

# Agilent E8257D PSG Analog Signal Generator

## Data Sheet



The Agilent E8257D is a fully synthesized signal generator with high output power, low phase noise, and optional ramp sweep capability.

All specifications apply over a 0 to 55 °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.

## Definitions

**Specifications (spec):** Represents warranted performance.

**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 average.

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



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# Specifications

## Frequency

<b>Range<sup>1</sup></b>		
Option 520	250 kHz to 20 GHz	
Option 540	250 kHz to 40 GHz	
Option 550	250 kHz to 50 GHz	
Option 567	250 kHz to 67 GHz (operational up to 70 GHz)	
<b>Resolution</b>		
CW	0.001 Hz	
All sweep modes	0.01 Hz <sup>2</sup>	
<b>CW switching speed<sup>3</sup></b>		
< 10 ms (typ)		
<b>Phase offset</b>		
Adjustable in nominal 0.1 ° increments		
<b>Frequency bands</b>		
<b>Band</b>	<b>Frequency range</b>	<b>N #</b>
1	250 kHz 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	> 40 GHz	8
<b>Accuracy</b>		
Calibration ± aging rate ± temperature effects ± line voltage effects (nom)		
<b>Internal timebase reference oscillator</b>		
Aging rate	Standard	Option UNR
	< ±1 × 10 <sup>-7</sup> /year or < ±4.5 × 10 <sup>-9</sup> /day after 45 days	< ±3 × 10 <sup>-8</sup> /year or < ±2.5 × 10 <sup>-10</sup> /day after 30 days
<b>Temperature effects (typ)</b>	< ±5 × 10 <sup>-8</sup> 0 to 55 °C	< ±4.5 × 10 <sup>-9</sup> 0 to 55 °C
<b>Line voltage effects (typ)</b>	< ±2 × 10 <sup>-9</sup> for +5% to -10% change	< ±2 × 10 <sup>-10</sup> for ±10% change
<b>External reference frequency</b>		
Lock range	1, 2, 2.5, 5, 10 MHz	10 MHz only
	±0.2 ppm	±1.0 ppm
<b>Reference output</b>		
Frequency	10 MHz	
Amplitude	> +4 dBm into 50 Ω load (typ)	
<b>External reference input</b>		
Amplitude	> -3 dBm	
Option UNR	5 dBm ±5 dB <sup>4</sup>	
Input impedance	50 Ω (nom)	

- Operational, but unspecified, down to 100 kHz.
- In ramp sweep mode (Option 007), resolution is limited with narrow spans and slow sweep speeds. Refer to ramp sweep specifications for more information.
- Time from GPIB trigger to frequency within 0.1 ppm of final frequency above 250 MHz or within 100 Hz below 250 MHz.
- To optimize phase noise use 5 dBm ± 2 dB.

## Step (digital) sweep

<b>Operating modes</b>	Step sweep of frequency or amplitude or both (start to stop) List sweep of frequency or amplitude or both (arbitrary list)
<b>Sweep range</b>	
Frequency sweep	Within instrument frequency range
Amplitude sweep	Within attenuator hold range (see "Output" section)
<b>Dwell time</b>	1 ms to 60 s
<b>Number of points</b>	2 to 65535 (step sweep) 2 to 1601 per table (list sweep)
<b>Triggering</b>	Auto, external, single, or GPIB
<b>Settling time</b>	
Frequency	< 8 ms (typ) <sup>1</sup>
Amplitude	< 5 ms (typ)

## Ramp (analog) sweep (Option 007)<sup>2</sup>

<b>Operating modes</b>	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		
<b>Sweep span range</b>	Settable from minimum <sup>3</sup> to full range		
<b>Maximum sweep rate</b>	<b>Start frequency</b>	<b>Maximum sweep rate</b>	<b>Max span for 100 ms sweep</b>
	250 kHz 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
<b>Frequency accuracy</b>	± 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 <sup>4</sup>		
<b>Sweep time</b>	(forward sweep, not including bandswitch 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		
<b>Triggering</b>	Auto, external, single, or GPIB		
<b>Markers</b>	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		
<b>Two-tone (master/slave) measurements<sup>5</sup></b>	Two PSG's can synchronously track each other, with independent control of start/stop frequencies		
<b>Network analyzer compatibility</b>	Fully compatible with Agilent 8757D scalar network analyzer <sup>6</sup> Also useable with Agilent 8757A/C/E scalar network analyzers for making basic swept measurements. <sup>7</sup>		

- 19 ms (typ) when stepping from greater than 3.2 GHz to less than 3.2 GHz.
- During ramp sweep operation, AM, FM, phase modulation, and pulse modulation are useable but performance is not guaranteed.
- 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  $[0.00004\% \text{ of carrier frequency or } 140 \text{ Hz}] \times [\text{sweep time in seconds}]$ . Actual span will always be displayed correctly.
- Typical accuracy for sweep times > 100 ms can be calculated from the equation:  $[(0.005\% \text{ of span}) / (\text{sweep time in seconds})] \pm \text{timebase}$ . Accuracy is not specified for sweep times < 100 ms.
- For master/slave operation use Agilent part #8120-8806 master/slave interface cable.
- When measuring low-pass devices in AC mode, dynamic range may be reduced up to 10 dB below 3.2 GHz. An external highpass filter may be required to remove 27 kHz pulse source feed-through (11742A 45 MHz to 26.5 GHz blocking capacitor recommended).
- GPIB system interface is not supported with 8757A/C/E, only with 8757D. As a result, some features of 8757A/C/E, such as frequency display, pass-through mode, and alternate sweep, do not function with PSG signal generators.

