Agilent E8267C
PSG Vector 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 520 250 kHz to 20 GHz	Option 540 250 kHz to 40 GHz
CW Only	E8247C	E8247C
Analog	E8257C	E8257C
Vector	E8267C	

(See E8247C/E8257C data sheet for PSG CW and Analog Signal Generator specifications)

Definitions

Specifications (spec): represent warranted performance.

Typical (typ): performance is not warranted. It applies at 25° C. 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

E8267C PSG Vector Signal Generator

Choose your required frequency range as an Option when configuring your PSG series. Please refer to the related literature in the section PSG application and product information for additional information.

Agilent Microwave Vector Signal Generators options

Frequency range	(required option)
Option-520	250 kHz to 20 GHz
Enhanced phase noise	
Option-UNR	Enhanced phase noise performance
Narrow pulse modulation	
Option-1E6	Provides narrow pulse modulation below 3.2GHz
Analog (ramp) sweep	
Option-007	Provides analog (ramp) sweep and scalar network analyzer interface
Connectors	
Option-1ED	Type-N (f) connector
Option-1EM	Moves all connector to rear panel
Power supply	
Option-UNS	External module allows operation at 400Hz
Internal baseband generator with memory	
Option-002	Internal baseband generator with 32 Msample memory
Option-005	6GB internal hard drive
Wideband external I/Q	
Option-015	Wideband external I/Q inputs

Specifications

Frequency

Range[1]		
Option 520	250 kHz to 20 GHz	
Resolution		
CW	0.001 Hz	
All Sweep Modes	0.01 Hz	
Accuracy	Aging rate ± temperature effects± line voltage effects	
Switching speed[2]	< 15 ms typical	
Phase offset	Adjustable in nominal 0.1° increments.	
Frequency bands		
Band	**Frequency range**	**N #**
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
Internal timebase reference oscillator		
	Standard	**Option UNR**
Aging rate	$< \pm 1 \times 10^{-7}$/year or $< \pm 4.5 \times 10^{-9}$/day after 45 days	$< \pm 3 \times 10^{-8}$/year or $< \pm 2.5 \times 10^{-10}$/day after 30 days
Temperature effects (typical)	$< \pm 5 \times 10^{-8}$ 0 to 55° C	$< \pm 4.5 \times 10^{-9}$ 0 to 55° C
Line voltage effects (typical)	$< \pm 2 \times 10^{-9}$ for +5% –10% change	$< \pm 2 \times 10^{-10}$ for ±10% change
External reference frequency	1, 2, 2.5, 5, 10 MHz (within 1 ppm)	10 MHz only (within 1 ppm)
Reference output		
Frequency	10 MHz	
Amplitude	> +4 dBm typical into 50 ohm load	
External reference input		
Amplitude	> -3 dBm	
Opt UNR	5 dBm ±5 dB[3]	
Input impedance	50 ohms, nominal	

1 Useable to 100 kHz
2 To within 0.1 ppm of final frequency above 250 MHz or within 100 Hz below 250 MHz
3 To optimize phase noise 5 dBm ± 2 dB

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
Dwell time	1 ms to 60 s
Frequency settling time	28 ms typical
Amplitude settling time	10 ms typical
Number of points	2 to 1601
Triggering	Auto, external, single, or GPIB

Ramp (Analog) sweep (Option 007) [4]

Operating modes	Synthesized frequency sweep (Start/Stop),(Center/Span),(Swept CW)		
	Power (amplitude) sweep (Start/Stop)		
	Manual sweep RPG control between Start and Stop frequencies		
	Alternate sweep Alternates successive sweeps between current and stored states		
Sweep span range	Settable 0 Hz (swept CW) to full range		
Maximum Sweep Rate	**Start frequency**	**Maximum sweep rate**	**Max Span for 100ms 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	20 GHz
Frequency accuracy	± 0.05% of span ± timebase (at 100ms sweep time, for sweep spans less than maximum values given above) Accuracy improves proportionally as sweep time increases [5]		
Sweep time	(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		
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 [6]	Two PSG's can synchronously track each other, with independent control of Start/Stop frequencies		
Network Analyzer Compatibility	Fully Compatible with Agilent 8757D Scalar Network Analyzer [7] Also useable with Agilent 8757A/C/E scalar network analyzers for making basic swept measurements. [8]		

4 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.

5 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.

6 For Master/Slave operation use Agilent Technologies part #8120-8806 Master/Slave interface cable.

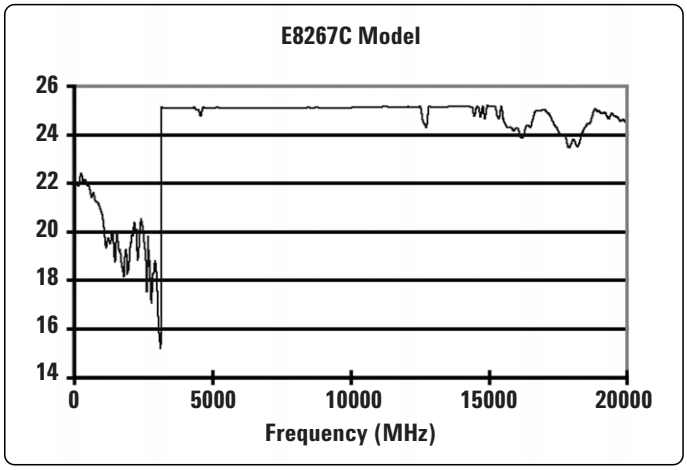
7 When measuring low-pass devices in AC mode, dynamic range may be reduced up to 10dB below 3.2 GHz

8 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[9] (dBm)	
Frequency range	
250 kHz to 3.2 GHz[10]	-130 to +13
250 kHz to 3.2 GHz (with Option 1E6)[10]	-130 to +10
> 3.2 to 20 GHz[11]	-130 to +18
Step attenuator	0 to 115 dB in 5 dB steps

Measured maximum available power in CW mode



Attenuator hold range	(Same as max power sweep 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[12]	
CW or analog modulation	< 5 ms, typical
When using power search	< 25 ms, typical

Level accuracy[13] (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

CW Level accuracy with I/Q modulation (relative to CW)[14]	(With PRBS modulated data)
With ALC On:	
QAM or QPSK formats[15]	± 0.2 dB
Constant-amplitude formats (FSK, GMSK, etc)	± 0.2 dB
With ALC Off:[16]	± 0.2 dB typical

9 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

10 With I/Q modulation on, maximum power specification is typical. With External inputs enabled, $\sqrt{(I^2 + Q^2)} > 0.2\ V_{RMS}$.

