

# Agilent E8247C/57C PSG CW and Analog Signal Generators

Data Sheet



All specifications and characteristics 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 or nominal, provide additional (non-warranted) information.

## PSG Signal Generators

|                | Option 520<br>250 kHz to 20 GHz | Option 540<br>250 kHz to 40 GHz |
|----------------|---------------------------------|---------------------------------|
| <b>CW only</b> | E8247C                          | E8247C                          |
| <b>Analog</b>  | E8257C                          | E8257C                          |
| <b>Vector</b>  | E8267C                          |                                 |

(See E8267C data sheet for PSG vector signal generator specifications)

## Definitions

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

**Typical (typ):** performance is not warranted. It applies at 25 °C. A minimum of 80% of all products meet typical performance.

**Nominal (nom):** values are not warranted. They represent the value of a parameter that is most likely to occur; the expected or mean value. They are included to facilitate the application of the product.

**Standard (std):** No options are included when referring to the signal generator unless noted otherwise.



Agilent Technologies

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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   |  |
| <b>Resolution</b>                             |   |  |
| CW  | 0.001 Hz <sup>2</sup>   |  |
| All Sweep modes                               | 0.01 Hz   |  |
| <b>Accuracy</b>                               |   |  |
|   | Aging rate ± temperature effects<br>± line voltage effects                          |  |
| <b>Switching speed<sup>3</sup></b>            |   |  |
|   | < 12 ms (typical)   |  |
| <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  |
| <b>Internal timebase reference oscillator</b> |   |  |
|   | <b>Standard</b>   | <b>Option UNR</b>  |
| <b>Aging rate</b>                             | < ±1 x 10 <sup>-7</sup> /year or<br>< ±4.5 x 10 <sup>-9</sup> /day<br>after 45 days | < ±3 x 10 <sup>-8</sup> /year or<br>< ±2.5 x 10 <sup>-10</sup> /day<br>after 30 days |
| <b>Temperature effects</b> (typical)          | < ±5 x 10 <sup>-8</sup> 0 to 55 °C  | < ±4.5 x 10 <sup>-9</sup> 0 to 55 °C   |
| <b>Line voltage effects</b> (typical)         | < ±2 x 10 <sup>-9</sup> for<br>+5% –10% change                                      | < ±2 x 10 <sup>-10</sup> for<br>±10% change  |
| <b>External reference frequency</b>           | 1, 2, 2.5, 5, 10 MHz<br>(within 0.2 ppm)  | 10 MHz only<br>(within 1 ppm)  |
| <b>Reference output</b>                       |   |  |
| Frequency                                     | 10 MHz  |  |
| Amplitude                                     | > +4 dBm into 50 Ω load (typical)   |  |
| <b>External reference input</b>               |   |  |
| Amplitude                                     | > –3 dBm  |  |
| Opt UNR                                       | 5 dBm ±5 dB <sup>4</sup>  |  |
| Input impedance                               | 50 Ω (nominal)  |  |

1. Useable to 100 kHz.
2. In ramp sweep mode (Option 007), resolution is limited with narrow spans and slow sweep speeds. Refer to ramp sweep specifications for more information.
3. To within 0.1 ppm of final frequency above 250 MHz or within 100 Hz below 250 MHz.
4. To optimize phase noise use 5 dBm ± 2 dB.

## Digital sweep

|                         |   |
|-------------------------|---|
| <b>Operating modes</b>  | Step sweep of frequency or amplitude or both (start to stop)<br>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  |
| <b>Dwell time</b>       | 1 ms to 60 s  |
| <b>Number of points</b> | 2 to 1601 (step sweep)<br>2 to 1601 per table (list sweep)  |
| <b>Triggering</b>       | Auto, external, single, or GPIB   |

## Ramp (analog) sweep (Option 007)<sup>1</sup>

|   |   |                           |                                 |
|---|---|---------------------------|---------------------------------|
| <b>Operating modes</b>                                  | Synthesized frequency sweep<br>(start/stop), (center/span), (swept CW)<br>Power (amplitude) sweep (start/stop)<br>Manual sweep<br>RPG control between start and stop frequencies<br>Alternate sweep<br>Alternates successive sweeps between current and stored states |                           |                                 |
| <b>Sweep span range</b>                                 | Settable from minimum <sup>2</sup> to full range  |                           |                                 |
| <b>Maximum sweep rate</b>                               | <b>Start frequency</b>  | <b>Maximum sweep rate</b> | <b>Max span for 100ms 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                | 36.8 GHz                        |
| <b>Frequency accuracy</b>                               | ± 0.05% of span ± timebase (at 100 ms sweep time, for sweep spans less than maximum values given above)<br>Accuracy improves proportionally as sweep time increases <sup>3</sup>  |                           |                                 |
| <b>Sweep time</b>                                       | (forward sweep, not including bandswitch and retrace intervals)   |                           |                                 |
| Resolution  | 1 ms  |                           |                                 |
| Manual mode   | Settable 10 ms to 99 seconds  |                           |                                 |
| 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>4</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>5</sup><br>Also useable with Agilent 8757A/C/E scalar network analyzers for making basic swept measurements. <sup>6</sup>  |                           |                                 |

