz	[-63]	-82 (-87)	-90 (-96)	-117 (-122)	-132 (-135)	-138 (-141)	-147 (-150)	-147 (-152)	-148 (-152)
20 GHz	[-57]	-76 (-80)	-83 (-89)	-111 (-116)	-126 (-129)	-132 (-135)	-141 (-144)	-141 (-146)	-142 (-147)

²² Specifications apply 20 to 30 °C with ALC auto in high SNR mode, excluding external mechanical vibration. Measured at +10 dBm or maximum specified power, whichever is less.

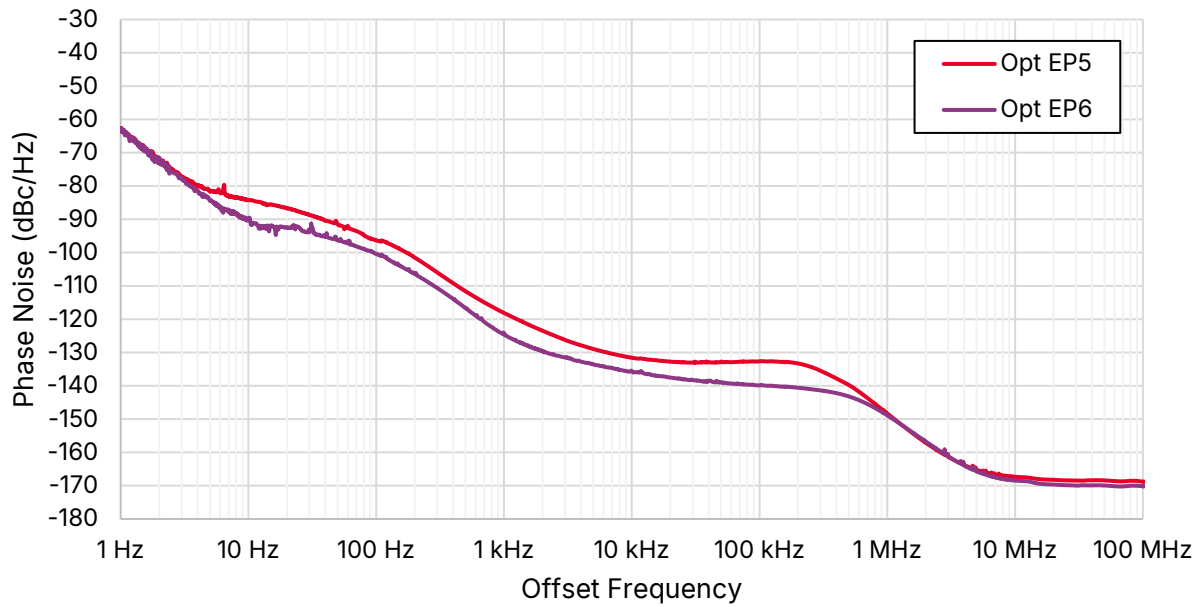
Measured Phase Noise at +10 dBm, YIG mode,
high SNR mode (Opt EP6)



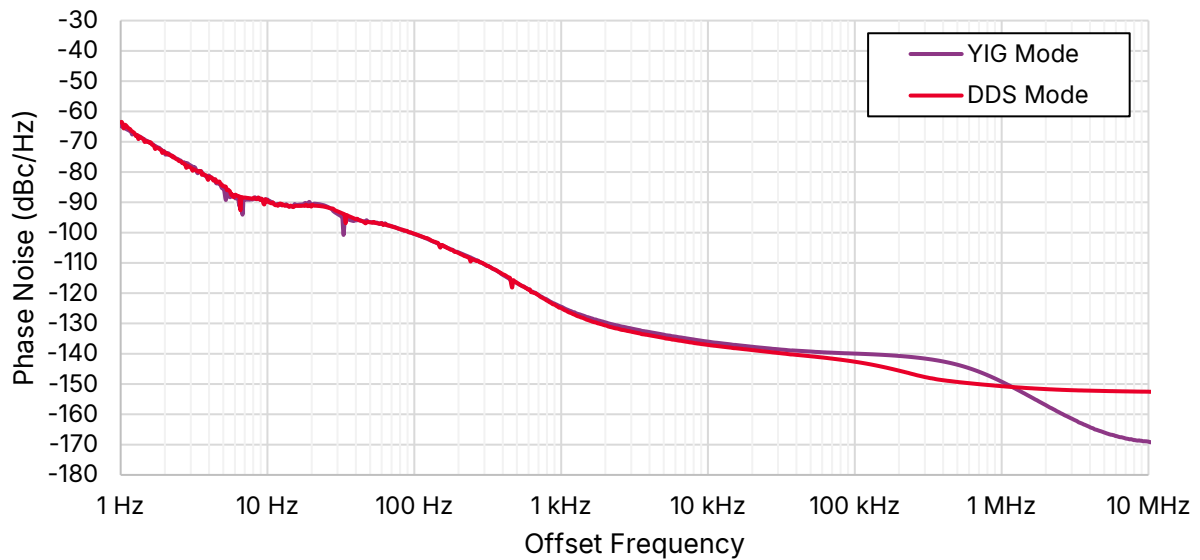
Measured Phase Noise at +10 dBm, YIG mode,
high SNR mode (Opt EP5)



