# Agilent E8267D PSG Vector Signal Generator

Data Sheet

The Agilent E8267D is a fully synthesized signal generator with high output power, low phase noise, and I/Q modulation capability.

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 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 average.

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

Agilent Technologies

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# Specifications

## Frequency

| | | |
|---|---|---|
| **Range**[1] | | |
| Option 520 | 250 kHz to 20 GHz | |
| Option 532 | 250 kHz to 31.8 GHz | |
| Option 544 | 250 kHz to 44 GHz | |
| **Resolution** | | |
| CW | 0.001 Hz | |
| All sweep modes | 0.01 Hz[2] | |
| **Switching speed** [3, 4] | < 16 ms (typ) with I/Q modulation off | |
| | < 24 ms (typ) with I/Q modulation on | |
| **Phase offset** | Adjustable in nominal 0.1 ° increments | |
| **Frequency bands** | | |
| **Band** | **Frequency range** | **N**[5] |
| 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 28.5 GHz | 3 |
| 9 | > 28.5 to 44 GHz | 5 |
| **Accuracy** | ± aging rate ± temperature effects | |
| | ± line voltage effects (nom) | |
| **Internal timebase reference oscillator** | | |
| | **Standard**[8] | **Option UNX** |
| **Aging rate** | < $\pm 3 \times 10^{-8}$/year or < $\pm 2.5 \times 10^{-10}$/day after 30 days | < $\pm 3 \times 10^{-8}$/year or < $\pm 2.5 \times 10^{-10}$/day after 30 days |
| **Temperature effects** (typ) | < $\pm 4.5 \times 10^{-9}$ 0 to 55 °C | < $\pm 4.5 \times 10^{-9}$ 0 to 55 °C |
| **Line voltage effects** (typ) | < $\pm 2 \times 10^{-10}$ for ±10% change | < $\pm 2 \times 10^{-10}$ for ±10% change |
| **External reference frequency** | 10 MHz only | 10 MHz only |
| Lock range | ±1.0 ppm | ±1.0 ppm |
| **Reference output** | | |
| Frequency | 10 MHz | |
| Amplitude | > +4 dBm into 50 Ω load (typ) | |
| **External reference input** | | |
| Amplitude | 5 dBm ±5 dB | |
| Option UNX | 5 dBm ±5 dB[6] | |
| Input impedance | 50 Ω (nom) | |

## Step (digital) sweep

| | |
|---|---|
| **Operating modes** | Step sweep of frequency or amplitude or both (start to stop) |
| | 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** | 2 to 65535 (step sweep) |
| | 2 to 1601 per table (list sweep) |
| **Triggering** | Auto, external, single, or GPIB |
| **Settling time** | |
| Frequency | < 8 ms[7] (typ) |
| Amplitude | < 5 ms (typ) |

1. Operational, but unspecified, down 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. 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 (typ) when switching from greater than 3.2 GHz to less than 3.2 GHz.
5. N is a factor used to help define certain specifications within the document.
6. To optimize phase noise 5 dBm ± 2 dB.
7. 19 ms (typ) when stepping from greater than 3.2 GHz to less than 3.2 GHz.
8. Standard performance applies to units with serial numbers ending with 48050000 or greater. For units with lower serial numbers, refer to the data sheet shipped with the unit or the version of this document dated November 6, 2007.

## Ramp (analog) sweep (Option 007)[1]

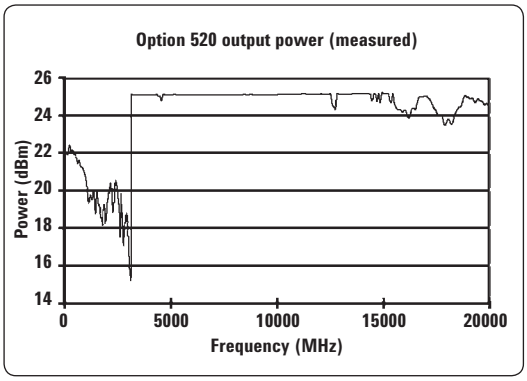
| | | | |
|---|---|---|---|
| **Operating modes** | • Synthesized frequency sweep (start/stop), (center/span), (swept CW)<br>• Power (amplitude) sweep (start/stop)<br>• Manual sweep RPG control between start and stop frequencies<br>• Alternate sweep Alternates successive sweeps between current and stored 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** |
| | 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 |
| **Frequency accuracy** | ± 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[3] | | |
| **Sweep time** | (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 | | |
| **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] | Two PSGs can synchronously track each other, with independent control of start/stop frequencies | | |
| **Network analyzer compatibility** | Fully compatible with Agilent 8757D scalar network analyzer[5]<br>Also useable with Agilent 8757A/C/E scalar network analyzers for making basic swept measurements.[6] | | |

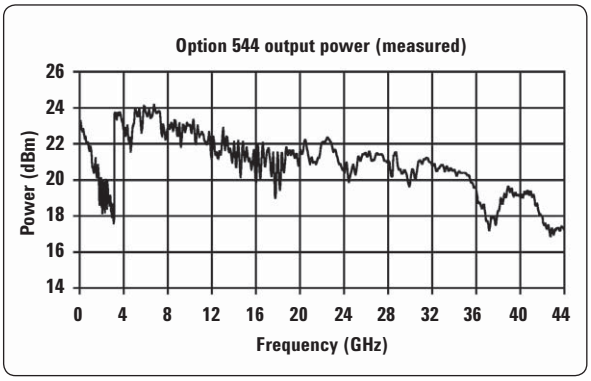
1. During ramp sweep operation, AM, FM, phase modulation, and pulse modulation are useable but performance is not specified; wideband AM and I/Q modulation are not useable.
2. Minimum settable sweep span is proportional to carrier frequency and sweep time. Actual sweep span may be slightly different than desired setting for spans less than [0.00004% 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 Agilent part number 8120-8806 master/slave interface cable.
5. 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).
6. 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 PSG signal generators.

## Output

| **Power**[1,2] (dBm) | |
|---|---|
| **Frequency range** | **spec (typ)** |
| **Option 520** | |
| 250 kHz to 3.2 GHz | –130 to +13 (+16) |
| 250 kHz to 3.2 GHz with Option UNW | –130 to +9 (+13) |
| 250 kHz to 3.2 GHz with Option 1EH | –130 to +10 (+13)[3] |
| 250 kHz to 3.2 GHz with Options UNW and 1EH | –130 to +7 (+12)[3] |
| > 3.2 to 10 GHz | –130 to +18 (+23)[4] |
| > 10 to 20 GHz | –130 to +18 (+22)[4] |
| **Options 532 and 544** | |
| 250 kHz to 3.2 GHz | –130 to +12 (+15) |
| 250 kHz to 3.2 GHz with Option UNW | –130 to +8 (+12) |
| 250 kHz to 3.2 GHz with Option 1EH | –130 to +9 (+12)[3] |
| 250 kHz to 3.2 GHz with Options UNW and 1EH | –130 to +6 (+11)[3] |
| > 3.2 to 10 GHz | –130 to +14 (+21)[4] |
| > 10 to 20 GHz | –130 to +14 (+18)[4] |
| > 20 to 32 GHz | –130 to +14 (+18)[5] |
| > 32 to 40 GHz | –130 to +12 (+18)[5] |
| > 40 to 44 GHz | –130 to +10 (+13)[5] |
| **Step attenuator**[6] | 0 to 115 dB in 5 dB steps |

**Maximum available power in CW mode** (measured)

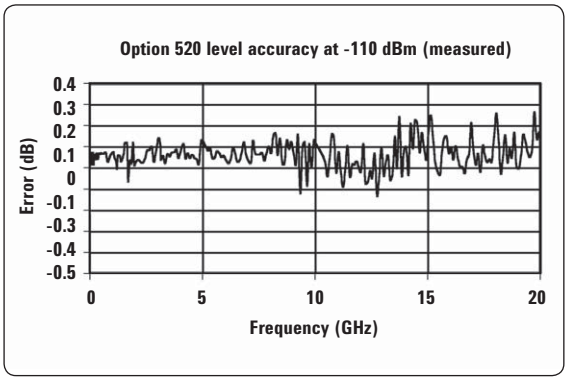


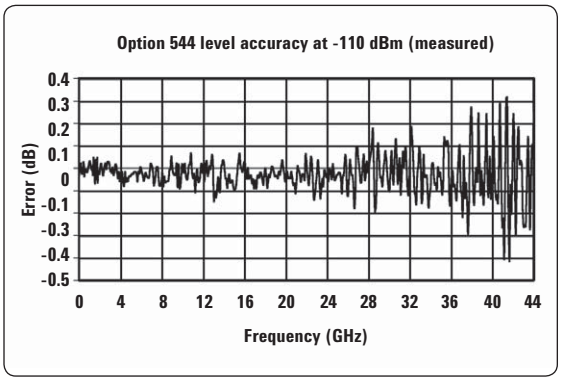




| **Attenuator hold range** | |
|---|---|
| **Minimum** | From –15 dBm to maximum specified output power with step attenuator in 0 dB position. Can be offset using step attenuator. |
| **Amplitude switching speed**[7] | |
| ALC on or off (without power search) | < 3 ms (typ) |

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 unlessotherwise stated.
2. With I/Q modulation on, maximum power specification is typical. With external inputs enabled, $\sqrt{(I^2 + Q^2)} > 0.2\ V_{rms}$.
3. With harmonic filters switched off. With filters on, maximum output power is reduced 3 dB for frequencies below 2 GHz.
4. With I/Q modulation on, maximum power specification is typically reduced 3 dB.
5. Maximum power over the 35 to 55 °C range typically degrades less than 4 dB. With I/Q modulation on, maximum power specification is typically reduced 5 dB.
6. 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.
7. To within 0.1 dB of final amplitude within one attenuator range. Add 10 to 50 ms when using power search.