## Output

Power <sup>1</sup> (dBm) Frequency range	Standard	Option 1EA spec. (typ)
<b>Option 520:</b>		
250 kHz to 3.2 GHz	-20 to +13	-20 to +16 (+19)
250 kHz to 3.2 GHz with Option UNW	-20 to +11	-20 to +11 (+14)
250 kHz to 3.2 GHz with Option 1EH	-20 to +13 <sup>2</sup>	-20 to +13 (+16) <sup>2</sup>
250 kHz to 3.2 GHz with Options UNW and 1EH	-20 to +10 <sup>2</sup>	-20 to +10 (+13) <sup>2</sup>
> 3.2 to 20 GHz	-20 to +13	-20 to +20 (+23)
<b>Option 540:</b>		
250 kHz to 3.2 GHz	-20 to +9	-20 to +15 (+18)
250 kHz to 3.2 GHz with Option UNW	-20 to +9	-20 to +10 (+13)
250 kHz to 3.2 GHz with Option 1EH	-20 to +9	-20 to +12 (+15) <sup>2</sup>
250 kHz to 3.2 GHz with Options UNW and 1EH	-20 to +9 <sup>2</sup>	-20 to +9 (+12) <sup>2</sup>
> 3.2 to 20 GHz	-20 to +9	-20 to +18 (+21)
> 20 to 30 GHz	-20 to +9	-20 to +14 (+20)
> 30 to 40 GHz	-20 to +9	-20 to +14 (+17)
<b>Options 550 and 567:</b>		
250 kHz to 3.2 GHz	-20 to +5	-20 to +14 (+17)
250 kHz to 3.2 GHz with Option UNW	-20 to +5	-20 to +9 (+12)
250 kHz to 3.2 GHz with Option 1EH	-20 to +5	-20 to +11 (+14) <sup>2</sup>
250 kHz to 3.2 GHz with Options UNW and 1EH	-20 to +5	-20 to +8 (+11) <sup>2</sup>
> 3.2 to 10 GHz	-20 to +5	-20 to +14 (+21)
> 10 to 20 GHz	-20 to +5	-20 to +14 (+17)
> 20 to 30 GHz	-20 to +5	-20 to +11 (+17)
> 30 to 65 GHz	-20 to +5	-20 to +11 (+14)
> 65 to 67 GHz	-20 to +5	-20 to +10 (+14)
> 67 to 70 GHz	-20 to +5 (typ)	-20 to +8 (typ)
<b>Option 520 with step attenuator (Option 1E1):</b>		
250 kHz to 3.2 GHz	-135 to +11	-135 to +15 (+18)
250 kHz to 3.2 GHz with Option UNW	-135 to +10	-135 to +10 (+13)
250 kHz to 3.2 GHz with Option 1EH	-135 to +11 <sup>3</sup>	-135 to +12 (+15) <sup>2</sup>
250 kHz to 3.2 GHz with Options UNW and 1EH	-135 to +9 <sup>2</sup>	-135 to +9 (+12) <sup>2</sup>
> 3.2 to 20 GHz	-135 to +11	-135 to +18 (+20)
<b>Option 540 with step attenuator (Option 1E1):</b>		
250 kHz to 3.2 GHz	-135 to +7	-135 to +14 (+17)
250 kHz to 3.2 GHz with Option UNW	-135 to +7	-135 to +9 (+12)
250 kHz to 3.2 GHz with Option 1EH	-135 to +7	-135 to +11 (+14) <sup>2</sup>
250 kHz to 3.2 GHz with Options UNW and 1EH	-135 to +7 <sup>3</sup>	-135 to +8 (+11) <sup>2</sup>
> 3.2 to 20 GHz	-135 to +7	-135 to +16 (+20)
> 20 to 30 GHz	-135 to +7	-135 to +12 (+18)
> 30 to 40 GHz	-135 to +7	-135 to +12 (+16)
<b>Options 550 and 567 with step attenuator (Option 1E1):</b>		
250 kHz to 3.2 GHz	-110 to +3	-110 to +13 (+16)
250 kHz to 3.2 GHz with Option UNW	-110 to +3	-110 to +8 (+11)
250 kHz to 3.2 GHz with Option 1EH	-110 to +3	-110 to +10 (+13) <sup>2</sup>
250 kHz to 3.2 GHz with Options UNW and 1EH	-110 to +3	-110 to +7 (+10) <sup>2</sup>
> 3.2 to 10 GHz	-110 to +3	-110 to +13 (+20)
> 10 to 20 GHz	-110 to +3	-110 to +13 (+16)
> 20 to 30 GHz	-110 to +3	-110 to +9 (+16)
> 30 to 65 GHz	-110 to +3	-110 to +9 (+12)
> 65 to 67 GHz	-110 to +3	-110 to +8 (+12)
> 67 to 70 GHz	-110 to +3 (typ)	-110 to +6 (typ)

1. Maximum power specification is warranted from 15 to 35 °C, and is typical from 0 to 15 °C. Maximum power over the 35 to 55 °C range typically degrades less than 2 dB.
2. With harmonic filters switched off. With filters on, maximum output power is reduced 3 dB for frequencies below 2 GHz.
3. With harmonic filters switched off. With filters on, maximum output power is reduced 2 dB for frequencies below 2 GHz.

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**Step attenuator<sup>1</sup> (Option 1E1)**

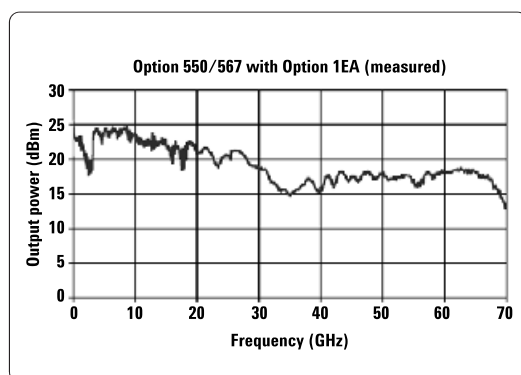
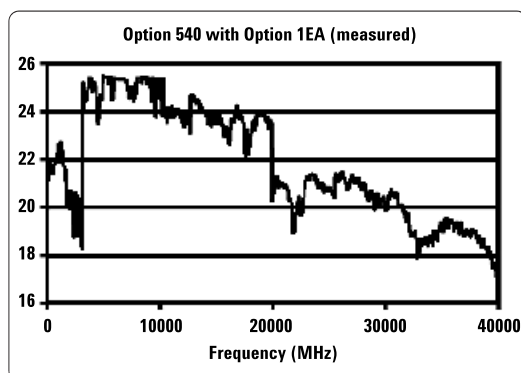
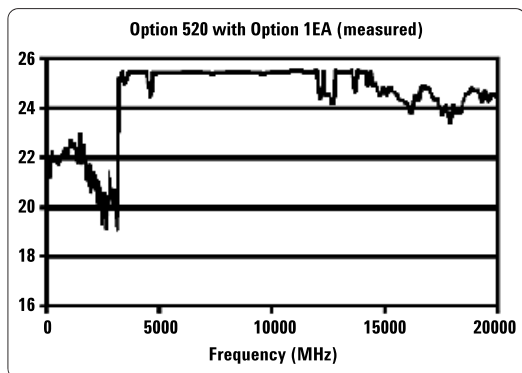
Options 520 and 540

0 dB and 5 dB to 115 dB in 10 dB steps

Options 550 and 567

0 dB to 90 dB in 10 dB steps

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**Maximum available power (measured)**

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**Attenuator hold range****Minimum**From  $-20$  dBm to maximum specified output power with step attenuator in 0 dB position. Can be offset using Option 1E1 attenuator.**Amplitude switching speed<sup>2</sup>**ALC on or off  $< 3$  ms (typ)  
(without power search)**Level accuracy<sup>3</sup> (dB)**