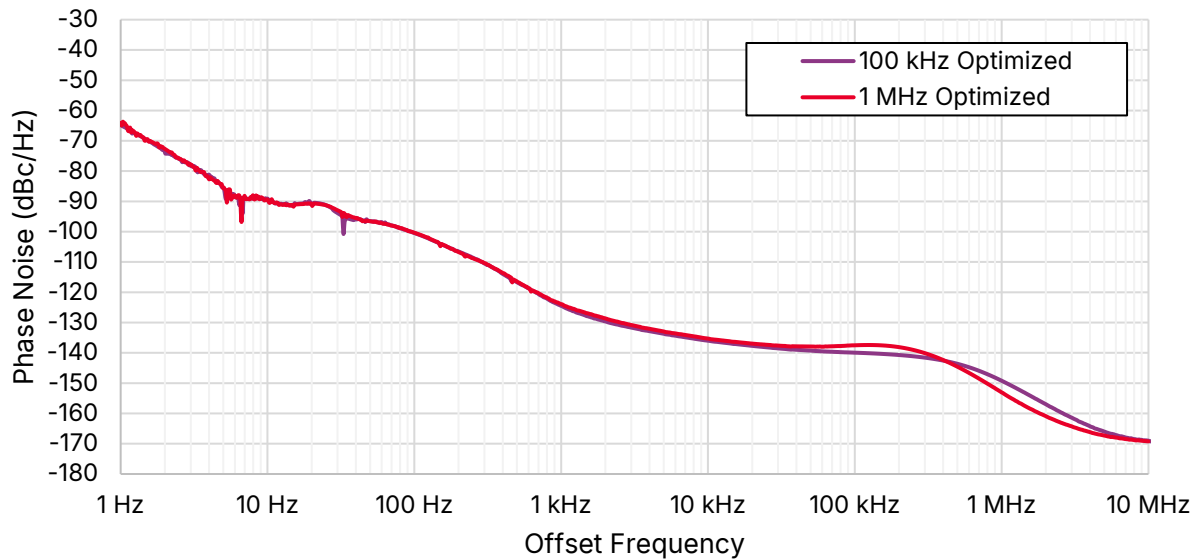
Measured Opt EP5 vs. Opt EP6 Phase Noise at 10 GHz



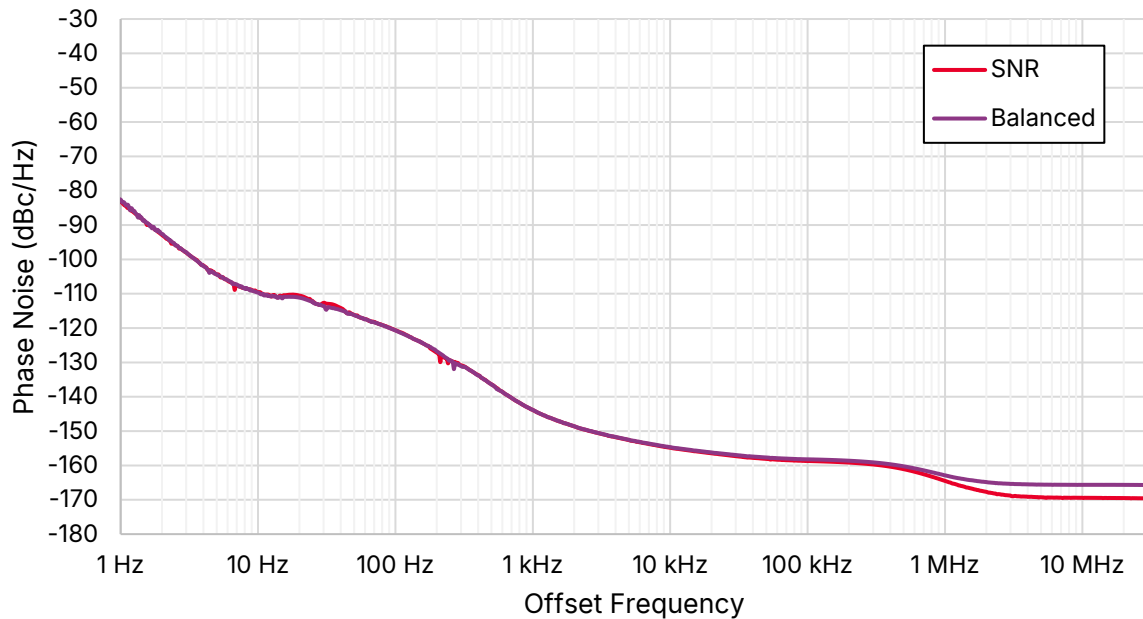
Measured Phase Noise at 10 GHz with Different Optimization Modes (Opt EP6)



