

HP ESG Series RF Signal Generators

Technical Specifications

Digital and Analog	Analog Only	
HP ESG-D1000A	HP ESG-1000A	1 GHz
HP ESG-D2000A	HP ESG-2000A	$2\mathrm{GHz}$
HP ESG-D3000A	HP ESG-3000A	$3~\mathrm{GHz}$
HP ESG-D4000A	HP ESG-4000A	4 GHz



HP ESG Series Key Features

- Expandable architecture
- Broad frequency coverage
- 4 GHz electronic attenuator for reliability and repeatability
- Superior level accuracy
- \bullet Wideband FM and ΦM
- Step sweep (frequency, power and list)
- Built-in function generator
- Lightweight, rack mountable

Additional HP ESG-D Series Features

- Broadband analog I/Q inputs
- Optional digital modulation formats for DECT, GSM, NADC, PDC, PHS and TETRA
- Superior level accuracy with digital modulation
- Excellent modulation accuracy and stability
- Optimize for adjacent channel power or EVM
- Versatile data and burst generation
- Wideband AM

SPECIFICATIONS describe the instrument's warranted performance and apply after a 45 minute warm-up. All specifications are valid over the signal generator's entire operating/environmental range while in phase noise mode 2, unless otherwise noted. **SUPPLEMENTAL CHARACTERISTICS**, denoted typical or nominal, provide additional (nonwarranted) information useful in applying the instrument.

Frequency

Range

-	
HP ESG-1000A	250 kHz to 1000 MHz
HP ESG-2000A	250 kHz to 2000 MHz
HP ESG-3000A	250 kHz to 3000 MHz
HP ESG-4000A	250 kHz to 4000 MHz
HP ESG-D1000A	250 kHz to 1000 MHz
HP ESG-D2000A	250 kHz to 2000 MHz
HP ESG-D3000A	250 kHz to 3000 MHz
HP ESG-D4000A	250 kHz to 4000 MHz
Underrange	100 kHz
Resolution	0.01 Hz
Accuracy	Same as timebase
Switching Speed ¹	
Modulation On ²	<45 ms, typical
Modulation Off	<35 ms, typical
Phase Offset	Phase is adjustable via HP-IB or front panel in nominal 0.1 ° increments

Frequency Bands

Band	Frequency Range	N #
1	250 kHz to ≤249.999 MHz	1
2	>249.999 to ≤500 MHz	0.5
3	>500 MHz to ≤1 GHz	1
4	>1 to ≤2 GHz	2
5	>2 to 4 GHz	4

Sweep Modes

Operating Modes Frequency step, amplitude step and arbitrary list

Dwell Time 1 ms to 60 s

Number of Points 2 to 401

Internal Reference Oscillator

Stability

	Standard (typical)	High Stability (Option 1E5)
Aging Rate	<±2 ppm/yr	<±0.1 ppm/yr or <±0.0005 ppm/day after 45 days
Temp. (0 to 55 °C)	<±1 ppm	<±0.05 ppm, typical
Line Voltage	<±0.1 ppm (+5%, -10%)	<±0.002 ppm, typical (+5%, -10%)

Timebase Reference Output

Frequency	10 MHz
Amplitude	>0.35 Vrms into 50 Ω load

External Reference Input

Frequency	1, 2, 5, 10 MHz ± typ. 10 ppm	
	(typ. 1 ppm, Option 1E5)	
Amplitude	>0.15 V _{rms}	
Input Impedance	50 Ω	

1. To within 0.1 ppm of final frequency above 250 MHz or within 100 Hz below 250 MHz.

2. With digital modulation active, performance is typically 80 ms when crossing frequency bands at 500 kHz, 250, 500, or 700 MHz, 1, 2, 2.4, 3.2 or 3.7 GHz. 3 For 23 ° ±5 °C. Accuracy degrades by 0.02 dB/ °C over the full temperature range and by 0.3 dB above +7 dBm.