1. During Ramp sweep operation, AM and Pulse Modulation are useable but not specified; FM, Phase Modulation, Wideband AM and I/Q modulation are not useable.
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  $[0.00004\% \text{ of carrier frequency or } 140 \text{ Hz}] \times [\text{sweep time in seconds}]$ . Actual span will always be displayed correctly.
3. Typical accuracy for sweep times > 100 ms can be calculated from the equation:  

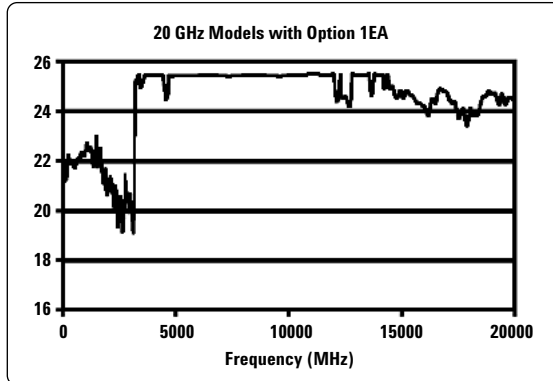
$$[(0.005\% \text{ of span}) / (\text{sweep time in seconds})] \pm \text{timebase}$$
Accuracy is not specified for sweep times < 10 ms.
4. For Master/Slave operation use Agilent Technologies part #8120-8806 Master/Slave interface cable.
5. When measuring low-pass devices in AC mode, dynamic range may be reduced up to 10dB below 3.2 GHz
6. 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)                               | Standard  | Option 1EA  |
|--|---|-------------|
| <b>Frequency range</b>                                 |   |             |
| <b>20 GHz models</b>                                   |   |             |
| 250 kHz to 3.2 GHz                                     | -20 to +13  | -20 to +16  |
| 250 kHz to 3.2 GHz (with Option 1E6)                   | -20 to +13  | -20 to +13  |
| > 3.2 to 20 GHz  | -20 to +13  | -20 to +20  |
| <b>40 GHz models</b>                                   |   |             |
| 250 kHz to 3.2 GHz                                     | -20 to +9   | -20 to +15  |
| 250 kHz to 3.2 GHz (with Option 1E6)                   | -20 to +9   | -20 to +12  |
| > 3.2 to 20 GHz  | -20 to +9   | -20 to +18  |
| > 20 to 40 GHz   | -20 to +9   | -20 to +14  |
| <b>20 GHz models with step attenuator</b> (Option 1E1) |   |             |
| 250 kHz to 3.2 GHz                                     | -135 to +11   | -135 to +15 |
| 250 kHz to 3.2 GHz (with Option 1E6)                   | -135 to +11   | -135 to +12 |
| > 3.2 to 20 GHz  | -135 to +11   | -135 to +18 |
| <b>40GHz models with step attenuator</b> (Option 1E1)  |   |             |
| 250 kHz to 3.2 GHz                                     | -135 to +7  | -135 to +14 |
| 250 kHz to 3.2 GHz (with Option 1E6)                   | -135 to +7  | -135 to +11 |
| > 3.2 to 20 GHz  | -135 to +7  | -135 to +16 |
| > 20 to 40 GHz   | -135 to +7  | -135 to +12 |
| <b>Step attenuator</b>                                 | 0 dB and 5 to 115 dB in 10 dB steps <sup>3</sup> (Option 1E1) |             |

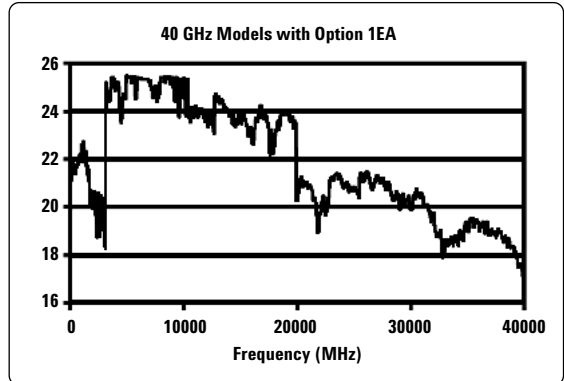
### 20 GHz models with Option 1EA

Measured maximum available power



### 40 GHz models with Option 1EA

Measured maximum available power



### Attenuator hold range

#### Minimum

(Same as max power sweep range)

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>

CW or analog modulation

< 5 ms (typical)

When using power search

< 25 ms (typical)

### Level accuracy<sup>3</sup> (dB)

| Frequency        | > +10 dBm | +10 to -10 dBm | -10 to -20 dBm |
|------------------|-----------|----------------|----------------|
| 250 kHz to 2 GHz | ±0.6      | ±0.6           | ±1.4           |
| 2 GHz to 20 GHz  | ±0.8      | ±0.8           | ±1.2           |
| > 20 to 40 GHz   | ±1.0      | ±0.9           | ±1.3           |

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.