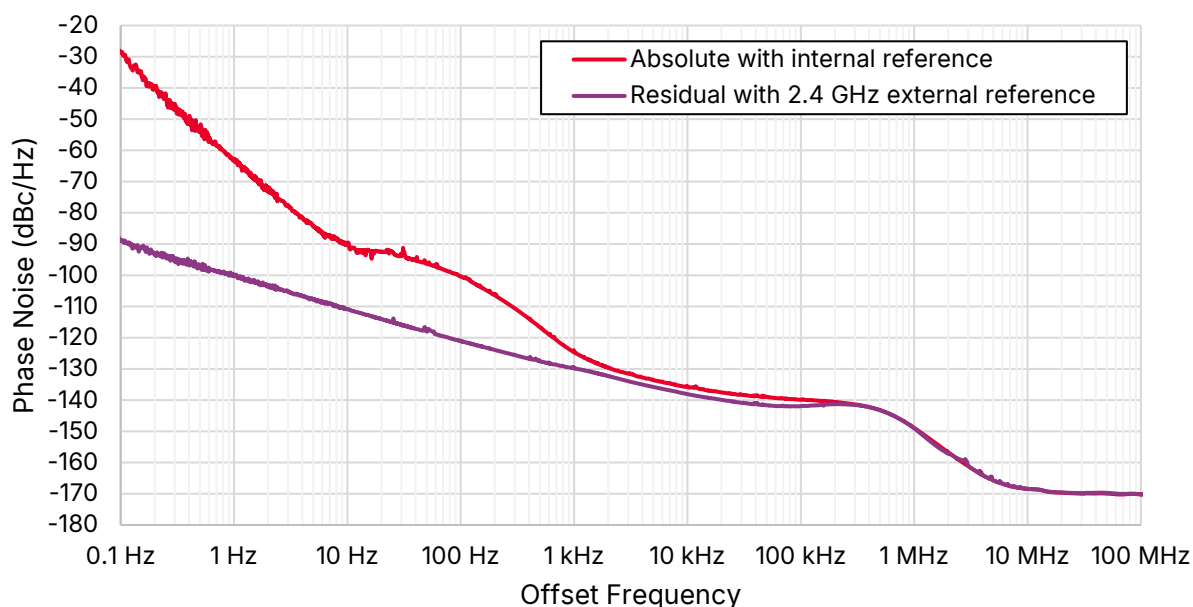
Measured Phase Noise at 10 GHz with Different PLL
Bandwidth Optimizations (Opt EP6)



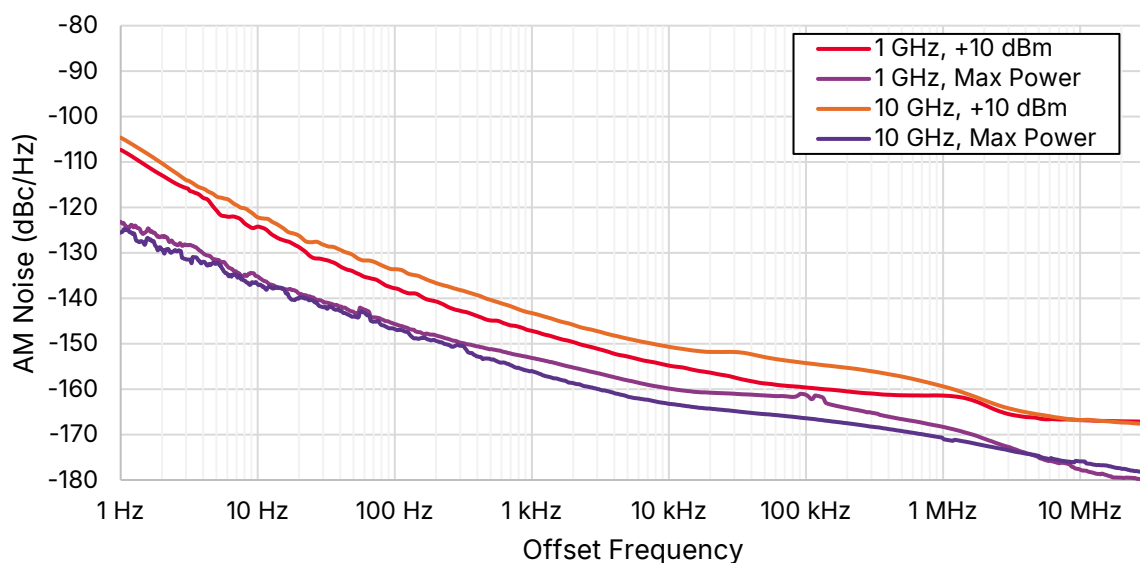
Measured Phase Noise with Different Noise
Preferences at 1 GHz (Opt EP6)



Measured Residual Phase Noise at 10 GHz (Opt EP6)



Measured AM Noise at different frequencies, power levels (Opt EP6)



RMS jitter (meas)²³

Carrier frequency (Option EP5)	SONET/SDH data rates	RMS jitter bandwidth	Unit intervals (Ω UI)	Time (fs)
155 MHz	155 MB/s	100 Hz to 1.5 MHz	7	7.9
622 MHz	622 MB/s	1 kHz to 5 MHz	27	4.3
2.488 GHz	2488 MB/s	5 kHz to 20 MHz	86	3.7
9.953 GHz	9953 MB/s	10 kHz to 80 MHz	197	3.3
Carrier frequency (Option EP6)	SONET/SDH data rates	RMS jitter bandwidth	Unit intervals (Ω UI)	Time (fs)
155 MHz	155 MB/s	100 Hz to 1.5 MHz	7	7.2
622 MHz	622 MB/s	1 kHz to 5 MHz	27	3.2
2.488 GHz	2488 MB/s	5 kHz to 20 MHz	86	2.5
9.953 GHz	9953 MB/s	10 kHz to 80 MHz	197	1.9

Residual FM, CW mode, Option EP5/EP6 (meas)

300 Hz to 3 kHz bandwidth	< N $\times$ 1 Hz RMS
30 Hz to 25 kHz bandwidth	< N $\times$ 4 Hz RMS

²³ Calculated from phase noise performance in CW mode only at +10 dBm. For other frequencies, data rates, or bandwidths, please contact Keysight.

