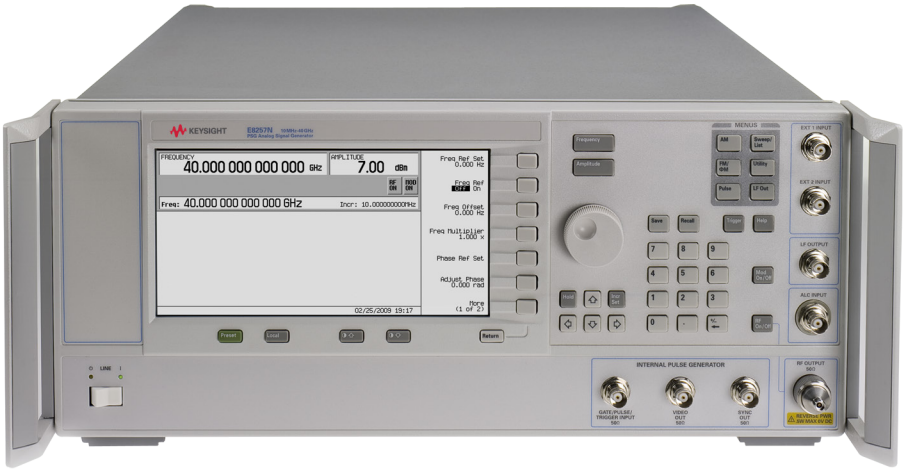
Keysight Technologies

PSG Analog Sweep Generator
E8257N

NSN 6625-01–569–7669
US Navy Contract No. N00104-15-D-D004

Data Sheet



KEYSIGHT TECHNOLOGIES

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Definitions and Conditions

The Keysight E8257N is a fully-synthesized signal generator with high output power, low phase noise, and optional ramp sweep capability.

Specifications apply over a 0 to 50 °C range, unless otherwise stated, and apply after a 45 minute warm-up time. Supplemental characteristics, denoted as typical, nominal, or measured, provide additional (non-warranted) information at 25 °C, which may be useful in the application of the product.

Unless otherwise noted, this data sheet applies to units with serial numbers ending with 55060000 or greater.

Specifications (spec): Represents warranted performance for instruments with a current calibration.

Typical (typ): Represents characteristic performance which is non-warranted; describes performance that will be met by a minimum of 80% of all products.

Nominal (nom): Represents characteristic performance which is non-warranted. Represents the value of a parameter that is most likely to occur; the expected mean or mode of all instruments at room temperature (approximately 25 °C).

Measured: Represents characteristic performance which is non-warranted. Represents the value of a parameter measured on an instrument during design verification.

Frequency and Time Specifications

Frequency		
range [1]		
Standard	10 MHz to 40 GHz	
Option 340	250 kHz to 40 GHz	
Option 550	250 kHz to 50 GHz	
Resolution		
CW	0.001 Hz	
All sweep modes [2]	0.01 Hz	
CW switching speed [3, 4, 5]		
	< 11 ms (typ)	
	7 ms (nom)	
Phase offset	**Adjustable in nominal 0.1° increments**	
Frequency bands	**Frequency range**	**N** [6]
1 (Option 340 or 550)	250 kHz to 10 MHz	1/8
1	10 MHz to 250 MHz	1/8
2	> 250 to 500 MHz	1/16
3	> 500 MHz to 1 GHz	1/8
4	> 1 to 2 GHz	1/4
5	> 2 to 3.2 GHz	1/2
6	> 3.2 to 10 GHz	1
7	> 10 to 20 GHz	2
8	> 20 to 40 GHz	4
9 (Option 550)	> 40 to 50 GHz	8
Accuracy	**± [(time since last adjustment x aging rate) + temperature effects + line voltage effects + calibration accuracy]**	
Internal timebase reference oscillator (OCXO)	**Standard**	**Option UNX**
Aging rate	< ± 1 x 10^{-9} /hr @ 25 °C ± 5 °C after 1 hr warm up	< ± 3 x 10^{-8} /yr or < ± 2.5 x 10^{-10} /day after 30 days
Temperature effects	< ± 2.0 x 10^{-6} from 0 to 50 °C	< ± 4.5 x 10^{-9} from 0 to 55 °C (typ)
Line voltage effects (typ)	< ± 2.0 x 10^{-10} for ± 10% change	< ± 2.0 x 10^{-10} for ± 10% change
External reference		
Frequency	10 MHz only	
Lock range	± 1.0 ppm	
Reference output		
Frequency	10 MHz	
Amplitude	> +4 dBm into 50 Ω load (typ)	
External reference input		
Amplitude	5 dBm ± 5 dB [7]	
Input impedance	50 Ω (nom)	

1. Operational, but unspecified, down to 100 kHz except where noted.
2. In ramp sweep mode, resolution is limited with narrow spans and slow sweep speeds. Refer to ramp sweep specifications for more information.
3. Time from GPIB trigger to frequency within 0.1 ppm of final frequency above 250 MHz or within 100 Hz below 250 MHz.
4. Add 12 ms (typical) when switching from greater than 3.2 GHz to less than 3.2 GHz.
5. With Option 1EH low band harmonic filters off. With the 1EH filters turned on, add 4 ms.
6. N is a factor used to help define certain specifications within the document.
7. To optimize phase noise use 5 dBm ± 2 dB.

Step (digital) sweep		
Operating modes		
Standard and Option 340	Step sweep of frequency or amplitude or both (start to stop)	
Option 340 only	List sweep of frequency or amplitude or both (arbitrary list)	
Sweep range		
Frequency sweep	Within instrument frequency range	
Amplitude sweep	Within attenuator hold range (see “Output” section)	
Dwell time	**1 ms to 60 s**	
Number of points	**Standard**	**Option 340**
Step sweep	2 to 65535	2 to 65535
List sweep		2 to 1601 per table
Triggering	**Auto, external, single, or GPIB**	
Settling time		
Frequency	< 9 ms (typ) [1]	
Amplitude	< 5 ms (typ)	

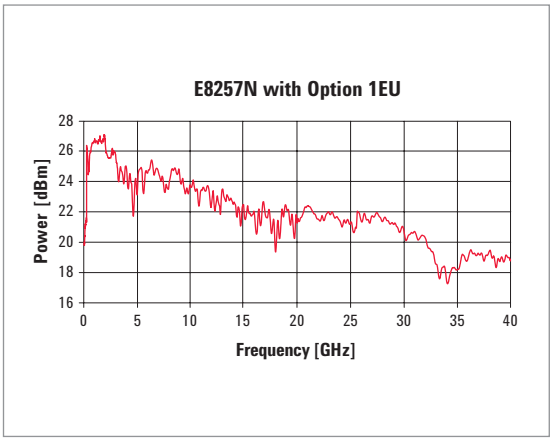
1. 19 ms (typ) when stepping from greater than 3.2 GHz to less than 3.2 GHz.

