Agilent E8663D PSG
RF Analog Signal Generator

Data Sheet

The Agilent E8663D PSG is a fully synthesized signal generator with high output power, low phase noise, and optional ramp sweep 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 mode of all instruments.

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

Agilent Technologies

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Specifications

Frequency

Range [1]		
Option 503	100 kHz to 3.2 GHz	
Option 509	100 kHz to 9 GHz	
Resolution		
CW	0.001 Hz	
All sweep modes	0.01 Hz [2]	
CW switching speed [3, 4]	< 11 ms (typ) (7 ms (nom))	
Phase offset	Adjustable in nominal 0.1 ° increments	
Frequency bands		
Band	**Frequency range**	**N** [5]
1	100 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 9 GHz	1
Accuracy	± aging rate ± temperature effects ± line voltage effects (nom) ± calibration accuracy	
Internal timebase reference oscillator		
Aging rate	< $\pm 3 \times 10^{-8}$/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	
Line voltage effects (typ)	< $\pm 2 \times 10^{-10}$ for ±10% change	
External reference frequency	10 MHz only	
Lock range	±1.0 ppm	
Reference output		
Frequency	10 MHz	
Amplitude	> +4 dBm into 50 Ω load (typ)	
External reference input		
Amplitude	5 dBm ±5 dB [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	< 9 ms (typ) [7]
Amplitude	< 5 ms (typ)

1. Performance is unspecified below 250 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 (typical) when switching from greater than 3.2 GHz to less than 3.2 GHz (option 509 only).
5. N is a factor used to help define certain specifications within the document.
6. To optimize phase noise use 5 dBm ± 2 dB.
7. 19 ms (typ) when stepping from greater than 3.2 GHz to less than 3.2 GHz (option 509 only).

Ramp (analog) sweep Option 007 [1]

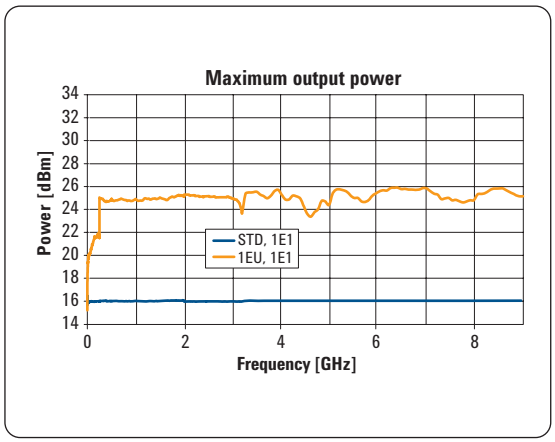
Operating modes	• Synthesized frequency sweep (start/stop), (center/span), (swept CW) • Power (amplitude) sweep (start/stop) • Manual sweep, RPG control between start and stop frequencies • Alternate sweep Alternates successive sweeps between current and stored states		
Sweep span range	Settable from minimum [2] to full range		
Maximum sweep rate	**Start frequency**	**Maximum sweep rate**	**Max span for 100 ms sweep**
	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	9 GHz
	2 to < 3. 2 GHz	200 MHz/ms	9 GHz
	≥ 3.2 GHz	400 MHz/ms	9 GHz
Frequency accuracy	± 0.05% of span ± timebase (at 100 ms sweep time, for sweep spans less than maximum values given above). Accuracy improves proportionally as sweep time increases. [3]		
Sweep time	(forward sweep, not including bandswitch and retrace intervals)		
Manual mode settable	10 ms to 200 s		
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 E8663D's can synchronously track each other, with independent control of start/stop frequencies		
Network analyzer compatibility	Fully compatible with Agilent 8757D scalar network analyzer. Also useable with Agilent 8757A/C/E scalar network analyzers for making basic swept measurements. [5]		

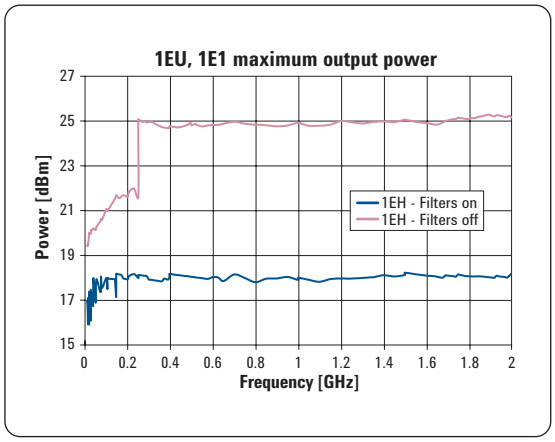
1. During ramp sweep operation, AM, FM, phase modulation, and pulse modulation are useable but performance is not guaranteed.
2. Minimum settable sweep span is proportional to carrier frequency and sweep time. Actual sweep span may be slightly different than desired setting for spans less than [0.00004%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

