

HP 8360B Series Synthesized Swept Signal Generators

HP 8360L Series Synthesized Swept CW Generators

Technical Specifications

10 MHz to 110 GHz

Specifications apply after full user calibration, and in coupled attenuator mode of operation (ALC level greater than -10 dBm).

Frequency

Range

HP 83620B	10 MHz to 20 GHz
HP 83622B	2 GHz to 20 GHz
HP 83623B	10 MHz to 20 GHz (high power)
HP 83624B	2 GHz to 20 GHz (high power)
HP 83630B	10 MHz to 26.5 GHz
HP 83640B	10 MHz to 40 GHz
HP 83650B	10 MHz to 50 GHz

HP 83623L	10 MHz to 20 GHz
HP 83630L	10 MHz to 26.5 GHz
HP 83640L	10 MHz to 40 GHz
HP 83650L	10 MHz to 50 GHz

Resolution

Standard 1 kHz
Option 008 1 Hz

Frequency Bands (for CW signals):

Frequency Range	n
10 MHz to <2 GHz	1
2 GHz to <7 GHz	1
7 GHz to <13.5 GHz	2
13.5 GHz to <20 GHz	3
20 GHz to <26.5 GHz	4
26.5 GHz to <38 GHz ¹	6
38 GHz to 50 GHz	8

1. This band is 26.5 GHz to 40 GHz for the HP 83640B/L.
 2. For operation below 2 GHz, add 1 ms.

Internal 10 MHz Time Base

Accuracy = Calibration ± Aging Rate ± Temperature Effects ± Line Voltage Effects
 Aging Rate: 5×10^{-10} /day, 1×10^{-7} /year
 With Temperature: $1 \times 10^{-10}/^{\circ}\text{C}$, typical
 With Line Voltage: 5×10^{-10} for line voltage change of 10%, typical

Sweep Functions

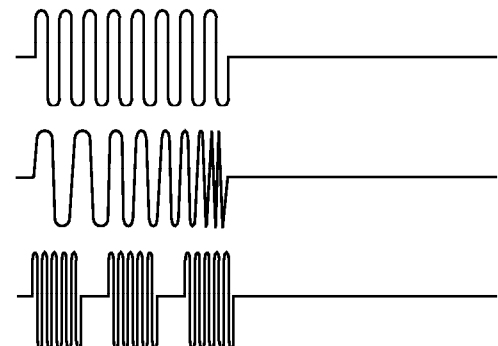
Control: Start/stop, center/span, marker (M1-M2), alternate sweep

Trigger: auto, external, single, or HP-IB

Sweep Modes

CW and Manual Modes

Accuracy: Same as time base
 Switching Time:
 For steps within a frequency band:
 $15 \text{ ms} + (\text{step size}/1 \text{ GHz}) \times 5 \text{ ms}$ step size Maximum, or across band switch points: 50 ms
 Step or list modes within a frequency band:
 $5 \text{ ms}_2 + (\text{step size}/1 \text{ GHz}) \times 5 \text{ ms}$



Step Sweep Mode

Accuracy: Same as time base
 Minimum Step Size: Same as frequency resolution
 Number of Points: 2 to 801
 Switching Time: Same as CW
 Dwell Time: 100 μ s to 3.2 s

List Mode

Accuracy: Same as time base
 Minimum Step Size: Same as frequency resolution
 Number of Points: 1 to 801
 Switching Time: Same as CW
 Dwell Time: 100 μ s to 3.2 s

Ramp Sweep Mode

Accuracy (sweep time ≥ 100 ms and ≤ 5 s):
 Sweep Widths $\leq n \times 10$ MHz: (phase-locked sweep)
 0.1% of sweep width \pm time base accuracy
 Sweep Widths $> n \times 10$ MHz: (start, stop, and band-edge frequencies are phase-locked corrected during sweep)
 Lesser of 1% of sweep width or $n \times 1$ MHz + 0.1% of sweep width.
 Sweep Time: 10 ms to 100 s, 300 MHz/ms maximum rate