Analog Modulation

Frequency bands

Multiplier "N" is a factor used to define certain specifications for FM and ϕ M

Frequency Range	Multiplier N in YIG mode	Multiplier N in DDS mode
9 kHz to < 8 MHz	Digital Synthesis	Digital Synthesis
8 MHz to < 11.71875 MHz	1/1024	1/4
11.71875 MHz to < 23.4375 MHz	1/512	1/4
23.4375 MHz to < 46.875 MHz	1/256	1/4
46.875 MHz to < 93.75 MHz	1/128	1/4
93.75 MHz to < 187.5 MHz	1/64	1/4
187.5 MHz to < 350 MHz	1/32	1/4
350 MHz to 375 MHz	1/32	1/32
> 375 MHz to 750 MHz	1/16	1/16
> 750 MHz to 1.5 GHz	1/8	1/8
> 1.5 GHz to 3 GHz	1/4	1/4
> 3 GHz to 6 GHz	1/2	1/2
> 6 GHz to 12 GHz	1	1
> 12 GHz to 20 GHz	2	2

Frequency modulation (Option UNT)²⁴

FM modes		High bandwidth (DDS), low noise (YIG)
Maximum deviation ²⁵	High bandwidth (DDS) mode	N x 250 MHz (nom)
	Low noise (YIG) mode	N x 1 MHz (nom)
Resolution		0.1% of deviation or 1 Hz, whichever is greater (nom)
Deviation accuracy (at 1 kHz rate, N x 100 kHz deviation)	Internal	< $\pm$ [1% of FM deviation + 20 Hz] (typ)
	External	< $\pm$ [3.5% of FM deviation + 20 Hz] (typ)
Distortion (at 1 kHz rate, N x 100 kHz deviation)		< 0.1%
Modulation frequency response ²⁶	High bandwidth (DDS) mode	3 dB bandwidth: DC/5Hz to 10 MHz (nom) 1 dB bandwidth: DC/20 Hz to 100 kHz (nom)
	Low noise (YIG) mode	3 dB bandwidth: DC/5Hz to 30 kHz ²⁷ (nom)
External inputs (EXT1, EXT2)	Coupling	AC, DC
	DCFM carrier offset ²⁸	$\pm$ 0.1% of set deviation + (N x 8 Hz) (nom)
	Sensitivity	$\pm$ 1 V _{peak} for indicated deviation
	Input impedance	50 Ω or 600 Ω or 100k Ω
	Paths	FM1 and FM2 are summed internally for composite modulation. Either path may be switched to any one of the modulation sources: EXT1, EXT2, internal1, internal2.

²⁴ During list/step sweep operation, FM is usable but not warranted.

²⁵ Below 8 MHz carrier is direct digital synthesis and max deviation of 5 MHz is limited by 9kHz lower frequency edge.

²⁶ Measurements validated with N X 100 kHz deviation external FM path1 relative to 1 kHz rate.

²⁷ In low noise mode, rate can be over-ranged to 600 kHz with degraded deviation accuracy.

²⁸ At the calibrated deviation and carrier frequency, within 5 °C of ambient temperature at time of user calibration.

Phase modulation (Option UNT)²⁹

φM modes		High bandwidth (DDS), low noise (YIG)
Maximum deviation	High bandwidth (DDS) mode	N×320 rad (nom)
	Low noise (YIG) mode	N×10 rad (nom)
Resolution		0.1% of deviation (nom)
Deviation accuracy (at 1 kHz rate, ≤ half max deviation)	Internal	< ± [1% + 0.01 rad] (typ)
	External	< ± [2% + 0.01 rad] (typ)
Distortion (at 1 kHz rate, ≤ half max deviation)		< 0.1%
Modulation frequency response (50 Ω)	High bandwidth (DDS) mode	< 1 dB bandwidth (N×320 rad): DC, 10 Hz to 100 kHz (nom)
		< 1 dB bandwidth (N×32 rad): DC, 10 Hz to 1 MHz (nom)
		< 1 dB bandwidth (N×3.2 rad): DC, 10 Hz to 10 MHz (nom)
External inputs (EXT1, EXT2)	Low noise (YIG) mode	3 dB bandwidth (N×10 rad): DC, 10 Hz to 30 kHz ³⁰ (nom)
	Coupling	AC, DC
	Sensitivity	± 1 V _{peak} for indicated deviation
	Input impedance	50 Ω or 600 Ω or 100k Ω
	Paths	φM1 and φM2 are summed internally for composite modulation. Either path may be switched to any one of the modulation sources: EXT1, EXT2, internal1, internal2.