Output

Minimum settable output power				
Standard		-20 dBm		
With Option 1E1 Step attenuator				
Option 503 and 509		-135 dBm		
Maximum output power (dBm) [1]		**spec. (typical)**		
Frequency range [2]	**Standard**	**Option 1EU**	**Option 1E1**	**Option 1E1 + 1EU**
Options 503 and 509				
10 to 250 MHz (1EH Filters on)	+12	+12 (+15)	+12	+12 (+15)
> 0.25 to 2 GHz (1EH Filters on)	+14	+14 (+16)	+14	+14 (+16)
100 kHz to 250 kHz	+10 (nom)	+10 (nom)	+10 (nom)	+10 (nom)
250 kHz to 10 MHz	+12	+12 (+15)	+12	+12 (+15)
10 to < 60 MHz	+14	+14 (+17)	+14	+14 (+17)
60 to 250 MHz	+15	+19 (+20)	+15	+19 (+20)
> 0.25 to 3.2 GHz [3]	+15	+21 (+23)	+15	+21 (+23)
> 3.2 to 9 GHz	+15	+22 (+23)	+14	+21 (+22)

Maximum output power (measured)





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

Step attenuator (Option 1E1) [1]	
Options 503 and 509	0 dB and 5 dB to 115 dB in 10 dB steps
With Optimize S/N On [2]	0 to 115 dB in 5 dB steps
Attenuator hold range minimum	From –20 dBm to maximum specified output power with step attenuator in 0 dB position. Can be offset using Option 1E1 attenuator.
Amplitude switching speed	
ALC On	< 6 ms (typ) [3]
ALC Off	< 10 ms (typ) (not including power search) [4]

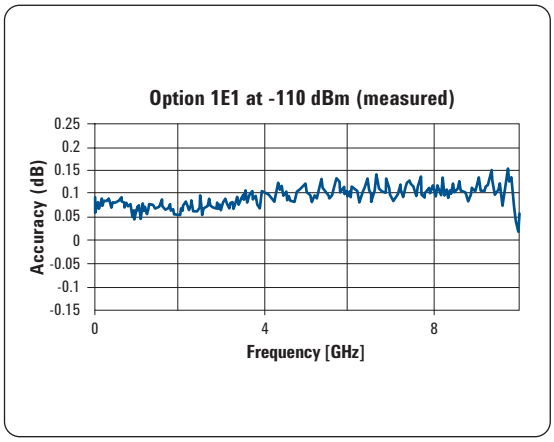
Level accuracy [5] (dB)

Frequency	> 20 dBm	20 to 16 dBm	16 to 10 dBm	10 to 0 dBm	0 to -10 dBm	-10 to -20 dBm
Options 503, 509						
250 kHz to 2 GHz [2]	±0.8 [7]	±0.8	±0.6	±0.6	±0.6	±1.2
> 2 to 9 GHz	±1.0	±0.8	±0.8	±0.8	±0.8	±1.2

Level accuracy with step attenuator (Option 1E1) [6] (dB)

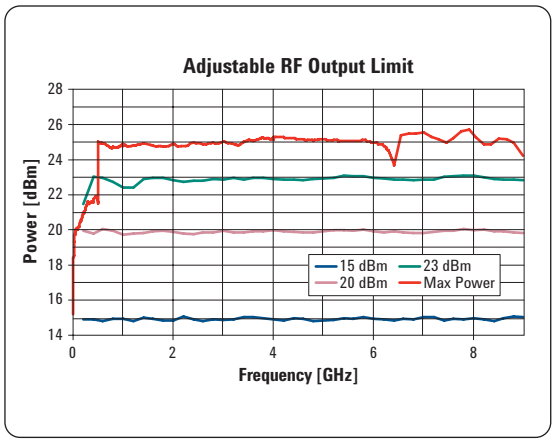
Frequency	> 20 dBm	20 to 16 dBm	16 to 10 dBm	10 to 0 dBm	0 to -10 dBm	-10 to -70 dBm	-70 to -90 dBm
Options 503, 509							
250 kHz to 2 GHz [2]	±0.8	±0.8 [7]	±0.6	±0.6	±0.6	±0.7	±0.8
> 2 to 9 GHz	±1.0	±0.8	±0.8	±0.8	±0.8	±0.9	±1.0