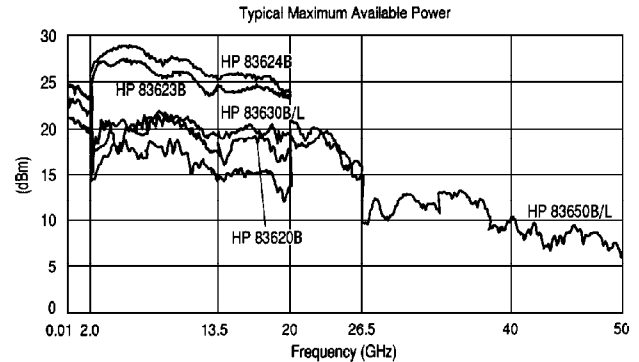
RF Output

Output Power

Maximum Leveled (dBm) ²	Standard	Option 006 (B models only)
HP 83620B, 83622B	+13	+13
HP 83623B	+17	+17
HP 83623L	+15	Not applicable
HP 83624B	+20	+17
HP 83630B/L		
Output Frequencies <20 GHz	+13	+13
Output Frequencies ≥ 20 GHz	+10	+10
HP 83640B/L		
Output Frequencies <26.5 GHz	+10	+10
Output Frequencies ≥ 26.5 GHz	+6	+6
HP 83650B/L		
Output Frequencies <26.5 GHz	+10	+10
Output Frequencies ≥ 26.5 GHz and <40 GHz	+5	+5
Output Frequencies ≥ 40 GHz	+2.5	+2.5

With attenuator (Option 001): Minimum settable output power is -110 dBm. Maximum leveled output power is reduced by 1.5 dB to 20 GHz, 2 dB above 20 GHz, and 2.5 dB above 40 GHz.

- Specification applies over the 0 to 35°C temperature range (0 to 25°C for output frequencies > 20 GHz). Maximum leveled output power over the 35 to 55°C temperature range typically degrades by less than 2 dB.
- Includes flatness.



Minimum Settable

Standard: -20 dBm
 Option 001: -110 dBm
Resolution: 0.02 dB
Switching Time (without attenuator change):
 10 ms, typical
Temperature Stability: 0.01 dB/°C, typical
Accuracy (dB)^{3,4}
 Specifications apply in CW, step, list, manual sweep, and ramp sweep modes of operation.

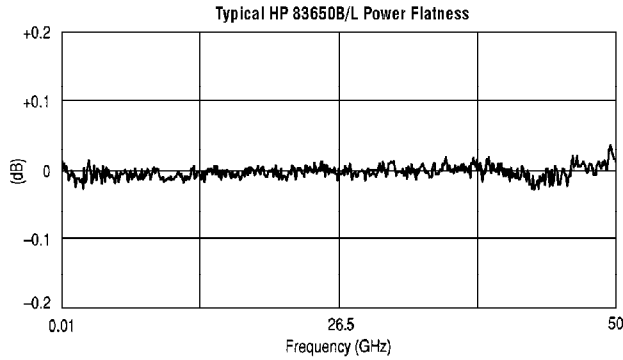
Power	Frequency (GHz)			
	<2.0	≥ 2.0 and ≤ 20	>20 and ≤ 40	>40
$> +10$ dBm	± 1.2	± 1.3		
> -10 dBm ⁵	± 0.6	± 0.7	± 0.9	± 1.7
> -60 dBm	± 0.9	± 1.0	± 1.2	± 2.0
≤ -60 dBm	± 1.4	± 1.5	± 1.7	± 2.5

User Flatness Correction

Number of points: 2 to 801 points/table.
 Number of tables = up to 8
 Entry modes: HPIB power meter, HPIB bus, and manual.
Flatness (dB)
 Specifications apply in CW, step, list, manual sweep, and ramp sweep modes of operation.