²⁹ Below 8 MHz carrier is direct digital synthesis and deviation is limited by 9 kHz lower frequency edge. During list/step sweep operation, φM is usable but not warranted.

³⁰ In low noise mode, rate can be over-ranged to 600 kHz with degraded deviation accuracy.

Amplitude modulation³¹ (Option UNT), (I) = typ

Linear mode			Exponential (log) (downward modulation only)	
			Option UNT	Option UNT + 1SM ³²
Depth	Settable	100%	50 dB	60 dB ³³
	Resolution	0.1% (nom)	0.01 dB (nom)	0.01 dB (nom)
Depth accuracy (1 kHz rate, < 80% depth)	ALC Auto mode	$\pm (4\% \text{ of setting} + 1\%)^{34}$	-	-
	< 2 dB depth	-	(± 0.5 dB)	(± 0.5 dB)
	< 10 dB depth	-	(± 1 dB)	(± 1 dB)
	< 40 dB depth	-	(± 2 dB)	(± 2 dB)
	< 50 dB depth	-	(± 3 dB)	(± 3 dB)
	< 60 dB depth	-	-	(± 4 dB)
Modulation frequency response (3 dB bandwidth, 30% depth) ³⁵	DC coupled (50 Ω)	(0 to 100 kHz)	-	-
	AC coupled (50 Ω)	(10 Hz to 100 kHz)	-	-
Total harmonic distortion ³⁶ (1 kHz rate, ALC on, linear mode)	30% depth	< 3% (2%)	-	-
	60% depth	< 3.5% (3%)	-	-
External inputs (selectable polarity) (EXT1, EXT2)	Coupling	AC, DC		
	Sensitivity	0 to 100%/V	0 to 50 dB/V	0 to 60 dB/V
	Sensitivity for indicated depth	1 V _{peak}	-1 V _{peak}	-1 V _{peak}
	Maximum allowable (50 Ω , 100 k Ω)	± 1 V	0 to -1 V	0 to -1 V
	Maximum allowable (600 Ω)	± 1 V	0 to -1 V	0 to -6 V
	Input Impedance	50 Ω or 600 Ω or 100k Ω (damage levels are 5 V _{peak} or 8 V _{peak} in for exponential AM)		
	Paths	AM1 and AM2 are summed internally for composite modulation. Either path may be switched to any one of the modulation sources: EXT1, EXT2, Internal1, Internal2		

31 Specifications apply 20 to 30 °C with ALC auto, +10 dBm. Envelope peaks within ALC operating range (-20 dBm to maximum output power, excluding step-attenuator setting.) For carrier frequencies below 8 MHz, AM is useable but not specified. If High SNR mode is enabled, AM performance is not specified. For frequencies below 350 MHz, specifications apply in DDS mode.

32 Option 1SM scan modulation is available with Options 520 only, and provides exponential (log) AM. If 600 Ω input impedance is selected, maximum input voltage is ± 6 V

33 Modulation depths greater than 60 dB are achievable with an external input less than -1 V and are not available with the internal modulation source.

34 Below 100 MHz carrier frequency, depth accuracy in linear mode is $\pm (6\% \text{ of setting} + 1\%)$.

35 In YIG mode, frequency response is specified to 10 kHz.

36 Specifications apply between 8 MHz and 3.5 GHz. Values are typical < 8 MHz and > 3.5 GHz.

Simultaneous and composite modulation (Option UNT)

Simultaneous modulation	All modulation types (FM, AM, ϕ M and pulse modulation) may be simultaneously enabled except FM and phase modulation cannot be combined; two modulation types cannot be simultaneously generated using the same modulation source. For example, the Pulse, AM, and FM can run concurrently, and all will modulate the output RF. This is useful for simulating signal impairments, FM chirp RADAR, or scan modulation			
Composite modulation	AM, FM, and ϕ M each consist of two modulation paths which are summed internally for composite modulation. Modulation can be any combination of internal or external sources.			
	AM/Scan Mod	FM	ϕ M	Pulse
AM/Scan mod	•	•	•	•
FM	•	•	-	•
ϕ M	•	-	•	•
Pulse	•	•	•	-

• = compatible, - = incompatible

Standard internal analog modulation source (Option UNT)

Waveform generator for use with AM, FM, ϕ M, and LF out	
Waveform	Sine, triangle, square, pos ramp, neg ramp, trapezoid, pulse
Rate range	0.1 Hz to 3 MHz
Resolution	0.1 Hz
Frequency accuracy	Same as RF reference source (nom)
LF output	0 to 5 V peak into 50 Ω , -5 V to 5 V offset (nom) (Combined peak + offset cannot exceed +/- 5 Volts)

Multifunction generator internal modulation source (Option 303)