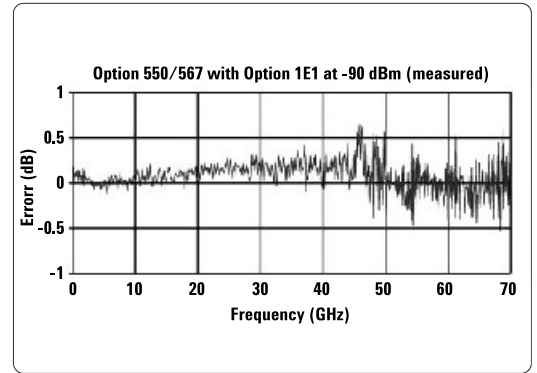
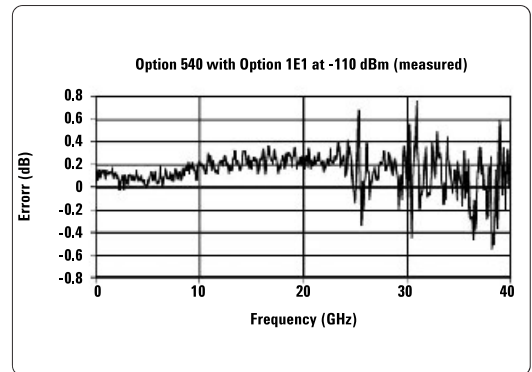
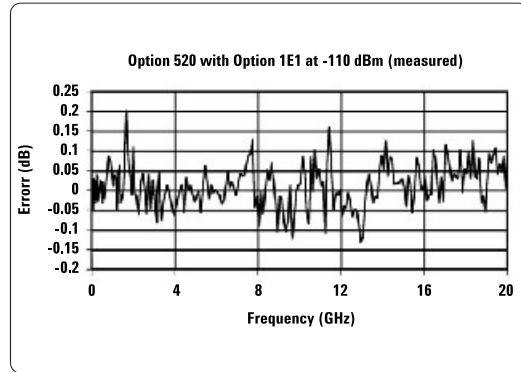
Frequency	$> +10$ dBm	$+10$ to $0$ dBm	$0$ to $-10$ dBm	$-10$ to $-20$ dBm
250 kHz to 2 GHz	$\pm 0.6$	$\pm 0.6$	$\pm 0.6$	$\pm 1.4$
2 GHz to 20 GHz	$\pm 0.8$	$\pm 0.8$	$\pm 0.8$	$\pm 1.2$
$> 20$ to 40 GHz	$\pm 1.0$	$\pm 0.9$	$\pm 0.9$	$\pm 1.3$
$> 40$ to 50 GHz	---	$\pm 1.3$	$\pm 0.9$	$\pm 1.2$
$> 50$ to 67 GHz	---	$\pm 1.5$	$\pm 1.0$	$\pm 1.2$ (typ)

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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. To within 0.1 dB of final amplitude within one attenuator range. Add 10 to 50 ms when using power search.
  3. Specifications apply in CW and list/step sweep modes over the 15 to 35 °C temperature range. Degradation outside this range, for power levels  $> -10$  dBm, is typically  $< 0.3$  dB. In ramp sweep mode (with Option 007), specifications are typical. For instruments with Type-N connectors (Option 1ED), specifications are degraded typically 0.2 dB above 18 GHz. Specifications do not apply above the maximum specified power.

**Level accuracy with step attenuator (Option 1E1)<sup>1</sup> (dB)**

Frequency	> +10 dBm	+10 to 0 dBm	0 to -10 dBm	-10 to -70 dBm	-70 to -90 dBm
250 kHz to 2 GHz	±0.6	±0.6	±0.6	±0.7	±0.8
> 2 to 20 GHz	±0.8	±0.8	±0.8	±0.9	±1.0
> 20 to 40 GHz	±1.0	±0.9	±0.9	±1.0	±2.0
> 40 to 50 GHz	---	±1.3	±0.9	±1.5	±2.5
> 50 to 67 GHz	---	±1.5	±1.0	±1.5 (typ)	±2.5 (typ)

**Level accuracy (measured)**



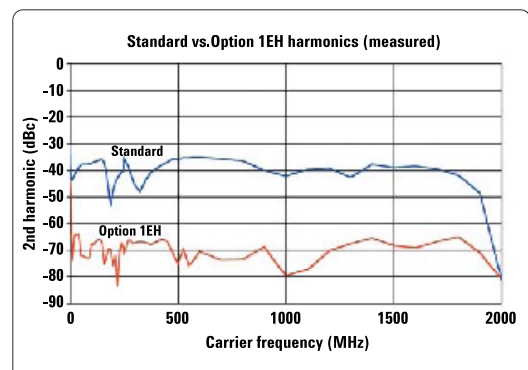
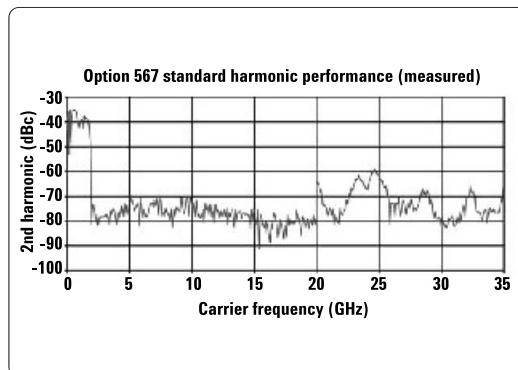
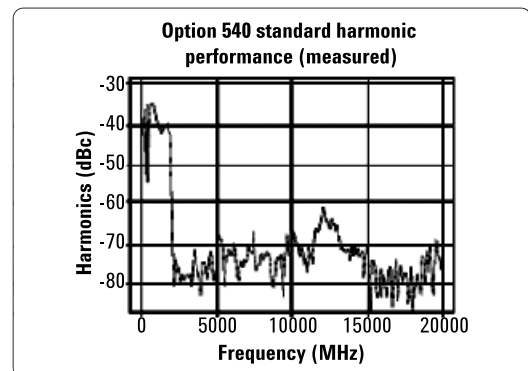
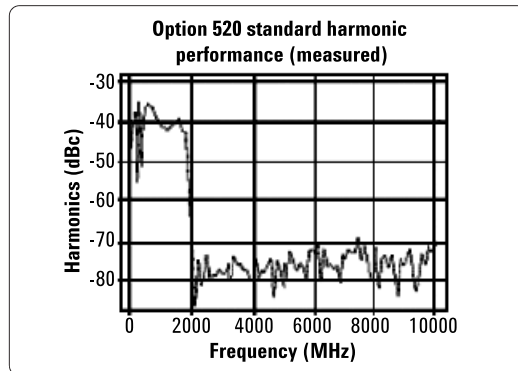
<b>Resolution</b>	0.01 dB
<b>Temperature stability</b>	0.01 dB/°C (typ) <sup>2</sup>
<b>User flatness correction</b>	
Number of points	2 to 1601 points/table
Number of tables	Up to 10,000, memory limited
Path loss	Arbitrary, within attenuator range
Entry modes	Remote power meter <sup>3</sup> , remote bus, manual (user edit/view)