11 With I/Q modulation on, maximum power specification is typically +15 dBm. With External inputs enabled, $\sqrt{(I^2 + Q^2)} > 0.2\ V_{RMS}$.

12 To within 0.1 dB of final amplitude within one attenuator range

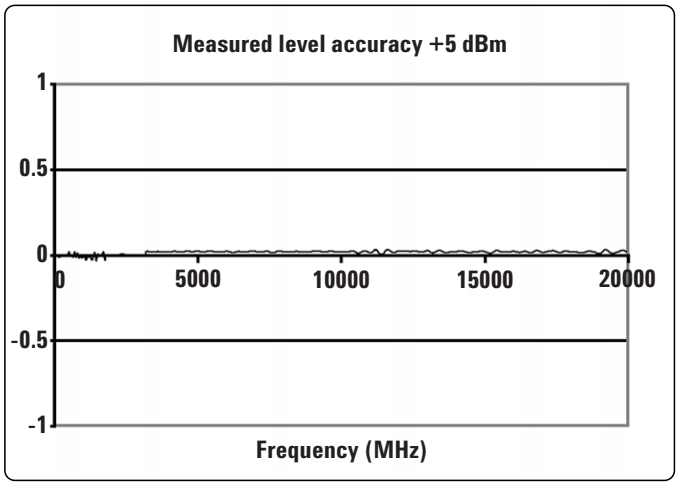
13 Specifications apply in CW and List/Step sweep modes over the 15 to 35° C temperature range, with attenuator hold off (normal operating mode). Degradation outside this range, for ALC power levels > -5 dBm, is typically < 0.3 dB. In Ramp sweep mode (with Option 007), specifications are typical. For instruments with Type-N connectors (Option 1ED), specifications are degraded typically 0.2 dB above 18 GHz. Level accuracy is not specified below -110 dBm.

14 If external inputs are used, specification applies with input level $\sqrt{(I^2 + Q^2)} = 0.3\ V_{RMS}$ and I/Q modulator attenuation = 10dB.

15 Measured with symbol rate > 10 kHz and power ≤ 0 dBm.

16 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.

20 GHz level accuracy



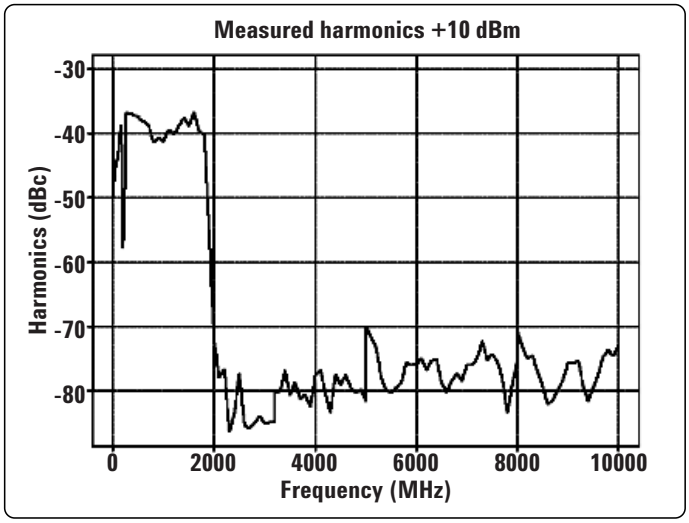
Resolution	0.01 dB
Temperature stability	0.01 dB/° C, typical
User flatness correction	
Number of points	2 to 1601 points/table
Number of tables	Up to 10,000, memory limited
Path loss	Arbitrary, within attenuator range
Entry modes	Remote power meter[17], remote bus, manual (user edit/view)
Output impedance	50 ohms nominal
SWR (internally leveled, typical)	
250 kHz to 2 GHz	< 1.4:1
> 2 GHz to 20 GHz	< 1.6:1
Leveling modes	Internal leveling, external detector leveling, millimeter source module, ALC Off
External detector leveling	
Range	-0.2 mV to -0.5 V, nominal (-36 dBm to +4 dBm using Agilent 33330D/E detector)
Bandwidth	Typically 10 kHz (Note: not intended for pulsed operation)
Maximum reverse power	1/2 Watt nominal

17 Compatible with Agilent Technologies EPM Series (E4418B and E4419B) power meters.

Spectral purity

Harmonics[18]	(dBc at +10 dBm or maximum specified output power, whichever is lower)
< 1 MHz	-27 dBc typical
1 MHz to 2 GHz	-27 dBc
> 2 GHz to 20 GHz	-55 dBc

20 GHz Measured harmonics



Sub-harmonics:[19]	(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	
Non-harmonics:	(dBc at +10 dBm or maximum specified output power, whichever is lower, for offsets > 3 KHz [>300 Hz with Option UNR])[20]	
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
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	–136	–140
> 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

18 Specifications for harmonics beyond maximum instrument frequencies are typical.
19 Specifications for sub-harmonics beyond maximum instrument frequencies are typical.
20 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.