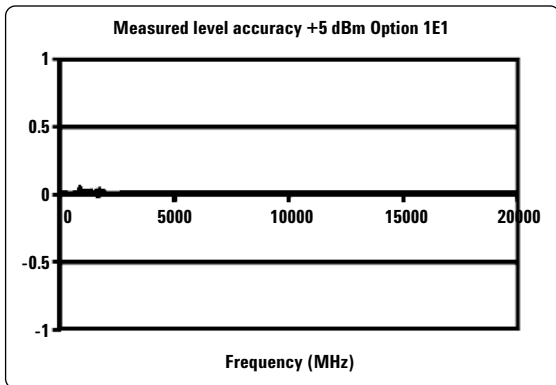
2. To within 0.1 dB of final amplitude within one attenuator range

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.

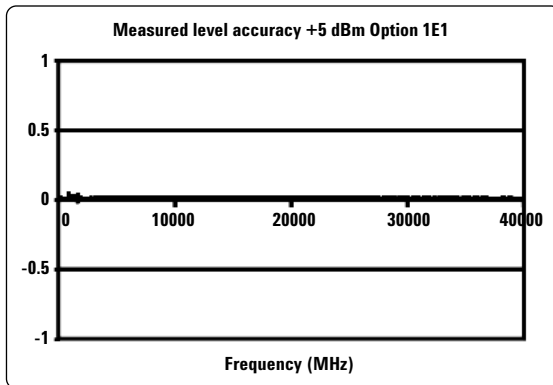
**Level accuracy with step attenuator<sup>1</sup> (dB)**

| Frequency        | > +10 dBm | +10 to -10 dBm | -10 to -70 dBm | -70 to -90 dBm | -90 to -110 dBm |
|------------------|-----------|----------------|----------------|----------------|-----------------|
| 250 kHz to 2 GHz | ±0.6      | ±0.6           | ±0.7           | ±0.8           | ±1.4            |
| > 2 to 20 GHz    | ±0.8      | ±0.8           | ±0.9           | ±1.0           | ±1.7            |
| > 20 to 40 GHz   | ±1.0      | ±0.9           | ±1.0           | ±2.0           |                 |

**20 GHz level accuracy**



**40 GHz level accuracy**



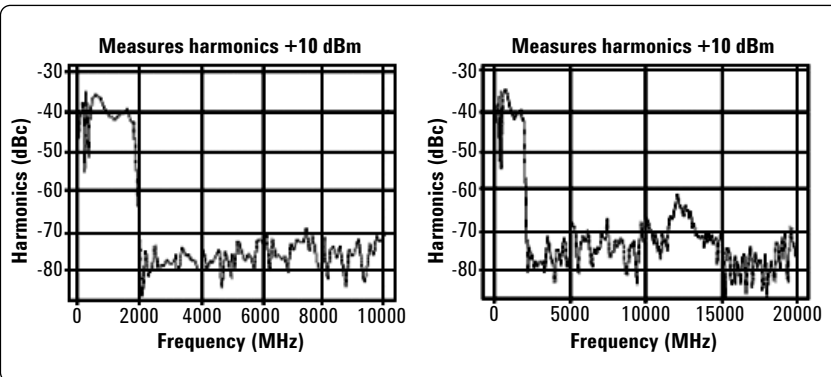
|   |  |
|---|--|
| <b>Resolution</b>                         | 0.01 dB  |
| <b>Temperature stability</b>              | 0.01 dB/°C (typical)   |
| <b>User flatness correction</b>           |  |
| Number of points                          | 2 to 1601 points/table   |
| Number of tables                          | Up to 10,000, memory limited   |
| Path loss                                 | Arbitrary, within attenuator range   |
| Entry modes<br>(user edit/view)           | Remote power meter <sup>2</sup> , remote bus, manual                             |
| <b>Output impedance</b>                   | 50 Ω (nominal)   |
| <b>SWR</b> (internally leveled) (typical) |  |
| 250 kHz to 2 GHz                          | < 1.4:1  |
| > 2 GHz to 20 GHz                         | < 1.6:1  |
| > 20 GHz to 40 GHz                        | < 1.8:1  |
| <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 (nominal) (-36 dBm to +4 dBm using Agilent 33330D/E detector)  |
| Bandwidth                                 | 10 kHz (typical) (Note: not intended for pulsed operation)                       |
| <b>Maximum reverse power</b>              | 1/2 Watt (nominal)   |

- 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. Level accuracy is not specified below -110 dBm.
- Compatible with Agilent Technologies EPM Series (E4418B and E4419B) power meters.

## Spectral purity

| Harmonics <sup>1</sup> | (dBc at +10 dBm or maximum specified output power, whichever is lower) |
|------------------------|--|
| < 1 MHz                | -28 dBc (typical)  |
| 1 MHz to 2 GHz         | -28 dBc  |
| > 2 GHz to 20 GHz      | -55 dBc  |
| > 20 GHz to 40 GHz     | -50 dBc (typical)  |

### 20 GHz measured harmonics ..... 40 GHz measured harmonics



| Sub-harmonics <sup>2</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 to 40 GHz         | < -50 dBc  |

| Non-harmonics      | (dBc at +10 dBm or maximum specified output power, whichever is lower, for offsets > 3 KHz [ $> 300$ Hz with Option UNR]) <sup>3</sup> |                          |
|--------------------|--|--------------------------|
| Frequency          | Spec   | Typical                  |
| 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                      |

| SSB phase noise (CW) | Offset from Carrier (dBc/Hz) |                  |
|----------------------|------------------------------|------------------|
| Frequency            | 20 kHz                       | 20 kHz (typical) |
| 250 kHz to 250 MHz   | -130                         | -134             |
| > 250 to 500 MHz     | -134 <sup>4</sup>            | -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             |

- Specifications for harmonics beyond maximum instrument frequencies are typical.
- Specifications for sub-harmonics beyond maximum instrument frequencies are typical.
- Performance is typical for spurs at frequencies above the maximum operating frequency of the instrument. Specifications apply for CW mode only. Performance typically is -60 dBc between 200 and 250 MHz.
- For instruments with serial number prefixes below MY4330 or US4330, the specification is -136 dBc/Hz.