4. The reverse power protection circuitry triggers at nominally 1 watt.

Output

Range

250 kHz to 1000 MHz >1000 MHz to 3000 MHz >3000 MHz to 4000 MHz 20

Typical maximum available power

Resolution 0.02 dB **Attenuator Hold Level Range** 250 kHz to 1000 MHz 23 dB

	20 00
>1000 MHz to 3000 MHz	20 dB
>3000 MHz to 4000 MHz	17 dB

Level Accuracy³

	+7 to -127 dBm	<-127 dBm	
250 kHz to 2 GHz	±0.5 dB	±1.5 dB	
2 to 4 GHz	±0.9 dB	±2.5 dB	

Amplitude Switching Speed	<25 ms, typical
When Using Power Search	<210 ms, typical

Reverse Power Protection⁴

250 kHz to 2000 MHz	50 watts
>2000 to 4000 MHz	25 watts
Max DC Voltage	50 V
SWR (typical)	
250 kHz to 2000 MHz	<1.4:1
>2000 MHz to 4000 MHz	<1.9:1
Output Impedance	50 Ω

2

Spectral Purity

SSB Phase Noise (typical, at 20 kHz offset)

Residual FM (CW mode, 0.3 to 3 kHz BW, CCITT, rms)

Phase Noise Mode 1	< N x 2 Hz
Phase Noise Mode 2	< N x 4 Hz

Harmonics (≤+4 dBm output level) <-30 dBc

Nonharmonics (<+7 dBm output level)¹

At offsets	>3 kHz	>10 kHz (typical)
250 kHz to 1000 MHz	<-65 dBc	<-75 dBc
>1000 to 2000 MHz	<-59 dBc	<-69 dBc
>2000 MHz	<-53 dBc	<-63 dBc

Subharmonics

≤1000 MHz >1000 MHz None <-40 dBc

Frequency Modulation

Maximum Deviation

Resolution

N x 10 MHz

0.1% of deviation or 1 Hz, whichever is greater

Modulation Frequency Response² (deviation = 100 kHz)

Path	Rates		
	1 dB Bandwidth	3 dB Bandwidth, typical	
FM1	dc/20 Hz to 100 kHz	dc/5 Hz to 10 MHz	
FM2	dc/20 Hz to 100 kHz	dc/5 Hz to 1 MHz	

Deviation Accuracy (1 kHz rate, dev. < N x 100 kHz) <± (3.5% of FM deviation + 20 Hz)

Carrier Frequency Accuracy Relative to CW in dcFM³ ±0.1% of set deviation + (N x 1 Hz)

Distortion (1 kHz rate, THD, dev.= N x 100 kHz) <1%		
External Inputs	Ext 1 or Ext 2	
Sensitivity	1 V_{peak} for indicated deviation	
Input Impedance	50 Ω , nominal	

Paths FM 1 and FM 2 are summed internally for composite modulation. Either path may be switched to any one of the modulation sources Int, Ext 1, Ext 2. The FM 2 path is limited to a maximum rate of 1 MHz. The FM 2 path must be set to a deviation less than FM 1.

Phase Modulation

Maximum Deviation N x 90 radians

Resolution 0.1% of set deviation

Modulation Frequency Response

Mode	Maximum Deviation	Rates (3 dB BW)	
		Φ M1	Ф М2
Normal	N x 90 rad	dc to 100 kHz	dc to 100 kHz
High	N x 2π rad	dc to 1.5 MHz (typ)	dc to 0.9 MHz (typ)
Bandwidth	N x $\pi/2$ rad	dc to 4 MHz (typ)	dc to 1 MHz (typ)

Deviation Accuracy (1 kHz rate)

 $<\pm(5\% \text{ of deviation} + 0.01 \text{ radians})$

Distortion (1 kHz rate, THD, dev <N x 90 rad) <1 %

External Inputs Ext 1 or Ext 2

Sensitivity 1 V_{peak} for indicated deviation

Input Impedance 50 Ω , nominal

Paths $\Phi M 1$ and $\Phi M 2$ are summed internally for composite modulation. Either path may be switched to any one of the modulation sources: Int, Ext 1, Ext 2. The $\Phi M 2$ path is limited to a maximum rate of 1 MHz. The $\Phi M 2$ path must be set to a deviation less than $\Phi M 1$.

1. Performance is typical for spurs at frequencies above the maximum operating frequency of the instrument. Performance typically is -60 dBc between 225 and 249.999 MHz. Specifications apply for FM deviations <100 kHz and is not valid for Φ M. Performance is typically limited to -45 dBc at the symbol rate of π /4 DQPSK modulating signals.