1. Specifications apply in CW and list/step sweep modes over the 15 to 35 °C temperature range, with attenuator hold off (normal operating mode). Degradation outside this range, for ALC power levels > -10 dBm, is typically < 0.3 dB. In ramp sweep mode (with Option 007), specifications are typical. For instruments with type-N connectors (Option 1ED), specifications are degraded typically 0.2 dB above 18 GHz. Specifications do not apply above the maximum specified power.
2. Options 550 and 567: 0.03dB/°C (typ) above 2 GHz.
3. Compatible with Agilent EPM Series (E4418B and E4419B) power meters.

<b>Output impedance</b>	50 $\Omega$ (nom)
<b>SWR (internally leveled)</b>	
250 kHz to 2 GHz	< 1.4:1 (typ)
> 2 GHz to 20 GHz	< 1.6:1 (typ)
> 20 GHz to 40 GHz	< 1.8:1 (typ)
> 40 GHz to 67 GHz	< 2.0:1 (typ)
<b>Leveling modes</b>	Internal leveling, external detector leveling, millimeter source module, ALC off
<b>External detector leveling</b>	
Range	-0.2 mV to -0.5 V (nom) (-36 dBm to +4 dBm using Agilent 33330D/E detector)
Bandwidth	Selectable 0.1 to 100 kHz (nom) (Note: not intended for pulsed operation)
<b>Maximum reverse power</b>	1/2 Watt, 0 V <sub>DC</sub>

## Spectral purity

<b>Harmonics<sup>1</sup></b>	(dBc at +10 dBm or maximum specified output power, whichever is lower)
< 10 MHz	-28 dBc (typical below 1 MHz)
10 MHz to 2 GHz	-28 dBc <sup>2</sup>
10 MHz to 2 GHz (with Option 1EH filters on)	-55 dBc <sup>3</sup>
> 2 GHz to 20 GHz	-55 dBc
> 20 GHz to 40 GHz (Option 540)	-50 dBc (typ)
> 20 GHz to 67 GHz (Options 550 & 567)	-45 dBc (-50 dBc typical)
<b>Harmonics (measured)</b>	



1. Specifications are typical for harmonics beyond specified frequency range (beyond 50 GHz for Option 567).
2. Typical below 250 MHz if Option 1EH is installed and the filters are off.
3. In ramp sweep mode (Option 007), harmonics are -28 dBc below 250 MHz.

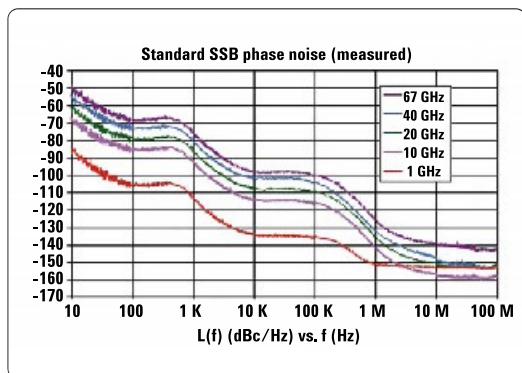


<b>Sub-harmonics</b> <sup>1</sup>	(dBc at +10 dBm or maximum specified output power, whichever is lower)			
250 kHz to 10 GHz	None			
> 10 GHz to 20 GHz	< -60 dBc			
> 20 GHz	< -50 dBc			
<b>Non-harmonics</b> <sup>2</sup>	(dBc at +10 dBm or maximum specified output power, whichever is lower, for offsets > 3 kHz [ $> 300$ Hz with Option UNR])			
<b>Frequency</b>	<b>Spec</b>	<b>Typical</b>		
250 kHz to 250 MHz	-65	-72 for > 10 kHz offsets		
> 250 MHz to 1 GHz	-80	-88		
> 1 to 2 GHz	-74	-82		
> 2 to 3.2 GHz	-68	-76		
> 3.2 to 10 GHz	-62	-70		
> 10 to 20 GHz	-56	-64		
> 20 to 40 GHz	-50	-58		
> 40 GHz	-44	-52		
<b>SSB phase noise (CW)</b>	Offset from carrier (dBc/Hz)			
<b>Frequency</b>	<b>20 kHz</b>	<b>20 kHz (typ)</b>		
250 kHz to 250 MHz <sup>3</sup>	-130	-134		
> 250 to 500 MHz <sup>3</sup>	-134	-138		
> 500 MHz to 1 GHz <sup>3</sup>	-130	-134		
> 1 to 2 GHz <sup>3</sup>	-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 67 GHz	-92	-96		
<b>Option UNR: Enhanced SSB phase noise (CW)</b>	Offset from carrier (dBc/Hz)			
<b>Frequency</b>	<b>100 Hz</b>	<b>1 kHz</b>	<b>10 kHz</b>	<b>100 kHz</b>
	spec (typ)	spec (typ)	spec (typ)	spec (typ)
250 kHz to 250 MHz <sup>3</sup>	-94 (-115)	-110 (-123)	-128 (-132)	-130 (-133)
> 250 to 500 MHz <sup>3</sup>	-100 (-110)	-124 (-130)	-132 (-136)	-136 (-141)
> 500 MHz to 1 GHz <sup>3</sup>	-94 (-104)	-118 (-126)	-130 (-135)	-130 (-135)
> 1 to 2 GHz <sup>3</sup>	-88 (-98)	-112 (-120)	-124 (-129)	-124 (-129)
> 2 to 3.2 GHz	-84 (-94)	-108 (-116)	-120 (-125)	-120 (-125)
> 3.2 to 10 GHz	-74 (-84)	-98 (-106)	-110 (-115)	-110 (-115)
> 10 to 20 GHz	-68 (-78)	-92 (-100)	-104 (-107)	-104 (-109)
> 20 to 40 GHz	-62 (-72)	-86 (-94)	-98 (-101)	-98 (-103)
> 40 to 67 GHz	-56 (-66)	-80 (-88)	-92 (-95)	-92 (-97)
<b>Residual FM</b>	(rms, 50 Hz to 15 kHz bandwidth)			
CW mode	< N x 6 Hz (typ)			
Option UNR	< N x 4 Hz (typ)			
Ramp sweep mode	< N x 1 kHz (typ)			
<b>Broadband noise</b>	(CW mode at +10 dBm or maximum specified output power, whichever is lower, for offsets > 10 MHz)			
> 2.4 to 20 GHz	< -148 dBc/Hz (typ)			
> 20 to 40 GHz	< -141 dBc/Hz (typ)			
> 40 GHz	< -135 dBc/Hz (typ)			