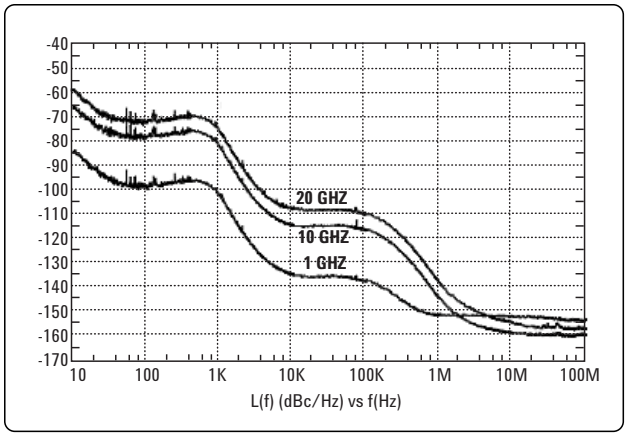
Option UNR: Enhanced SSB phase noise (CW)

	Offset from carrier (dBc/Hz)			
Frequency	**100 Hz**	**1 kHz**	**10 kHz**	**100 kHz**
	spec (typ)	spec (typ)	spec (typ)	spec (typ)
250 kHz to 250 MHz	-94 (-115)	-110 (-123)	-128 (-132)	-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)

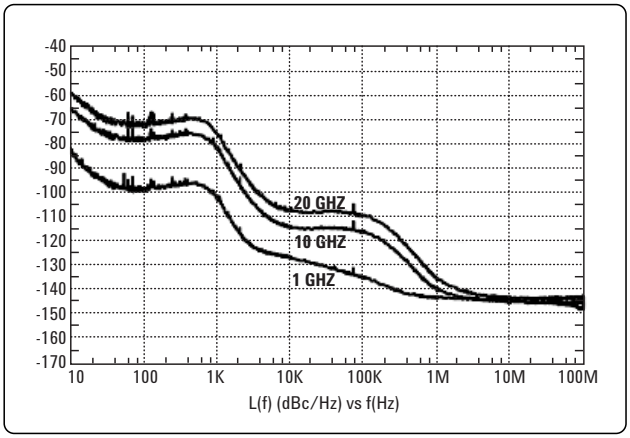
Residual FM	
CW mode	< N x 8 Hz, typical
Option UNR	< N x 4 Hz, typical
Ramp sweep mode:	< N x 1 kHz, typical
(rms, 50 Hz to 15 kHz bandwidth)	
Broadband noise	(CW mode at +10 dBm output, for offsets > 10 MHz)
> 2.4 to 20 GHz	< -148 dBc/Hz, typical

Measured phase noise

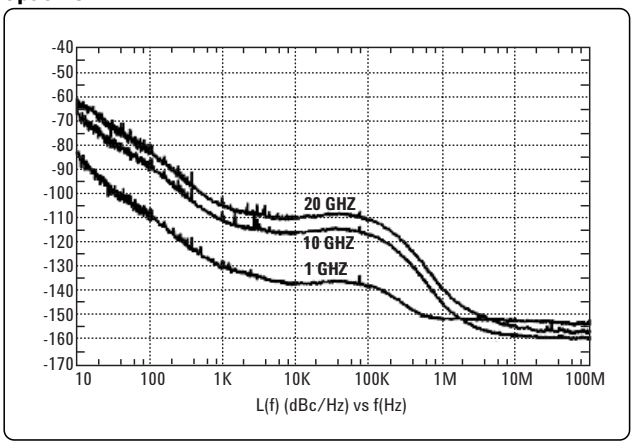
Standard Phase noise



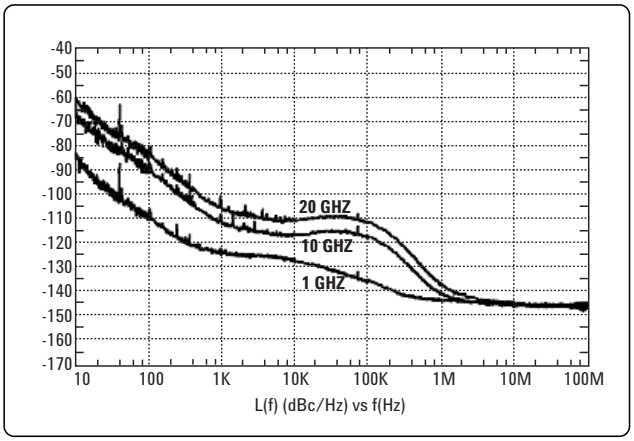
Standard Phase noise with I/Q modulation on [21]



Option UNR

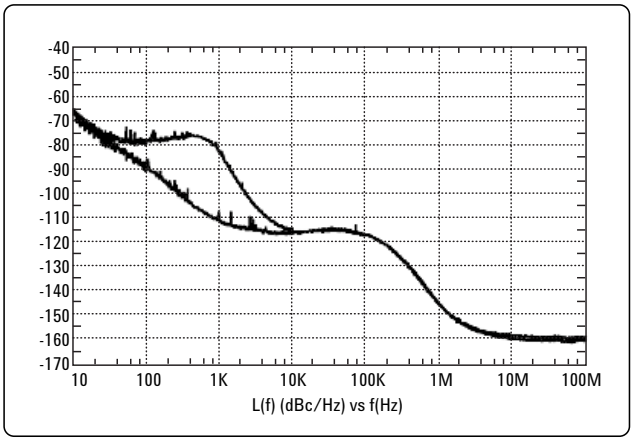


Option UNR with I/Q modulation on [21]

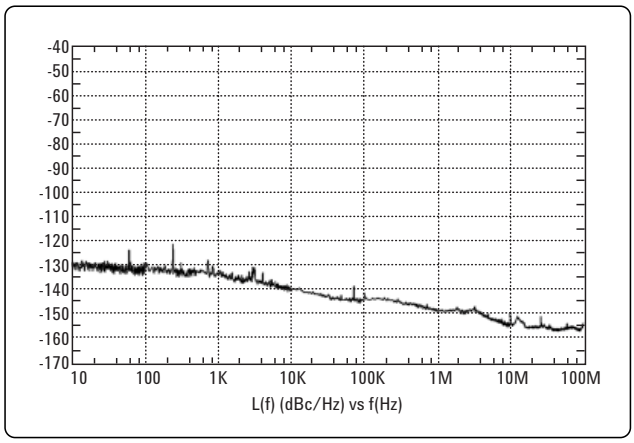


21 External I/Q input level $\sqrt{(I^2 + Q^2)}$ = 250 $mV_{RMS.}$, I/Q modulator attenuator = 0dB.

Measured Standard vs. Option UNR at 10 GHz



Measured AM noise at 10 GHz



Typical RMS Jitter:[22]