 $2. Since the internal modulation source operates over 0.1 \, Hz to 50 \, \rm kHz, FM rates above 50 \, \rm kHz must be supplied externally.$

3. At the calibrated deviation and carrier frequency, within 5 $^{\circ}\mathrm{C}$ of ambient temperature at time of calibration.

Amplitude Modulation $f_c > 500 \text{ kHz}$

Range (envelope peak ≤ maximum specified power) 0 to 100%		
Resolution	0.1%	
Rates (3 dB Bandwidth)	dc/10 Hz to 10 kHz	
Accuracy (1 kHz rate)	< ± (5% of setting + 1%)	
Distortion (1 kHz rate, THD) 30% AM 90% AM	<1.5% <4 %	
External Inputs	Ext 1 or Ext 2	
Sensitivity	1 V_{peak} for indicated depth	
Input Impedance	50 Ω , nominal	

Path: AM 1 and AM 2 are summed internally for composite modulation. Either path may be switched to any one of the modulation sources: Int, Ext 1, Ext 2.

Wide Band AM (ESG-D series only)

Rate (1 dB bandwidth, typica ALC On ALC Off	ical) 400 Hz to 10 MHz dc to 10 MHz	
External Input	I input	
Sensitivity	0.5 V = 100 %	
Input Impedance	50 Ω , nominal	

Pulse Modulation

On/Off Ratio		
≤ 3GHz	>80 dB	
>3 GHz	>60 dB	
Rise/Fall Times	150 ns, typical	
Minimum Width		
ALC On	2 µs, typical	
ALC Off	0.4 µs, typical	
Pulse Repetition Fr	equency	
ALC On	10 Hz to 250 kHz, typical	
ALC Off	DC to 1.0 MHz, typical	

Level Accuracy (relative to CW)² \pm 0.5 dB, typical

External Input

RF On RF Off	>+0.5 V, nominal <+0.5 V, nominal
Input Impedance	50 Ω , nominal
Internal Pulse Generator Squarewave rate Pulse	0.1 Hz to 50 kHz

Input Voltage

Period 16 μs to 30 sec Width 8 μs to 30 sec Resolution 4 μs

Internal Modulation Source

Provides FM, Φ M, and AM Modulation Signals and LF Out

Waveforms	Sine, square, ramp, triangle, pulse, noise
Rate Range Sine Square, ramp, triangle	0.1 Hz - 50 kHz 0.1 Hz - 10 kHz
Resolution Pulse Only	0.1 Hz 4 μs
Frequency Accuracy	0.005%

Swept Sine Mode (frequency, phase continuous)

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Operating Modes	Triggered or continuous sweeps		
Frequency Range	0.1 Hz to 50 kHz		
Sweep Time	1 ms to 65 sec		
Resolution	1 ms		

Dual Sinewave Mode

Frequency Range	0.1 Hz to 50 kHz
Amplitude Ratio	0 to 100 %
Amplitude Resolution	0.1 %

LF Out (Internal Modulation Source)

Amplitude0 to 3 V_{peak} into 50 Ω Output Impedance<1 Ω

External Modulation Inputs

Modulation Types	
Ext 1	FM, Φ M, AM, and burst envelope
Ext 2	FM, Φ M, AM, and pulse

High/Low Indicator (100 Hz to 10 MHz BW, AC coupled inputs only) Activated when input level error exceeds 3% (nominal)

1. AM is typical above 3 GHz or if wideband AM or I/Q modulation is simultaneously enabled.

Ext 2

2. With ALC off, specifications apply after the execution of power search. With ALC on, specifications apply for repetition rates <10 kHz and pulse widths \geq 5µs.

Simultaneous Modulation

All modulation types may be simultaneously enabled, except: FM with Φ M; AM with Burst Envelope;Wideband AM with I/Q. AM, FM, and Φ M can sum simultaneous inputs from any two sources (INT, EXT 1, and EXT 2.) Any given source (INT, EXT 1, or EXT 2) may only be routed to one activated modulation type.