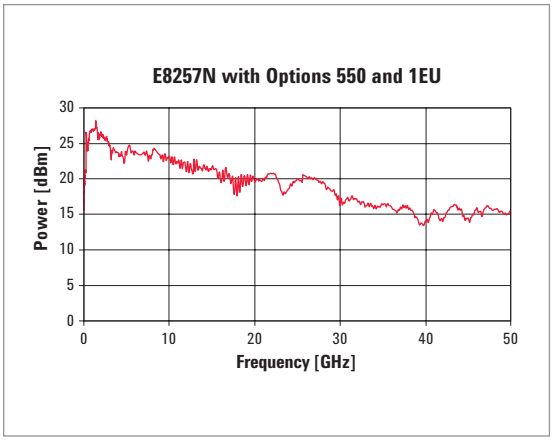
Ramp (analog) sweep [1]			
Operating modes			
	– Synthesized frequency sweep (start/stop), (center/span), (swept CW) – Power (amplitude) sweep (start/stop) – Manual sweep – RPG control between start and stop frequencies – Alternate sweep – Alternates successive sweeps between current and stored states		
Sweep span range	**Settable from minimum** [2] **to full range**		
Maximum sweep rate	**Start frequency**	**Maximum sweep rate**	**Max span for 100 ms sweep**
Option 340 only	250 kHz to < 0.5 GHz	25 MHz/ms	2.5 GHz
Standard and Option 340	10 MHz to < 0.5 GHz	25 MHz/ms	2.5 GHz
	0.5 to < 1 GHz	50 MHz/ms	5 GHz
	1 to < 2 GHz	100 MHz/ms	10 GHz
	2 to < 3.2 GHz	200 MHz/ms	20 GHz
	≥ 3.2 GHz	400 MHz/ms	40 GHz
Frequency accuracy			
(Option 340 only)	± 0.05% of span ± timebase (at 100 ms sweep time, for sweep spans less than maximum values given above). Accuracy improves proportionally as sweep time increases [3]		
Frequency resolution			
For sweep width < 20 GHz	< 0.1%		
For sweep width ≥ 20 GHz	< 0.2%		
Sweep time (forward sweep, not including band switch and retrace intervals)			
Manual mode	Settable 10 ms to 200 seconds		
Resolution	1 ms		
Auto mode	Set to minimum value determined by maximum sweep rate and 8757D setting		
Triggering	**Auto, external, single, or GPIB**		
Markers	**10 independent continuously variable frequency markers**		
Display	Z-axis intensity or RF amplitude pulse		
Functions	M1 to center, M1/M2 to start/stop, marker delta		
Two-tone (master/slave) measurements [4] **(Option 340)**	**Two PSGs can synchronously track each other, with independent control of start/stop frequencies**		
Network analyzer compatibility			
Option 340	Keysight 8757D scalar network analyzer. Also useable with Keysight 8757A/C/E scalar network analyzers for making basic swept measurements. [5]		

1. During ramp sweep operation, AM, FM, phase modulation, and pulse modulation are useable but performance is not guaranteed.
2. Minimum settable sweep span is proportional to carrier frequency and sweep time. Actual sweep span may be slightly different than desired setting for spans less than [0.00004% of carrier frequency or 140 Hz] x [sweep time in seconds]. Actual span will always be displayed correctly.
3. Typical accuracy for sweep times > 100 ms can be calculated from the equation: [(0.005% of span)/(sweep time in seconds)] ± timebase. Accuracy is not specified for sweep times < 100 ms.
4. For master/slave operation use Keysight part number 8120–8806 master/slave interface cable.
5. GPIB system interface is not supported with 8757A/C/E, only with 8757D. As a result, some features of the 8757A/C/E, such as frequency display, pass-through mode, and alternate sweep, do not function with the PSG signal generators.

Output			
Minimum settable output power	**Standard**	**Option 340**	**Option 550**
250 kHz to < 10 MHz		–135 dBm	–110 dBm
10 MHz to 40 GHz	–105 dBm	–135 dBm	–110 dBm
> 40 to 50 GHz			–110 dBm

Maximum output power (dBm) [1, 2]	**Spec (Typ)**	
Standard	**Standard**	**Option 1EU**
10 to 250 MHz (Option 1EH filters on)	+10	+11 (+14)
> 250 MHz to 2 GHz (Option 1EH filters on)	+10	+13 (+15)
250 kHz to 10 MHz (Option 340)	+10	+11 (+14)
> 10 to < 60 MHz	+10	+13 (+16)
60 to 250 MHz	+10	+18 (+19)
> 250 MHz to 3.2 GHz[3]	+10	+20 (+22)
> 3.2 to 17 GHz	+10	+17 (+20)
> 17 to 18 GHz	+10	+14 (+17)
> 18 to 37 GHz	+7	+14 (+17)
> 37 to 40 GHz	+7	+12 (+16)
Option 550	**Standard**	**Option 1EU**
10 to 250 MHz (Opt 1EH filters on)	+5	+10 (+13)
> 250 MHz to 2 GHz (Opt 1EH filters on)	+5	+12 (+14)
250 kHz to 10 MHz	+5	+10 (+13)
> 10 to < 60 MHz	+5	+12 (+15)
60 to 250 MHz	+5	+17 (+18)
> 250 MHz to 3.2 GHz [3]	+5	+19 (+22)
> 3.2 to 10 GHz	+4	+13 (+20)
> 10 to 20 GHz	+4	+13 (+16)
> 20 to 30 GHz	+3	+9 (+16)
> 30 to 50 GHz	+3	+9 (+12)

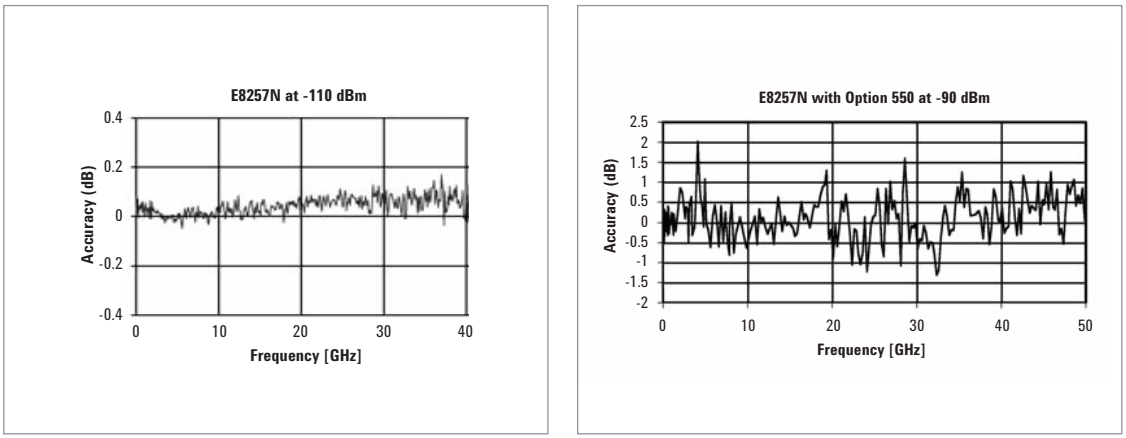




Maximum output power (measured)

1. Maximum power specifications are warranted from 15 to 35 °C, and are typical from 0 to 15 °C. Maximum power over the 35 to 55 °C range typically degrades less than 2 dB.
2. With Option 1EH low-pass filters below 2 GHz switched off, unless otherwise specified.
3. With Option 1EH low-pass filters below 2 GHz switched off. With filters on, this specification applies above 2 GHz.