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	95	497
622 MHz	622 MB/s	1 kHz to 5 MHz	54	55
2.488 GHz	2488 MB/s	5 kHz to 15 MHz	64	24
9.953 GHz	9953 MB/s	20 kHz to 80 MHz	162	16

Option UNR

Carrier frequency	SONET/SDH Data Rates	RMS jitter bandwidth	Unit Intervals (µUI)	Time (fs)
155 MHz	155 MB/s	100 Hz to 1.5 MHz	85	400
622 MHz	622 MB/s	1 kHz to 5 MHz	25	39
2.488 GHz	2488 MB/s	5 kHz to 15 MHz	61	24
9.953 GHz	9953 MB/s	20 kHz to 80 MHz	158	15

22 Calculated from phase noise performance in CW mode only at +3 dBm. For other frequencies, data rate, or bandwidths, please contact your sales representative.

Frequency modulation

Maximum deviation	N x 8 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		
Path	**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
dc FM[23] 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.	

Phase modulation

Maximum deviation	N x 80 radians (N x 8 radians in high-bandwidth mode)	
Resolution	0.1% of set deviation	
Deviation accuracy	< ±5% of deviation + 0.01 radians (1 kHz rate, normal BW mode)	
Modulation frequency response		
Mode	**Maximum Deviation**	**Rates (3 dB BW)**
Normal BW	N x 80 rad	dc – 100 kHz
High BW	N x 8 rad	dc – 1 MHz (typ)
Distortion	< 1 % (1 kHz rate, 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 (f_c > 2 MHz)[24] (typical)

Depth	**Linear mode**	**Exponential (log) mode**
		(Downward modulation only)
Maximum	> 90%	> 20 dB
Settable[25]	0 - 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 for indicated depth
Rates (3 dB bandwidth, 30% depth)	dc/10 Hz to 100 kHz typical (useable to 1 MHz)	
Distortion (1 kHz rate, linear mode, THD)		
30% AM	< 1.5%	
90% AM	< 4 %	
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.	

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

24 For f_c < 2 MHz AM is usable but not specified. AM specifications apply with ALC on, and envelope peaks < maximum specified power.

25 For AM depth settings > 90% or > 20 dB, deep AM mode or 1 kHz ALC BW is recommended.

Wide band 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, nominal

External modulation inputs (Ext1 & Ext2)

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

Simultaneous modulation

All modulation types 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.

Internal modulation source

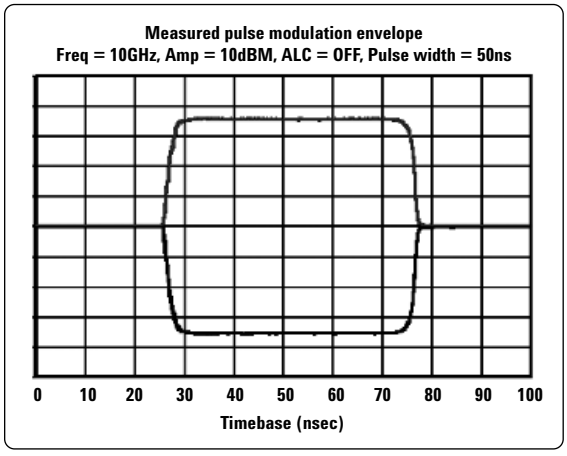
Dual function generators provides two independent signals (internal1 and internal2) for use with AM, FM, ΦM, or LF Out.

Waveforms	Sine, square, positive ramp, negative ramp, triangle, Gaussian noise, uniform noise, swept sine, dual sine[26]
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}, nominal into 50 ohms
Output impedance	50 ohms, nominal
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 sweeps/s, equivalent to sweep times 10 us to 2 s
Resolution	0.5 Hz (0.5 sweep/s)

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

Pulse modulation [27]

	Standard	Option 1E6	
	≥ 500 MHz to ≤3.2 GHz	**≥ 500 MHz to ≤ 3.2 GHz**	**> 3.2 GHz**
On/off ratio	80 dB typical	80 dB	80 dB
Rise/fall times (Tr, Tf)	100 ns typical	10 ns (8 ns typical)	10 ns (6 ns typical)
Pulse width			
Internally leveled	≥ 2 µs typical	≥ 1µs	≥ 1µs
Level hold (ALC Off with power search) [28]	≥ 0.5 µs typical	≥ 20 ns typical	≥ 20 ns typical
Repetition freq			
Internally leveled	10 Hz to 250 kHz typical	10 Hz to 500 kHz typical	10 Hz to 500 kHz typical
Level hold (ALC Off with power search) [28]	dc to 1 MHz typical	dc to 10 MHz typical	dc to 10 MHz typical
Level accuracy (relative to CW)			
Internally leveled	±0.5 dB	± 0.5 dB	± 0.5 dB (±0.15 dB typical)
Level hold (ALC Off with power search) [28]	±0.5 dB typical	± 1.0 dB typical	≤ 20 GHz ±0.8 dB typical
Width compression	±50 ns typical	±5 ns typical	±5 ns typical
Video feed-through [29]	< 200 mV typical	< 125 mV typical	< 2 mV typical
Video Delay			
(Ext input to Video)	40 ns nominal	40 ns nominal	40 ns nominal
RF Delay (Tm)			
(Video to RF output)	280 ns nominal	45 ns nominal	35 ns nominal
Pulse overshoot (Vor)	< 10% typical	< 1GHz 20% typical ≥ 1GHz 10% typical	< 10% typical
Input level	+1 Vpeak = RF On	+1 Vpeak = RF On	+1 Vpeak = RF On
Input impedance	50 Ω, nominal	50 Ω, nominal	50 Ω, nominal



27 With ALC off, specs apply after the execution of power search. Specs apply with Atten Hold Off (default mode), or ALC level between 0 and +10 dBm.