Level Accuracy with Digital Modulation

(In HP ESG-D series only; with ALC On; relative to CW; with PRBS modulated data; if using I/Q inputs, $\sqrt{I^2+Q^2}=0.5 \text{ V}_{\text{rms}}$, nominal)¹

 π /4 DQPSK or QPSK Formats (Relative to CW; With raised cosine or root-raised cosine filter and $\alpha \ge 0.35$; with 10 kHz < Symbol Rate <1 MHz; at RF freq >25 MHz; power < max specified -3 dB) ±0.15 dB

Constant Amplitude Formats (FSK, GMSK, etc) no degradation in power level accuracy

Level Accuracy with ALC Off² (After power search is executed; relative to CW level accuracy with ALC on; with burst off; if external I/Q is enabled $\sqrt{l^2+Q^2} = 0.5 V_{rms}$)

±0.3 dB, typical

I/Q Modulation (HP ESG-D series only)

I/Q Inputs

Input Impedance Full Scale Input¹

50 Ω 12.02

Typical I/Q frequency response

±4 dB

Adjustments/Impairments (nominal) DC Offset (I and Q independently adjustable) ±100 %

I/Q Gain Ratio

DC Vector Accuracy³ (relative to full scale, power \leq +7 dBm)

Frequency (GHz)	<0.6	0.6 to 2	2 to 3.7	≤4
Static EVM ⁴ (rms)	<0.75%	<0.5%	0.75%	<1%
Mag. Error ⁴ (rms)	<0.5%	< 0.35%	<0.5%	<0.75%
Phase Error ⁴ (rms)	<0.35°	< 0.25°	<0.35°	<0.5°
Origin Offset (dBc)	<-46	<-46	<-40	<-40

Burst Envelope (HP ESG-D series only)

Input Voltage

RF On	0 V
RF Off	-1.0 V
Linear Control Range	0 to -1 V

On/Off Ratio	
≤3 GHz	>75 dB
-3 GHz	>65 dB
/in	≤ - 1.05 V

Rise/Fall Time

<2 µs with rectangular input, typical

Minimum Burst Repetition Frequency

ALC On	10 Hz, typical
ALC Off	DC

Ext	terna	Input	t E	Ext 1

Input Impedance 50 Ω , nominal

Optional I/Q Baseband Generator (UN3/UN4)

(Only available on HP ESG-D series)

Data Structure

Frames and timeslots may be configured as different types of traffic or control channels. The data field of a timeslot can accept user file, PRBS (PN9 or PN15), or external data with the appropriate clock.

Internal Data

Pseudorandom Patterns (meets ITU-T standard) Continuous PN9 (PRBS 29-1) or PN15⁵ (PRBS 2¹⁵ -1)

Repeating Sequence Any 4 bit sequence

Downloadable Data

Туре	Serial data
Minimum Size	Must fill entire field for which it was selected
Max Size (Pattern RAM)	1 Mbits (Option UN3), 8 Mbits (Option UN4)
Max Size (User File)	128 kbytes

^{1.} The optimum I/Q input level is $\sqrt{I^2+Q^2}=0.5$ V_{ms}, I/Q drive level affects EVM, origin offset, spectral regrowth, and noise floor. Typically, level accuracy with ALC on will be maintained with drive levels between 0.25 and 1.0 $V_{\rm rms}$

4. Measured at full scale with origin offset removed.

5. PN15 is not continuous in bursted mode when TETRA is operated in a downlink mode.

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^{2.} When applying external I/Q signals with ALC off, output level will vary directly with I/Q input level. Power Search is an internal calibration routine used to set output power when ALC is off. The routine disables all modulation inputs, adjusts output power while applying 0.5 V_{rms} to the I/Q modulator, then enables modulation.

^{3.} Valid for 10 days after executing internal calibration routine, provided temperature is maintained within ±5 °C of calibration temperature.