Level accuracy (Measured)



1. The step attenuator provides coarse power attenuation to achieve low power levels. Fine power level adjustment is provided by the ALC (Automatic Level Control) within the attenuator hold range.
2. Optimize S/N mode provides improved Signal/Noise performance, and is included with Option 1EU models. Specs in the following sections (such as level accuracy, spectral purity, modulation, etc.) are only tested with Optimize S/N mode turned off.
3. To within 0.1 dB of final amplitude within one attenuator range.
4. To within 0.5 dB of final amplitude within one attenuator range. Add up to 50 ms when using Power Search.
5. Specifications apply in CW and list/step sweep modes over the 15 to 35 °C temperature range with the ALC on. Degradation outside this range, for power levels > –10 dBm, is typically < 0.3 dB. In ramp sweep mode (with Option 007), specifications are typical. Specifications do not apply above the maximum specified power.
6. Specifications apply in CW and list/step sweep modes over the 15 to 35 °C temperature range, with attenuator hold off (normal operating mode). Degradation outside this range, for ALC power levels > –10 dBm, is typically < 0.3 dB. In ramp sweep mode (with Option 007), specifications are typical. Specifications do not apply above the maximum specified power.
7. Nominal above +16 dBm from 10 MHz to 60 MHz.

Resolution	0.01 dB
Temperature stability	0.02 dB/°C (typ)
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 [1], 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 9 GHz	< 1.6:1 (typ)
Leveling modes	Internal leveling, external detector leveling, ALC off
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}
Adjustable RF output limit	
Function	Protects external devices by limiting maximum RF output. Operates in all leveling modes (internal, external).
Range	User-adjustable from +15 dBm to maximum output power
Accuracy	
+15 to +25 dBm	±1 dB (typical)
> +25 dBm	±1.5 dB (typical)
Resolution	1 dB
Response Time	30 µsec (measured)
Adjustment	Can be locked to prevent accidental change
RF output limit (measured)	

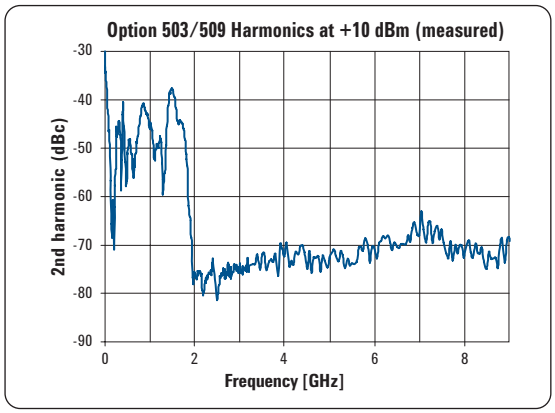


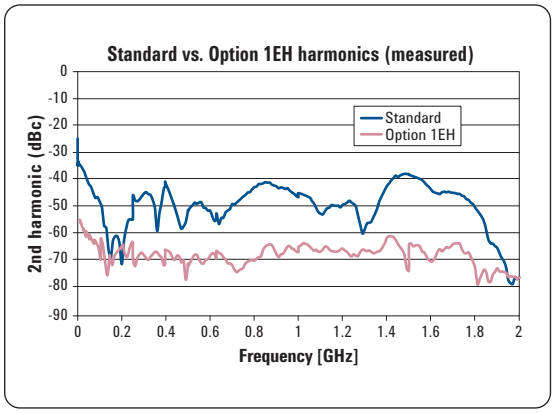
1. Compatible with Agilent EPM Series (E4418B and E4419B) power meters.

Spectral purity

Harmonics [1]	dBc at +10 dBm or maximum specified output power, whichever is lower
Frequency	**Options 503, 509**
< 10 MHz	-25 dBc (typ < 1 MHz)
10 to 50 MHz	-28 dBc
10 to 50 MHz with Option 1EH Filters On:	-45 dBc [2]
0.05 to 2 GHz	-30 dBc
0.01 to 2 GHz with Option 1EH Filters On:	-55 dBc [2]
2 to 9 GHz	-55 dBc
10 to 250 MHz, Option UNX Low Phase Noise mode:	
With Option 1EH Filters Off:	-8 dBc (typ)
With Option 1EH Filters On:	-50 dBc

Harmonics (measured)