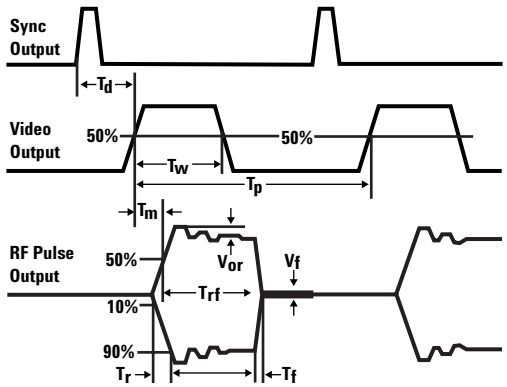
28 Power search is a calibration routine that improves level accuracy in ALC-off mode. Un-pulsed RF power will be present typically up to 50 ms when executing power search.

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

Internal pulse generator

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



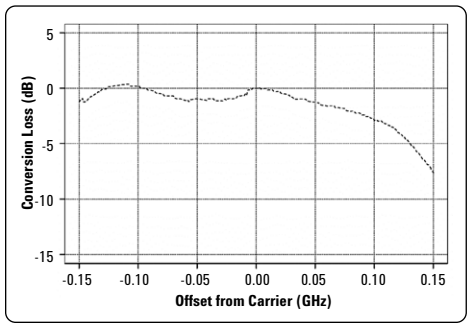
Vector modulation

External I/Q inputs

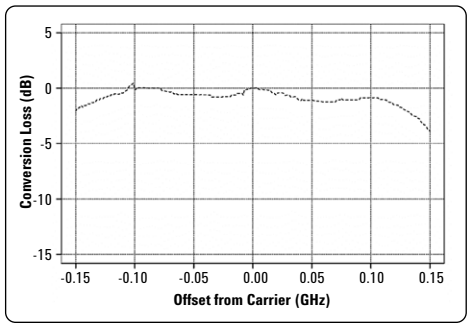
Input impedance	switched 50 or 600 W, nominal
Input range [30]	Minimum 0.1 VRMS, Maximum $1V_{PEAK}$
Flatness	Typically ± 1 dB within ± 40 MHz of carrier (with ALC off)

Measured I/Q frequency response

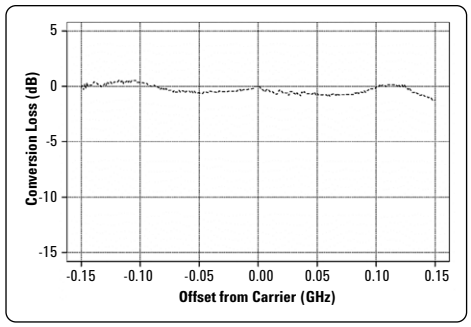
1.5GHz



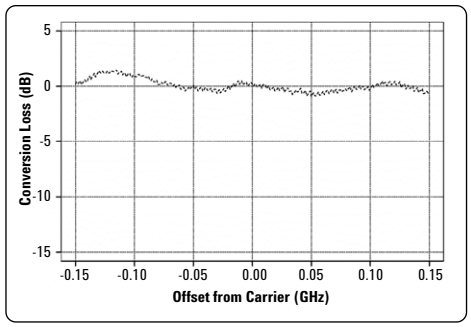
3 GHz



12 GHz



20 GHz



Vector Accuracy [31]	Formats: BPSK, QPSK, 16-256QAM (α= 0.3, Root Nyquist Filter, Symbol rate 4 Msyms/s)
EVM	<1.2% RMS (typically < 0.8% RMS)
Origin Offset	
250 kHz - 3.2 GHz	-45 dBc Typical
3.2 – 20 GHz	-50 dBc Typical

I/Q adjustments

I & Q offsets	External inputs (600 Ω) ± 5 Volts External inputs (50 Ω) ± 50 % Internal baseband generator ± 50 %
I/Q attenuation	0 to 40 dB
I/Q gain balance	± 4 dB
I/Q quadrature skew	± 10° range Typical
Low pass filter	Selectable 40 MHz or through

I/Q baseband outputs

Differential	I, I bar, Q, Q bar
Single ended	I, Q
Frequency range	DC to 40 MHz
Output voltage into 50 Ω	1.5 V_{p-p} typical
DC offset adjustments	± 3 V
DC offset resolution	1 mV
Low pass filter	Selectable 40 MHz or though

30 For optimum signal quality, the I and Q inputs should be $1V_{peak}$. 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 $\sqrt{(I^2 + Q^2)} = 0.1\ V_{RMS}$.

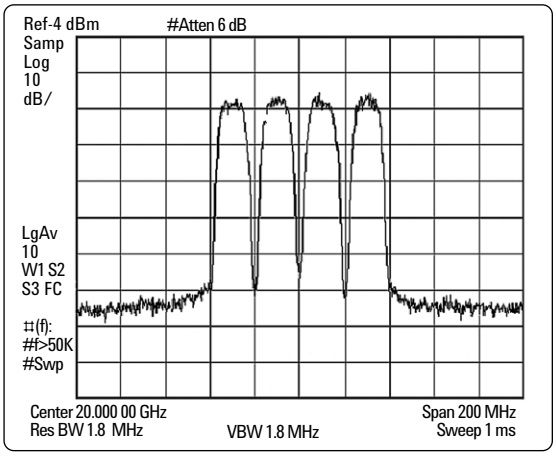
31 Measured with Agilent 89441A Vector Signal Analyzer. Valid after executing I/Q calibration, and instrument is maintained within ± 5° C of calibration temperature. RF power < 0dBm. External I/Q input level $\sqrt{(I^2 + Q^2)}$ = 0.3 VRMS., I/Q modulator attenuator = 10dB.