| **Level accuracy**[1] **(dB)** | | | | |
|---|---|---|---|---|
| **Frequency** | **> +10 dBm** | **+10 to –10 dBm** | **–10 to –70 dBm** | **–70 to –90 dBm** |
| 250 kHz to 2 GHz | ±0.6 | ±0.6 | ±0.7 | ±0.8 |
| > 2 to 20 GHz | ±0.8 | ±0.8 | ±0.9 | ±1.0 |
| >20 to 32 GHz | ±1.0 | ±0.9 | ±1.0 | ±1.7 |
| > 32 to 44 GHz | ±1.0 | ±0.9 | ±1.5 | ±2.0 |
| **CW level accuracy with I/Q modulation** (With PRBS modulated data) (relative to CW)[2] | | | | |
| *With ALC on:* | | | | |
| QAM or QPSK formats[3] | | | ± 0.2 dB | |
| Constant-amplitude formats (FSK, GMSK, etc) | | | ± 0.2 dB | |
| *With ALC off:*[4] | | | ± 0.2 dB (typ) | |
| **Level accuracy** (measured) | | | | |




| | |
|---|---|
| **Resolution** | 0.01 dB |
| **Temperature stability** | 0.01 dB/ °C (typ)[5] |
| **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 [6], remote bus, manual (user edit/view) |
| **Output impedance** | 50 Ω (nom) |
| **SWR (internally leveled)** | |
| 250 kHz to 2 GHz | < 1.4:1 (typ) |
| > 2 GHz to 20 GHz | < 1.6:1 (typ) |
| > 20 GHz | < 1.8:1 (typ) |
| **Leveling modes** | Internal leveling, external detector leveling, millimeter source module, ALC off |

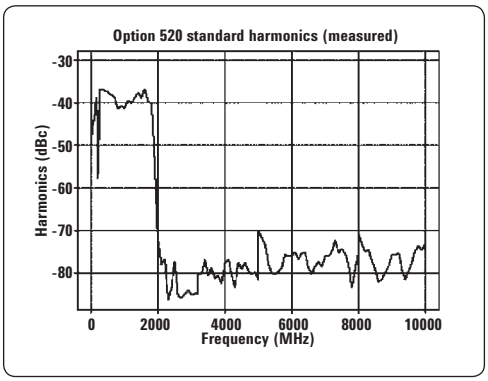
1. Specifications apply in CW and list/step sweep modes over the 15 to 35 ºC temperature range, with attenuator hold off (normal operating mode). Degradation outside this range, for ALC power levels > –5 dBm, is typically < 0.3 dB. In ramp sweep mode (with Option 007), specifications are typical. For 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. If external inputs are used, specification applies with input level $\sqrt{(I^2 + Q^2)} = 0.3\ V_{rms}$ and I/Q modulator attenuation is internally optimized based on input levels.
3. Measured with symbol rate > 10 kHz and power ≤ 0 dBm.
4. Relative to ALC on, after power search is executed. When applying external I/Q signals with ALC off, output level will vary directly with I/Q input level.
5. Options 532 and 544: 0.02 dB/°C (typ) above 2 GHz.
6. Compatible with Agilent EPM Series (E4418B and E4419B) power meters.

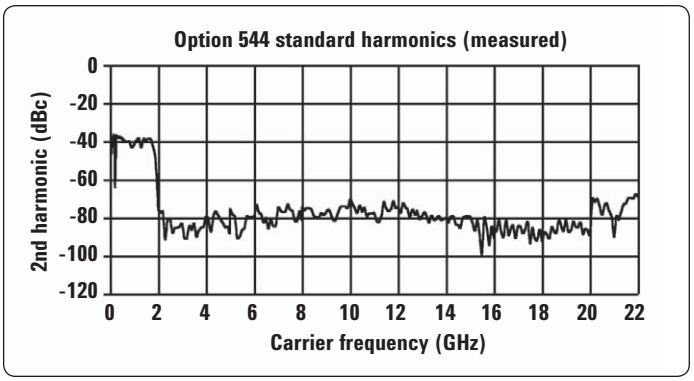
| | |
|---|---|
| **External detector leveling** | |
| Range | –0.2 mV to –0.5 V (nom) (–36 dBm to +4 dBm using Agilent 33330D/E detector) |
| Bandwidth | Selectable 0.1 to 100 kHz (nom) (Note: not intended for pulsed operation) |
| **Maximum reverse power** | 1/2 Watt, 0 $V_{DC}$ |

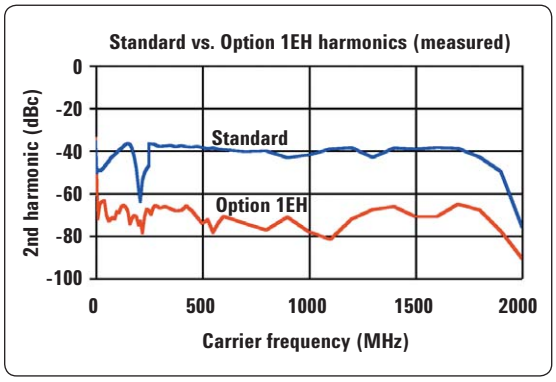
## Spectral purity

| | |
|---|---|
| **Harmonics**[1] (at +10 dBm or maximum specified output power, whichever is lower) | |
| < 10 MHz | –28 dBc (typical below 1 MHz) |
| 10 MHz to 2 GHz | –30 dBc[2,3] |
| 10 MHz to 2 GHz (with Option 1EH filters on) | –55 dBc[4] |
| > 2 GHz to 20 GHz | –55 dBc |
| > 20 GHz to 44 GHz | –45 dBc |

**Harmonics (measured)**




1. Specifications are typical for harmonics beyond specified frequency range.
2. Specification applies to units with serial numbers ending with 45160000 or greater. For serial numbers below that, the specification is –28 dBc.
3. Typical below 250 MHz if Option 1EH is installed and the filters are off.
4. In ramp sweep mode (Option 007), harmonics are –30 dBc below 250 MHz.

| | | |
|---|---|---|
| **Sub-harmonics**[1] | (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 44 GHz | < –45 dBc | |
| **Non-harmonics**[2] | (dBc at +10 dBm or maximum specified output power, whichever is lower, for offsets > 3 kHz [> 300 Hz with Option UNX or UNR]) | |
| **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 28.5 GHz | –52 | –60 |
| > 28.5 to 44 GHz | –48 | –56 |
| **SSB phase noise (CW)** | 20 kHz offset from carrier (dBc/Hz) | |
| **Frequency** | **Spec** | **Typical** |
| 250 kHz to 250 MHz[3] | –130 | –134 |
| > 250 to 500 MHz[3] | –134 | –138 |
| > 500 MHz to 1 GHz[3] | –130 | –134 |
| > 1 to 2 GHz[3] | –124 | –128 |
| > 2 to 3.2 GHz | –120 | –124 |
| > 3.2 to 10 GHz | –110 | –113 |
| > 10 to 20 GHz | –104 | –108 |
| > 20 to 28.5 GHz | –100 | –104 |
| > 28.5 GHz | –96 | –100 |

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

**Option UNX: Absolute SSB phase noise (CW)**[1]

| | Offset from carrier and Phase Noise (dBc/Hz) | | | | | |
|---|---|---|---|---|---|---|
| **Frequency** | **1 Hz** | **10 Hz** | **100 Hz** | **1 kHz** | **10 kHz** | **100 kHz** |
| | **Spec (typ)** | **Spec (typ)** | **Spec (typ)** | **Spec (typ)** | **Spec (typ)** | **Spec (typ)** |
| 250 kHz to 250 MHz[2] | –58 (–66) | –87 (–94) | –104 (–120) | –121 (–128) | –128 (–132) | –130 (–133) |
| > 250 to 500 MHz[2] | –61 (–72) | –88 (–98) | –108 (–118) | –126 (–132) | –132 (–136) | –136 (–141) |
| > 500 MHz to 1 GHz[2] | –57 (–65) | –84 (–93) | –101 (–111) | –121 (–130) | –130 (–134) | –130 (–135) |
| > 1 to 2 GHz[2] | –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 28.5 GHz | –25 (–34) | –56 (–62) | –72 (–83) | –92 (–102) | –100 (–103) | –100 (–105) |
| > 28.5 to 44 GHz | –20 (–30) | –51 (–58) | –68 (–77) | –88 (–97) | –96 (–99) | –96 (–101) |

**Option UNX: Residual SSB phase noise (CW)**[1]

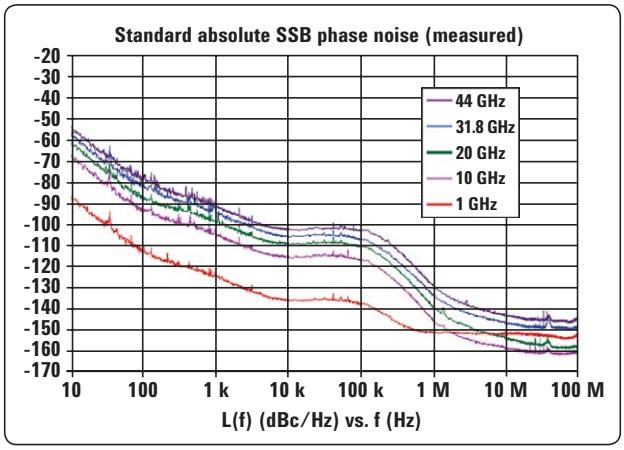
| | Offset from carrier and Phase Noise (dBc/Hz) | | | | | |
|---|---|---|---|---|---|---|
| **Frequency** | **1 Hz** | **10 Hz** | **100 Hz** | **1 kHz** | **10 kHz** | **100 kHz** |
| | **Spec (typ)** | **Spec (typ)** | **Spec (typ)** | **Spec (typ)** | **Spec (typ)** | **Spec (typ)** |
| 250 kHz to 250 MHz[2] | (–94) | –100 (–107) | –110 (–118) | –120 (–126) | –128 (–132) | –130 (–133) |
| > 250 to 500 MHz[2] | (–101) | –105 (–112) | –115 (–122) | –124 (–131) | –132 (–136) | –136 (–141) |
| > 500 MHz to 1 GHz[2] | (–94) | –100 (–107) | –110 (–118) | –120 (–126) | –130 (–134) | –130 (–134) |
| > 1 to 2 GHz[2] | (–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) |

| | |
|---|---|
| **Residual FM** | |
| (RMS, 50 Hz to 15 kHz bandwidth) | |
| CW mode | < N x 8 Hz (typ) |
| Option UNX | < N x 4 Hz (typ) |
| Ramp sweep mode | < N x 1 kHz (typ) |
| **Broadband noise** | (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 GHz | < –141 dBc/Hz (typ) |