Step attenuator [1]			
Standard	0 dB and 5 dB to 115 dB in 10 dB steps		
With Optimize S/N On [2] (Opt 1EU)	0 dB to 115 dB in 5 dB steps		
Option 550	0 dB to 90 dB in 10 dB steps		
Attenuator hold range minimum	**From –20 dBm to maximum specified output power with step attenuator in 0 dB position; can be offset using attenuator**		
Amplitude switching speed			
ALC On	< 6 ms (typ) [3]		
ALC Off	< 10 ms (typ) (not including power search) [4]		
Level accuracy [5] (dB)	**Standard**	**Option 1EU**	
Standard	**+10 to –90 dBm**	**+20 to –90 dBm**	**< –90 to –105 dBm**
250 kHz to 10 MHz [2] (Option 340)	± 1.5 dB	± 1.5 dB	Additional 0.2 dB/10 dB step
> 10 MHz to 20 GHz	± 1.5 dB	± 1.5 dB	Additional 0.2 dB/10 dB step
> 20 to 40 GHz	± 2.0 dB	± 2.0 dB	Additional 0.2 dB/10 dB step
Option 550	**+5 to –90 dBm**	**+19 to –90 dBm**	**< –90 to –105 dBm**
250 kHz to 2 GHz [6]	± 1.5 dB	± 1.5 dB	Additional 0.2 dB/10 dB step
> 2 GHz to 20 GHz	± 1.5 dB	± 1.5 dB	Additional 0.2 dB/10 dB step
> 20 GHz to 40 GHz	± 2.0 dB	± 2.0 dB	Additional 0.2 dB/10 dB step
> 40 GHz to 50 GHz	± 2.5 dB	± 2.5 dB	
Flatness	**± 1.5 dB measured at 0 dBm**		



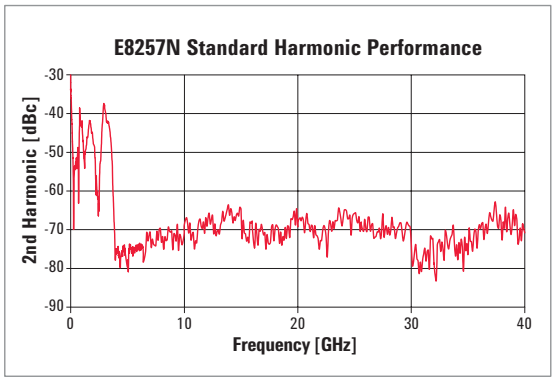
Level accuracy (measured)

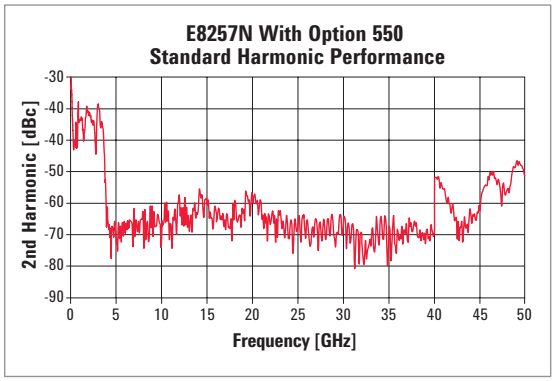
1. The step attenuator provides coarse power attenuation to achieve low power levels. Fine power level adjustment is provided by the ALC (automatic level control) within the attenuator hold range.
2. With attenuator in auto mode. Optimize S/N mode provides improved signal/noise performance and is included with Option 1EU models. Specs in the following sections (such as level accuracy, spectral purity, modulation, etc.) are only tested with optimize S/N mode turned off.
3. To within 0.1 dB of final amplitude within one attenuator range.
4. To within 0.5 dB of final amplitude within one attenuator range. Add up to 50 ms when using power search.
5. Specifications apply in CW and list/step sweep modes over the 15 to 35 °C temperature range with the ALC on. Degradation outside this range, for power levels > –10 dBm, is typically < 0.3 dB. In ramp sweep mode, specifications are typical. For instruments with Type-N connectors, specifications are degraded typically 0.2 dB above 18 GHz. Specifications do not apply above the maximum specified power.
6. When Option UNX low phase noise mode is on, specifications below 250 MHz apply only when Option 1EH low-pass filters below 2 GHz are on. With Option 1EH low-pass filters below 2 GHz off, accuracy is typically ± 2 dB.

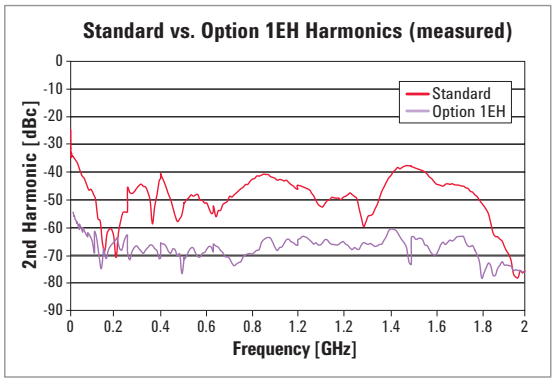
Resolution	**0.01 dB**	
Temperature stability	**0.02 dB/°C (typ)** [1]	
User flatness correction		
Number of points	2 to 1601 points/table	
Number of tables	Up to 10,000, memory limited	
Path loss	Arbitrary, within attenuator range	
Entry modes	Remote power meter [2], remote bus, manual (user edit/view)	
Output impedance	**50 Ω (nom)**	
SWR (internally leveled)	**Standard**	**Option 340**
250 kHz to 10 MHz		< 2.0:1 (typ)
10 MHz to 40 GHz	< 2.0:1 [3]	< 2.0:1 [3]
> 40 to 50 GHz (Opt 550 only)		< 2.0:1(typ)
Leveling modes		
Standard	Internal leveling, external detector leveling, ALC off	
Options 340 or 550	Keysight 8355xA millimeter source module	
External detector leveling		
Range	–0.2 mV to –0.5 V (nom) (–36 dBm to +4 dBm using Keysight 33330D/E detector)	
Bandwidth	Selectable 0.1 to 100 kHz (nom) (Note: not intended for pulsed operation)	
Maximum reverse power	**1/2 Watt, 0 V_{DC}**	
Adjustable RF output limit (Option 1EU only)		
Function	Protects external devices by limiting maximum RF output. Operates in all leveling modes (internal, external, source module)	
Range	User-adjustable from +15 dBm to maximum output power	
Accuracy	+15 to +20 dBm: ± 1 dB (typ)	
Resolution	1 dB	
Response time	30 µsec (measured)	
Adjustment	Can be locked to prevent accidental change	

1. Option 550: 0.03 dB/°C (typ) above 2 GHz.
2. Compatible with Keysight EPM/EPM-P Series power meters.
3. SWR specification applies at –20 dBm output power

Spectral purity		
Harmonics [1] (dBc at +10 dBm or maximum specified output power, whichever is lower)		
Frequency	Standard	Option 340
250 kHz to 1 MHz		–25 dBc (typ)
> 1 to 10 MHz		–25 dBc
> 10 MHz to 2 GHz	–30 dBc	–30 dBc
> 10 MHz to 50 MHz (w/Option 1EH filters on)		–45 dBc [2]
> 50 MHz to 2 GHz (w/Option 1EH filters on)		–55 dBc [2]
> 2 to 20 GHz	–50 dBc	–55 dBc
> 20 to 50 GHz (Option 550 only)		–50 dBc (typ)







Harmonics (measured)

1. Specifications are typical for harmonics beyond specified frequency range. Specifications are with Option 1EH low-pass filters below 2 GHz off and Option UNX low phase noise mode off, unless noted.
2. Below 250 MHz in ramp sweep mode, Option 1EH filters are always off. Refer to harmonic specification with filters off.