Sub-harmonics [3]			
100 kHz to 9 GHz	None		
Non-harmonics [4]	dBc at +10 dBm or maximum specified output power, whichever is lower, for offsets > 3 kHz [> 300 Hz with Option UNX]		
Frequency	**Spec**	**Typical**	**Line-related (≤ 300 Hz) Typical**
250 kHz to 250 MHz	-65	-72 [5]	-55
1 to 250 MHz (Option UNX low phase noise mode)	-80	-88	-55
> 250 MHz to 1 GHz	-80	-88	-55
> 1 to 2 GHz	-74	-82	-55
> 2 to 3.2 GHz	-68	-76	-55
> 3.2 to 9 GHz	-62	-70	-50

1. Specifications are typical for harmonics beyond specified frequency range. Specifications are with Option 1EH Low-pass filters below 2 GHz off and Option UNX Low Phase Noise Mode off unless noted.
2. Below 250 MHz in ramp sweep mode (Option 007), Option 1EH filters are always off. Refer to harmonic specification with filters off.
3. Sub-harmonics are defined as Carrier Freq/N.
4. Specifications apply for CW mode, without modulation. In ramp sweep mode (Option 007), performance is typical for offsets > 1 MHz.
5. For > 10 kHz offsets.

Residual FM	(RMS, 50 Hz to 15 kHz bandwidth)
CW mode	< N x 6 Hz (typ)
CW mode with 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)
10 MHz to 9 GHz	< –148 dBc/Hz (typ)

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	30	190
622 MHz	622 MB/s	1 kHz to 5 MHz	27	43
2.488 GHz	2488 MB/s	5 kHz to 20 MHz	84	34

Option UNX

Carrier frequency	SONET/SDH data rates	RMS jitter bandwidth	Unit intervals (µUI)	Time (fs)
155 MHz	155 MB/s	100 Hz to 1.5 MHz	7	47
622 MHz	622 MB/s	1 kHz to 5 MHz	27	43
2.488 GHz	2488 MB/s	5 kHz to 20 MHz	86	35

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

SSB phase noise (dBc/Hz) (CW) [1]

	Offset from carrier	
Frequency	**20 kHz**	**20 kHz (typical)**
250 kHz to 250 MHz [2]	-130	-134
> 250 to 500 MHz [2]	-134	-138
> 500 MHz to 1 GHz [2]	-130	-134
> 1 to 2 GHz [2]	-124	-128
> 2 to 3.2 GHz	-120	-124
> 3.2 to 9 GHz	-110	-113

Option UNX: Absolute SSB phase noise (dBc/Hz) (CW) [1]

	Offset from carrier					
Frequency	**1 Hz Spec (typ)**	**10 Hz Spec (typ)**	**100 Hz Spec (typ)**	**1 kHz Spec (typ)**	**10 kHz Spec (typ)**	**100 kHz Spec (typ)**
250 kHz to 250 MHz [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 9 GHz	-37 (-44)	-65 (-72)	-81 (-92)	-101 (-109)	-110 (-114)	-110 (-115)

Option UNX: Residual SSB phase noise (dBc/Hz) (CW) [1]

	Offset from carrier					
Frequency	**1 Hz Spec (typ)**	**10 Hz Spec (typ)**	**100 Hz Spec (typ)**	**1 kHz Spec (typ)**	**10 kHz Spec (typ)**	**100 kHz Spec (typ)**
250 kHz to 250 MHz [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 9 GHz	(-74)	(-87)	(-98)	(-106)	(-114)	(-115)

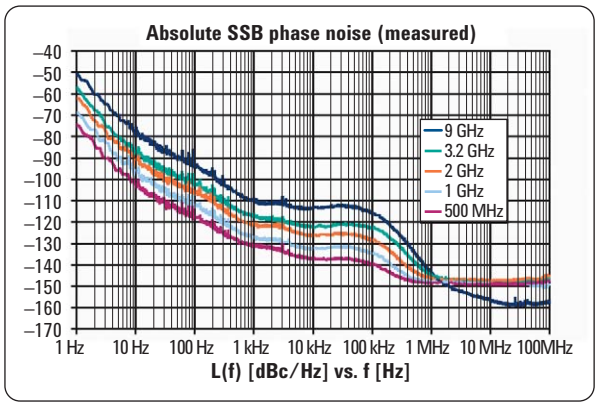
Option UNX low phase noise mode (1 to 250 MHz) [1]

Absolute SSB phase noise (CW)	Offset from carrier (dBc/Hz at +16 dBm)					
Frequency	**1 Hz Spec (typ)**	**10 Hz Spec (typ)**	**100 Hz Spec (typ)**	**1 kHz Spec (typ)**	**10 kHz Spec (typ)**	**100 kHz Spec (typ)**
1 MHz	(-109)	(-120)	(-130)	(-143)	(-150)	(-150)
10 MHz	-90(-95)	-125 (-130)	-130 (-135)	-143 (-148)	-155 (-158)	-155 (-158)
100 MHz	-70(-75)	-97 (-102)	-119 (-124)	-130 (-135)	-140 (-145)	-140 (-145)
250 MHz	(-76)	(-104)	(-121)	(-138)	(-142)	(-142)