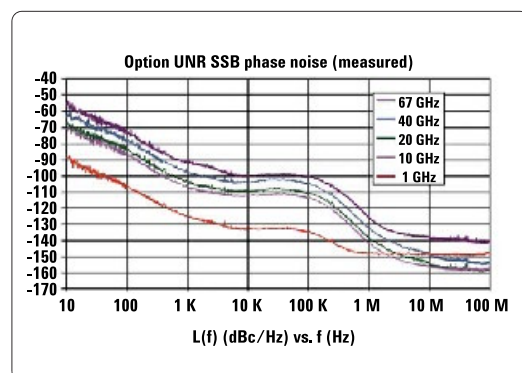
1. Sub-harmonics are defined as Carrier Freq / N). Specifications are typical for sub-harmonics beyond specified frequency range (beyond 50 GHz for Option 567).
2. Specifications are typical for spurs beyond specified frequency range (beyond 50 GHz for Option 567). Specifications apply for CW mode, without modulation. In ramp sweep mode (Option 007), performance is typical for offsets > 1 MHz.
3. Measurement at +10 dBm or maximum specified output power, whichever is less.

Measured phase noise with E5500 and plotted without spurs

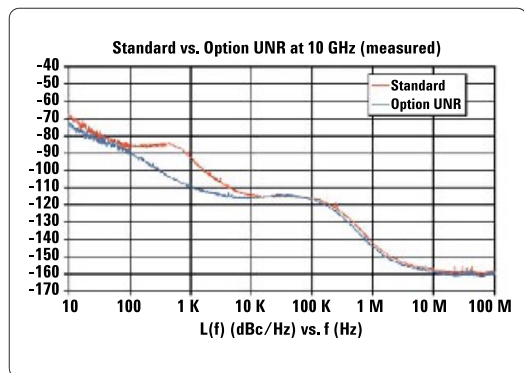
Standard phase noise



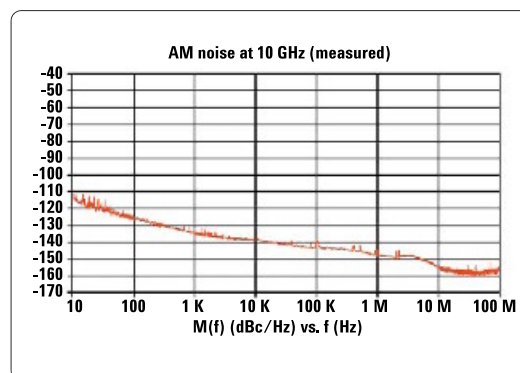
Option UNR phase noise



Standard vs. Option UNR phase noise



AM noise at 10 GHz



Measured rms jitter<sup>1</sup>

*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	26	170
622 MHz	622 MB/s	1 kHz to 5 MHz	25	41
2.488 GHz	2488 MB/s	5 kHz to 20 MHz	77	31
9.953 GHz	9953 MB/s	10 kHz to 80 MHz	232	23
39.812 GHz	39812 MB/s	40 kHz to 320 MHz	1203	30

*Option UNR*

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	29	184
622 MHz	622 MB/s	1 kHz to 5 MHz	25	40
2.488 GHz	2488 MB/s	5 kHz to 20 MHz	78	31
9.953 GHz	9953 MB/s	10 kHz to 80 MHz	210	21
39.812 GHz	39812 MB/s	40 kHz to 320 MHz	750	19

1. Calculated from phase noise performance in CW mode only at +10 dBm. For other frequencies, data rate, or bandwidths, please contact your sales representative.

## Frequency modulation<sup>1</sup> (Option UNT)

<b>Maximum deviation<sup>2</sup></b>	<b>Frequency</b>	<b>Maximum deviation</b>
	250 kHz to 250 MHz	2 MHz
	> 250 to 500 MHz	1 MHz
	> 500 MHz to 1 GHz	2 MHz
	> 1 GHz to 2 GHz	4 MHz
	> 2 GHz to 3.2 GHz	8 MHz
	> 3.2 GHz to 10 GHz	16 MHz
	> 10 GHz to 20 GHz	32 MHz
	> 20 GHz to 40 GHz	64 MHz
	> 40 GHz to 67 GHz	128 MHz
<b>Resolution</b>	0.1% of deviation or 1 Hz, whichever is greater	
<b>Deviation accuracy</b>	< ± 3.5% of FM deviation + 20 Hz (1 kHz rate, deviations < N x 800 kHz)	
<b>Modulation frequency response<sup>3</sup></b> (at 100 kHz deviation)		
<b>Path [coupling]</b>		
	<b>1 dB bandwidth</b>	<b>3 dB bandwidth (typ)</b>
FM path 1 [DC]	DC to 100 kHz	DC to 10 MHz
FM path 2 [DC]	DC to 100 kHz	DC to 1 MHz
FM path 1 [AC]	20 Hz to 100 kHz	5 Hz to 10 MHz
FM path 2 [AC]	20 Hz to 100 kHz	5 Hz to 1 MHz
<b>DC FM<sup>4</sup> carrier offset</b>	±0.1% of set deviation + (N x 8 Hz)	
<b>Distortion</b>	< 1% (1 kHz rate, deviations < N x 800 kHz)	
<b>Sensitivity</b>	±1 V <sub>peak</sub> for indicated deviation	
<b>Paths</b>	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.	

## Phase modulation<sup>5</sup> (Option UNT)

<b>Maximum deviation<sup>6</sup></b>	<b>Frequency</b>	<b>Normal BW mode</b>	<b>High BW mode</b>
	250 kHz to 250 MHz	20 rad	2 rad
	> 250 to 500 MHz	10 rad	1 rad
	> 500 MHz to 1 GHz	20 rad	2 rad
	> 1 GHz to 2 GHz	40 rad	4 rad
	> 2 GHz to 3.2 GHz	80 rad	8 rad
	> 3.2 GHz to 10 GHz	160 rad	16 rad
	> 10 GHz to 20 GHz	320 rad	32 rad
	> 20 GHz to 40 GHz	640 rad	64 rad
	> 40 GHz to 67 GHz	1280 rad	128 rad
<b>Resolution</b>	0.1% of set deviation		
<b>Deviation accuracy</b>	< ±5% of deviation + 0.01 radians (1 kHz rate, normal BW mode)		
<b>Modulation frequency response<sup>7</sup></b>			
	<b>Normal BW mode</b>	<b>High BW mode</b>	
Rates (3 dB BW)	DC to 100 kHz	DC to 1 MHz (typ) <sup>8</sup>	
<b>Distortion</b>	< 1% (1 kHz rate, Total Harmonic Distortion (THD), dev < N x 80 rad, normal BW mode)		
<b>Sensitivity</b>	±1 V <sub>peak</sub> for indicated deviation		
<b>Paths</b>	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 must be set to a deviation less than ΦM1.		