Sub-harmonics [1] (dBc at +10 dBm or maximum specified output power, whichever is lower)				
Frequency	**Standard**	**Option 340**		
250 kHz to 10 MHz		None		
10 MHz to 2 GHz	–30 dBc	None		
> 2 GHz to 10 GHz	–50 dBc	None		
> 10 GHz to 20 GHz	–50 dBc	–60 dBc		
> 20 GHz	–40 dBc	–50 dBc		
Non-harmonics [2] (dBc at +10 dBm or maximum specified output power, whichever is lower, for offsets > 10 kHz [> 3 kHz with Option 340; > 300 Hz with Option UNX]) [3]				
Frequency	**Standard**	**Option 340 Spec/(Typ)**		
10 MHz to 2 GHz	–40 dBc			
> 2 GHz to 20 GHz	–55 dBc			
> 20 to 40 GHz	–45 dBc			
250 kHz to 250 MHz		–65 dBc (–72) [4]		
1 to 250 MHz (Option UNX low phase noise mode)		–80 dBc (–88)		
> 250 MHz to 1 GHz		–80 dBc (–88)		
> 1 to 2 GHz		–74 dBc (–82)		
> 2 to 3.2 GHz		–68 dBc (–76)		
> 3.2 to 10 GHz		–62 dBc (–70)		
> 10 to 20 GHz		–56 dBc (–64)		
> 20 to 40 GHz		–50 dBc (–58)		
> 40 GHz (Option 550 only)		–44 dBc (–52)		
Residual FM (RMS, 50 Hz to 15 kHz bandwidth)				
Mode	**Standard**	**Option 340**		
CW	< 500 Hz	< N x 6 Hz (typ)		
CW (with Option UNX)		< N x 4 Hz (typ)		
Ramp sweep		< N x 1 kHz (typ)		
Residual AM	**< 1.0% peak**	**< 1.0% peak**		
Broadband noise (CW mode at +10 dBm or maximum specified output power, whichever is lower, for offsets > 10 MHz)				
Frequency	**Standard**	**Option 340**		
10 MHz to 20 GHz		< –148 dBc/Hz (typ)		
> 20 to 40 GHz		< –141 dBc/Hz (typ)		
> 40 GHz (Option 550 only)		< –135 dBc/Hz (typ)		
Measured RMS jitter [5] (Option 340 only)				
Standard carrier frequency	**SONET/SDH data rates**	**RMS jitter bandwidth**	**Unit intervals (µUI)**	**Time (fs)**
155 MHz	155 MB/s	100 Hz to 1.5 MHz	30	190
622 MHz	622 MB/s	1 kHz to 5 MHz	27	43
2.488 GHz	2488 MB/s	5 kHz to 20 MHz	84	34
9.953 GHz	9953 MB/s	10 kHz to 80 MHz	222	22
39.812 GHz	39812 MB/s	40 kHz to 320 MHz	804	21
Option UNX carrier frequency	**SONET/SDH data rates**	**RMS jitter bandwidth**	**Unit intervals (µUI)**	**Time (fs)**
155 MHz	155 MB/s	100 Hz to 1.5 MHz	7	47
622 MHz	622 MB/s	1 kHz to 5 MHz	27	43
2.488 GHz	2488 MB/s	5 kHz to 20 MHz	86	35
9.953 GHz	9953 MB/s	10 kHz to 80 MHz	197	20
39.812 GHz	39812 MB/s	40 kHz to 320 MHz	817	21

1. Sub-harmonics are defined as Carrier Freq/*(x/y), where x and y are integers, and x is not an integer multiple of y. Specifications are typical for sub-harmonics beyond specified frequency range.
2. Specifications are typical for spurs beyond specified frequency range. Specifications apply for CW mode, without modulation. In ramp sweep mode, performance is typical for offsets > 1 MHz.
3. Excluding external mechanical vibration.
4. For > 10 kHz offsets.
5. Calculated from phase noise performance in CW mode only at +10 dBm. For other frequencies, data rates, or bandwidths, please contact your sales representative.

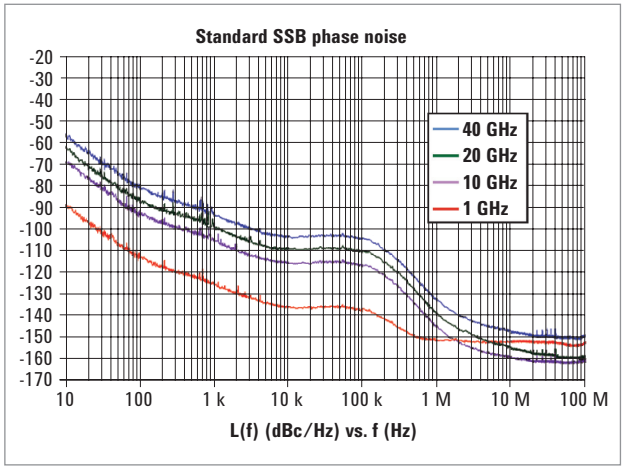
SSB phase noise (dBc/Hz) (CW) [1, 2]	Offset from carrier	
Frequency	**Standard 10 kHz spec**	**Option 340 20 kHz spec (typ)**
10 MHz to 20 GHz	–100	
> 20 to 40 GHz	–90	
250 kHz to 250 MHz		–130 (–134)
> 250 MHz to 500 MHz		–134 (–138)
> 500 MHz to 1 GHz		–130 (–134)
> 1 to 2 GHz		–124 (–128)
> 2 to 3.2 GHz		–120 (–124)
> 3.2 to 10 GHz		–110 (–113)
> 10 to 20 GHz		–104 (–108)
> 20 to 40 GHz		–98 (–102)
> 40 to 50 GHz (Option 550 only)		–92 (–96)

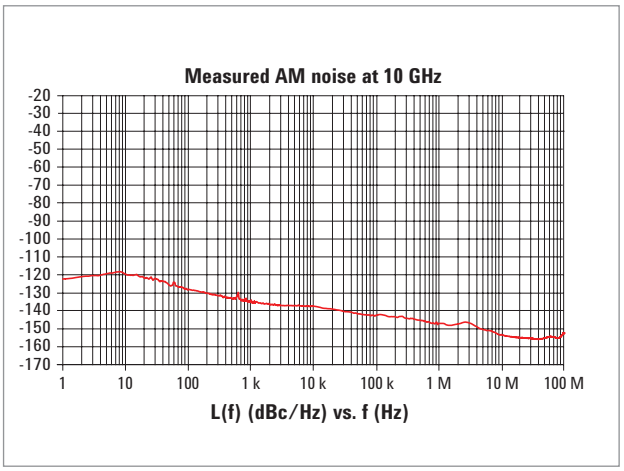
Option UNX: absolute SSB phase noise (dBc/Hz) (CW) [1, 2]	Offset from carrier					
Frequency	**1 Hz spec (typ)**	**10 Hz spec (typ)**	**100 Hz spec (typ)**	**1 kHz spec (typ)**	**10 kHz spec (typ)**	**100 kHz spec (typ)**
250 kHz to 250 MHz	–58 (–66)	–87 (–94)	–104 (–120)	–121 (–128)	–128 (–132)	–130 (–133)
> 250 to 500 MHz	–61 (–72)	–88 (–98)	–108 (–118)	–125 (–132)	–132 (–136)	–136 (–141)
> 500 MHz to 1 GHz	–57 (–65)	–84 (–93)	–101 (–111)	–121 (–130)	–130 (–134)	–130 (–135)
> 1 to 2 GHz	–51 (–58)	–79 (–86)	–96 (–106)	–115 (–124)	–124 (–129)	–124 (–129)
> 2 to 3.2 GHz	–46 (–54)	–74 (–82)	–92 (–102)	–111 (–120)	–120 (–124)	–120 (–124)
> 3.2 to 10 GHz	–37 (–44)	–65 (–72)	–81 (–92)	–101 (–109)	–110 (–114)	–110 (–115)
> 10 to 20 GHz	–31 (–38)	–59 (–66)	–75 (–87)	–95 (–106)	–104 (–107)	–104 (–109)
> 20 to 40 GHz	–25 (–32)	–53 (–60)	–69 (–79)	–89 (–99)	–98 (–101)	–98 (–103)
> 40 to 50 GHz (Option 550 only)	–20 (–26)	–47 (–56)	–64 (–73)	–84 (–90)	–92 (–95)	–92 (–97)