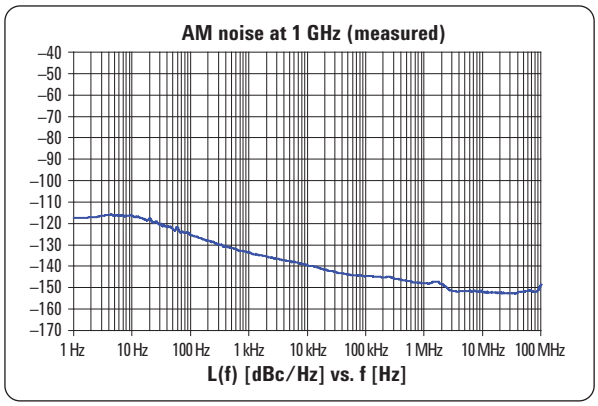
1. Phase noise specifications are warranted from 15 to 35 °C, excluding external mechanical vibration.
2. Measured at +10 dBm or maximum specified power, whichever is less.

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

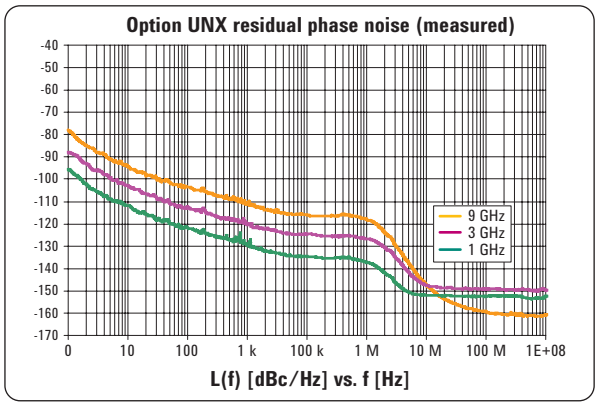
UNX phase noise



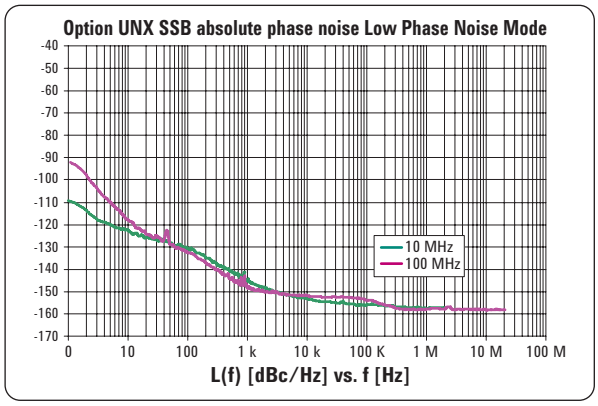
AM noise



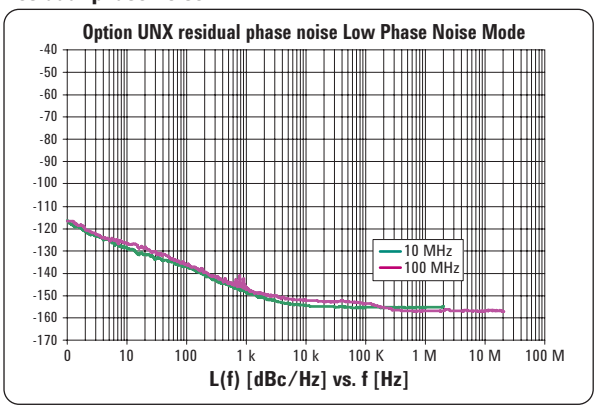
Residual phase noise



UNX Phase Noise < 250 MHz in Low Phase Noise mode



Residual phase noise



Frequency modulation (Option UNT)

Maximum deviation [1]

Normal mode:

Frequency	Max 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 9 GHz	16 MHz

Option UNX Low Phase Noise Mode:

Frequency	Max deviation
> 0.98 to 1.953 MHz	3.906 kHz
> 1.953 to 3.906 MHz	7.8125 kHz
> 3.906 to 7.813 MHz	15.625 kHz
> 7.813 to 15.63 MHz	31.25 kHz
> 15.63 to 31.25 MHz	62.5 kHz
> 31.25 to 62.5 MHz	125 kHz

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 [2] (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 [3] carrier offset	±0.1% of set deviation + (N x 8 Hz)
Distortion	< 1% (1 kHz rate, deviations < N x 800 kHz)
Sensitivity	±1 Vpeak 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. 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 10 MHz (FM1 path), and 50 kHz to 1 MHz (FM2 path).
3. At the calibrated deviation and carrier frequency, within 5 °C of ambient temperature at time of user calibration.