**Option UNR: Enhanced SSB phase noise (CW)**

Offset from carrier (dBc/Hz)

| Frequency          | 100 Hz                       | 1 kHz                         | 10 kHz                        | 100 kHz                       |
|--------------------|------------------------------|-------------------------------|-------------------------------|-------------------------------|
| 250 kHz to 250 MHz | spec (typical)<br>-94 (-115) | spec (typical)<br>-110 (-123) | spec (typical)<br>-128 (-132) | spec (typical)<br>-130 (-133) |
| > 250 to 500 MHz   | -100 (-110)                  | -124 (-130)                   | -132 (-136)                   | -136 (-141)                   |
| > 500 MHz to 1 GHz | -94 (-104)                   | -118 (-126)                   | -130 (-135)                   | -130 (-135)                   |
| > 1 to 2 GHz       | -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)                    |

**Residual FM**

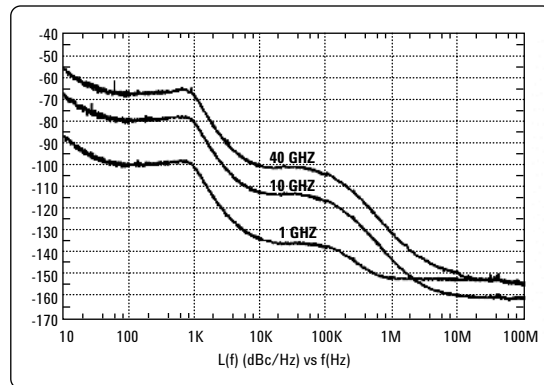
|  |                       |
|--|-----------------------|
| CW mode  | < N x 6 Hz (typical)  |
| Option UNR   | < N x 4 Hz (typical)  |
| Ramp sweep mode:<br>(rms, 50 Hz to 15 kHz bandwidth) | < N x 1 kHz (typical) |

**Broadband noise (CW mode at +10 dBm output, for offsets > 10 MHz)**

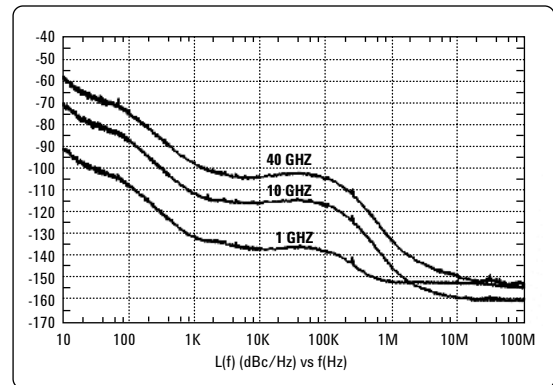
|                 |                         |
|-----------------|-------------------------|
| > 2.4 to 20 GHz | < -148 dBc/Hz (typical) |
| > 20 to 40 GHz  | < -141 dBc/Hz (typical) |

**Measured phase noise**

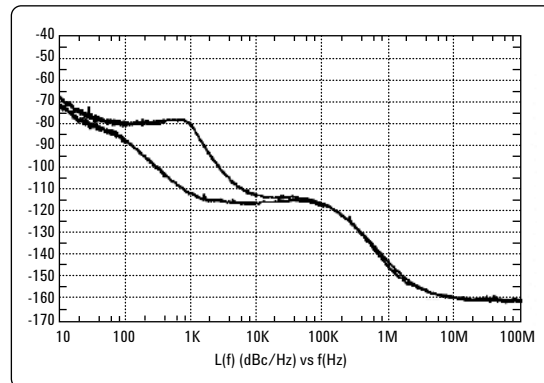
**Standard product**



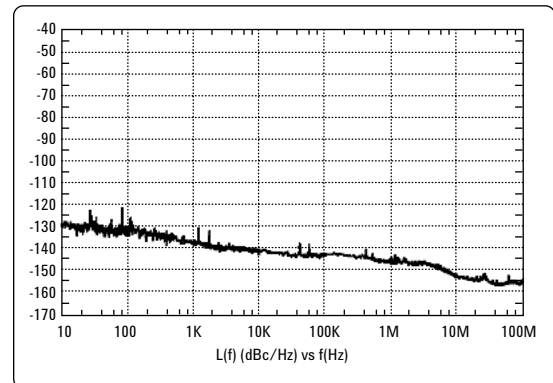
**Option UNR**



**Measured Standard vs. Option UNR at 10 GHz**



**Measured AM noise at 10 GHz**





**Typical rms jitter:<sup>1</sup>****Standard**

| Carrier frequency | SONET/SDH data rates | rms jitter bandwidth | Unit intervals ( $\mu$ UI) | Time (fs) |
|-------------------|----------------------|----------------------|----------------------------|-----------|
| 155 MHz           | 155 MB/s             | 100 Hz to 1.5 MHz    | 48                         | 303       |
| 622 MHz           | 622 MB/s             | 1 kHz to 5 MHz       | 34                         | 50        |
| 2.488 GHz         | 2488 MB/s            | 5 kHz to 15 MHz      | 65                         | 25        |
| 9.953 GHz         | 9953 MB/s            | 20 kHz to 80 MHz     | 173                        | 16        |