- Above 50 GHz, FM is useable; however performance is not warranted.
- Through any combination of path1, path2, or path1 + path2.
- Specifications apply in CW and list/step sweep modes. During ramp sweep operation (Option 007), 3 dB bandwidth is typically 50 kHz to 10 MHz (FM1 path), and 50 kHz to 1 MHz (FM2 path).
- At the calibrated deviation and carrier frequency, within 5 °C of ambient temperature at time of user calibration.
- Above 50 GHz, phase modulation is useable; however performance is not warranted.
- Through any combination of path1, path2, or path1 + path2.
- Specifications apply in CW and list/step sweep modes. During ramp sweep operation (Option 007), 3 dB bandwidth is typically 50 kHz to 1 MHz (high BW mode).
- Path 1 is useable to 4 MHz for external inputs less than 0.3 V peak.

**Amplitude modulation<sup>1</sup>**  
(Option UNT)  
(typ)

Depth	Linear mode	Exponential (log) mode (Downward modulation only)
Maximum		
ALC on	> 90%	> 20 dB
ALC off or deep AM on <sup>2</sup>	> 95%	> 40 dB <sup>3</sup>
Settable	0 to 100 %	0 to 40 dB
Resolution	0.1%	0.01 dB
Accuracy (1 kHz rate)	< ±(6 % of setting + 1 %)	< ±(2% of setting + 0.2 dB)
<b>Ext sensitivity</b>	±1 V <sub>peak</sub> for indicated depth	−1 V for indicated depth
<b>Rates</b> (3 dB bandwidth, 30% depth)		
DC Coupled	0 to 100 KHz	
AC Coupled	10 Hz to 100 KHz (usable to 1 MHz)	
<b>Distortion</b> (1 kHz rate, linear mode, Total Harmonic Distortion)		
30% AM	< 1.5%	
60% AM	< 2%	
<b>Paths</b>	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.	

**External modulation inputs**  
(Ext1 & Ext2)  
(Option UNT)

<b>Modulation types</b>	AM, FM, and ΦM
<b>Input impedance</b>	50 or 600 Ω (nom) switched
<b>High/low indicator</b> (100 Hz to 10 MHz BW, ac coupled inputs only)	Activated when input level error exceeds 3% (nom)

**Internal modulation source**  
(Option UNT)

Dual function generators provides two independent signals (internal1 and internal2) for use with AM, FM, ΦM, or LF Out.	
<b>Waveforms</b>	Sine, square, positive ramp, negative ramp, triangle, Gaussian noise, uniform noise, swept sine, dual sine <sup>4</sup>
<b>Rate range</b>	
Sine	0.5 Hz to 1 MHz
Square, ramp, triangle	0.5 Hz to 100 kHz
Resolution	0.5 Hz
Accuracy	Same as timebase
<b>LF Out</b>	
Output	Internal1 or internal2. Also provides monitoring of internal1 or internal2 when used for AM, FM, or ΦM.
Amplitude	0 to 3 V <sub>peak</sub> (nom) into 50 Ω
Output impedance	50 Ω (nom)
<b>Swept sine mode:</b> (frequency, phase continuous)	
Operating modes	Triggered or continuous sweeps
Frequency range	1 Hz to 1 MHz
Sweep rate	0.5 Hz to 100 kHz sweeps/s, equivalent to sweep times 10 us to 2 s
Resolution	0.5 Hz (0.5 sweep/s)

1. AM specifications are typical. For carrier frequencies below 2 MHz or above 50 GHz, AM is useable but not warranted. Unless otherwise stated, specifications apply with ALC on, deep AM off, and envelope peaks within ALC operating range (−20 dBm to maximum specified power, excluding step-attenuator setting).
2. For reduced distortion at high modulation depths, either level hold mode (ALC-off with power search) or deep AM mode should be used. With ALC on in deep AM mode, waveform peaks are controlled by ALC system, and the lower portion of the waveform (below −10 dBm nominal ALC level) is subject to sample-and-hold drift of approximately 0.25 dB/second.
3. To achieve > 40 dB depth, less than −1 V external input may be required.
4. Internal2 is not available when using swept sine or dual sine modes.

**Pulse modulation**<sup>1,2</sup>  
(Option UNU)

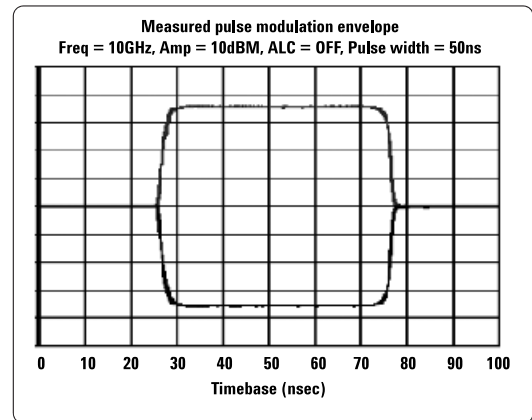
	500 MHz to 3.2 GHz	Above 3.2 GHz
<b>On/Off ratio</b>	80 dB (typ)	80 dB
<b>Rise/Fall times</b> (Tr, Tf)	100 ns (typ)	6 ns (typ)
<b>Minimum pulse width</b>		
Internally leveled	2 us	1 us
Level hold (ALC off with power search)	0.5 us	0.15 us
<b>Repetition frequency</b>		
Internally leveled	10 Hz to 250 kHz	10 Hz to 500 kHz
Level hold (ALC off with power search)	dc to 1 MHz	dc to 3 MHz
<b>Level accuracy</b> (relative to CW)		
Internally leveled	±0.5 dB	±0.5 dB
Level hold (ALC off with power search)	±0.5 dB (typ)	±0.5 dB (typ)
<b>Width compression</b>		
(RF width relative to video out)	±50 ns (typ)	±5 ns (typ)
<b>Video feed-through</b> <sup>3</sup>	< 200 mv (typ)	< 2 mv (typ)
<b>Video delay</b> (ext input to video)	50 ns (nom)	50 ns (nom)
<b>RF delay</b> (video to RF output)	270 ns (nom)	35 ns (nom)
<b>Pulse overshoot</b>	< 10% (typ)	< 10% (typ)
<b>Input level</b>	+1 V <sub>peak</sub> = RF On	+1 V <sub>peak</sub> = RF On
<b>Input impedance</b>	50 Ω (nom)	50 Ω (nom)