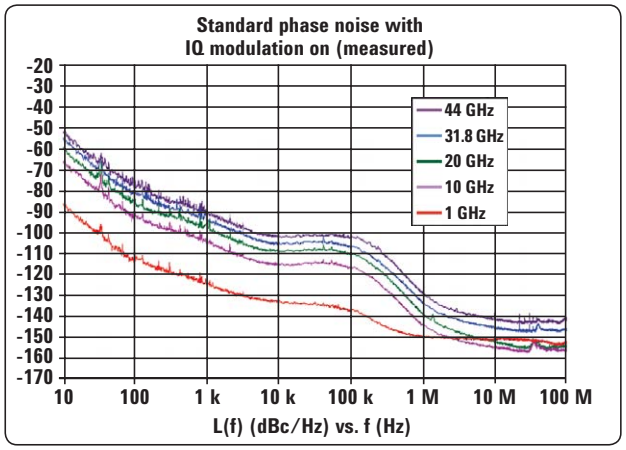
1. Phase noise specifications are warranted from 15 to 35 °C.
2. Measured at +10 dBm or maximum specified power, whichever is less.

**Measured phase noise with an Agilent E5500 phase noise measurement system and plotted without spurs**

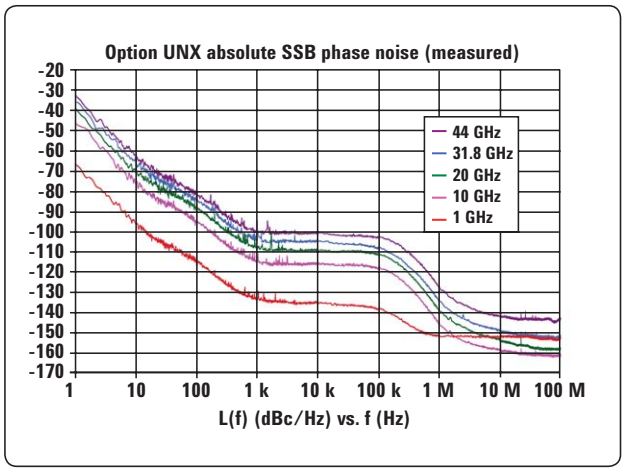
**Standard phase noise**[2]



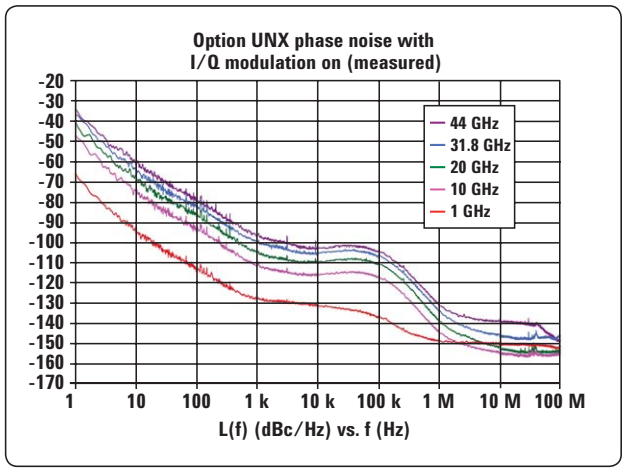

**Standard phase noise with I/Q modulation on**[1,2]




**Option UNX phase noise**

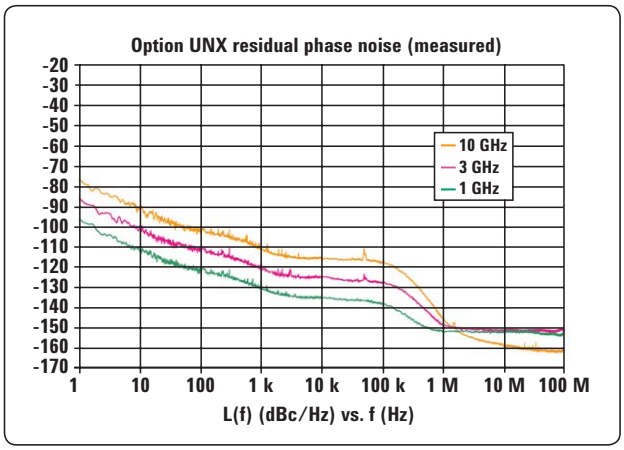



**Option UNX phase noise with I/Q modulation on**[1]

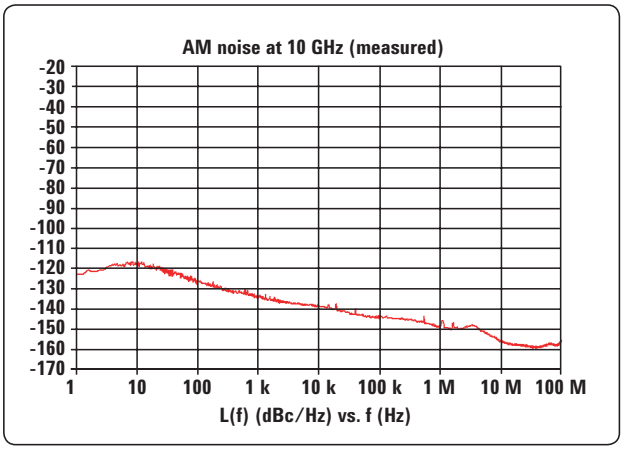



1. External I/Q input level $\sqrt{(I^2 + Q^2)}$ = 250 mVrms, I/Q modulator attenuator set to auto.
2. Measured standard performance applies to units with serial numbers ending with 48050000 or greater. For units with lower serial numbers, refer to the data sheet shipped with the unit or the version of this document dated November 6, 2007.

### Option UNX phase noise




### AM noise at 10 GHz



**Measured RMS jitter:**[1]

*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 | 25 | 158 |
| 622 MHz | 622 MB/s | 1 kHz to 5 MHz | 21 | 34 |
| 2.488 GHz | 2488 MB/s | 5 kHz to 20 MHz | 57 | 23 |
| 9.953 GHz | 9953 MB/s | 10 kHz to 80 MHz | 152 | 15 |
| 39.812 GHz | 39812 MB/s | 40 kHz to 320 MHz | 627 | 16 |

*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 | 23 | 151 |
| 622 MHz | 622 MB/s | 1 kHz to 5 MHz | 19 | 30 |
| 2.488 GHz | 2488 MB/s | 5 kHz to 20 MHz | 56 | 22 |
| 9.953 GHz | 9953 MB/s | 10 kHz to 80 MHz | 152 | 15 |
| 39.812 GHz | 39812 MB/s | 40 kHz to 320 MHz | 626 | 16 |

## Frequency modulation
(Option UNT)

| **Maximum deviation**[2] | **Frequency** | **Maximum deviation** |
|---|---|---|
| | 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 28.5 GHz | 48 MHz |
| | > 28.5 GHz to 44 GHz | 80 MHz |
| **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) | |
| **Modulation frequency response**[3] (at 100 kHz deviation) | | |
| **Path** [coupling] | **1 dB bandwidth** | **3 dB bandwidth (typ)** |
| 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 |
| **DC FM**[4] **carrier offset** | ±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. | |

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.
2. Through any combination of path1, path2, or path1 + path2.
3. 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).
4. At the calibrated deviation and carrier frequency, within 5 °C of ambient temperature at time of user calibration.

## Phase modulation
(Option UNT)

| **Maximum deviation**[1] | **Frequency** | **Normal BW mode** | **High BW mode** |
|---|---|---|---|
| | 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 28.5 GHz | 480 rad | 48 rad |
| | > 28.5 GHz to 44 GHz | 800 rad | 80 rad |
| **Resolution** | 0.1% of set deviation | | |
| **Deviation accuracy** | < ±5% of deviation + 0.01 radians (1 kHz rate, normal BW mode) | | |
| **Modulation frequency response**[2] | | | |
| | **Normal BW mode** | **High BW mode** | |
| **Rates (3 dB BW)** | DC to 100 kHz | DC to 1MHz (typ)[3] | |
| **Distortion** | < 1 % (1 kHz rate, Total Harmonic Distortion (THD), dev < 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 must be set to a deviation less than ΦM1. | | |

## Amplitude modulation[4]
(Option UNT)
(typical)

| **Depth** | | |
|---|---|---|
| | **Linear mode** | **Exponential (log) mode** (downward modulation only) |
| Maximum | | |
| ALC On | > 90% | > 20 dB |
| ALC Off with power search[5] or ALC On with Deep AM[6] | > 95% | > 40 dB |
| 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) |
| **Ext sensitivity** | ±1 $V_{peak}$ for indicated depth | –1 $V_{peak}$ for indicated depth |
| **Rates** (3 dB bandwidth, 30% depth) | | |
| DC coupled | 0 to 100 kHz | |
| AC coupled | 10 Hz to 100 kHz (useable to 1 MHz) | |
| **Distortion** (1 kHz rate, linear mode, Total Harmonic Distortion (THD)) | | |
| 30% AM | < 1.5% | |
| 60% AM | < 2 % | |
| **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. Through any combination of path1, path2, or path1 + path2.
2. 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).
3. Path 1 is useable to 4 MHz for external inputs less than 0.3 $V_{peak}$.
4. AM specifications are typical. 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 (–15 dBm to maximum specified power, excluding step attenuator setting).
5. 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.
6. ALC On with Deep AM provides high AM depths together with closed-loop internal leveling. This mode can be used with a repetitive AM waveform (frequency > 10 Hz) with peaks > –5 dBm (nominal, excluding step-attenuator setting).