**Option UNR**

| Carrier frequency | SONET/SDH data rates | rms jitter bandwidth | Unit intervals ( $\mu$ UI) | Time (fs) |
|-------------------|----------------------|----------------------|----------------------------|-----------|
| 155 MHz           | 155 MB/s             | 100 Hz to 1.5 MHz    | 47                         | 297       |
| 622 MHz           | 622 MB/s             | 1 kHz to 5 MHz       | 26                         | 40        |
| 2.488 GHz         | 2488 MB/s            | 5 kHz to 15 MHz      | 66                         | 25        |
| 9.953 GHz         | 9953 MB/s            | 20 kHz to 80 MHz     | 161                        | 15        |

**Frequency modulation  
(E8257C only)**

| <b>Maximum deviation</b>                | $N \times 8$ MHz   |                          |                              |  |  |                |                          |      |                     |                   |      |                     |                  |
|---|--|--------------------------|------------------------------|--|--|----------------|--------------------------|------|---------------------|-------------------|------|---------------------|------------------|
| <b>Resolution</b>                       | 0.1% of deviation or 1 Hz, whichever is greater  |                          |                              |  |  |                |                          |      |                     |                   |      |                     |                  |
| <b>Deviation accuracy</b>               | $< \pm 3.5\%$ of FM deviation + 20 Hz<br>(1 kHz rate, deviations $< N \times 800$ kHz)   |                          |                              |  |  |                |                          |      |                     |                   |      |                     |                  |
| <b>Modulation frequency response</b>    |  |                          |                              |  |  |                |                          |      |                     |                   |      |                     |                  |
| <b>Path</b>                             | <table border="0"> <thead> <tr> <th></th> <th colspan="2">Rates (at 100 kHz deviation)</th> </tr> <tr> <th></th> <th>1 dB Bandwidth</th> <th>3 dB Bandwidth (typical)</th> </tr> </thead> <tbody> <tr> <td>FM 1</td> <td>dc/20 Hz to 100 kHz</td> <td>dc/5 Hz to 10 MHz</td> </tr> <tr> <td>FM 2</td> <td>dc/20 Hz to 100 kHz</td> <td>dc/5 Hz to 1 MHz</td> </tr> </tbody> </table> |                          | Rates (at 100 kHz deviation) |  |  | 1 dB Bandwidth | 3 dB Bandwidth (typical) | FM 1 | dc/20 Hz to 100 kHz | dc/5 Hz to 10 MHz | FM 2 | dc/20 Hz to 100 kHz | dc/5 Hz to 1 MHz |
|   | Rates (at 100 kHz deviation)   |                          |                              |  |  |                |                          |      |                     |                   |      |                     |                  |
|   | 1 dB Bandwidth   | 3 dB Bandwidth (typical) |                              |  |  |                |                          |      |                     |                   |      |                     |                  |
| FM 1                                    | dc/20 Hz to 100 kHz  | dc/5 Hz to 10 MHz        |                              |  |  |                |                          |      |                     |                   |      |                     |                  |
| FM 2                                    | dc/20 Hz to 100 kHz  | dc/5 Hz to 1 MHz         |                              |  |  |                |                          |      |                     |                   |      |                     |                  |
| <b>dc FM<sup>2</sup> carrier offset</b> | $\pm 0.1\%$ of set deviation + ( $N \times 8$ Hz)  |                          |                              |  |  |                |                          |      |                     |                   |      |                     |                  |
| <b>Distortion</b>                       | $< 1\%$ (1 kHz rate, deviations $< N \times 800$ kHz)  |                          |                              |  |  |                |                          |      |                     |                   |      |                     |                  |
| <b>Sensitivity</b>                      | $\pm 1 V_{\text{peak}}$ 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  
(E8257C only)**

|                                      |  |                        |
|--------------------------------------|--|------------------------|
| <b>Maximum deviation</b>             | $N \times 80$ radians ( $N \times 8$ radians in high-bandwidth mode)   |                        |
| <b>Resolution</b>                    | 0.1% of set deviation  |                        |
| <b>Deviation accuracy</b>            | $< \pm 5\%$ of deviation + 0.01 radians<br>(1 kHz rate, normal BW mode)  |                        |
| <b>Modulation frequency response</b> |  |                        |
| <b>Mode</b>                          | <b>Maximum deviation</b>   | <b>Rates (3 dB BW)</b> |
| Normal BW                            | $N \times 80$ rad  | dc to 100 kHz          |
| High BW                              | $N \times 8$ rad   | dc to 1 MHz (typical)  |
| <b>Distortion</b>                    | $< 1\%$ (1 kHz rate, THD, dev $< N \times 80$ rad, normal BW mode)   |                        |
| <b>Sensitivity</b>                   | $\pm 1 V_{\text{peak}}$ for indicated deviation  |                        |
| <b>Paths</b>                         | $\Phi$ M1 and $\Phi$ M2 are summed internally for composite modulation. Either path may be switched to any one of the modulation sources: Ext1, Ext2, internal1, internal2. The $\Phi$ M2 path must be set to a deviation less than $\Phi$ M1. |                        |

1. Calculated from phase noise performance in CW mode only at +0 dBm. For other frequencies, data rate, or bandwidths, please contact your sales representative.
2. At the calibrated deviation and carrier frequency, within 5 °C of ambient temperature at time of user calibration.