I/Q baseband generator (arbitrary waveform mode)
(Option 002)

Channels	2 [I and Q]
Resolution	16 bits [1/65,536]
Baseband waveform memory	
Length (playback)	32 Msamples/channel
Length (storage)	1.2 Gsamples on 6 GB hard drive (Option 005)
Waveform segments	
Segment length	60 samples to 32 Msamples
Maximum number of segments	4,096
Minimum memory allocation	256 samples or 1 kbyte blocks
Waveform sequences	
Maximum total number of segments	16,384
Sequencing	Continuously repeating
Maximum number of sequences	16,384
Maximum segments/sequence	1 to 32,768
Maximum segment repetitions	1 to 65,536
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 typical
Phase noise	< –127 dBc/Hz typical (baseband output of 10 MHz sinewave at 20 kHz offset])
IM performance	< –74 dB typical (two sinewaves at 950 kHz and 1050 kHz at baseband)
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 sec 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
Multi-carrier	
Number of carriers	Up to 100 (limited by a max 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	
PSK	BPSK, QPSK, OQPSK, π/4DQPSK, 8PSK,16PSK, D8PSK
QAM	4, 16, 32, 64, 256
FSK	Selectable: 2, 4, 8, 16
MSK	
Data	Random ONLY

Measured Multi-carrier

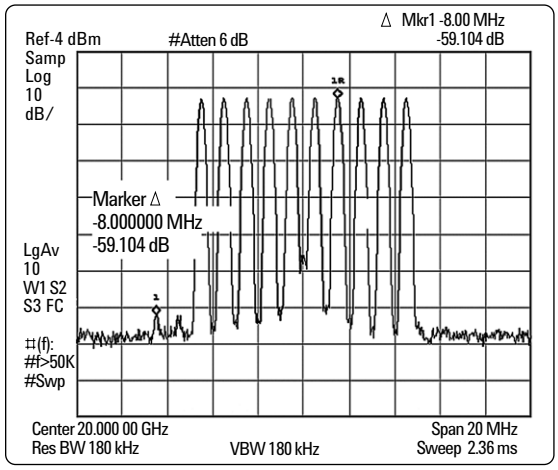
4 Carriers with 64 QAM at 10 Msybls\s with 20 MHz spacing



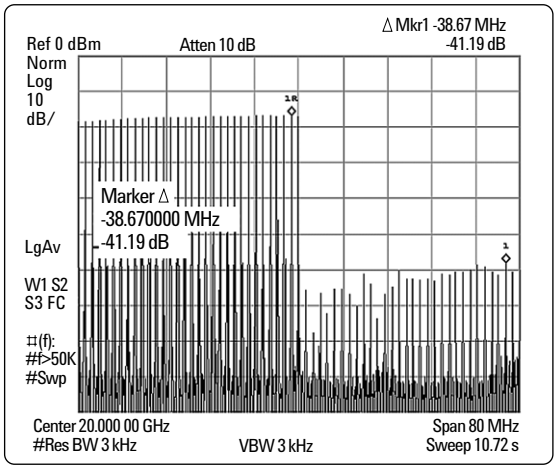
Multitone

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

Measured multitone



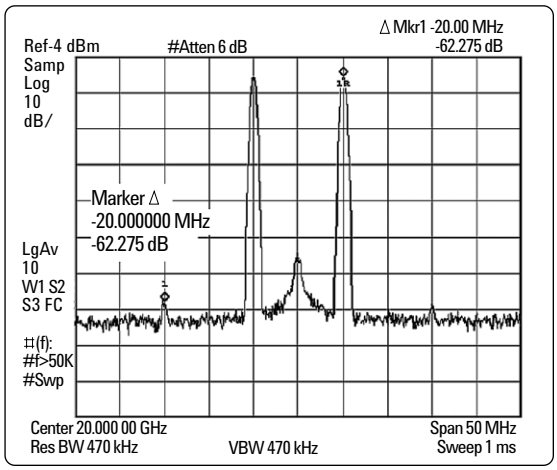
Measured image rejection > 3.2 GHz



Two-Tone

Frequency Spacing	100 Hz to 80 MHz (symmetrical about carrier)
IM Distortion	
250 kHz to 3.2 GHz	<-45 dBc for RF levels < 0dBm Typical
>3.2 GHz to 20 GHz	<-55 dBc for RF levels < 0dBm Typical

Measured two-tone



I/Q baseband generator (real-time mode)

(Option 002)

Basic modulation types (custom format)	
PSK	BPSK, QPSK, OQPSK, π/4DQPSK, 8PSK, 16PSK, D8PSK
MSK	User-defined phase offset from 0 to 100°
QAM	4, 16, 32, 64, 256
FSK	Selectable: 2, 4, 8, 16 level symmetric
User defined	Custom map of up to 16 deviation levels
Symbol rate	Maximum deviation
< 5 MHz	4 times symbol rate
5 MHz to 50 MHz	20 MHz
Resolution: 0.1 Hz	
I/Q	Custom map of 256 unique values
FIR Filter	
Selectable	Nyquist, root Nyquist, Gaussian, rectangular 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 (max) > 32 to 64 symbol filter: symbol rate ≤12.5 MHz > 16 to 32 symbol filter: symbol rate ≤25 MHz 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/sec. and a maximum of 8 bits per symbol. Modulation quality may be degraded at high symbol rates.
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 Other fixed patterns

Direct-pattern RAM [PRAM]

Max size	32 Mbits (each bit uses an entire sample space)
Use	Non-standard framing

User file

Max size	3.2 Mbytes
Use	Continuous modulation or internally generated TDMA standard