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

| | |
|---|---|
| **Modulation types** | AM, FM, and ΦM |
| **Input impedance** | 50 or 600 Ω (nom), switched |
| **High/low indicator** | |
| (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 provide two independent signals (internal1 and internal2) for use with AM, FM, ΦM, or LF Out.

| | |
|---|---|
| **Waveforms** | Sine, square, positive ramp, negative ramp, triangle, Gaussian noise, uniform noise, swept sine, dual sine[1] |
| **Rate range** | |
| Sine | 0.5 Hz to 1 MHz |
| Square, ramp, triangle | 0.5 Hz to 100 kHz |
| Resolution | 0.5 Hz |
| Accuracy | Same as timebase |
| **LF out** | |
| Output | Internal1 or internal2. Also provides monitoring of internal1 or internal2 when used for AM, FM, or ΦM. |
| Amplitude | 0 to 3 $V_{peak}$, into 50 Ω (nom) |
| Output impedance | 50 Ω (nom) |
| **Swept sine mode: (frequency, phase continuous)** | |
| Operating modes | Triggered or continuous sweeps |
| Frequency range | 1 Hz to 1 MHz |
| Sweep rate | 0.5 Hz to 100 kHz sweep/s, equivalent to |
| sweep | times 10 µs to 2 s |
| Resolution | 0.5 Hz (0.5 sweep/s) |

## Wideband AM

| | |
|---|---|
| **Rate (typical 1 dB bandwidth)** | |
| ALC on | 1 kHz to 80 MHz |
| ALC off | DC to 80 MHz |
| **External I input** | |
| Sensitivity | 0.5 V = 100% |
| Input impedance | 50 Ω (nom) |

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

## Pulse modulation[1,2]
(Option UNU)

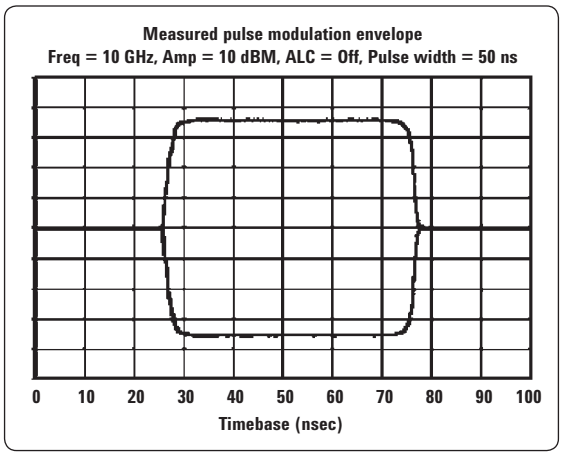
| | 500 MHz to 3.2 GHz | Above 3.2 GHz |
|---|---|---|
| **On/Off ratio** | 80 dB (typ) | 80 dB |
| **Rise/Fall times (Tr, Tf)** | 100 ns (typ) | 6 ns (typ) |
| **Minimum pulse width** | | |
| Internally leveled | 2 µs | 1 µs |
| Level hold (ALC off with power search) | 0.5 µs | 0.15 µs |
| **Repetition frequency** | | |
| 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 |
| **Level accuracy** (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) |
| **Width compression** | | |
| (RF width relative to video out) | ±50 ns (typ) | ±5 ns (typ) |
| **Video feed-through**[3] | < 200 mv (typ) | < 2 mv (typ) |
| **Video delay** (Ext input to video) | 50 ns (nom) | 50 ns (nom) |
| **RF delay** (video to RF output) | 270 ns (nom) | 35 ns (nom) |
| **Pulse overshoot** | < 10% (typ) | < 10% (typ) |
| **Input level** | +1 $V_{peak}$ = RF On | +1 $V_{peak}$ = RF On |
| **Input impedance** | 50 Ω (nom) | 50 Ω (nom) |

## Narrow pulse modulation[1,2]
(Option UNW)

| | 10 MHz to 3.2 GHz | Above 3.2 GHz |
|---|---|---|
| **On/Off ratio** | 80 dB | 80 dB |
| **Rise/Fall times** (Tr, Tf) | 10 ns (8 ns typ) | 10 ns (6 ns typ) |
| **Minimum pulse width** | | |
| Internally leveled: | 1 µs | 1 µs |
| Level hold (ALC off with power search): | 20 ns | 20 ns |
| **Repetition frequency** | | |
| 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 |
| **Level accuracy** (relative to CW) | | |
| Internally leveled | ±0.5 dB | ±0.5 dB (0.15 dB typ) |
| Level hold (ALC off with power search): | ±1.3 dB (typ) | ±0.5 dB (typ) |

1. With ALC off, specifications apply after the execution of power search. Specifications apply with Atten Hold Off (default mode), or ALC level between –5 and +10 dBm or maximum specified power, whichever is lower .
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 10-50 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.
3. With attenuator in 0 dB position. Video feed-through decreases with attenuator setting.

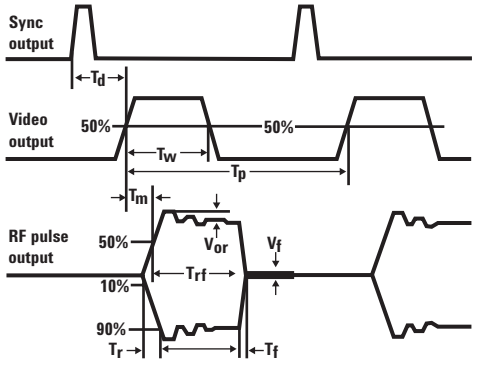
| | 10 MHz to 3.2 GHz | Above 3.2 GHz |
|---|---|---|
| **Width compression** (RF width relative to video out) | ±5 ns (typ) | ±5 ns (typ) |
| **Video feed-through**[1] | < 125 mv (typ) | < 2 mv (typ) |
| **Video delay** (Ext input to video) | 50 ns (nom) | 50 ns (nom) |
| **RF delay** (video to RF output) | 45 ns (nom) | 35 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) |




## Internal pulse generator (Option UNU or UNW)

| | |
|---|---|
| **Modes** | Free-run, triggered, triggered with delay, doublet, and gated. Triggered with delay, doublet, and gated modes require an 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 | 75 ns to 42 s with ±10 ns jitter |
| **Resolution** | 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, ΦM, pulse. and I/Q) may be simultaneously enabled except: FM with ΦM, linear AM with exponential AM, and wideband AM with I/Q. 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.

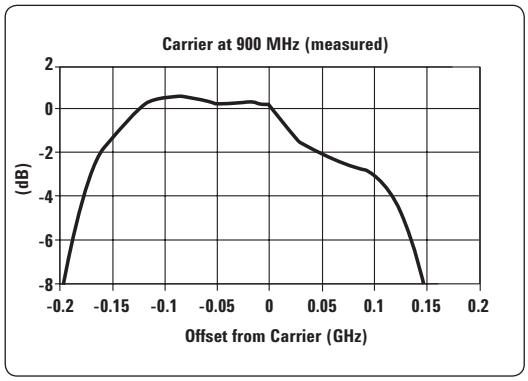
1. With attenuator in 0 dB position. Video feed-through decreases with attenuator setting.

## Vector modulation[1]

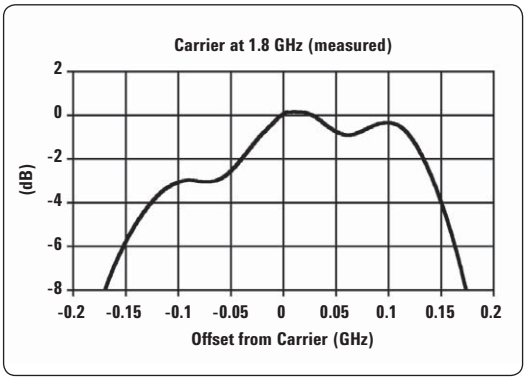
| External I/Q inputs | |
|---|---|
| Input impedance switched | 50 or 600 Ω (nom) |
| Input range[2] | Minimum 0.1 $V_{rms}$, maximum 1$V_{peak}$ |
| Flatness | ± 1 dB within ± 40 MHz of carrier (with ALC off) (typ) |