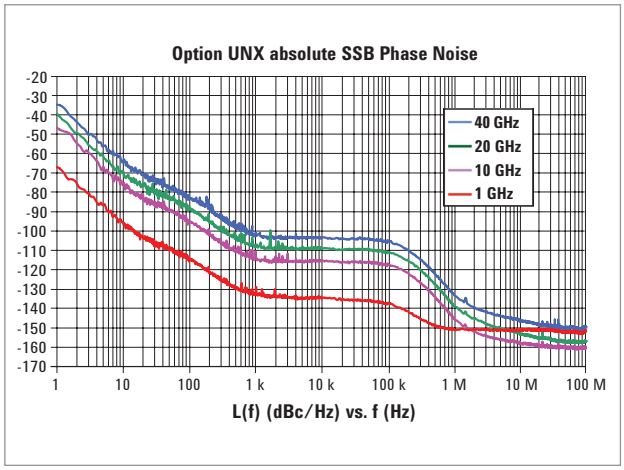
Option UNX: residual SSB phase noise (dBc/Hz) (CW) [1, 2]	Offset from carrier					
Frequency	**1 Hz spec (typ)**	**10 Hz spec (typ)**	**100 Hz spec (typ)**	**1 kHz spec (typ)**	**10 kHz spec (typ)**	**100 kHz spec (typ)**
250 kHz to 250 MHz	(–94)	–100 (–107)	–110 (–118)	–120 (–126)	–128 (–132)	–130 (–133)
> 250 to 500 MHz	(–101)	–105 (–112)	–115 (–122)	–124 (–131)	–132 (–136)	–136 (–141)
> 500 MHz to 1 GHz	(–94)	–100 (–107)	–110 (–118)	–120 (–126)	–130 (–134)	–130 (–134)
> 1 to 2 GHz	(–89)	–96 (–101)	–104 (–112)	–114 (–120)	–124 (–129)	–124 (–129)
> 2 to 3.2 GHz	(–85)	–92 (–97)	–100 (–108)	–110 (–116)	–120 (–124)	–120 (–124)
> 3.2 to 10 GHz	(–74)	(–87)	(–98)	(–106)	(–114)	(–115)

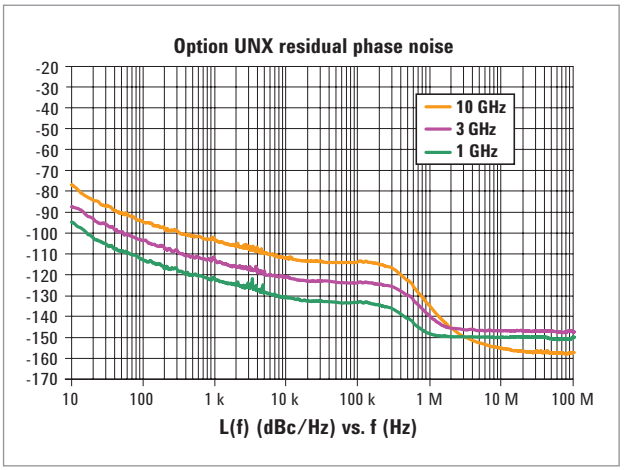
Option UNX low phase noise mode (1 to 250 MHz) absolute SSB phase noise (dBc/Hz) (CW) [1, 3]	Offset from carrier					
Frequency	**1 Hz spec (typ)**	**10 Hz spec (typ)**	**100 Hz spec (typ)**	**1 kHz spec (typ)**	**10 kHz spec (typ)**	**100 kHz spec (typ)**
1 MHz	(–109)	(–120)	(–130)	(–143)	(–150)	(–150)
10 MHz	–90 (–95)	–125 (–130)	–130 (–135)	–143 (–148)	–155 (–158)	–155 (–158)
100 MHz	–70 (–75)	–97 (–102)	–119 (–124)	–130 (–135)	–140 (–145)	–140 (–145)
250 MHz	(–76)	(–104)	(–121)	(–138)	(–142)	(–142)

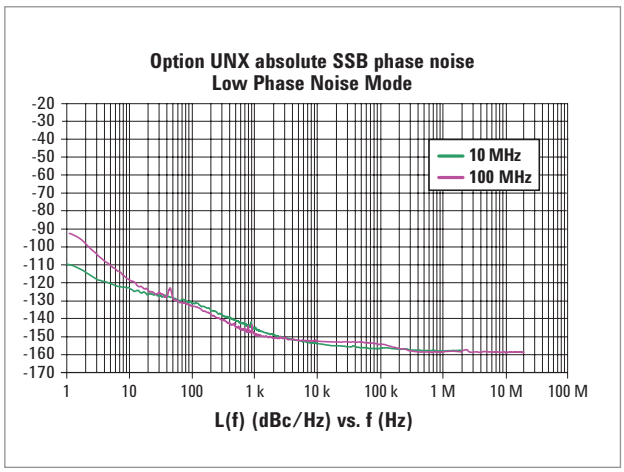
1. Phase noise specifications are warranted from 15 to 35 °C, excluding external mechanical vibration.
2. Measurement at +10 dBm or maximum specified power, whichever is less.
3. Measurement at +16 dBm or maximum specified power, whichever is less.

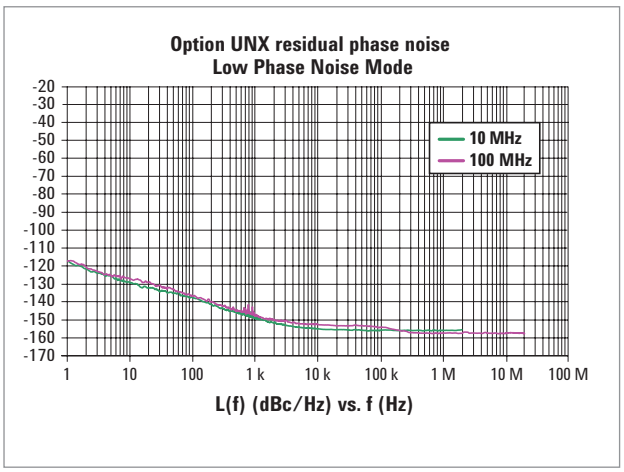












Measured phase noise (data collected with the E5500 and plotted without spurs)