Externally generated data

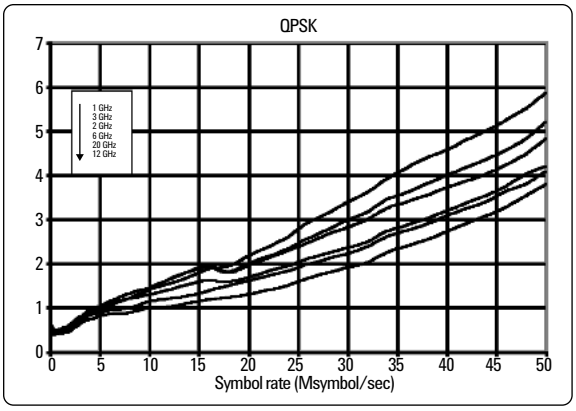
Type	Serial data
Inputs	Data, bit clock, symbol sync Accepts data rates ±5% of specified data rate

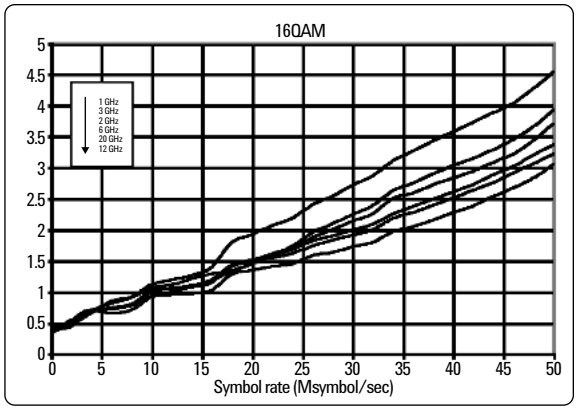
Internal burst shape control

Varies with standards and bit rates

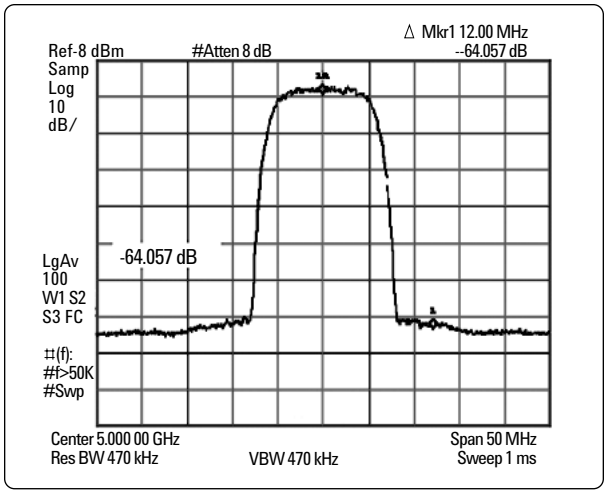
Rise/fall time range	Up to 30 bits
Rise/fall delay range	0 to 63.5 bits

Measured EVM





Measured spectral re-growth
5 GHz carrier with 16 QAM signal at 10 Msymbls/s

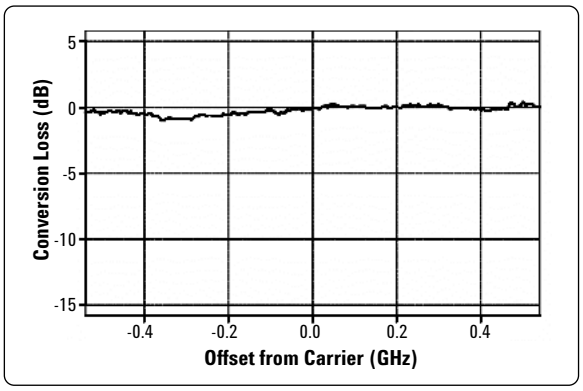


Wideband External I/Q Inputs
(Option 015)

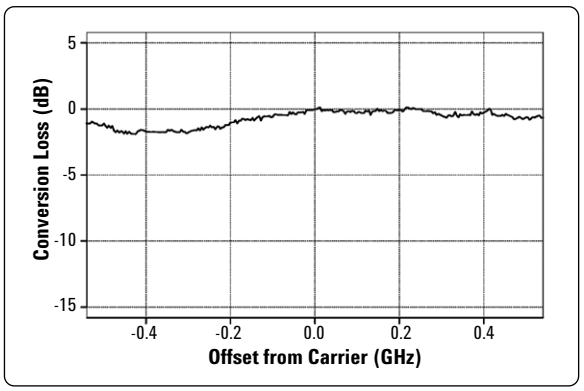
RF Output frequency range:	3.2 to 20 GHz
Input	
Input (Baseband) Frequency Range	DC to >500 MHz nominal
Input impedance	50 ohms, nominal
Recommended input level	0dBm nominal
Maximum input voltage	±1 volt DC
I/Q offset adjustments	±50%
RF path filters[32]	
Carrier Frequency	Low-pass 3dB Cuttoff Frequency (nominal)
>3.2 to 5 GHz	5.5 GHz
>5 to 8 GHz	8.9 GHz
> 8 to 12.8 GHz	13.9 GHz
> 12.8 GHz	22.5 GHz