The multifunction generator option (Option 303) consists of 7 waveform generators that can be set independently with up to 5 simultaneously using the composite modulation features in AM, FM/ ϕ M plus LF out		
Waveform	Function generator 1	Sine, triangle, square, pos ramp, neg ramp, trapezoid, pulse
	Function generator 2	Sine, triangle, square, pos ramp, neg ramp, trapezoid, pulse
	Dual function generator	Sine, triangle, square, pos ramp, neg ramp, trapezoid, pulse, phase offset and amplitude ratio for Tone2 relative to Tone1
	Swept function generator	Sine, triangle, square, pos ramp, neg ramp, trapezoid Trigger: free run, trigger key, bus, external, internal, timer trigger
	Noise generator 1	Uniform, Gaussian
	Noise generator 2	Uniform, Gaussian
Frequency ranges / parameters	Sine wave	0.1 Hz to 10 MHz
	Triangle, square, ramp, pulse, trapezoid	0.1 Hz to 1 MHz
	Noise bandwidth	Tunable 100kHz to 10 MHz, in 100 kHz steps
	Resolution	0.1 Hz
	Frequency accuracy	Same as RF reference source (nom)

Pulse Modulation

Pulse modulation (Option PMR)³⁷, () = typ

On/off ratio		> 80 dB
Rise/fall times (Tr, Tf)	50 MHz to < 100 MHz	< 50 ns (45 ns)
	100 MHz to 350 MHz	< 30 ns (20 ns)
	> 350 MHz to 1 GHz	< 10 ns (6 ns)
	> 1 GHz	< 10 ns (3.5 ns)
Minimum pulse width	50 MHz to < 100 MHz	1 μ s
	100 MHz to 350 MHz	100 ns ³⁸
	> 350 MHz	20 ns
Level accuracy (relative to CW) ³⁹		± 0.7 dB (± 0.3)
Width compression (RF width relative to video out)		(< ± 5 ns)
Video feed-through ⁴⁰	50 MHz to 400 MHz	(< 50 mV or < 11%), whichever is lower
	< 3.2 GHz	(< 50 mV or < 6 %), whichever is lower
	≥ 3.2 GHz	(< 2 mV)
Video delay (external input to video)		50 ns (nom)
RF delay (video to RF output)	50 to 350 MHz	150 ns (nom)
	> 350 MHz	35 ns (nom)
Pulse overshoot		(< 10%)
Input level Threshold Voltage		+1 V peak = RF on 0 V = RF off into 50 Ω , nominal
Input impedance		50 Ω or 10k Ω nominal
Input Polarity		Normal, inverse
Td video delay (variable) Tw video pulse width (variable) Tp pulse period (variable) Tm RF delay Trf RF pulse width Tfr RF pulse fall time Tr RF pulse rise time Vor pulse overshoot Vf video feedthrough		

37 Specifications apply with ALC auto and Atten Hold Off (default mode for instruments with attenuator). Modulation source can be internal or externally applied. Below 50 MHz, pulse modulation is useable; however performance is not warranted.

38 Overrange to 30 ns.

39 Applies over the same operating temperature range indicated in level accuracy section of data sheet. With ALC On, specifications apply for ≥ 40 ns pulse widths or stated minimum pulse width, whichever is greater. With ALC off, specifications apply to stated minimum pulse width for frequency range.

40 Video feed through applies to power levels < +10 dBm or with Option 1E1 step attenuator in 0 dB position. Above 3.2 GHz, video feed-through decreases with step attenuator setting. Below 3.2 GHz, video feed-through is expressed as a percentage of RF output level.

Internal pulse generator (Option PMR)

Modes	Free-run, square, triggered, adjustable doublet, trigger doublet, gated, and external pulse. Triggered with delay, doublet, and gated require external trigger source.	
Square wave rate	0.1 Hz to 10 MHz, 0.1 Hz resolution (nom)	
Pulse period (PRI)(Tp)	20 ns to 42 s (nom)	
Pulse width 2 (Tw)	10 ns to (pulse period minus 10 ns) (nom)	
Resolution	10 ns	
Adjustable trigger delay (Td)	(-pulse period +10 ns) to (pulse width -10 ns)	
Settable delay	Free run	-3.99 to 3.97 μ s
	Triggered	0 to 40 s
Resolution (delay, width, period)	10 ns, nominal	
Pulse doublets	1st pulse delay	(Relative to sync out) 0 to 42 s - pulse width - 10 ns
	1st pulse width	20 ns to 42 s - delay - 10 ns
	2nd pulse delay	0 to 42 s - (delay1 + width2) - 10 ns
	2nd pulse width	20 ns to 42 s - (delay1 + delay2) - 10 ns

Pulse train generator (Option 320)

Number of pulse patterns	2047	
On time range	20 ns to 42 s - 10 ns	
Off time range	10 ns to 42 s - 20 ns	
Signal Routing	Pulse input	PULSE IN
	Pulse sync output	SYNC OUT/TRIG 4
	Pulse video output	VIDEO OUT/TRIG 5

Remote Programming

Remote programming

Interfaces	VXI-11, HiSlip, SOCKET, USB-488, GPIB
Control languages	SCPI version 1997.0.
Code compatibility modes	E8257D PSG, N5181B MXG, N5183B MXG, N5185A MXG, N5171B EXG, N5173B EXG, R&S SMA100B
IEEE-488 functions	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E2
Keysight IO libraries	Keysight's IO Library Suite helps you quickly establish an error-free connection between your PC and instruments - regardless of the vendor.