Phase modulation (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 9 GHz	160 rad	16 rad
Opt UNX low phase noise mode			
	> 0.98 to 1.953 MHz	0.03906 rad	0.003906 rad
	> 1.953 to 3.906 MHz	0.078125 rad	0.0078125 rad
	> 3.906 to 7.813 MHz	0.15625 rad	0.015625 rad
	> 7.813 to 15.63 MHz	0.3125 rad	0.03125 rad
	> 15.63 to 31.25 MHz	0.625 rad	0.0625 rad
	> 31.25 to 62.5 MHz	1.25 rad	0.125 rad
	> 62.5 to 125 MHz	2.5 rad	0.25 rad
	> 125 to 250 MHz	5 rad	0.5 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 1 MHz (typ) [3]	
Distortion	< 1% (1 kHz rate, Total Harmonic Distortion (THD), dev < N x 80 rad, normal BW mode)		
Sensitivity	±1 Vpeak 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 [3, 4] (Option UNT)

	Linear mode	**Exponential (log) mode** (downward modulation only)	
Depth		**Option UNT**	**Option UNT + 1SM** [4]
Maximum			
ALC On	> 90%	> 20 dB	
ALC Off with Power Search [5] or ALC On with Deep AM [6]	> 95%	> 50 dB [7]	> 60 dB [7]
Settable	0 to 100%	0 to 40 dB	0 to 40 dB
Sensitivity	0 to 100%/V	0 to 40 dB/V	0 to 40 dB/V
Resolution	0.1%	0.01 dB	0.01 dB
Depth accuracy (1 kHz rate)			
ALC On	±6% of setting +1%	±2% of setting +0.2 dB	±2% of setting +0.2 dB
ALC Off with Power Search [4] or ALC On with Deep AM [5]	---	---	±0.5 dB (< 2 dB depth)
	---	---	±1 dB (< 10 dB depth)
	---	---	±2 dB (< 40 dB depth)
	---	---	±3 dB (< 50 dB depth)
	---	---	±5 dB (< 60 dB depth)
External input (selectable polarity)			
Sensitivity for indicated depth	1 V peak	-1 or +1 V	-1 or +1 V
Maximum allowable	±1 V	±3.5 V [8]	±3.5 V [8]
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, ALC On, linear mode, total harmonic distortion)			
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. All AM specifications are typical. For carrier frequencies below 2 MHz, AM is useable but not specified. Unless otherwise stated, specifications apply with ALC on, deep AM off, and envelope peaks within ALC operating range (–20 dBm to maximum specified power, excluding step-attenuator setting). With Option UNX low phase noise mode on, AM is useable but not recommended or specified below 250 MHz.
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 must be used with a repetitive AM waveform (frequency > 10 Hz) with peaks > -5 dBm (nominal, excluding step-attenuator setting).
7. Modulation depths greater than 40 dB require an external input greater than ±1 volt, and are not available with the internal modulation source.
8. If 600 Ω input impedance is selected, maximum input voltage is ±6 V.

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 internal1or internal2 when used for AM, FM, or ΦM.
Amplitude	0 to 3 Vpeak, (nom) into 50 Ω
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 sweeps/s, equivalent to sweep times 10 us to 2 s
Resolution	0.5 Hz (0.5 sweep/s)

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

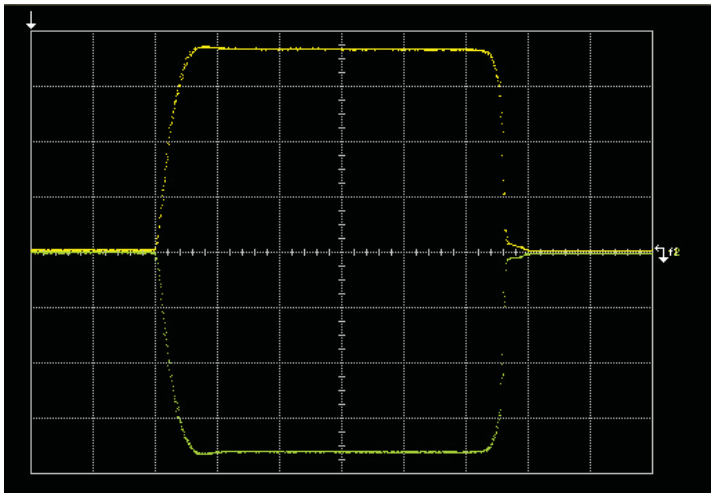
Pulse modulation [1]