**Amplitude modulation**  
**( $f_c > 2$  MHz)<sup>1</sup>** (typical)  
 (E8257C only)

| Depth  | Linear mode   | Exponential (log) mode<br>(Downward modulation only) |
|--|---|--|
| Maximum  | > 90%   | > 20 dB  |
| Settable <sup>2</sup>                            | 0 to 100 %  | 0 to 40 dB   |
| Resolution                                       | 0.1%  | 0.01 dB  |
| Accuracy<br>(1 kHz rate)                         | < $\pm(6$ % of setting + 1 %)   | < $\pm(2\%$ of setting + 0.2 dB)                     |
| <b>Ext sensitivity</b>                           | $\pm 1 V_{\text{peak}}$ for indicated depth   | -1 V for indicated depth                             |
| <b>Rates</b> (3 dB bandwidth, 30% depth)         | dc/10 Hz to 100 kHz (typical) (useable to 1 MHz)  |  |
| <b>Distortion</b> (1 kHz rate, linear mode, THD) |   |  |
| 30% AM   | < 1.5%  |  |
| 90% AM   | < 4 %   |  |
| <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)  
 (E8257C only)

|  |   |
|--|---|
| <b>Modulation types</b>  | AM, FM, and $\Phi$ M                                  |
| <b>Input impedance</b>   | 50 or 600 $\Omega$ (nominal) switched                 |
| <b>High/low indicator</b><br>(100 Hz to 10 MHz BW, ac coupled inputs only) | Activated when input level error exceeds 3% (nominal) |

**Simultaneous modulation**  
 (E8257C only)

All modulation types 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.

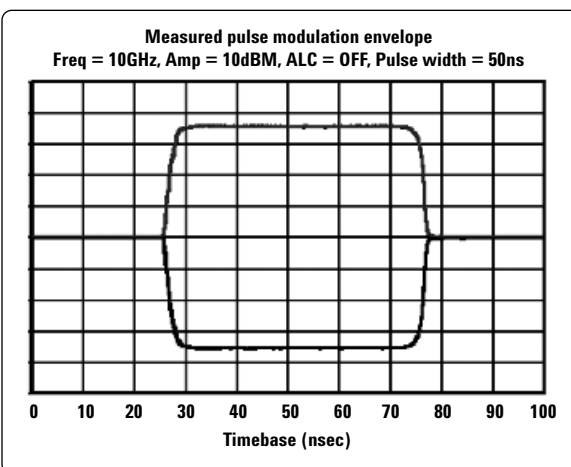
**Internal modulation source**  
 (E8257C only)

|   |   |
|---|---|
| Dual function generators provides two independent signals (internal1 and internal2) for use with AM, FM, $\Phi$ M, or LF Out. |   |
| <b>Waveforms</b>  | Sine, square, positive ramp, negative ramp, triangle, Gaussian noise, uniform noise, swept sine <sup>3</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 $\Phi$ M. |
| Amplitude   | 0 to 3 $V_{\text{peak}}$ (nominal) into 50 $\Omega$   |
| Output impedance  | 50 $\Omega$ (nominal)   |
| <b>Swept sine mode:</b><br>(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. For  $f_c < 2$  MHz AM is usable but not specified. AM specifications apply with ALC on, and envelope peaks < maximum specified power. For instruments without Option 1E1 attenuator, specs apply for carrier amplitude > -2 dBm.
2. For AM depth settings > 90% or > 20 dB, deep AM mode or 1 kHz ALC BW is recommended.
3. Internal2 is not available when using swept sine or dual sine modes.