**I/Q frequency response**[3] (measured)

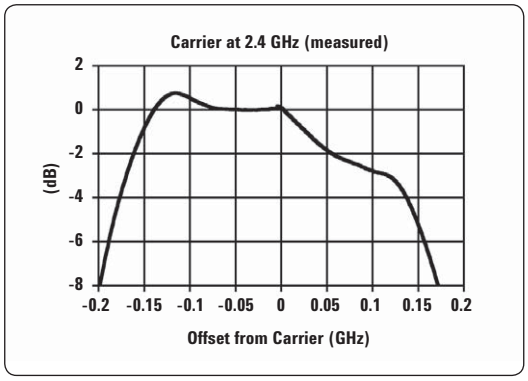
**900 MHz**



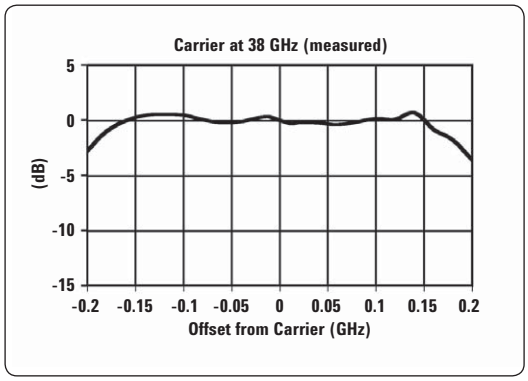

**1.8 GHz**




**2.4 GHz**




**38 GHz**




| RF path filters | Carrier frequency | Nominal filter cutoff |
|---|---|---|
| | ≤ 250 MHz | 300 MHz low-pass filter |
| | > 250 to 396 MHz | 220 to 420 MHz bandpass filter |
| | > 396 to 628 MHz | 350 to 650 MHz bandpass filter |
| | > 628 to 1000 MHz | 1040 MHz low-pass filter |
| | > 1.0 to 1.5 GHz | 1.6 GHz low-pass filter |

1. With Option 007, vector modulation is not useable in ramp sweep mode. With Option 1EH, specifications apply with filters off.
2. For optimum signal quality, the I and Q inputs should be 0.7 $V_{peak}$, with $\sqrt{(I^2 + Q^2)}$ + 150 $mV_{rms}$. Different RMS levels are accommodated by adjusting the internal I/Q modulator attenuator, which may be either manually or automatically set. The minimum input level required to maintain RF level accuracy is $\sqrt{(I^2 + Q^2)}$ = 0.1 $V_{rms}$.
3. Sine wave response, measured with input level = 100 mVrms on one channel, and ALC off. For carrier frequencies below 1.5 GHz, modulation frequency response within ± 150 MHz of carrier may be limited by RF chain filtering.

| | |
|---|---|
| **I/Q adjustments** | |
| I & Q offsets | External inputs (600 Ω): ± 5 Volts<br>External inputs (50 Ω): ± 50 %<br>Internal baseband generator: ± 50 % |
| I/Q attenuation | 0 to 40 dB |
| I/Q gain balance | ± 4 dB |
| I/Q quadrature skew | ± 10 ° range (typ) |
| Low pass filter | Selectable 40 MHz or through path |
| **I/Q baseband outputs** | |
| Differential | I, $\overline{I}$, Q, $\overline{Q}$ |
| Single ended | I, Q |
| Frequency range | DC to 40 MHz |
| Output voltage into 50 Ω | 1.5 $V_{peak\text{-}to\text{-}peak}$ (typ) |
| DC offset adjustments | ± 3 V |
| DC offset resolution | 1 mV |
| Low pass filter | Selectable 40 MHz or through path |

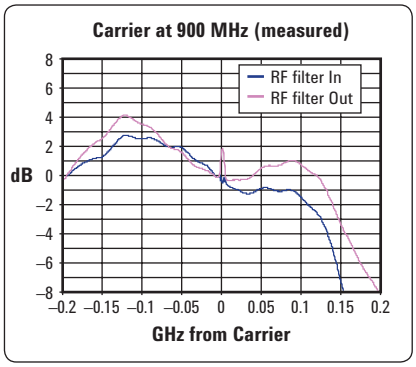
## Wideband external differential I/Q inputs[1] (Option 016)

| **RF output frequency range** | 250 kHz to 3.2 GHz | 3.2 to 44 GHz |
|---|---|---|
| **Input** | | |
| Input (baseband) frequency range | DC to 130 MHz (nom) | DC to 1.0 GHz [2] |
| Input impedance | 50 Ω (nom) | 50 Ω (nom) |
| Recommended input level | –1 dBm | 0 dBm (nom) |
| Maximum input voltage | ±1 $V_{DC}$ | ±1 $V_{DC}$ |
| **I/Q offset adjustments** | ±50% | ±50% |
| **I/Q quadrature skew** | ±10 degrees | ±10 degrees (nom) |

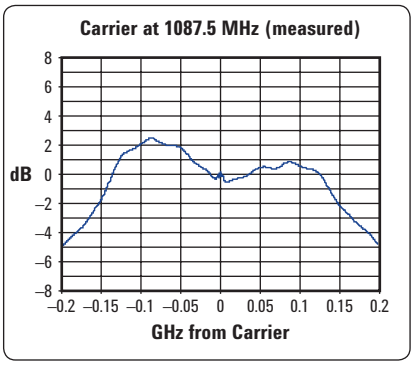
**I/Q frequency response** (measured)

## I/Q frequency response[3] for frequencies < 3.2 GHz (measured)

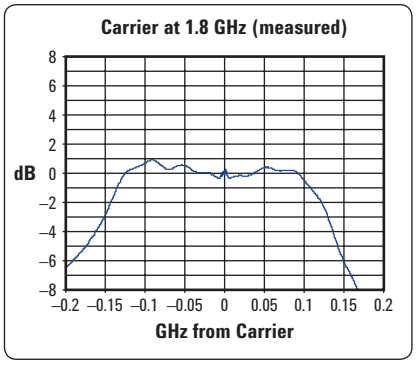
**900 MHz**



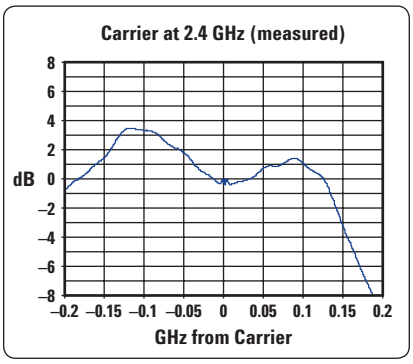

**1087.5 GHz**




**1.8 GHz**



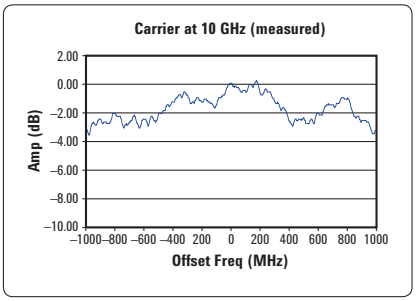

**2.4 GHz**



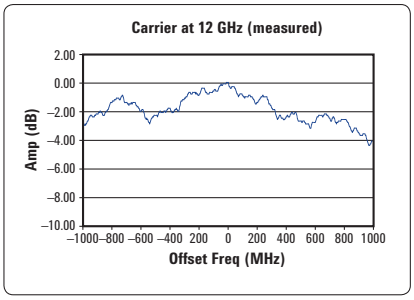

1. With Option 007, vector IQ modulation is not useable in ramp sweep mode.
2. Modulation frequency response within ±1 GHz of the carrier frequency may be limited by the RF chain cutoff frequencies.
3. Sine wave response, measured with input level = 100 mVrms on one channel, and ALC off. For carrier frequencies below 1.5 GHz, modulation frequency response within ±150 MHz of carrier may be limited by RF chain filtering.

## I/Q frequency response[1] for frequencies > 3.2 GHz (measured)

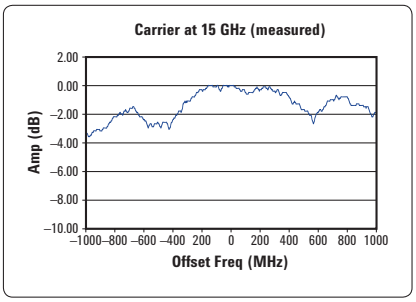
**10 GHz**



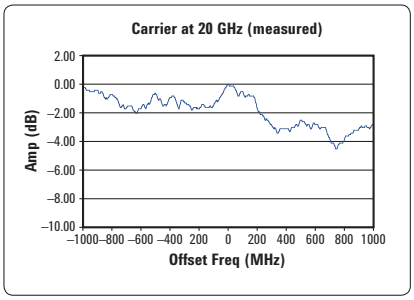

**12 GHz**




**15 GHz**




**20 GHz**




| **RF path filters**[2] | |
|---|---|
| Carrier frequency | Nominal filter cutoff frequencies |
| > 3.2 to 5 GHz | 5.5 GHz low-pass filter |
| > 5 to 8 GHz | 8.9 GHz low-pass filter |
| > 8 to 12.8 GHz | 13.9 GHz low-pass filter |
| > 12.8 to 20 GHz | 22.5 GHz low-pass filter |
| > 20 to 24 GHz | 19.6 to 24.5 GHz band-pass filter |
| > 24 to 28.5 GHz | 23.5 to 29.0 GHz band-pass filter |
| > 28.5 to 32 GHz | 28.0 to 32.5 GHz band-pass filter |
| > 32 to 36 GHz | 31.7 to 36.5 GHz band-pass filter |
| > 36 to 40 GHz | 35.5 to 40.4 GHz band-pass filter |
| > 40 to 44 GHz | 39.5 to 44.3 GHz band-pass filter |

## Internal baseband generator: arbitrary waveform mode (Options 602)

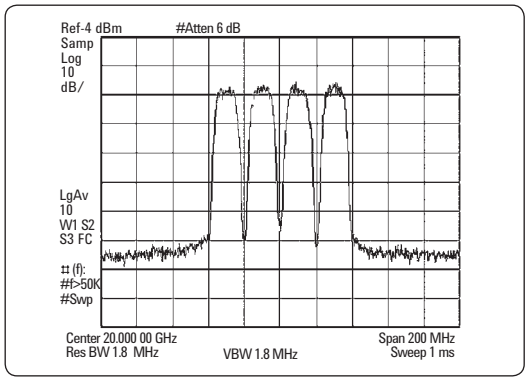
| | |
|---|---|
| **Channels** | 2 [I and Q] |
| **Resolution** | 16 bits [1/65,536] |
| **Baseband waveform memory** | |
| Length (playback) | |
| Option 602 | 64 megasamples (MSa/channel) |
| Length (non-volatile storage) | 1.2 gigasamples (GSa) on 8 GB removable flash memory (Option 009) |
| **Waveform segments** | |
| Segment length | 60 samples to 8 or 64 MSa |
| Maximum number of segments | 8,192 (Option 602) |
| Minimum memory allocation | 256 samples or 1 kbyte blocks |
| **Waveform sequences** | |
| Sequencing | Continuously repeating |
| Maximum number of sequences | 16,384 |
| Maximum segments/sequence | 32,768 |
| Maximum segment repetitions | 65,536 |