**Narrow pulse modulation**<sup>1,2</sup>  
(Option UNW)

	10 MHz to 3.2 GHz	Above 3.2 GHz
<b>On/Off ratio</b>	80 dB	80 dB
<b>Rise/Fall times</b> (Tr, Tf)	10 ns (8 ns typical)	10 ns (6 ns typical)
<b>Minimum pulse width</b>		
Internally leveled	1 us	1 us
Level hold (ALC off with power search)	20 ns	20 ns
<b>Repetition frequency</b>		
Internally leveled	10 Hz to 500 kHz	10 Hz to 500 kHz
Level hold (ALC off with power search)	dc to 5 MHz	dc to 10 MHz
<b>Level accuracy</b> (relative to CW)		
Internally leveled	±0.5 dB	±0.5 dB (0.15 dB typical)
Level hold (ALC off with power search)	±1.3 dB (typ)	±0.5 dB (typ)

1. With ALC off, specs apply after the execution of power search. Specifications apply with Atten Hold Off (default mode for instruments with attenuator), or ALC level between -5 and +10 dBm or maximum specific power, whichever is lower. Above 50 GHz, pulse modulation is useable; however performance is not warranted.
2. 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 (Option 1E1) 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.
3. With attenuator in 0 dB position. Video feed-through decreases with attenuator setting.

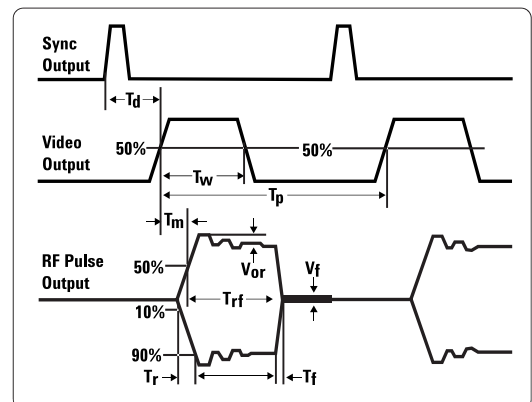
	10 MHz to 3.2 GHz	Above 3.2 GHz
<b>Width compression</b> (RF width relative to video out)	±5 ns (typ)	±5 ns (typ)
<b>Video feed-through<sup>1</sup></b>	< 125 mv (typ)	< 2 mv (typ)
<b>Video delay</b> (ext input to video)	50 ns (nom)	50 ns (nom)
<b>RF delay</b> (video to RF output)	45 ns (nom)	35 ns (nom)
<b>Pulse overshoot</b>	< 15% (typ)	< 10% (typ)
<b>Input level</b>	+1 V <sub>peak</sub> = RF On	+1 V <sub>peak</sub> = RF On
<b>Input impedance</b>	50 Ω (nom)	50 Ω (nom)



## Internal pulse generator (Option UNU or UNW)

<b>Modes</b>	Free-run, triggered, triggered with delay, doublet, and gated. Triggered with delay, doublet, and gated require external trigger source.
<b>Period (PRI) (Tp)</b>	70 ns to 42 s (Repetition frequency: 0.024 Hz to 14.28 MHz)
<b>Pulse width (Tw)</b>	10 ns to 42 s
<b>Delay (Td)</b>	Free-run mode: 0 to ±42 s Triggered with delay and doublet modes: 75 ns to 42s with ±10 ns jitter
<b>Resolution</b>	10 ns (width, delay, and PRI)

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,  $\Phi$ M, and pulse modulations) may be simultaneously enabled except: FM with  $\Phi$ M, and linear AM with exponential AM. AM, FM, and  $\Phi$ M 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.

1. With attenuator in 0 dB position. Video feed-through decreases with attenuator setting.

## Remote programming

<b>Interfaces</b>	GPIB (IEEE-488.2,1987) with listen and talk, RS-232, and 10BaseT LAN interface.
<b>Control languages</b>	SCPI version 1997.0. Completely code compatible with previous PSG signal generators. Also will emulate most applicable Agilent 836xxB, Agilent 837xxB, and Agilent 8340/41B commands, providing general compatibility with ATE systems which include these signal generators.
<b>IEEE-488 functions</b>	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E2.
<b>ISO compliant</b>	This family of signal generators is manufactured in an ISO-9001 registered facility in concurrence with Agilent commitment to quality.
<b>Agilent IO Libraries</b>	Agilent's IO Library Suite ships with the E8257D to help 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

<b>Power requirements</b>	90 to 132 VAC 47 to 64 Hz or 365 to 435 Hz; or 195 to 267 VAC 47 to 64 Hz, (automatically selected); < 250 W typical, 300 W maximum.
<b>Operating temperature range</b>	0 to 55 °C
<b>Storage temperature range<sup>1</sup></b>	–40 to 70 °C
<b>Shock and vibration</b>	
Operating random vibration	5 to 500 Hz, 0.21 g rms
Survival swept sine vibration	5 to 500 Hz, 0.5 g
Survival random vibration	5 to 500 Hz, 2.09 g rms
Functional shock (half-sine, 30 g, 11 ms) and bench drop test	Meets the requirements of MIL-PRF-28800F for class 3 equipment.
<b>EMC</b>	Meets the conducted and radiated interference and immunity requirements of IEC/EN 61326-1. Meets radiated emission requirements of CISPR Pub 11/1997 Group 1 class A.
<b>Storage registers</b>	Memory is shared by instrument states, user data files, sweep list files, and waveform sequences. Depending on the number and size of these files, up to 800 storage registers and 10 register sequences are available.
<b>Security</b>	Display blanking Memory clearing functions (see Application Note <i>Security of Agilent Signal Generators Issues and Solutions</i> , literature number 5989-1091EN)
<b>Compatibility</b>	Agilent 83550 Series Millimeter Heads and OML millimeter source modules, Agilent 8757D scalar network analyzers, Agilent EPM Series power meters
<b>Self-test</b>	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.
<b>Weight</b>	< 22 kg (48 lb.) net, < 30 kg (68 lb.) shipping
<b>Dimensions</b>	178 mm H x 426 mm W x 515 mm D (7” H x 16.8” W x 20.3” D in.)
<b>Recommended calibration cycle</b>	24 months