## Pulse modulation<sup>1</sup> (E8257C only)

|  | <b>Standard<br/>&gt; 3.2 GHz</b> | <b>Standard<br/>500 MHz<br/>to 3.2 GHz</b> | <b>Option 1E6<br/>10 MHz<br/>to 3.2 GHz</b>  |
|--|----------------------------------|--|--|
| <b>On/off ratio</b>                                    | 80 dB (typical)                  | 80 dB                                      | 80 dB  |
| <b>Rise/fall times</b> (Tr, Tf)                        | 10 ns (6 ns typical)             | 100 ns (typical)                           | 10 ns (8 ns typical)                         |
| <b>Pulse width</b>                                     |                                  |  |  |
| Internally leveled                                     | ≥ 1 μs                           | ≥ 2 μs (typical)                           | ≥ 1 μs                                       |
| Level hold<br>(ALC Off with power search) <sup>2</sup> | ≥ 20 ns (typical)                | ≥ 0.5 μs (typical)                         | ≥ 20 ns (typical)                            |
| <b>Repetition frequency</b>                            |                                  |  |  |
| Internally leveled                                     | 10 Hz to 500 kHz<br>(typical)    | 10 Hz to 250 kHz<br>(typical)              | 10 Hz to 500 kHz<br>(typical)                |
| Level hold<br>(ALC Off with power search) <sup>2</sup> | dc to 10 MHz (typical)           | dc to 1 MHz (typical)                      | dc to 10 MHz (typical)                       |
| <b>Level accuracy</b><br>(relative to CW)              |                                  |  |  |
| Internally leveled                                     | ±0.5 dB<br>±0.15 (typical)       | ±0.5 dB                                    | ±0.5 dB                                      |
| Level hold<br>(ALC Off with power search) <sup>2</sup> | ≤ 20 GHz ±0.8 dB<br>(typical)    | ±0.5 dB (typical)                          | ±1.0 dB (typical)                            |
|  | ≤ 40 GHz ±1.2 dB<br>(typical)    |  |  |
| <b>Width compression</b>                               | ±5 ns (typical)                  | ±50 ns (typical)                           | ±5 ns (typical)                              |
| <b>Video feed-through<sup>3</sup></b>                  | < 2 mV (typical)                 | < 200 mV (typical)                         | < 125 mV (typical)                           |
| <b>Video delay</b>                                     |                                  |  |  |
| (Ext input to Video)                                   | 40 ns (nominal)                  | 40 ns (nominal)                            | 40 ns (nominal)                              |
| <b>RF delay</b> (Tm)                                   |                                  |  |  |
| (Video to RF output)                                   | 35 ns (nominal)                  | 280 ns (nominal)                           | 45 ns (nominal)                              |
| <b>Pulse overshoot</b> (Vor)                           | < 10% (typical)                  | < 10% (typical)                            | < 1GHz 20% (typical)<br>≥ 1GHz 10% (typical) |
| <b>Input level</b>                                     | +1 V <sub>peak</sub> = RF On     | +1 V <sub>peak</sub> = RF On               | +1 V <sub>peak</sub> = RF On                 |
| <b>Input impedance</b>                                 | 50 Ω (nominal)                   | 50 Ω (nominal)                             | 50 Ω (nominal)                               |



1. With ALC off, specs apply after the execution of power search. For instruments without a step attenuator, specs apply between 0 and +10 dBm. For instruments with the step attenuator, specs apply with Atten Hold Off, or ALC level between 0 and +10 dBm.
2. Power search is a calibration routine that improves level accuracy in ALC-off mode. Un-pulsed RF power will be present typically up to 50 ms when executing power search.
3. With attenuator in 0 dB position. Video feed-through decreases with attenuator setting.

## Internal pulse generator (E8257C only)

|  |  |
|--|--|
| <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) (<math>T_p</math>)</b> | 70 ns to 42 s<br>(Repetition frequency: 0.024 Hz to 14.28 MHz)   |
| <b>Pulse width (<math>T_w</math>)</b>  | 10 ns to 42 s  |
| <b>Delay (<math>T_d</math>)</b>        |  |
| Free-run mode                          | 0 to $\pm 42$ s  |
| Triggered with delay and doublet modes | 75 ns to 42s with $\pm 10$ ns jitter   |
| <b>Resolution</b>                      | 10 ns (width, delay, and PRI)  |

### **$T_d$ Video delay (variable)**

$T_w$  Video pulse width (variable)

$T_p$  Pulse period (variable)

$T_m$  RF delay

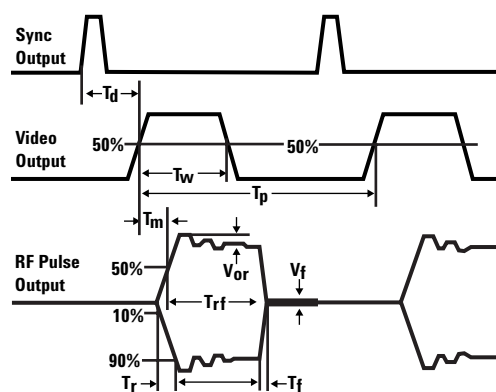
$T_{rf}$  RF pulse width

$T_f$  RF pulse fall time

$T_r$  RF pulse rise time

$V_{or}$  Pulse overshoot

$V_f$  Video feedthrough



## 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. 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, PPO, DC1, DT0, CO, E2.  |
| <b>ISO compliant</b>      | This family of signal generators is manufactured in an ISO-9001 registered facility in concurrence with Agilent Technologies commitment to quality.   |