1. Sine wave response, measured with input level = 100 mVrms on one channel, and ALC off. For carrier frequencies below 1.5 GHz, modulation frequency response within ±150 MHz of carrier may be limited by RF chain filtering.
2. Modulation frequency response within ±1 GHz of the carrier frequency may be limited by the RF chain cutoff frequencies. For operation near a filter edge, filters can be bypassed using sofware commands to increase modulation bandwidth.

| | |
|---|---|
| **Clock** | |
| Sample rate | 1 Hz to 100 MHz |
| Resolution | 0.001 Hz |
| Accuracy | Same as timebase $+2^{-42}$ [in non-integer applications] |
| **Reconstruction filter:** [fixed] | 50 MHz [used for all symbol rates] |
| **Baseband spectral purity** | |
| [full scale sinewave] | |
| Harmonic distortion | 100 kHz to 2 MHz: < –65 dBc (typ) |
| Phase noise | < –127 dBc/Hz (typ) (baseband output of 10 MHz sinewave at 20 kHz offset) |
| IM performance | < –74 dB (typ) |
| **Triggers** | |
| Types | Continuous, single, gated, segment advance |
| Source | Trigger key, external, remote [LAN, GPIB, RS-232] |
| External polarity | Negative, positive |
| External delay time | 10 ns to 40 s plus latency |
| External delay resolution | 10 ns |
| **Markers** | |
| *(Markers are defined in a segment during the waveform generation process, or from the PSG front panel. A marker can also be tied to the RF blanking feature of the PSG.)* | |
| Marker polarity | Negative, positive |
| Number of markers | 4 |
| **Multicarrier** | |
| Number of carriers | Up to 100 (limited by a maximum bandwidth of 80 MHz depending on symbol rate and modulation type) |
| Frequency offset (per carrier) | –40 MHz to +40 MHz |
| Power offset (per carrier) | 0 dB to –40 dB |
| **Modulation** | **Types** |
| PSK | BPSK, QPSK, OQPSK, π/4 DQPSK, 8PSK, 16PSK, D8PSK |
| QAM | 4, 16, 32, 64, 128, 256 |
| FSK | Selectable: 2, 4, 8, 16 |
| MSK | |
| **Data** | Random ONLY |

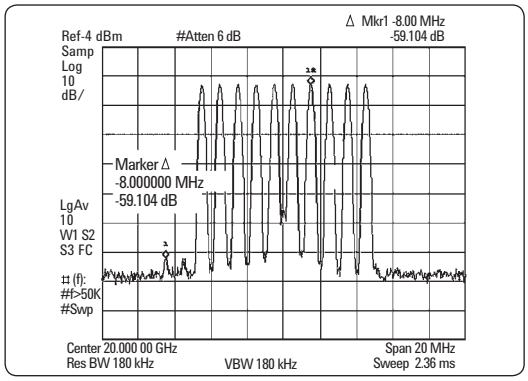
**Multicarrier (measured)**

**4 Carriers with 64 QAM at 10 Msym/s with 20 MHz spacing**

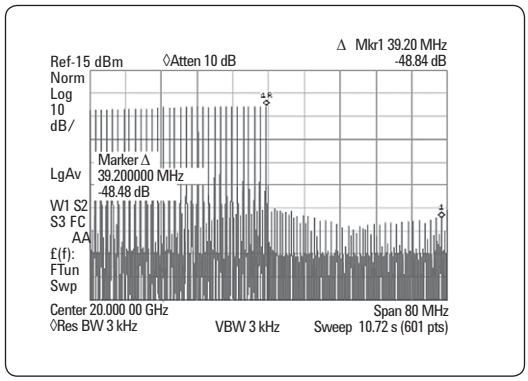



| | |
|---|---|
| **Multitone** | |
| Number of tones | 2 to 64, with selectable on/off state per tone |
| Frequency spacing | 100 Hz to 80 MHz |
| Phase (per tone) | Fixed or random |
| Power offset (per tone) | 0 to –40 dB |

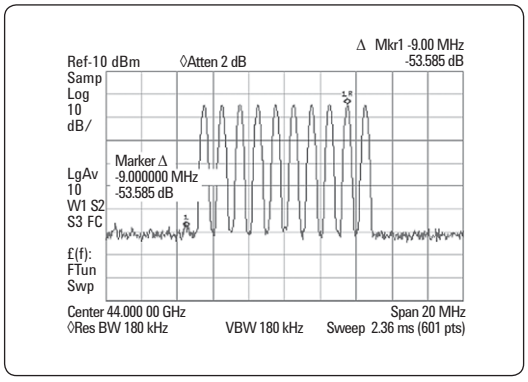
**20 GHz multitone (measured)**



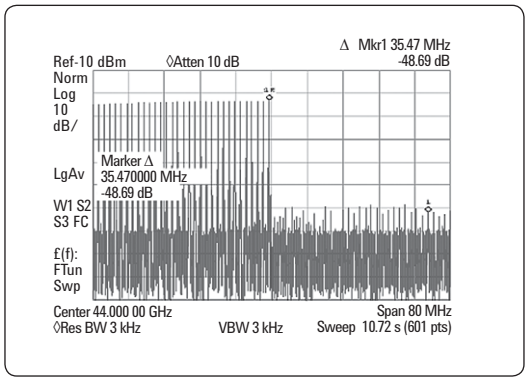

**20 GHz image rejection (measured)**




**44 GHz multitone (measured)**



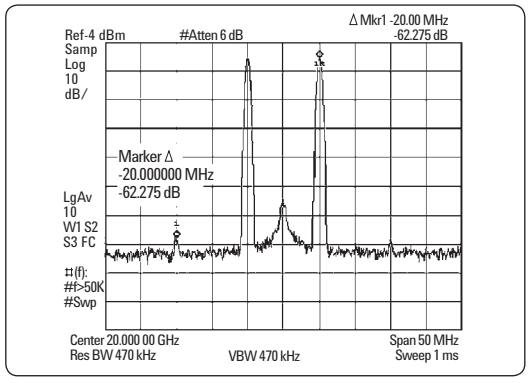

**44 GHz image rejection (measured)**



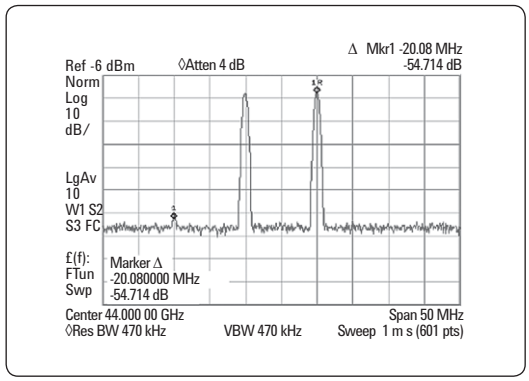

**Two-tone**

| | |
|---|---|
| Frequency spacing | 100 Hz to 80 MHz) |
| Alignment | Left, centered, or right |
| IM distortion[1] | |
| 250 kHz to 3.2 GHz | < –45 dBc (typ) |
| > 3.2 GHz to 20 GHz | < –55 dBc (typ) |
| > 20 to 40 GHz | < –50 dBc (typ) |
| > 40 to 44 GHz | < –45 dBc (typ) |

**20 GHz two tone (measured)**



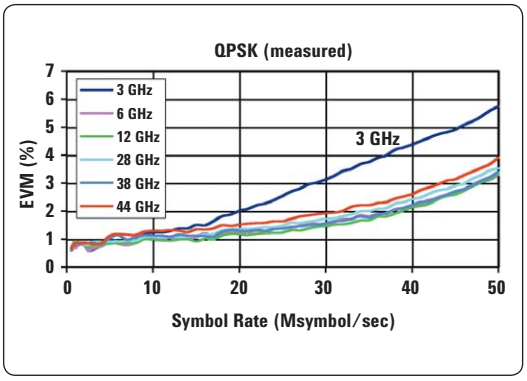

**44 GHz two tone (measured)**

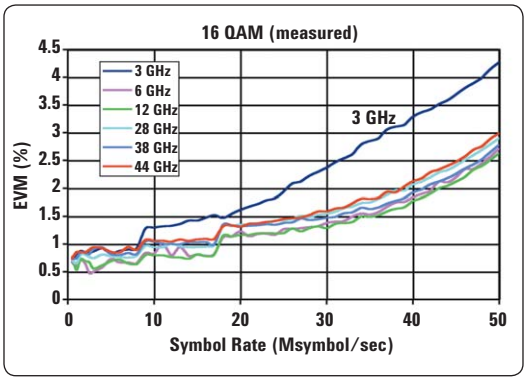



1. RF power < 0 dBm (Option 520) or < –3 dBm (Option 532, 544). When external inputs are used, vector accuracy is equivalent to internal performance after system calibration.