1. Storage below –20 °C instrument states may be lost.

## Input/Output Descriptions

### Front panel connectors

(All connectors are BNC female unless otherwise noted.)<sup>1</sup>

<b>RF output</b> <b>Option 520</b> <b>Options 540 and 550</b>	Output impedance 50 $\Omega$ (nom) Precision APC-3.5 male, or Type-N with Option 1ED Precision 2.4 mm male; plus 2.4 – 2.4 mm and 2.4 – 2.9 mm female adaptors
<b>Option 567</b>	Precision 1.85 mm male; plus 1.85 – 1.85 mm and 2.4 – 2.9 mm female adaptors
<b>ALC input</b>	Used for negative external detector leveling. Nominal input impedance 120 k $\Omega$ , damage level $\pm 15$ V.
<b>LF output</b>	Outputs the internally generated LF source. Nominal output impedance 50 $\Omega$ .
<b>External input 1</b>	Drives either AM, FM, or $\Phi$ M. Nominal input impedance 50 or 600 $\Omega$ , damage levels are 5 $V_{rms}$ and 10 $V_{peak}$ .
<b>External input 2</b>	Drives either AM, FM, or $\Phi$ M. Nominal input impedance 50 or 600 $\Omega$ , damage levels are 5 $V_{rms}$ and 10 $V_{peak}$ .
<b>Pulse/trigger gate input</b>	Accepts input signal for external fast pulse modulation. Also accepts external trigger pulse input for internal pulse modulation. Nominal impedance 50 $\Omega$ . Damage levels are 5 $V_{rms}$ and 10 $V_{peak}$ .
<b>Pulse video out</b>	Outputs a signal that follows the RF output in all pulse modes. TTL-level compatible, nominal source impedance 50 $\Omega$ .
<b>Pulse sync out</b>	Outputs a synchronizing pulse, nominally 50 ns width, during internal and triggered pulse modulation. TTL-level compatible, nominal source impedance 50 $\Omega$ .

### Rear panel connectors

(all connectors are BNC female unless otherwise noted.)<sup>1</sup>

<b>Auxiliary interface</b> (dual mode)	Used for RS-232 serial communication and for master/slave source synchronization. (9-pin subminiature female connector).
<b>GPIB</b>	Allows communication with compatible devices
<b>LAN</b>	Allows 10BaseT LAN communication
<b>10 MHz input</b>	Accepts an external reference (timebase) input (at 1, 2, 2.5, 5, 10 MHz for standard and 10 MHz only for Option UNR) Nominal input impedance 50 $\Omega$ Damage levels > +10 dBm
<b>10 MHz output</b>	Outputs internal or external reference signal. Nominal output impedance 50 $\Omega$ . Nominal output power +8 dBm.
<b>Sweep output</b> (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.  When connected to an Agilent 8757D scalar network analyzer (Option 007), generates a selectable number of equally spaced 1 us 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 $\Omega$ (nom), can drive 2000 $\Omega$ .

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



<b>Stop sweep In/Out</b>	Open-collector, TTL-compatible input/output. In ramp sweep operation, provides low level (nominally 0 V) 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.
<b>Trigger output (dual mode)</b>	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 us pulses (nom) across a ramp sweep. When using LF Out, provides 2 us pulse at start of LF sweep.
<b>Trigger input</b>	Accepts TTL signal for triggering point-to-point in manual sweep mode, or to trigger start of LF sweep. Damage levels $\geq +10$ V or $\leq -4$ V.
<b>Source module interface</b>	Provides power and leveling connections to the millimeter source modules.
<b>Source settled</b>	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.
<b>Z-axis Blank/Markers</b>	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.
<b>10 MHz EFC</b>	(Option UNR only) 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 $-0.0025$ ppm/V. The nominal input impedance is greater than 1 M $\Omega$ .

## Options, Accessories, and Related Products

<b>Model/option</b>	<b>Description</b>
<b>E8257D-520</b>	Frequency range from 250 kHz to 20 GHz
<b>E8257D-540</b>	Frequency range from 250 kHz to 40 GHz
<b>E8257D-550</b>	Frequency range from 250 kHz to 50 GHz
<b>E8257D-567</b>	Frequency range from 250 kHz to 67 GHz
<b>E8257D-007</b>	Analog ramp sweep
<b>E8257D-UNR</b>	Enhanced phase noise performance
<b>E8257D-UNT</b>	AM, FM, phase modulation, and LF output
<b>E8257D-UNU</b>	Pulse modulation
<b>E8257D-UNW</b>	Narrow pulse modulation
<b>E8257D-1EA</b>	High output power
<b>E8257D-1E1</b>	Step attenuator
<b>E8257D-1ED</b>	Type-N (f) RF output connector (Option 520 only)
<b>E8257D-1EH</b>	Improved harmonics below 2 GHz
<b>E8257D-1EM</b>	Moves all front panel connectors to the rear panel
<b>E8257D-1CN</b>	Front handle kit
<b>E8257D-1CM</b>	Rackmount flange kit
<b>E8257D-1CP</b>	Rackmount flange and front handle kit
<b>E8257D-UK6</b>	Commercial calibration certificate and test data
<b>E8257D-CD1</b>	CD-ROM containing the English documentation set
<b>E8257D-ABA</b>	Printed copy of the English documentation set
<b>E8257D-0BW</b>	Printed copy of the assembly-level service guide
<b>8120-8806</b>	Master/slave interface cable
<b>9211-2656</b>	Transit case
<b>9211-7481</b>	Transit case with wheels

## Web Resources

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For additional information, visit:

[www.agilent.com/find/psg](http://www.agilent.com/find/psg)

For more information about renting, leasing or financing Agilent's latest technology, visit:

[www.agilent.com/find/buy/alternatives](http://www.agilent.com/find/buy/alternatives)

For more accessory information, visit:

[www.agilent.com/find/accessories](http://www.agilent.com/find/accessories)

For additional description of Agilent's IO Libraries Suite features and installation requirements, please go to:

[www.agilent.com/find/iosuite/database](http://www.agilent.com/find/iosuite/database)

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## Related Agilent Literature

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*PSG Self Guided Demo*

Literature number 5988-2414EN

*E8257D PSG Signal Generators*

Configuration Guide, Literature number 5989-1325EN

*E8267D PSG Vector Signal Generator*

Data Sheet, Literature number 5989-0697EN

*E8267D PSG Vector Signal Generator*

Configuration Guide, Literature number 5989-1326EN

*Millimeter Wave Source Modules*

Product Note, Literature number 5988-2567EN

*PSG Two-Tone and Multitone*

Application Note -1410, Literature number 5988-7689EN

*Security of Agilent Signal Generators*

Issues and Solutions, Literature number 5989-1091EN

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