	NADC		PDC PI		IS	TETRA		DECT	GSM (D	CS, PCS)	
Modulation Format				π/4 DQ	PSK				GFSK	GM	ISK
Data Rate (default, kbits/sec) Adjustment Range (kbits/sec)	48.6 40 to	48.6 40 to 75.5		42 40 to 75.5		384 320 to 605		37.8	1,152 922 to 1209.6	270.8 163 to	33 o 300
Filter			Root Rai	sed Cosir	ne or Rais	ed Cosine	;		Gaus	ssian	
Default Value	α=0	0.35	α=	0.5	α=	:0.5	α=	0.35	B _b T=0.5	В _b Т	=0.3
Range (α or B _b T)				0.3,0.35,	0.4, 0.5, 0	.6			0.2 to 0.7 i	n 0.05 step	S
Error Vector Magnitude1 (% rms)	Cont.	Burst	Cont.	Burst	Cont.	Burst	Cont.	Burst	N/A	Ν	I/A
Optimize EVM Mode	1.4	1.9	1.9	1.8	1.5	1.5	1.5	1.9			
Optimize EVM Mode (typical)	0.8	1.4	0.9	1.4	0.9	0.9	0.8	1.5			
Optimize ACP Mode (typical)	1.4	1.8	1.0	1.2	1.2	1.2	3.1	3.2			
Global Phase Error ¹ (rms / pk)	bal Phase Error ¹ (rms / pk) N/A		N/A		N/A		N/A		N/A	0.8° / 2.8° 0.25° / 1.5°(typ)	
Deviation Accuracy ¹ (kHz)	N	N/A		N/A		N/A		/A	6.1 (2.5, typ)	N/A	
Channel Spacing (kHz)	30		25		3	00	2	5	1,728	2	00
Adjacent Channel Power ¹ (ACP)	Cont.	Burst	Cont.	Burst	Cont.	Burst	Cont.	Burst	N/A	Cont.	Burst
(Optimize ACP Mode, dBc, typical) at Adjacent Channel ³ at 1st Alternate Channel ³ at 2nd Alternate Channel ³ at 3rd Alternate Channel ³	35 75 78 78	-34 -73 -77 -78	- -71 - -78	- -69 - -78	- -76 -78 -	- -75 -77 -	68 77 79 79	65 76 79 79		38 71 81 83	37 69 79 81
Supported Burst Types	upported Burst Types Custom, Up/Down TCH		Custom, Up/Down TCH, Up Vox		Custom, TCH, Sync		Custom Up Cont Up Norr Down N Down S	, rol 1 & 2 nal, ormal, ync	Custom, Dummy B 1 & 2, Traffic B, Low Capacity	Custom, FCorr, S Dummy,	Normal, ync, Access
Scramble Capabilities					Y	es	Y	es			

Specifications apply for the frequency range, data rates, root raised cosine filter and filter factors (α or B_bT) specified for each standard and at power levels ≤ + 7 dBm (≤ 4 dBm for TETRA).
 ACP for TETRA is measured over a 25 kHz bandwidth, with an 18 kHz root raised cosine filter applied.
 The "channel spacing" determines the offset size of the adjacent and alternate channels: Adjacent Chan. offset = 1 x channel spacing, 1st Alt. Chan.= 2 x channel spacing, 2 nd Alt. Chan.= 3 x channel spacing, etc.

19 434

NADC spectrum

 $F_{C} = 849 \text{ MHz}$ Span = 0.3 MHz Scale = 10 dB/div Level = +4 dBm

PDC spectrum

 $F_{C} = 810 \text{ MHz}$ Span = 0.25 MHz Scale = 10 dB/div Level = +4 dBm

TETRA spectrum

 $F_{C} = 400 \text{ MHz}$ Span = 0.25 MHz Scale = 10 dB/div Level = +4 dBm

GSM spectrum

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 $F_{C} = 920 \text{ MHz}$ Span = 2 MHz Scale = 10 dB/div Level = +4 dBm

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			~			0			
			7	0		\cap			
	m	m	/				m	~~~	~
CINER	1987 1948							STIN 2	94x

PHS spectrum

 $F_c = 1907 \text{ MHz}$ Span = 2 MHz Scale = 10 dB/div Level = +4 dBm

DECT spectrum

 $F_{C} = 1800 \text{ MHz}$ Span = 7 MHz Scale = 10 dB/div Level = +4 dBm

6

External Data	
Type Inputs	Serial data Data, bit/symbol clocks Accepts data rates ±5% of specified data rate
Reference Frequency	Internal or External 1,2,5,10 MHz reference Data clock can be locked to an external 13 MHz (GSM) reference
Frame Trigger Delay	Control
Range	0 to 65,000 bits
Resolution	1 bit
Internal Burst Shape	e Control
Rise/Fall Time Range	Up to 30 bits
Rise/Fall Delay Range	0 to 63.5 bits (varies with standard)
I/Q Outputs	
Level	$\sqrt{l^2 + Q^2} = 0.5$ Vrms, nominal
π/4 DQPSK EVM (optimize	
	∠ % (1 %, typical)

Coherent Carrier Out¹ (**ESG-D series only**)

GMSK Global Phase Error 1 °rms GFSK Deviation Accuracy 8 kHz

Range	250 MHz to maximum carrier frequency
Level	0 dBm ± 5 dB, typical
Impedance	50 Ω

Remote Programming

Interface	HP-IB (IEEE-488.2-1987) with Listen and Talk. RS-232.
Control languages	SCPI version 1992.0, also compatible with HP 8656B and 8657A/B/C/D/J 2 mnemonics.
Functions controlled	All front panel functions except power switch and knobs.
IEEE-488 functions	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E2.