Environmental Specifications

Environmental specifications		
Operating temperature range ⁴¹	0° to 55 °C	
Storage temperature range	-40 to 70 °C	
Altitude ⁴¹	0 to 4600 m (15,000 ft)	
Humidity	Relative humidity - type tested at 95%, +40 °C (non-condensing)	
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.	
Safety	Complies with European Low Voltage Directive 2006/95/EC	IEC/EN 61010-1 ⁴² Canada: CSA C22.2 No. 61010-1 USA: UL std no. 61010-1 German Acoustic statement Acoustic noise emission LpA < 77 dB ⁴³ Operator position Normal position Per ISO 7779
	Complies with European EMC Directive 2004/108/EC	Geraeuschemission LpA < 77 dB ⁴³ Am Arbeitsplatz Normaler Betrieb Nach DIN 45635 t.19 IEC/EN 61326-1or IEC/EN 61326-2-1 CISPR Pub 11 Group 1, class A AS/NZS CISPR 11 ICES/NMB-001 2This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB001 du Canada.
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.	
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.	
Security	Display blanking. Removable non-volatile memory (SD card) with all user data. Operational (with limitations) without non-volatile memory (SD card).	
Self-test	Internal diagnostic routine tests most modules in a preset condition. If a module's node voltages are within acceptable limits, then the module passes the test.	
Recommended calibration cycle	12 months	

41 Maximum operating temperature is reduced to 40°C at altitudes above 12,500 ft for one channel instruments (option 001) and to 35°C at altitudes above 7,500 ft for two channel instruments (option 001 and 002).

42 AC line voltage dropouts (IEC 61000-4-11) of duration greater than 5 ms will cause the RF output to turn off until it is re-enabled by the operator, in order to protect internal hardware.

43 At ambient temperature, LpA < 54 dBA (nom).

Physical Specifications

Physical specifications

AC power requirements		100/120 VAC 50/60/400 Hz or 220/240 VAC 50/60 Hz (automatically selected)
Power consumption	Single channel (Option 001)	< 450 W typical, 1400 W maximum
	Dual channel (Option 001 and 002)	< 670 W typical, 1400 W maximum
Power switch	Green	On
	Yellow	Standby
Weight	Single channel (Option 001)	21 kg (46.3 lb), 28 kg (61.8 lb) shipping
	Dual channel (Option 001 and 002)	24.3 kg (53.6 lb), 31.3 kg (69 lb) shipping
Dimensions	Including feet, handles and connectors	104 mm H x 475 mm W x 675 mm D (4.1" H x 18.7" W x 26.6" D)
	Excluding feet, handles and connectors	89 mm H x 426 mm W x 584 mm D (3.5" H x 16.8" W x 22" D)
	Rack mounting height	2U (89 mm or 3.5")
Display	Size	190.08 mm W x 59.4 mm H, 199.2 mm diagonal (7.48" W x 2.34" H, 7.84" diagonal)
	Resolution	1280 x 400
	Colors	16.7 million

Input / Output Descriptions

Front panel connectors

RF OUTPUT	Outputs a CW or modulated output signal. Nominal output impedance is 50 Ω . Maximum reverse power is +27 dBm or 0 VDC (nom). One connector per channel. One or two channels. Option 1EM moves this connector to the rear panel. Option 520 provides a precision APC-3.5 male connector plus a 3.5 to 3.5 mm female adapter.
USB Type A (1 port)	Connector for compatible USB devices such as a power sensor, keyboard, mouse, or memory. USB 3.0.
USB Type C (2 ports)	Two high power connectors for external mixers and other compatible USB devices. Outputs 2 A at 15 V. USB 3.0.

Rear panel connectors

RF OUTPUT	Option 1EM moves all RF connectors from the front panel to the rear panel. See RF OUTPUT in the Front Panel section above.
EXT 1 IN	Drives either AM, FM, or ϕ M. Nominal input impedance is 50 Ω , 600 Ω or 100 k Ω , and polarity is selectable. BNC female. Limited to 10 MHz bandwidth. Damage levels are 6 V (10 V in exponential AM mode). One connector per channel.
EXT 2 IN	Drives either AM, FM, or ϕ M. Nominal input impedance is 50 Ω , 600 Ω or 100 k Ω and polarity is selectable. BNC female. Limited to 1 MHz bandwidth. Damage levels are 6 V (10 V in exponential AM mode). One connector per channel.
PULSE IN	Accepts input signal for external pulse modulation. Also accepts external trigger pulse input for internal pulse modulation. Nominal input impedance is 50 Ω . BNC female. Damage levels are 5 V _{rms} and 10 V _{peak} . One connector per channel.
LF OUT	Outputs the internally generated low frequency source or the modulating signal. Nominal output impedance is 50 Ω . BNC female. One connector per channel.
SWEEP OUT	Supplies a voltage proportional to the RF power or frequency sweep ranging from 0 volts at the start of sweep to +10 volts (nom) at the end of sweep, regardless of sweep width. During CW operation, supplies a voltage proportional to the output frequency, +10 volts (nom) corresponding to the maximum specified frequency. Number of pulses can be set from 101 to 1601. Output impedance: < 1 Ω (nom), can drive 2 k Ω . BNC female. One connector per channel.
STOP SWEEP IN/OUT	Reserved for future use.