Frequency modulation			
Maximum deviation [1]			
Default RF path	Frequency	Standard	Option 340
	250 kHz to < 10 MHz		2 MHz
	10 MHz to 250 MHz	2 MHz	2 MHz
	> 250 to 500 MHz	1 MHz	1 MHz
	> 500 MHz to 1 GHz	2 MHz	2 MHz
	> 1 GHz to 2 GHz	4 MHz	4 MHz
	> 2 GHz to 3.2 GHz	8 MHz	8 MHz
	> 3.2 GHz to 10 GHz	8 MHz	16 MHz
	> 10 GHz to 20 GHz	8 MHz	32 MHz
	> 20 GHz to 40 GHz	8 MHz	64 MHz
	> 40 GHz to 50 GHz (Option 550)		128 MHz
Option UNX low phase noise mode	Frequency	Max deviation	
	0.98 to 1.953 MHz	3.906 kHz	
	> 1.953 to 3.906 MHz	7.8125 kHz	
	> 3.906 to 7.813 MHz	15.625 kHz	
	> 7.813 to 15.63 MHz	31.25 kHz	
	> 15.63 to 31.25 MHz	62.5 kHz	
	> 31.25 to 62.5 MHz	125 kHz	
	> 62.5 to 125 MHz	250 kHz	
	> 125 to 250 MHz	500 kHz	
Resolution	**0.1% of deviation or 1 Hz, whichever is greater**		
Deviation accuracy	**< ± (3.5% of FM deviation + 20 Hz) (1 kHz rate, deviations < N x 800 kHz)**		
Incidental AM	**< 0.3% (for 50 Hz to 15 kHz BW)**		
Residual FM	**< 3000 Hz rms (for 50 Hz to 15 kHz BW)**		
Modulation frequency response [2] **(at 100 kHz deviation)**		**Standard**	**Option 340**
Path [coupling]	1 dB bandwidth (typ)	3 dB BW	3 dB BW (typ)
FM path 1 [DC]	DC to 100 kHz	DC to 5 MHz	DC to 10 MHz
FM path 2 [DC]	DC to 100 kHz	DC to 1 MHz	DC to 1 MHz
FM path 1 [AC]	20 Hz to 100 kHz	10 Hz to 5 MHz	5 Hz to 10 MHz
FM path 2 [AC]	20 Hz to 100 kHz	10 Hz to 1 MHz	5 Hz to 1 MHz
DC FM [3] **carrier offset**	**Standard**	**Option 340**	
		± 0.1% of set deviation + (N x 8 Hz)	
Distortion	**< 1% (1 kHz rate, deviations < N x 800 kHz)**		
Sensitivity	**± 1 V_{peak} for indicated deviation**		
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; The FM2 path is limited to a maximum rate of 1 MHz; The FM2 path must be set to a deviation less than FM1. To avoid distortion and clipping, signals applied with any combination of FM1, FM2, or FM1+FM2 should not exceed 1 V_{peak}.**		

1. Through any combination of path1, path2, or path1 + path2.
2. Specifications apply in CW and list/step sweep modes. During ramp sweep operation, 3 dB bandwidth is typically 50 kHz to 10 MHz (FM1 path) and 50 kHz to 1 MHz (FM2 path).
3. At the calibrated deviation and carrier frequency, within 5 °C of ambient temperature at time of user calibration.

Phase modulation		
Maximum deviation [1]		
Standard	**Normal BW mode (rad)**	**High BW mode (rad)**
10 MHz to 250 MHz	10	1
250 MHz to 500 MHz	10	1
> 500 MHz to 1 GHz	20	2
> 1 GHz to 2 GHz	40	4
> 2 GHz to 3.2 GHz	50	5
> 3.2 GHz to 10 GHz	50	5
> 10 GHz to 20 GHz	50	5
> 20 GHz to 40 GHz	50	5
Option 340	**Normal BW mode (rad)**	**High BW mode (rad)**
250 kHz to 10 MHz	20	2
10 MHz to 250 MHz	20	2
250 MHz to 500 MHz	10	1
> 500 MHz to 1 GHz	20	2
> 1 GHz to 2 GHz	40	4
> 2 GHz to 3.2 GHz	80	8
> 3.2 GHz to 10 GHz	160	16
> 10 GHz to 20 GHz	320	32
> 20 GHz to 40 GHz	640	64
Option 550 only	**Normal BW mode (rad)**	**High BW mode (rad)**
> 40 GHz to 50 GHz	1280	128
Option UNX low phase noise mode	**Normal BW mode (rad)**	**High BW mode (rad)**
> 0.98 to 1.953 MHz	0.03906	0.003906
> 1.953 to 3.906 MHz	0.078125	0.0078125
> 3.906 to 7.813 MHz	0.15625	0.015625
> 7.813 to 15.63 MHz	0.3125	0.03125
> 15.63 to 31.25 MHz	0.625	0.0625
> 31.25 to 62.5 MHz	1.25	0.125
> 62.5 to 125 MHz	2.5	0.25
> 125 to 250 MHz	5	0.5

1. Through any combination of path1, path2, or path1 + path2.

Resolution	**0.1% of set deviation**	
Deviation accuracy	**< ± 5% of deviation + 0.01 radians (1 kHz rate, normal BW mode)**	
Modulation frequency response [1]	**Normal BW mode**	**High BW mode**
Rates (3 dB BW)	DC to 100 kHz	DC to 1 MHz (typ) [2]
Distortion	**< 1% (1 kHz rate, total harmonic distortion (THD), deviation < N x 80 rad, normal BW mode)**	
Sensitivity	**± 1 V_{peak} for indicated deviation**	
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. The ΦM2 path is limited to a maximum rate of 1 MHz. The ΦM2 path must be set to a deviation less than ΦM1. To avoid distortion and clipping, signals applied with any combination of ΦM1, ΦM2, or ΦM1 + ΦM2 should not exceed 1 V_{peak}.**	
Amplitude modulation [3, 4, 5]		
Depth	**Standard and Option 340 Linear mode**	**Option 340 only Exponential (log) mode (typ) (downward modulation only)**
ALC On	> 90%	> 20 dB
ALC Off with Power Search [6] or ALC On with Deep AM [7]	> 90%	> 50 dB [8]
Settable	0 to 100%	0 to 40 dB
Sensitivity	0 to 100%/V	0 to 40 dB/V
Resolution	0.1%	0.01 dB
Depth accuracy		
ALC On, 1 kHz rate	± (6% of setting + 1%)	± (2% of setting + 0.2 dB)
External input (selectable polarity)		
Sensitivity for indicated depth	1 V peak	–1 V or +1 V
Maximum allowable	± 1 volt	± 3.5 volts [9]
Rates (3 dB bandwidth, 30% depth)		
DC coupled	0 to 100 kHz	
AC coupled	10 Hz to 100 kHz (useable to 1 MHz) [10]	
Distortion (1 kHz rate, ALC on, linear mode, total harmonic distortion)		
Depth	**Standard**	**Option 340**
30% AM		< 1.5% (typ)
50% AM	< 5%	< 5%
60% AM		< 2% (typ)
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**	

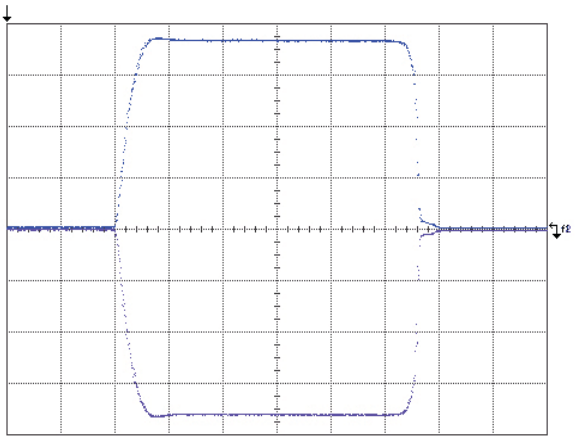
1. Specifications apply in CW and list/step sweep modes. During ramp sweep operation, 3 dB bandwidth is typically 50 kHz to 1 MHz (high BW mode)
2. Path 1 is useable to 4 MHz for external inputs less than 0.3 V peak, useable to 8 MHz for external inputs less than 0.1 V peak.
3. For carrier frequencies below 2 MHz, AM is useable but not specified. Unless otherwise stated, specifications apply with ALC on and envelope peaks within ALC operating range (–20 dBm to maximum specified power, excluding step-attenuator setting).
4. With Option UNX low phase noise mode on, AM is useable but not recommended or specified below 250 MHz.
5. AM specifications apply for frequencies ≥ 10 MHz.
6. ALC off is used for narrow pulse modulation and/or high AM depths, with envelope peaks below ALC operating range. Carrier power level will be accurate after a Power Search is executed.
7. ALC on with deep AM provides high AM depths together with closed-loop internal leveling. This mode must be used with a repetitive AM waveform (frequency > 10 Hz) with peaks > –5 dBm (nominal, excluding step-attenuator setting).
8. Modulation depths greater than 40 dB require an external input greater than ±1 volt, and are not available with the internal modulation source.
9. If a 600 Ω input impedance is selected, maximum input voltage is ± 6 volts.
10. For Option 550, maximum rate is 80 kHz from 20 GHz to 40 GHz.