## General specifications

|   |   |
|---|---|
| <b>Power requirements</b>                                     | 90 to 132 VAC 50 to 60 Hz or 365 to 435 Hz;<br>195 to 267 VAC 50 to 60 Hz, (automatically selected),<br>300 W maximum.  |
| <b>Operating temperature range</b>                            | 0 to 55 °C  |
| <b>Storage temperature range<sup>1</sup></b>                  | -40 to 71 °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, 0.75 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.<br>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.   |
| <b>Compatibility</b>  | Agilent Technologies 83550 Series millimeter heads, Agilent Technologies 8757D Scalar Network Analyzers, Agilent Technologies 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 498 mm D<br>(7" H x 16.8" W x 19.6" 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><br><b>For 20 GHz models</b><br><b>For 40 GHz models</b> | Nominal output impedance 50 Ω.<br>Precision APC-3.5 male, or Type-N with Option 1ED.<br>Precision 2.4 mm male; plus 2.4 - 2.4 mm and 2.4 - 2.9 mm female adaptors also included.  |
| <b>ALC input</b>   | Used for negative external detector leveling. Nominal input impedance 120 kΩ, damage level ±15 V.   |
| <b>LF output</b> (E8257C only)   | Outputs the internally generated LF source.<br>Nominal output impedance 50 Ω.   |
| <b>External input 1</b> (E8257C only)                                    | Drives either AM, FM, or ΦM. Nominal input impedance 50 or 600 Ω, damage levels are 5 V <sub>rms</sub> and 10 V <sub>peak</sub> .   |
| <b>External input 2</b> (E8257C only)                                    | Drives either AM, FM, or ΦM. Nominal input impedance 50 or 600 Ω, damage levels are 5 V <sub>rms</sub> and 10 V <sub>peak</sub> .   |
| <b>Pulse/trigger gate input</b> (E8257C only)                            | 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 <sub>rms</sub> and 10 V <sub>peak</sub> . |
| <b>Pulse video out</b> (E8257C only)                                     | Outputs a signal that follows the RF output in all pulse modes. TTL-level compatible, nominal source impedance 50 Ω.  |
| <b>Pulse sync out</b> (E8257C only)                                      | Outputs a synchronizing pulse, nominally 50 ns width, during internal and triggered pulse modulation. TTL-level compatible, nominal source impedance 50 Ω.  |

## 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 Ω.<br>Damage levels > +10 dBm        |
| <b>10 MHz output</b>                   | Outputs internal or external reference signal. Nominal output impedance 50 Ω. 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 (nominal) 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 (nominal) 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, can drive 2000 Ω.

1. Digital inputs and output are 3.3 V CMOS unless indicated otherwise. Inputs will accept 5 V CMOS, 3V CMOS, or TTL voltage levels.
2. Digital inputs and output are 3.3 V CMOS unless indicated otherwise. Inputs will accept 5 V CMOS, 3V 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</b> (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 us pulses (nominal) 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 bias, flatness correction, and leveling connections to the Agilent model 83550 Series mm-wave 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 (nominal) level during retrace and bandswitch intervals. Supplies – 5 V (nominal) 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 –0.07 ppm/V. The nominal input impedance is greater than 1 M. |

## Options, Accessories, and Related Products

| Model/option          | Description  |
|-----------------------|--|
| <b>E8247C/57C-520</b> | Frequency range 250 kHz to 20 GHz                                |
| <b>E8247C/57C-540</b> | Frequency range 250 kHz to 40 GHz                                |
| <b>E8247C/57C-UNR</b> | Enhanced close-in phase noise                                    |
| <b>E8257C-1E6</b>     | Narrow pulse modulation below 3.2 GHz                            |
| <b>E8247C/57C-007</b> | Ramp (analog) sweep  |
| <b>E8247C/57C-1ED</b> | Type-N (f) connector (20 MHz models only)                        |
| <b>E8247C/57C-1EM</b> | Moves all connectors to rear panel                               |
| <b>E8247C/57C-1CM</b> | Rack mount kit   |
| <b>E8247C/57C-1CN</b> | Front handle kit   |
| <b>E8247C/57C-1CP</b> | Rack mount kit with front handle kit                             |
| <b>E8247C/57C-H30</b> | Frequency upconversion of RF signals                             |
| <b>E8247C/57C-HEH</b> | Improve low band harmonics (from 10 MHz to 2.0 GHz)              |
| <b>83554A</b>         | Millimeter-wave source module (26.5 to 40 GHz)                   |
| <b>83555A</b>         | Millimeter-wave source module (33 to 50 GHz)                     |
| <b>83556A</b>         | Millimeter-wave source module (40 to 60 GHz)                     |
| <b>83557A</b>         | Millimeter-wave source module (50 to 75 GHz)                     |
| <b>83558A</b>         | Millimeter-wave source module (75 to 110 GHz)                    |
| <b>8120-8806</b>      | Master/slave interface cable                                     |
| <b>9211-2656</b>      | Standard transit case  |
| <b>9211-7481</b>      | Tote-style transit case (includes wheels and telescoping handle) |

## Web Resources

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

## Related Agilent Literature

*PSG Signal Generators*, Brochure  
Literature number 5989-1324EN

*E8267C PSG Vector Signal Generator*, Data Sheet  
Literature number 5988-6632EN

*PSG Self Guided Demo*  
Literature number 5988-2414EN

*E8247C/57C PSG CW and Analog Signal Generators*, Configuration Guide  
Literature number 5988-7879EN

*E8267C PSG Vector Signal Generator*, Configuration Guide  
Literature number 5988-7541EN

*PSG Series Product Note: Millimeter Head*  
Literature number 5988-2567EN

*PSG Two-Tone and Multitone Application Note AN 1410*  
Literature number 5988-7689EN



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Product specifications and descriptions in this document subject to change without notice.

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Printed in USA, February 8, 2007

5988-7454EN



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