Z-AXIS OUT	Reserved for future use.
SOURCE SETTLED/TRIG 1	Default behavior is Source Settled (TRIG 1 on channel 1 and channel 2 can be flexibly configured in software). This female BNC connector provides a 3.3V or 5V CMOS output trigger, indicating when the signal generator has settled to a new frequency or power level. A high indicates that the source has not settled. A low indicates that the source has settled. Nominal input/output impedance is 50 Ω . BNC female. Damage levels are $\geq +6$ V or ≤ -1 V. One connector per channel.
TRIG IN/TRIG 2	Default behavior is Trig In (TRIG 2 on channel 1 and channel 2 can be flexibly configured in software). This female BNC connector accepts a 3.3V CMOS signal, which is used for point-to-point triggering in manual sweep mode, or in a low frequency (LF) or analog (AM, FM, and ϕ M) external sweep trigger setup. Triggering can occur on either the positive or negative edge of the signal start. Nominal input/output impedance is 50 Ω . BNC female. Damage levels are $\geq +6$ V or ≤ -1 V. One connector per channel.
TRIG OUT/TRIG 3	Default behavior is Trigger Out (TRIG 3 on channel 1 can be flexibly configured in software). This female BNC connector, in step/list sweep mode, outputs a TTL signal that is high at the start of a dwell sequence or when waiting for a point trigger in manual sweep mode. The signal is low when the dwell is over or when a point trigger is received. When using LF Out, the output provides a 2 μ s pulse at the start of an LF sweep. Nominal input/output impedance is 50 Ω . BNC female. Damage levels are $\geq +6$ V or ≤ -1 V. One connector per channel.
SYNC OUT/TRIG 4	Default behavior is Pulse Sync Out, requires Option PMR (TRIG 4 on channel 1 can be flexibly configured in software). This female BNC output connector outputs a synchronizing TTL-compatible pulse signal that is nominally 50 ns wide during internal and triggered pulse modulation. Nominal input/output impedance is 50 Ω . BNC female. Damage levels are $\geq +6$ V or ≤ -1 V. One connector per channel.
VIDEO OUT/TRIG 5	Default behavior is Pulse Video Out, requires Option PMR (TRIG 5 on channel 1 can be flexibly configured in software). This female BNC output connector outputs a TTL-level compatible pulse signal that follows the output envelope in all pulse modes. Nominal input/output impedance is 50 Ω . BNC female. Damage levels are $\geq +6$ V or ≤ -1 V. One connector per channel.
EFC In	Reserved for future use.
REF OUT	Outputs 10 MHz or 100 MHz internal or external reference signal. Nominal output power greater than 10 dBm. Nominal output impedance is 50 Ω . BNC female.
REF IN	Accepts a 10 MHz or 100 MHz reference signal used to frequency lock the internal timebase; Option 1ER adds the capability to lock to a frequency from 1 MHz to 110 MHz; nominal input level -3 dBm to +20 dBm, sine or square waveform. Nominal input impedance is 50 Ω . BNC female.
2.4 GHz IN	Accepts a 2.4 GHz reference input (bypasses internal reference) in the range of -3 dBm to +20 dBm (nom). Nominal input impedance is 50 Ω . SMA female. Requires Option PCL. One connector per instrument.
2.4 GHz OUT	Outputs a 2.4 GHz reference output in the range of +15 dBm to +17 dBm (nom). Nominal output impedance is 50 Ω . SMA female. One connector per instrument.
SYNC IN	Reserved for future use.
USB Type A (2 ports)	Two connectors for compatible USB devices such as a power sensor, keyboard, mouse, or memory. USB 3.0.
USB Type B (1 port)	USB 2.0 Connector for SCPI and IVI control.
GPIO	Allows communication with GPIO devices. Micro-D 25-pin connector.
LAN	Allows 100BaseT LAN TCP/IP communication. The connector provides SCPI remote programming functionality. The LAN supports DHCP, HiSLIP, sockets SCIP, VXI-11 SCPI, connection monitoring, dynamic hostname services, and TCP keep alive. RJ-45 connector.
Removeable Memory	Provides a removeable Secure Digital (SD) card of 32 GB. The instrument can operate without SD card installed.
AC Power Input	See Physical Specifications .

Keysight Support Services

Accelerate your learning curve, enhance your test uptime, and confidently guarantee your instrument accuracy with Keysight Support Services. Keysight Services are here to support your test needs with expert technical support, instrument repair and calibration, training, alternative acquisition program options, and more.

A KeysightCare agreement provides dedicated, proactive support through a single point of contact for an extensive group of instruments, software, and solutions to ensure optimal uptime, with fast response times and resolution. Explore the services that are right for you.

Keysight Services

Offering	Benefits
KeysightCare  KEYSIGHTCARE	KeysightCare provides elevated support for Keysight instruments and software, with access to technical support experts who 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 provides a commitment to respond to your engineer's technical needs quickly. When unexpected repairs are necessary, you can count on a committed repair service turnaround time to get you back up and running.
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 lease-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 instrument uptime and confidently make accurate measurements by securing technical support, repair, and calibration services with committed response and turnaround times. High-performance instruments include 1 year of KeysightCare Assured. 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 and 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.

Related Literature

- [SG6311A PSG Configuration Guide](#)



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