External modulation inputs (Ext1 & Ext2)		
Modulation types	AM, FM, and ΦM	
Input impedance	50 or 600 Ω (nom) switched	
High/low indicator	100 Hz to 10 MHz BW, activated when input level error exceeds 3% (nom), ac coupled inputs only	
Internal modulation source		
Waveforms	**Standard**	**Option 340**
	Sine	Sine, square, positive ramp, negative ramp, triangle, Gaussian noise, uniform noise, swept sine, dual sine [1]
Rate range		
Sine	0.5 Hz to 100 kHz	0.5 Hz to 1 MHz
Square, ramp, triangle		0.5 Hz to 100 kHz
Resolution	0.5 Hz	0.5 Hz
Accuracy	Same as timebase	Same as timebase
LF out (Option 340 only)		
Output		Internal1 or internal2; also provides monitoring of internal1 or internal2 when used for AM, FM, or ΦM.
Amplitude		0 to 3 V_{peak}, (nom) into 50 Ω
Output impedance		50 Ω (nom)
Swept sine mode (Option 340 only)		**(frequency, phase continuous)**
Operating modes		Triggered or continuous sweeps
Frequency range		1 Hz to 1 MHz
Sweep rate		0.5 to 100,000 sweeps/s, equivalent to sweep times 10 µs to 2 s
Resolution		0.5 Hz (0.5 sweep/s)

1. Internal2 is not available when using swept sine or dual sine modes.

Pulse modulation [1]		
On/off ratio	**Standard**	**Option 340**
	80 dB	80 dB
Rise/fall times (Tr, Tf)		
10 to < 50 MHz	20 ns	20 ns
50 MHz to 400 MHz	20 ns	15 ns (10 ns typ)
> 400 MHz	20 ns	10 ns (6 ns typ)
Minimum pulse width		
ALC on	1 µs	1 µs
ALC off with power search [2]		
10 to < 50 MHz	100 ns	40 ns
50 MHz to 400 MHz	100 ns	30 ns
> 400 MHz to 3.2 GHz	100 ns	20 ns
> 3.2 GHz	25 ns	20 ns
Repetition frequency		
ALC on	10 Hz to 500 kHz	10 Hz to 500 kHz
ALC off with power search	dc to 1 MHz	dc to 10 MHz
Level accuracy		
ALC on [2]		
50 MHz to 3.2 GHz		± 0.5 dB
> 3.2 GHz		± 0.5 dB (0.15 dB typ)
ALC Off with power search [3]		
50 MHz to 3.2 GHz		± 0.7 dB (typ)
> 3.2 GHz		± 0.5 dB (typ)
Width compression (RF width relative to video out)		**± 5 ns (typ)**
Video feed-through [4]		
50 MHz to 250 MHz		< 3% (typ)
> 250 to 400 MHz		< 11% (typ)
> 0.4 to 3.2 GHz		< 6% (typ)
> 3.2 GHz		< 2 mV (typ)
Video delay (ext input to video)		**50 ns (nom)**
RF delay (video to RF output)		
50 MHz to 250 MHz		35 ns (nom)
> 250 MHz to 3.2 GHz		25 ns (nom)
> 3.2 GHz		30 ns (nom)
Pulse overshoot	< 15% (typ)	< 10% (typ)
Input level	+1 V_{peak} = RF on	+1 V_{peak} = RF on
Input impedance	50 Ω (nom)	50 Ω (nom)

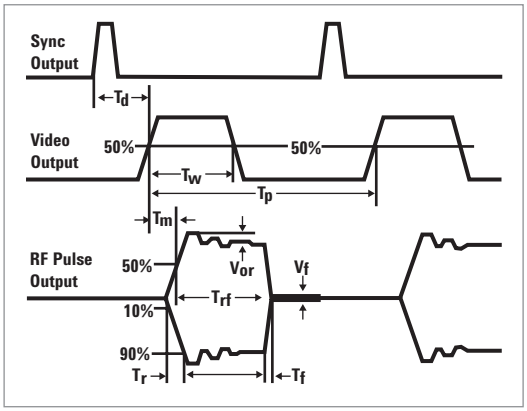
1. With ALC off, specs apply after the execution of power search. Specifications apply with Atten Hold Off, or ALC level between –5 and +10 dBm or maximum specified power, whichever is lower.
2. ± 0.7 dB for pulse width < 2us
3. Power search is a calibration routine that improves level accuracy with ALC off. The instrument microprocessor momentarily closes the ALC loop to find the modulator drive setting necessary to make the quiescent RF level equal to an entered value, then opens the ALC loop while maintaining that modulator drive setting. When executing power search, RF power will be present for typically 10 to 50 ms; the step attenuator can be set to automatically switch to maximum attenuation to protect sensitive devices. Power search can be configured to operate either automatically or manually at the carrier frequency, or over a user definable frequency range.
4. With 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.



Measured pulse modulation envelope
Frequency = 9 GHz, amplitude = 10 dBm, ALC = off, 10 ns/div

Internal pulse generator	
Modes	Free-run, triggered, triggered with delay, doublet, and gated; triggered with delay, doublet, and gated require external trigger source
Period (PRI) (Tp)	70 ns to 42 s (repetition frequency: 0.024 Hz to 14.28 MHz)
Pulse width (Tw)	10 ns to 42 s
Delay (Td)	
Free-run mode	0 to ± 42 s
Triggered with delay and doublet modes	5 ns to 42 s with ± 10 ns jitter
Delay accuracy	10 ns or 10% of setting
Resolution	10 ns (width, delay, and PRI)
Sync pulse output rise time	< 50 ns

- Td video delay (variable)
- Tw video pulse width (variable)
- Tp pulse period (variable)
- Tm RF delay
- Trf RF pulse width
- Tf RF pulse fall time
- Tr RF pulse rise time
- Vor pulse overshoot
- Vf video feedthrough



Simultaneous modulation

All modulation types (FM, AM, ΦM, and pulse modulation) may be simultaneously enabled except: FM with ΦM, and linear AM with exponential AM. AM, FM, and ΦM can sum simultaneous inputs from any two sources (Ext1, Ext2, internal1, or internal2). Any given source (Ext1, Ext2, internal1, or internal2) may be routed to only one activated modulation type.

Remote programming

	Standard	Option 340
Interfaces	GPIB (IEEE–488.2, 1987)	GPIB (IEEE–488.2, 1987) RS–232 10BaseT LAN interface
Control languages	SCPI version 1997.0	SCPI version 1997.0. Completely code compatible with previous PSG signal generator models: E8241A E8244A E8251A E8254A E8247C E8257C The E8257N Option 340 will emulate the applicable commands for the following signal generators, providing general compatibility with ATE systems: 8340 Series (8340/41B) 8360 Series (836xxB/L) 83700 Series (837xxB) 8662A/63A 8664A/8665B 8643A/44B Aeroflex 2040 Series
IEEE–488 functions	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E2	

General specifications	
Power requirements	100/120 VAC, 50/60 or 400 Hz, or 220/240 VAC, 50/60 Hz, (automatically selected); < 250 W typical, 400 W maximum
Operating temperature range	0 to 50 °C
Storage temperature range [1]	–40 to 71 °C
Altitude	0 to 4,600 m (15,000 ft.)
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 MIL-PRF–28800F Class 3 [2]
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 11/2003 Group 1 class A
Storage	Memory is shared by instrument states and sweep list files; there is 14 MB of flash memory available in the E8257N PSG; depending on how the memory is used, a maximum of 1000 instrument states can be saved
Self-test	Internal diagnostic routine tests most modules (including microcircuits) in a preset condition; for each module, if its node voltages are within acceptable limits, then the module "passes" the test
Weight	< 22 kg (48 lb.) net, < 30 kg (68 lb.) shipping
Dimensions	178 mm H x 426 mm W x 515 mm D (7" H x 16.8" W x 20.3" D)
Recommended calibration cycle	24 months
Security	
Option 340	Display blanking Memory clearing functions; see *Security Features of Keysight Technologies Signal Generators,* Part Number E4400-90621
Option 008	8 GB removable compact flash memory; all user-written files are saved to this memory card
Compatibility	
Standard	Keysight EPM/EPM-P Series power meters
Option 340	Keysight 8757D scalar network analyzer Keysight 83550 Series millimeter heads OML millimeter source modules VDI millimeter frequency extenders

1. During storage below –20 °C, instrument states may be lost.
2. As is the case with all signal generation equipment, phase noise specifications are not warranted in a vibrating environment.