ISO Compliant

The ESG series RF signal generators are manufactured in an ISO 9001registered facility in concurrence with Hewlett-Packard's commitment to quality.

General

Power Requirements 90 to 254 V; 50, 60, or 400 Hz; 200 W max

Operating Temp Range 0 to 55°C

Storage Temp Range -40 to 71°C

1. Coherent Carrier is modulated by FM or ΦM when enabled.

2. HP ESG series does not implement HP 8657A/B "Standby" or "On" (R0 or R1, respectively) mnemonics.

Shock and vibration Meets MIL-STD-28800E Type III, Class 3.

Leakage Conducted and radiated interference meets MIL-STD-461B RE02 Part 2 and CISPR 11. Leakage is typically <1µV (nominally 0.1µV with a 2-turn loop) at ≤1000 MHz, measured with a resonant dipole antenna one inch from any surface with output level <0 dBm (all inputs/outputs properly terminated).

Storage registers Up to 50 storage registers with sequence and register number displayed. Up to 10 sequences available.

Weight	<12.7 kg (28 lb.) net, <21 kg (46 lb.) shipping
Dimensions	133 mm H x 426 mm W x 432 mm D (5.25 in H x 16.8 in W x 17 in D)

Accessories

Transit case Part number 9211-1296

HP 83300A Remote Interface

Ordering Information

Model Number	Ordering Number
HP ESG-1000A	E4400A
HP ESG-2000A	E4420A
HP ESG-3000A	E4421A
HP ESG-4000A	E4422A
HP ESG-D1000A	E4430A
HP ESG-D2000A	E4431A
HP ESG-D3000A	E4432A
HP ESG-D4000A	E4433A

Options

OB0	Deletes the standard manual set
OB1	Extra manual set
OBV	Service documentation, component level
OBW	Service documentation, assembly level
OBX	Service documentation, assembly and component level
1CM	Rack mount kit, part number 5063-9214
1CN	Front handle kit, part number 5063-9227
1CP	Rack mount kit with handles, part number 5063-9221
1E5	Add high stability timebase
UN3	Add baseband I/Q generator with 1 Mbits of pattern RAM
	(includes premodulation filtering, and PRBS)
UN4	Add baseband I/Q generator with 8 Mbits of pattern RAM (includes premodulation filtering, and PRBS)
1EM	Moves all front panel connectors to rear panel
W30	Three-vear warranty

Inputs and Outputs

(All front panel connectors can be moved to rear with Option 1EM) **RF Output**

Nominal output impedance 50 ohms. (type-N female, front panel) LF Output

Outputs the internally-generated LF source. Outputs 0 to 3 Vpeak into 50 ohms, or 0 to 5 Vpeak into high impedance. This output can drive 50 ohms or greater. (BNC female, front panel)

External Input 1

Drives either AM, FM, ΦM , or burst envelope. Nominal input impedance 50 ohms, damage levels are 5 V_{rms} and 10 V_{peak}. (BNC female, front panel)

External Input 2

Drives either AM, FM, Φ M, or pulse. Nominal input impedance 50 ohms, damage levels are 5 V_{rms} and 10 V_{peak}. (BNC female, front panel) Auxiliary Interface

Used with HP 83300A remote keypad sequencer (9-pin RS-232 connector female, rear panel)

10 MHz Input

Accepts a 10 MHz \pm typ. 10 ppm (standard timebase) or \pm typ. 1 ppm (high-stability timebase) reference signal for operation with an external timebase. Nominal input impedance 50 ohms. (BNC female, rear panel)

10 MHz Output

Outputs level nominally +7 dBm ±2 dB. Nominal output impedance 50 ohms. (BNC female, rear panel)

HP-IB

Allows communication with compatible devices. (rear panel)

Sweep Output

Generates output voltage, 0 to +10 V when signal generator is sweeping. Output impedance <1 ohm, can drive 2000 ohms. (BNC female, rear panel)