	Standard pulse modulation	Option UNW narrow pulse modulation
On/Off ratio	80 dB (typical)	80 dB
Rise/Fall times (Tr, Tf)		
Options 503, 509		
50 to 400 MHz	10 ns (typical)	15 ns (10 ns typical)
Above 400 MHz	6 ns (typical)	10 ns (6 ns typical)
Minimum pulse width		
ALC On	1 µs	1 µs
ALC Off with Power Search [2]		
Options 503, 509		
50 to 400 MHz	150 ns	30 ns
Above 400 MHz	150 ns	20 ns
Repetition frequency		
ALC On	10 Hz to 500 kHz	10 Hz to 500 kHz
ALC Off	dc to 3 MHz	dc to 10 MHz
Level accuracy (relative to CW)		
ALC On	± 0.5 dB (0.15 dB typical)	
ALC Off with Power Search [2]		
50 MHz to 3.2 GHz	± 0.7 dB (typical)	
Above 3.2 GHz	± 0.5 dB (typical)	
Width compression (RF width relative to video out)	± 5 ns (typical)	
Video feed-through [3]		
50 to 250 MHz	< 3% (typical)	
> 250 to 400 MHz	< 10% (typical)	
> 0.4 to 3.2 GHz	< 5% (typical)	
Above 3.2 GHz	< 2 mV pk-pk (typical)	
Video delay (ext input to video)	50 ns (nom)	
RF delay (video to RF output)		
50 to 250 MHz	35 ns (nominal)	
> 0.25 to 3.2 GHz	25 ns (nominal)	
Above 3.2 GHz	30 ns (nominal)	
Pulse overshoot	< 10% (typical)	
Input level	+1 V = RF On	
Input impedance	50 Ω (nom)	

1. With ALC off, specs apply after the execution of Power Search. Specifications apply with Atten Hold Off (default mode for instruments with attenuator), or ALC level between –5 and +10 dBm or maximum specific power, whichever is lower. Below 50 MHz, pulse modulation is useable; however performance is not warranted. Pulse modulation does not operate if Option UNX Low Phase Noise mode is on.
2. Power Search is a calibration routine that improves level accuracy with ALC off. The instrument microprocessor momentarily closes the ALC loop to find the modulator drive setting necessary to make the quiescent RF level equal to an entered value, then opens the ALC loop while maintaining that modulator drive setting. When executing Power Search, RF power will be present for typically 10 to 50 ms; the step attenuator (Option 1E1) can be set to automatically switch to maximum attenuation to protect sensitive devices. Power search can be configured to operate either automatically or manually at the carrier frequency, or over a user-definable frequency range.
3. With Option 1E1 step attenuator in 0 dB position. Above 3.2 GHz, video feed-through decreases with step attenuator setting. Below 3.2 GHz, video feed-through is expressed as a percentage of RF output level.

Measured pulse modulation envelope

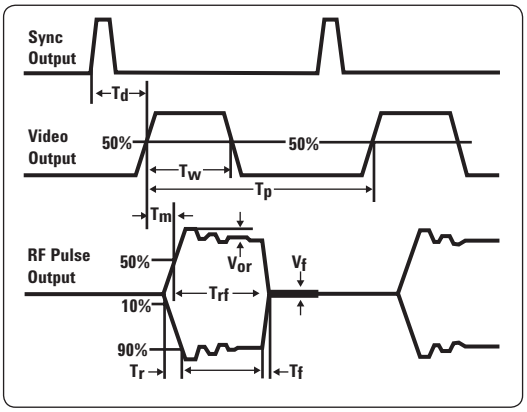
Freq = 9 GHz, Ampl = 10 dBm, ALC Off, 10 ns/div