Input/Output Descriptions

Front panel connectors (all connectors are BNC female unless otherwise noted) [1]	
RF output	Output impedance 50 Ω (nom)
Standard	2.9 mm (Type K) female modular connector; type N female modular connector
Option 550	2.4 mm male connector plus 2.4 mm (f) – 2.4 mm (f) and 2.4 mm (f) – 2.9 mm (f) adapters
ALC input	Used for negative external detector leveling; nominal input impedance 120 kΩ, damage level ± 15 V
LF output	Outputs the internally generated LF source; nominal output impedance 50 Ω. (Option 340 required for LF output operation)
External input 1	Drives either AM, FM, or ΦM. Nominal input impedance 50 or 600 Ω, damage levels are 5 V_{rms} and 10 V_{peak}
External input 2	Drives either AM, FM, or ΦM. Nominal input impedance 50 or 600 Ω, damage levels are 5 V_{rms} and 10 V_{peak}
Pulse/trigger gate input	Accepts input signal for external fast pulse modulation; also accepts external trigger pulse input for internal pulse modulation. Nominal impedance 50 Ω; damage levels are 5 V_{rms} and 10 V_{peak}
Pulse video out	Outputs a signal that follows the RF output in all pulse modes; TTL-level compatible, nominal source impedance 50 Ω
Pulse sync out	Outputs a synchronizing pulse, nominally 50 ns width, during internal and triggered pulse modulation; TTL-level compatible, nominal source impedance 50 Ω

1. Digital inputs and outputs are 3.3 V CMOS unless indicated otherwise. Inputs will accept 5 V CMOS, 3 V CMOS, or TTL voltage levels.

Rear panel connectors (all connectors are BNC female unless otherwise noted) [1]	
Auxiliary interface (dual mode)	Used for RS–232 serial communication and for master/slave source synchronization; (9-pin subminiature female connector); (Option 340 required for RS–232 operation)
GPIB	Allows communication with compatible devices
LAN	Allows 10BaseT LAN communication (Option 340 required for LAN operation)
10 MHz input	Accepts a 10 MHz external reference (timebase) input Nominal input impedance 50 Ω. Damage level > +10 dBm
10 MHz output	Outputs internal or external reference signal; nominal output impedance 50 Ω. Nominal output power +8 dBm
Sweep output (dual mode)	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. When connected to an Keysight 8757D scalar network analyzer, generates a selectable number of equally spaced 1 µs pulses (nom) across a ramp (analog) sweep; number of pulses can be set from 101 to 1601 by remote control from the 8757D; output impedance: < 1 Ω (nom), can drive 2 kΩ
Stop sweep in/out	Open-collector, TTL-compatible input/output; in ramp sweep operation, provides low level (nominally 0V) during sweep retrace and bandcross intervals, and high level during the forward portion of the sweep; sweep will stop when grounded externally, sweep will resume when allowed to go high
Trigger output (dual mode)	Outputs a TTL signal. High at start of dwell, or when waiting for point trigger; low when dwell is over or point trigger is received. In ramp sweep mode, provides 1601 equally-spaced 1 µs pulses (nom) across a ramp sweep. When using LF Out, provides 2 µs pulse at start of LF sweep
Trigger input	Accepts 3.3 V CMOS signal for triggering point-to-point in manual sweep mode, or to trigger start of LF sweep. Damage levels > +10 V or < –4 V
Source module interface	Keysight 83550 Series mm source modules: Provides bias, flatness correction and leveling connections. OML SxxMS-AG mm source modules: Provides power to the module and returns frequency multiplication information from the module. (Option 340 required for source module interface operation)
Source settled	Provides an output trigger that indicates when the signal generator has settled to a new frequency or power level; high indicates source not settled, low indicates source settled
Z-axis blank/markers	During ramp sweep, supplies +5 V (nom) level during retrace and bandswitch intervals; supplies –5 V (nom) level when the RF frequency is at a marker frequency
10 MHz EFC	Accepts an external DC voltage, ranging from –5 V to +5 V, for electronic frequency control (EFC) of the internal 10 MHz reference oscillator. This voltage inversely tunes the oscillator about its center frequency approximately –0.07 ppm/V. The nominal input impedance is greater than 1 MΩ. (Option UNX required for 10 MHz EFC operation)
1 GHz out	Low noise 1 GHz reference output signal, approximately +5 dBm (nom). (Option UNX required for 1 GHz out operation)
Removable flash memory drive	Accepts 8 GB compact flash memory card for optional non-volatile memory. All user information (Save/Recall settings, flatness files, presets, etc) is stored on removable memory card. (Options 340 and 008 required for removable flash memory drive operation)

1. Digital inputs and outputs are 3.3 V CMOS unless indicated otherwise. Inputs will accept 5 V CMOS, 3 V CMOS, or TTL voltage levels.

Options, Accessories, and Related Products

Model/option	Description
E8257N	Frequency range from 10 MHz to 40 GHz
E8257N-1CM	Rackmount flange kit
E8257N-1CP	Rackmount flange with front handle kit
E8257N-AXT	Hard transit case
E8257N-A6J	ANSI Z540-1-1994 compliant calibration
E8257N-340	Enhanced performance and functionality
E8257N-008 (requires Option 340)	8 GB removable flash memory
E8257N-UNX (requires Option 340)	Ultra low phase noise
E8257N-1EH (requires Option 340)	Improved harmonics below 2 GHz
E8257N-1EU (requires Option 340)	High output power
E8257N-550 (requires Options 340 and UNX)	Frequency range from 250 kHz to 50 GHz
1819-0427	8 GB compact flash memory card
1250-3699	Type-N (f) RF output adapter
1250-3700	Type-K (f) RF output adapter
8120-8806	Master/slave interface cable

Related Keysight Literature

Keysight Microwave Signal Generators Brochure,
literature number 5991-4876EN

E8257D PSG Microwave Analog Signal Generator, Data Sheet,
literature number 5989-0698EN

E8267D PSG Vector Signal Generator, Data Sheet,
literature number 5989-0697EN

E8663D PSG RF Analog Signal Generator, Data Sheet,
literature number 5990-4136EN

Millimeter Wave Source Modules from OML, Inc. for the Keysight PSG Signal Generators, Technical Overview, literature number 5989-2923EN

Security Features of Keysight Technologies Signal Generators
Part Number E4400-90621

Web Resources

For additional information, visit: **www.keysight.com/find/psg**

For more information about renting, leasing or financing Keysight's latest technology, visit: **www.keysight.com/find/buy/alternatives**

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