Trigger Output

Outputs a TTL signal: high at start of dwell, or when waiting for point trigger in manual sweep mode; low when dwell is over or point trigger is received. (BNC female, rear panel)

Trigger Input

Accepts TTL signal for triggering point-to-point in manual sweep mode. Damage levels \geq +10 V or \leq -4 V. (BNC female, rear panel)

With HP ESG-D series only:

"I" Input

Accepts an "I" input either for I/Q modulation or for wideband AM. Nominal input impedance 50 ohms, damage levels are 1 $V_{\mbox{rms}}$ and 10 $V_{\mbox{peak}}$. (BNC female, front panel)

"Q" Input

Accepts a "Q" input for I/Q modulation. Nominal input impedance 50 ohms, damage levels are 1 V_{rms} and 10 V_{peak} . (BNC female, front panel) Coherent Carrier Output

Outputs RF modulated with FM or Φ M. Nominal power 0 dBm ±5 dB. Frequency range from 249.99900001 MHz to maximum frequency. For RF carriers below this range, output frequency = 1E⁹ - frequency of RF output. Damage levels 20 V_{dc} and 13 dBm reverse RF power.

With HP ESG-D series and Option UN3/UN4 only: Data Input

Accepts serial data for digital modulation applications.

Expects CMOS input. Leading edges must be synchronous with DATA CLOCK rising edges. The data must be valid on the DATA CLOCK falling edges. Damage levels are \geq +8 and \leq -4 V. (BNC female, front panel)

Data Clock Input

Accepts CMOS clock signal (either bit or symbol) to synchronize inputting serial data. Damage levels are >+8 and <-4 V. (BNC female, front panel) Symbol Sync Input

Accepts CMOS synchronization signal. Symbol clock may be continuous or a single, one bit wide pulse to synchronize the first bit of the first symbol. Damage levelsare are >+8 and <-4 V. (BNC female, front panel) **13 MHz Input**

Accepts 0 to +20 dBm sinewave or TTL squarewave to use as reference clock for GSM applications. Only locks the internal data generator to the external reference: the RF frequency is still locked to the 10 MHz refer-

external reference; the RF frequency is still locked to the 10 MHz reference. Nominal impedance is 50 ohms at 13 MHz, AC-coupled. Damage levels are >+8 and <-8 V. (BNC female, rear panel)

"I" Output

Outputs in-phase component of I/Q modulation from the internal baseband generator. Nominal impedance is 50 ohms, DC-coupled, damage levels >+2 and <-2 V. (BNC female, rear panel)

"Q" Output

Outputs quadrature-phase component of I/Q modulation from the internal baseband generator. Nominal impedance is 50 ohms, DC-coupled, damage levels >+2 and <-2 V. (BNC female, rear panel)

Burst Gate Input

Accepts CMOS signal for gating burst power when externally supplying data and clock information. Damage levels >+8 and <-4 V. (BNC or SMB connector (with Option 1EM), rear panel)

Pattern Trig Input

Accepts CMOS signal to trigger internal pattern or frame generator to start single pattern output. Damage levels >+ 8 and <-4 V. (BNC or SMB connector (with Option 1EM), rear panel)

Event 1 Output

Outputs pattern or frame synchronization pulse for triggering or gating external equipment. May be set to start at the beginning of a pattern, frame, or timeslot and is adjustable to within \pm one timeslot with one bit resolution. Damage levels >+ 8 and <-4 V. (BNC or SMB connector (with Option 1EM), rear panel)

Event 2 Output

Outputs data enable signal for gating external equipment. Applicable when external data is clocked into internally generated timeslots. Data is enabled when signal is low. Damage levels >+ 8 and <-4 V. (BNC or SMB connector (with Option 1EM), rear panel)

Data Output

Outputs data from the internal pattern generator or the externally supplied signal at Data Input. CMOS signal. (BNC or SMB connector (with Option 1EM), rear panel)

Data Clk Output

Outputs a CMOS clock signal for synchronizing serial data. (BNC or SMB connector (with Option 1EM), rear panel)

Symbol Sync Output

Outputs CMOS symbol clock for symbol synchronization, one data-clock period wide. (BNC or SMB connector (with Option 1EM), rear panel)

For more information, call your local HP sales office listed in your telephone directory.

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