## Internal baseband generator: real-time mode
(Option 602)

| **Basic modulation types** (custom format) | |
|---|---|
| PSK | BPSK, QPSK, OQPSK, π/4 DQPSK, 8PSK, 16PSK, D8PSK |
| MSK | User-defined phase offset from 0 to 100 ° |
| QAM | 4, 16, 32, 64, 128, 256 |
| FSK | Selectable: 2, 4, 8, 16 level symmetric, C4FM<br>User defined: Up to 16 custom deviation levels<br>Deviation resolution: 0.1 Hz |
| | **Symbol rate** — **Maximum deviation**<br>< 5 MHz — 4 times symbol rate<br>5 MHz to 50 MHz — 20 MHz |
| User-defined I/Q | Custom map of 256 unique values |
| **Vector accuracy**[1] | Formats: BPSK, QPSK, 16-256 QAM (α = 0.3, root Nyquist filter, symbol rate 4 Msym/s) |
| EVM (% RMS) | |
| ≤ 20 GHz | < 1.2%, < 0.8% (typ) |
| > 20 to 32 GHz | < 1.3% < 0.9% (typ) |
| > 32 to 44 GHz | < 1.4% < 0.9% (typ) |
| Origin offset | |
| 250 kHz to 3.2 GHz | –45 dBc (typ) |
| 3.2 to 44 GHz | –50 dBc (typ) |
| **EVM** (measured) | |



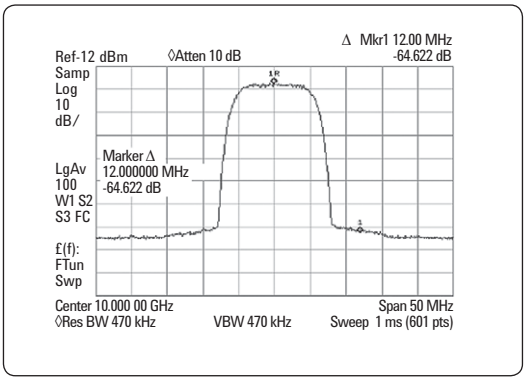




| **FIR filter** | |
|---|---|
| Selectable | Nyquist, root Nyquist, Gaussian, rectangular<br>α: 0 to 1, $B_bT$: 0.1 to 1 |
| Custom FIR | 16-bit resolution, up to 64 symbols long, automatically resampled to 1024 coefficients (maximum)<br>> 32 to 64 symbol filter: symbol rate ≤ 12.5 MHz<br>> 16 to 32 symbol filter: symbol rate ≤ 25 MHz<br>Internal filters switch to 16 tap when symbol rate is between 25 and 50 MHz |
| **Symbol rate** | |
| For external serial data: | Adjustable from 1000 symbols/sec to a maximum symbol rate of 50 Mbits/sec ÷ (#bits/symbol) |
| For internally generated data: | Adjustable from 1000 symbols/sec to 50 Msymbols/second and a maximum of 8 bits per symbol. Modulation quality may be degraded at high symbol rates. |

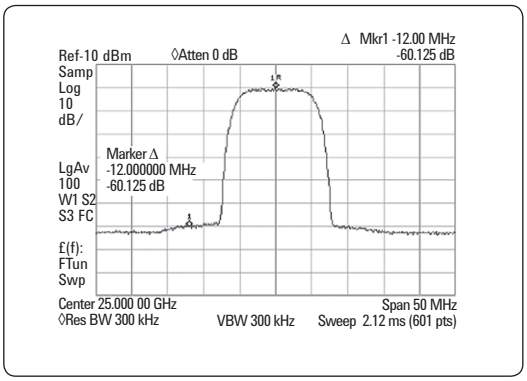
1. Measured with Agilent 89441A vector signal analyzer. Valid after executing I/Q calibration, and instrument is maintained within ±5 °C of calibration temperature. RF power < 0 dBm (Option 520) or < –3 dBm (Option 532, 544). When external inputs are used, vector accuracy is equivalent to internal performance, after system calibration.

| | |
|---|---|
| **Baseband reference frequency** | Data clock can be phase locked to an external reference. |
| Input | ECL, CMOS, TTL compatible, 50 Ω AC coupled |
| **Frame trigger delay control** | |
| Range | 0 to 1,048,575 bits |
| Resolution | 1 bit |
| **Data types** | |
| **Internally generated data** | |
| Pseudo-random patterns | PN9, PN11, PN15, PN20, PN23 |
| Repeating sequence | Any 4-bit sequence<br>Other fixed patterns |
| **Direct-pattern RAM** [PRAM] | |
| Max size | 64 Mb (Option 602)<br>(each bit uses an entire sample space) |
| Use | Non-standard framing |
| **User file** | |
| Max size | 6.4 Mb (Option 602) |
| Use | Continuous modulation or internally generated TDMA standard |
| **Externally generated data** | |
| Type | Serial data |
| Inputs | Data, data (bit) clock, symbol sync<br>Accepts data rates ±5% of specified data rate |
| **Internal burst shape control** | |
| Varies with standards and bit rates | |
| Rise/Fall time range | Up to 30 bits |
| Rise/Fall delay range | 0 to 63.5 bits |
| **Spectral re-growth** (measured) | |

**10 GHz carrier with 16 QAM signal at 10 Msym/s**




**25 GHz carrier with 16 QAM signal at 10 Msym/s**



## Remote programming

| | |
|---|---|
| **Interfaces** | GPIB (IEEE-488.2,1987) with listen and talk, RS-232, and 10BaseT LAN interface |
| **Control languages** | SCPI version 1997.0. Completely code compatible with previous PSG signal generator models:<br>• E8241A<br>• E8244A<br>• E8251A<br>• E8254A<br>• E8247C<br>• E8257C<br>The E8257D will emulate the applicable commands for the following Agilent signal generators, providing general compatibility with ATE systems:<br>• 8340-series (8340/41B)<br>• 8360-series (836xxB/L)<br>• 83700-series (837xxB)<br>• 8662A/63A |
| **IEEE-488 functions** | SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E2 |
| **ISO compliant** | This family of signal generators is manufactured in an ISO-9001 registered facility in concurrence with Agilent Technologies' commitment to quality. |
| **Agilent IO Libraries** | Agilent's IO Libraries Suite ships with the E8267D 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

| | |
|---|---|
| **Power requirements** | 100-120 V 50/60 Hz, 220-240 V 50/60 Hz (automatically selected)<br>< 400 W typ 650 W maximum |
| **Operating temperature range** | 0 to 55 °C[1] |
| **Storage temperature range**[1]<br>With Option 005 | –40 to 70 °C<br>–4 ° to 65 °C, gradient less than 20 °C/hour |
| **Altitude** | 0 to 4600 m (15,00 ft) |
| **Environmental Testing** | Samples of this product have been type tested in accordance with the Agilent Environmental Test Manual and verified to be robust against the environmental stresses of storage, transportation and end-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power line conditions. Test methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.[2] |
| **EMC** | 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. |
| **Storage** | Memory is shared by instrument states, user data files, sweep list files, and waveform sequences. There is 14 MB of flash memory available in the E8267D PSG. With Option 005 there is an additional 6 GB of storage, and with option 009, there is an additional 8 GB of storage. Depending on how the memory is utilized, a maximum of 1000 instrument states can be saved. |
| **Security** | Display blanking<br>Memory clearing functions (See Application Note "Security of Agilent Singal Generators Issues and Solutions," Literature Number, 5989-1091EN) |
| **Compatibility** | Agilent 83550 Series Millimeter Heads and OML millimeter source modules<br>Agilent 8757D scalar network analyzers<br>Agilent EPM Series power meters |
| **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** | < 25 kg (54 lb.) net, < 33 kg (74 lb.) shipping |
| **Dimensions** | 178 mm H x 426 mm W x 515 mm D<br>(7" H x 16.8" W x 20.3" D in.) |
| **Recommended calibration cycle** | 24 months |

1. 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) |
| Option 520 | Precision APC-3.5 male or precision Type-N female with Option 1ED |
| Options 532 and 544 | Precision 2.4 mm male; plus 2.4(f) - 2.4(f) mm and 2.4(f) - 2.9(f) mm adaptors |
| **ALC input** | Used for negative external detector leveling<br>Nominal input impedance 120 kΩ, damage level ±15 V. |
| **LF output** | Outputs the internally generated LF source. Nominal output impedance 50 Ω. |
| **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. |
| **Data clock input** | Accepts a data clock signal to synchronize serial data for use with internal baseband generator (Option 601 or 602). Maximum rate 50 MHz. Damage levels are > +5.5 V and < –0.5 V. |
| **Data input** | Accepts serial data for use with internal baseband generator (Option 601 or 602). Maximum rate 50 Mb/s. Data must be valid on the falling edges of data clock (normal mode) or the symbol sync (symbol mode). Damage levels are > +5.5 V and < –0.5 V. |
| **I input** | Accepts an "I" input either for I/Q modulation or for wideband AM. Nominal input impedance 50 or 600 Ω. Damage levels are 1 $V_{rms}$ and 5 $V_{peak}$. |
| **Q input** | Accepts a "Q" input for I/Q modulation. Nominal input impedance 50 or 600 Ω. Damage levels are 1 $V_{rms}$ and 5 $V_{peak}$. |
| **Symbol sync input** | Accepts symbol sync signal for use with internal baseband generator (Option 601 or 602). Symbol sync might occur once per symbol or be a single, one bit wide pulse to synchronize the first bit of the first symbol. Maximum rate 50 MHz. Damage levels are > +5.5 V and < –0.5 V. |