Internal pulse generator

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



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

Simultaneous modulation

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

Remote programming

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 model, E8663B The E8663D will emulate the applicable commands for the following Agilent signal generators, providing general compatibility with ATE systems and the E5500 phase noise system: 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's commitment to quality.
Agilent IO Libraries	Agilent's IO Library Suite ships with the E8663D 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 VAC 50/60/400 Hz; or 220/240 VAC 50/60 Hz, (automatically selected); < 250 W typical, 350 W maximum
Operating temperature range	0 to 55 °C
Storage temperature range [1]	-40 to 70 °C
Altitude	< 4,572 m (15,000 ft.)
Environmental testing	Samples of this product have been 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.
Acoustic noise	Normal: 51 dBA (nom) Worst case: 62 dBA (nom) [3]
Storage registers	Memory is shared by instrument states and sweep list files. There is 14 MB of flash memory available in the E8663D. Depending on how the memory is used, a maximum of 1000 instrument states can be saved.
Security	Display blanking Memory clearing functions (see Application Note *Security of Agilent Signal Generators Issues and Solutions,* literature number 5989-1091EN)
Compatibility	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	< 22 kg (48 lb.) net, < 30 kg (68 lb.) shipping
Dimensions	178 mm H x 426 mm W x 515 mm D (7" H x 16.8" W x 20.3" D 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.
3. This is louder than typical Agilent equipment: 60 dBA (nom).

Input/Output Descriptions

Front panel connectors (All connectors are BNC female unless otherwise noted.) [1]

RF output	Output impedance 50 Ω (nom)
Option 503 and 509	Type-N
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 V_{peak}.
External input 2	Drives either AM, FM, or ΦM. Nominal input impedance 50 or 600 Ω, damage levels are 5 Vrms 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 Vrms 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.

Rear panel connectors (all connectors are BNC female unless otherwise noted.) [1]

Auxiliary interface (dual mode)	Used for RS-232 serial communication and for master/slave source synchronization. (9-pin subminiature female connector).
GPIB	Allows communication with compatible devices
LAN	Allows 10BaseT LAN communication
10 MHz input	Accepts an external reference (timebase) input (at 10 MHz) 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 +8 dBm.
Sweep output (dual mode)	Supplies a voltage proportional to the RF power or frequency sweep ranging from 0 volts at the start of sweep to +10 volts (nom) at the end of sweep, regardless of sweep width. During CW operation, supplies a voltage proportional to the output frequency, +10 volts (nom) corresponding to the maximum specified frequency. Output impedance: < 1 Ω (nom), can drive 2000 Ω.

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

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. 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 LF sweep. Damage levels ≥ +10 V or ≤ -4 V.
Source module interface	Reserved for future use
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	Supplies –5 V (nom) level when the RF frequency is at a marker frequency.
10 MHz EFC	(Option UNX only) Accepts an external DC voltage, ranging from -5 V to +5 V, for electronic frequency control (EFC) of the internal 10 MHz reference oscillator. This voltage inversely tunes the oscillator about its center frequency approximately -0.07 ppm/V. The nominal input impedance is greater than 1 MΩ.
1 GHz Out	(Option UNX only) Low noise 1 GHz reference output signal, approximately +5 dBm (nom).
Removable flash memory drive	Accepts 8 GB compact flash memory card for optional non-volatile memory (Option 008 only). All user information (Save/Recall settings, flatness files, presets, etc) is stored on removable memory card when Option 008 is installed.

Options, Accessories, and Related Products

Model/option	Description
E8663D-503	Frequency range from 100 kHz to 3.2 GHz
E8663D-509	Frequency range from 100 kHz to 9 GHz
E8663D-007	Analog ramp sweep
E8663D-008	8 GB removable flash memory
E8663D-063	E8663B backwards compatibility option bundle (1EU, 1E1, 1EH, UNX, UNT)
E8663D-UNX	Ultra-low phase noise
E8663D-UNT	AM, FM, phase modulation, and LF output
E8663D-UNW	Narrow pulse modulation
E8663D-1E1	Step attenuator
E8663D-1EH	Improved harmonics below 2 GHz (low-pass filters)
E8663D-1EM	Moves all front panel connectors to the rear panel
E8663D-1EU	High output power
E8663D-1SM	Scan Modulation
E8663D-1CN	Front handle kit
E8663D-1CM	Rackmount flange kit
E8663D-1CP	Rackmount flange and front handle kit
E8663D-C09	Move all front panel connectors to the rear panel except for the RF output connector
E8663D-H1S	1 GHz external frequency reference input and output
E8663D-HCC	Connections for phase coherency > 250 MHz
E8663D-UK6	Commercial calibration certificate and test data
E8663D-CD1	CD-ROM containing the English documentation set
E8663D-ABA	Printed copy of the English documentation set
E8663D-0BW	Printed copy of the assembly-level service guide
8120-8806	Master/slave interface cable
9211-2656	Transit case
9211-7481	Transit case with wheels

Web Resources

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

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

For more 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

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

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

E8663D PSG Signal Generators
Configuration Guide, Literature number 5990-4137EN

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