Measured I/Q frequency response

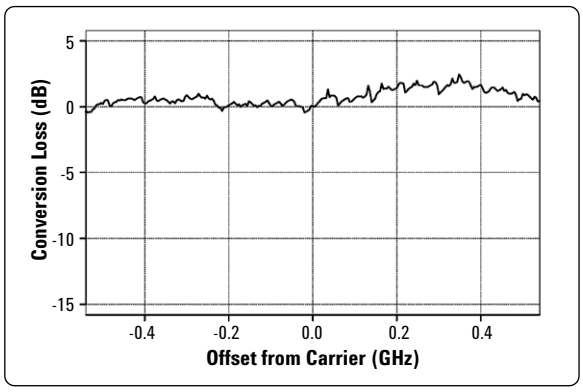
6GHz



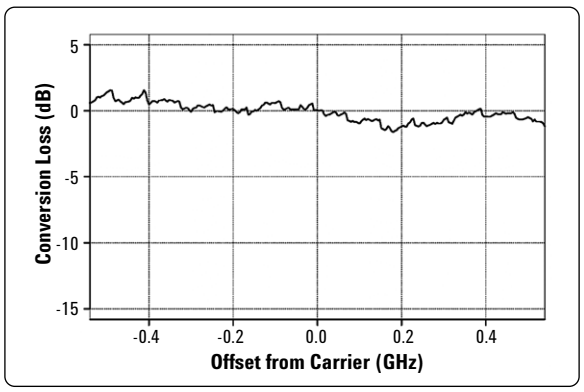
10 GHz



15GHz



20 GHz



32 Operation close to RF filter cutoff frequencies will affect channel flatness.

Remote programming

Interfaces	GPIB (IEEE-488.2,1987) with listen and talk, RS-232, and 10BaseT LAN interface.
Control languages	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.
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.

General

Power requirements	90 to 267 Vac 50 to 60 Hz, (automatically selected), 650 W maximum. Option UNS: External module allows operation at 400Hz
Operating temperature range	0 to 55° C [33]
Storage temperature range [34]	-40 to 71° C With Option 005: -4° to 65° C, gradient less than 20° C/hour
Shock and vibration	Meets MIL-STD-28800E Type III, Class 3.
EMC	Conducted and radiated interference and immunity meets IEC/EN 61326-1 and MIL-STD-461C Part 2, RE02. Meets radiated emission requirements of CISPR Pub 11/1997 Group 1 class A.
Storage registers	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.
Security	Display blanking.
Compatibility	Agilent Technologies 83550 Series millimeter heads (not for use with I/Q modulation), Agilent Technologies 8757D Scalar Network Analyzers, Agilent Technologies 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 498 mm D (7" H x 16.8" W x 19.6" D in.).
Recommended calibration cycle	24 months

Front panel connectors

(All connectors are BNC female unless otherwise noted.) [35]

RF output	Nominal output impedance 50 Ω. Precision APC-3.5 male, or Type-N with Option 1ED.
ALC input	Used for negative external detector leveling. Nominal input impedance 120 kΩ, damage level ±15 V.
LF output	Outputs the internally generated LF source. Nominal output impedance 50 Ω.
External input 1	Drives either AM, FM, or ΦM. Nominal input impedance 50 or 600 Ω, damage levels are 5 Vrms and 10 Vpeak.
External input 2	Drives either AM, FM, or ΦM. Nominal input impedance 50 or 600 Ω, damage levels are 5 Vrms and 10 Vpeak.

33 Save and recall of user files and instrument states from Option 005 Hard Drive is guaranteed only over the range 0 to 40° C.

34 Storage below –20° C Instrument states may be lost.

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

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 002). Maximum rate 50 MHz. Damage levels are > + 5.5 and <-0.5 V.
Data input	Accepts serial data for use with internal baseband generator (option 002). 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 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 Vrms and 5 V_{peak}.
Q input	Accepts a "Q" input for 1/0 modulation. Nominal input impedance 50 or 600 Ω. Damage levels are 1 Vrms and 5 V_{peak}.
Symbol sync input	Accepts symbol sync signal for use with internal baseband generator (option 002). 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 and <-0.5 V.

Rear panel connectors

(All connectors are BNC female unless otherwise noted.) [36]

Auxilliary 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 Technologies part #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 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 form 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 form 101 to 1601 by remote control from the 8757D. Output impedance: < 1 Ω, can drive 2000 Ω.

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

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 1us pulses (nominal) across a ramp sweep. When using LF Out, provides 2 us pulse at start of LF sweep.
Trigger input	Accepts TTL signal for triggering point-to-point in manual sweep mode, or to trigger start of LFsweep. 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 (nominal) level during retrace and bandswitch intervals. Supplies – 5V (nominal) level when the RF frequency is at a marker frequency.
EFC	> 0.25 ppm for -5 to +5 V Input impedance: >1 Mohm
.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 Vdc and 13 dBm reverse RF power. (SMA female)
Baseband generator reference input	Accepts 0 to + 20 dBm sinewave, or TTL squarewave, reference input to use as reference clock for the baseband generator (Option 002). Phase locks the internal data generator to the external reference: the RF frequency is still locked to the 10 MHz reference. Rate is 250 kHz to 100 MHz 50 Ω nominal, AC coupled.
Burst gate input	Accepts signal for gating burst power for use with internal baseband generator (option 002). 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 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 002). 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 002). 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 ohms, DC-coupled. Damage levels ±3.5 V.
I-bar and Q-bar outputs	Outputs the complement of the I and Q signals for differential applications. Nominal output impedance 50 ohms, 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 002).Minimum pulse width 100 ns. Damage levels are >+5.5 and <-0.5 V.
Wideband I and Q inputs	Direct high-bandwidth analog inputs to I/Q modulator in 3.2-20 GHz range. Not calibrated. 0 dBm maximum. (Option 015 only)

Auxillary I/O connector (37-pin) used with Option 002

Alternate power input	Accepts CMOS signal for synchronization of external data and alternate power signal timing. Damage levels are >+8 and <-4V.
Data clock output	Relays a CMOS bit clock signal for synchronizing serial data.
Data output	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 and <4 V.
Event 4 output	In arbitrary waveform mode, outputs a timing signal generated by marker 4. Damage levels >+8 and <4 V.
Symbol sync output	Outputs CMOS symbol clock for symbol synchronization, one data clock period wide.

Related Agilent literature

PSG Signal Generator, Brochure
Literature number: 5988-7538EN

Agilent E8247/57C PSG CW and Analog Signal Generator, Data Sheet
Literature number 5988-7454EN

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

PSG Self Guided Demo
Literature number 5988-2414EN

PSG Configuration Guide
Literature number 5988-7541EN

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

PSG Two-tone and Multi-tone Application Note AN 1410
Literature number: 5988-7689EN

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