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 D-subminiature female connector) For master/slave operation, use Agilent part number 8120-8806 master/slave interface cable. |
| **GPIB** | Allows communication with compatible devices |
| **LAN** | Allows 10baseT LAN communication |
| **10 MHz input** | Accepts an external reference (timebase) input (at 1, 2, 2.5, 5, 10 MHz for standard and 10 MHz only for Option UNX and UNR). Nominal input impedance 50 Ω. Damage levels > +10 dBm. |
| **10 MHz output** | Outputs internal or external reference signal. Nominal output impedance 50 Ω. Nominal output power +4 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.<br><br>During CW operation, supplies a voltage proportional to the output frequency, +10 volts (nom) corresponding to the maximum specified frequency.<br><br>When connected to an Agilent 8757D scalar network analyzer (Option 007), 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.<br><br>Output impedance: < 1 Ω (nom), can drive 2000 Ω. |
| **Stop sweep In/Out** | 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. |
| **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** | Provides bias, flatness correction, and leveling connections to the Agilent model 83550 Series mm-wave source modules. |
| **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** | (Option UNR/UNX only) Accepts an external DC voltage, ranging from –5V to +5V, 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 |
| **.25 – 3.2 GHz coherent carrier output** | Outputs RF signal modulated with FM or ΦM but not I/Q, AM or pulse. Nominal power 0 dBm. Frequency range from 250 MHz to 3.2 GHz. Not useful for output frequency > 3.2 GHz. Damage levels 20 $V_{DC}$ and 13 dBm reverse RF power. (SMA female). |

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.

| | |
|---|---|
| **Baseband generator clock input** | Accepts a sine or square wave PECL clock input with a frequency range of 200 MHz o 400 MHz (resulting in sample rates of 50 MSa/s to 100 MSa/s). The recommended input level is approximately 1 $V_{peak\text{-}to\text{-}peak}$ for a square wave and 0 dBm to 6 dBm for a sine wave. Allows the baseband generators of multiple signal sources to run off same clock. |
| **Burst gate input** | Accepts signal for gating burst power for use with internal baseband generator (Option 601 or 602). The burst gating is used when you are externally supplying data and clock information. The input signal must be synchronized with the external data input that will be output during the burst. The burst power envelope and modulated data are internally delayed and re-synchronized. The input signal must be CMOS high for normal burst RF power or CW RF output power and CMOS low for RF off. Damage levels are > +5.5 V and < –0.5 V. |
| **Event 1 output** | In real-time mode, outputs a pattern or frame synchronization pulse for triggering or gating external equipment, for use with internal baseband generator (Option 601 or 602). May be set to start at the beginning of a pattern, frame, or timeslot and is adjustable to within ± one timeslot with one bit resolution. In arbitrary waveform mode, outputs a timing signal generated by marker 1. |
| **Event 2 output** | In real-time mode, outputs a data enable signal for gating external equipment, for use with internal baseband generator (Option 601 or 602). Applicable when external data is clocked into internally generated timeslots. Data is enabled when signal is low. In arbitrary waveform mode, outputs a timing signal generated by marker 2. |
| **I and Q outputs** | Outputs the analog I/Q modulation signals from the internal baseband generator. Nominal output impedance 50 Ω, DC-coupled. Damage levels ±3.5 V. |
| **$\overline{\text{I}}$ and $\overline{\text{Q}}$ outputs** | Outputs the complement of the I and Q signals for differential applications. Nominal output impedance 50 Ω, DC-coupled. Damage levels ±3.5 V. |
| **Pattern trigger input** | Accepts signal to trigger internal pattern or frame generator to start single pattern output, for use with internal baseband generator (Option 601 or 602). Minimum pulse width 100 ns. Damage levels are > +5.5 V and < –0.5 V. |
| **Wideband I and Q inputs** | Direct differential high-bandwidth analog inputs to I/Q modulator in 3.2 to 44 GHz range and useable for carriers < 3.2 GHz.. Not calibrated. 0 dBm maximum. (Option 016 only). |
| **Removable flash memory drive** | Accepts 8 GB compact flash memory card for optional non-volatile memory (Option 009 only). |

## Auxiliary I/O connector
(37-pin) used with Option 602

| | |
|---|---|
| **Alternate power input** | Accepts CMOS signal for synchronization of external data and alternate power signal timing. Damage levels are > +8 V and < –4V. |
| **Data clock output**<br>**Data output** | Relays a CMOS bit clock signal for synchronizing serial data. Outputs data from the internal data generator or the externally supplied signal at data input. CMOS signal. |
| **Event 3 output** | In arbitrary waveform mode, outputs a timing signal generated by marker 3. Damage levels > +8 V and < 4 V. |
| **Event 4 output** | In arbitrary waveform mode, outputs a timing signal generated by marker 4. Damage levels > +8 V and < 4 V. |
| **Symbol sync output** | Outputs CMOS symbol clock for symbol synchronization, one data clock period wide. |

# Options, Accessories, and Related Products

| Model/option | Description |
|---|---|
| E8267D-520 | Frequency range from 250 kHz to 20 GHz |
| E8267D-532 | Frequency range from 250 kHz to 31.8 GHz |
| E8267D-544 | Frequency range from 250 kHz to 44 GHz |
| E8267D-602 | Internal baseband generator, 64 MSa memory |
| E8267D-003 | PSG digital output connectivity with N5102A |
| E8267D-004 | PSG digital input connectivity with N5102A |
| E8267D-007 | Analog ramp sweep |
| E8267D-009[2] | 8 GB removable flash memory |
| E8267D-016 | Wideband external I/Q inputs |
| E8267D-403 | Calibrated AWGN |
| E8267D-SP1 | Signal Studio for jitter injection |
| E8267D-UNX | Ultra low phase noise |
| E8267D-UNT | AM, FM, phase modulation, and LF output |
| E8267D-UNU | Pulse modulation |
| E8267D-UNW | Narrow pulse modulation |
| E8267D-1ED | Type-N (f) RF output connector |
| E8267D-1EH | Improved harmonics below 2 GHz |
| E8267D-1EM | Moves all front panel connectors to the rear panel |
| E8267D-SP2 | Dynamic sequencing capability |
| N7620A | Signal Studio for pulse building |
| N7622A | Signal Studio Toolkit |
| N7619A | Signal Studio for UWB |
| N7613A | Signal Studio for 802.16-2004 Fixed WiMax |
| N7620A | Signal Studio for pulse building |
| N7621B | Signal Studio for multitone distortion testing |
| N7623A | Signal Studio for DVB |
| N7600B | Signal Studio for 3GPP W-CDMA |
| N7601B | Signal Studio for cdma2000 |
| N7602B | Signal Studio for GSM/Edge |
| N7615B | Signal Studio for 802.16 OFDMA mobile WiMax |
| N7617B | Signal Studio for 802.11 WLAN |
| E8267D-H1S | 1 GHz external frequency reference input |
| E8267D-H1G | Connections for phase coherency and improved phase stability < 250 MHz |
| E8267D-HCC | Connections for phase coherency > 250 MHz[1] |
| E8267D-1CN | Front handle kit |
| E8267D-1CM | Rackmount flange kit |
| E8267D-1CP | Rackmount flange and front handle kit |
| E8267D-UK6 | Commercial calibration certificate and test data |
| E8267D-CD1 | CD-ROM containing the English documentation set |
| E8267D-ABA | Printed copy of the English documentation set |
| E8267D-0BW | Printed copy of the assembly-level service guide |
| N5102A | Baseband Studio digital signal interface module |
| N5101A | Baseband Studio PCI card |
| N5110B | Baseband Studio for waveform capture and playback |
| N5110B-194 | Play waveform from Baseband Studio PCI card |
| N5110B-195 | Capture waveform to Baseband Studio PCI card |
| N5110B-130 | 40 MSa/s sample rate |
| N5110B-132 | 100 MSa/s sample rate |
| N5110B-134 | 200 MSa/s sample rate |
| Z5623A-Kxx | Distribution network (lock box)[1] |
| 8120-8806 | Master/slave interface cable |
| 9211-2656 | Transit case |
| 9211-7481 | Transit case with wheels |

1. Utilized for multiple source phase coherency applications.
2. Option 009 applies to units with serial numbers ending with 48290000 or greater. For units with lower serial numbers, refer to the data sheet shipped with the unit or the version of this document dated January 15, 2008.

# Web Resources

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

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

For accessory information, visit:
**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**

# Related Agilent Literature

*E8267D PSG Vector Signal Generator*
Configuration Guide, Literature number 5989-1326EN

*E8257D PSG Analog Signal Generator*
Data Sheet, Literature number 5989-0698EN

*PSG Two-tone and Multitone Personalities*
Application Note AN 1410, Literature number 5988-7689EN

*Signal Studio for Noise Power Ratio*
Technical Overview, Literature number 5988-9161EN

*Signal Studio for Enhanced Multitone*
Technical Overview, Literature number 5988-5639EN

*Signal Studio for 802.11 WLAN*
Technical Overview, Literature number 5988-8618EN

*Baseband Studio Digital Signal Interface Module*
Technical Overview, Literature number 5988-9495EN

*Security of Agilent Signal Generators: Issues and Solutions*
Literature number 5989-1091EN

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| Latin America | 305 269 7500 |
| United States | 800 829 4444 |

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| Australia | 1 800 629 485 |
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| Hong Kong | 800 938 693 |
| India | 1 800 112 929 |
| Japan | 81 426 56 7832 |
| Korea | 080 769 0800 |
| Malaysia | 1 800 888 848 |
| Singapore | 1 800 375 8100 |
| Taiwan | 0800 047 866 |
| Thailand | 1 800 226 008 |

**Europe & Middle East**

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|---|---|
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| Belgium | 32 (0) 2 404 93 40 |
| Denmark | 45 70 13 15 15 |
| Finland | 358 (0) 10 855 2100 |
| France | 0825 010 700*<br>*0.125 €/minute |
| Germany | 07031 464 6333**<br>**0.14 €/minute |
| Ireland | 1890 924 204 |
| Israel | 972 3 9288 504/544 |
| Italy | 39 02 92 60 8484 |
| Netherlands | 31 (0) 20 547 2111 |
| Spain | 34 (91) 631 3300 |
| Sweden | 0200-88 22 55 |
| Switzerland | 0800 80 53 53 |
| United Kingdom | 44 (0) 118 9276201 |

Other European Countries:
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