Power	Frequency (GHz)			
	<2.0	≥ 2.0 and ≤ 20	>20 and ≤ 40	>40
$> +10$ dBm	± 0.9	± 1.0		
> -10 dBm ⁵	± 0.5	± 0.6	± 0.8	± 1.5
> -60 dBm	± 0.7	± 0.8	± 1.0	± 1.7
≤ -60 dBm	± 1.1	± 1.2	± 1.4	± 2.1

- Specifications apply over the 15 to 35°C temperature range for output frequencies < 50 MHz.
- Specifications apply over the 15 to 35°C temperature range and are degraded 0.3 dB outside of that range.



Analog Power Sweep

-20 dBm to maximum available power, can be offset using step attenuator.

External Leveling

Range

At external HP 33330D/E detector: -36 to +4 dBm

At external leveling input: -200 μ V to -0.5 volts

Bandwidth

External detector mode: 10 or 100 kHz (sweep speed and modulation mode dependent), nominal

Power meter mode: 0.7 Hz, nominal

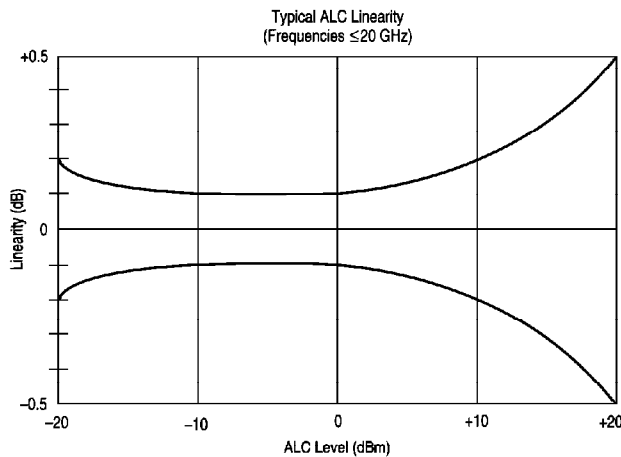
Source Match

(internally leveled), typical⁶

<20 GHz 1.6:1 SWR

<40 GHz 1.8:1 SWR

<50 GHz 2.0:1 SWR



6. Typically 2.0:1 SWR at frequencies below 50 MHz.

7. Specification is -20 dBc below 50 MHz.

8. Specifications typical below 0 dBm.

Spectral Purity

Specifications apply in CW, step, list, and manual sweep modes of operation. Specifications for harmonics beyond maximum instrument frequencies are typical.

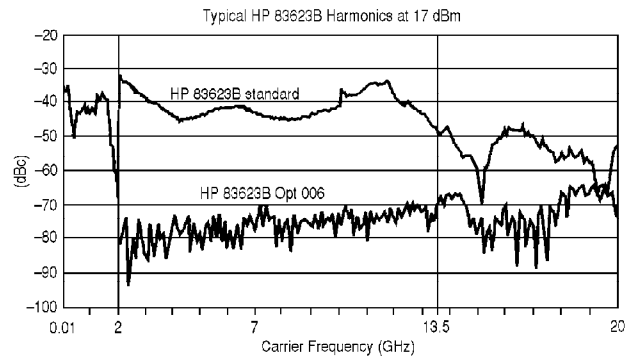
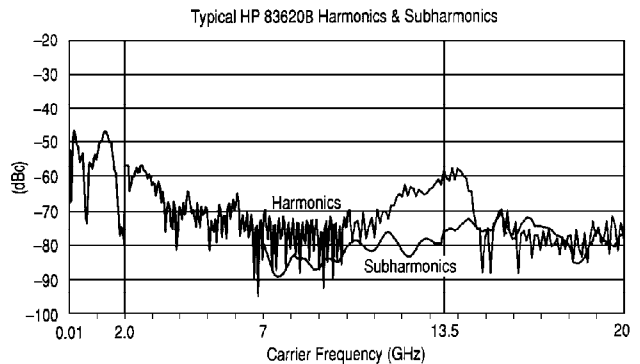
Spurious Signals (dBc)

Harmonics

Output Frequencies	HP Model Numbers				
	83620B 83622B	83623B 83624B	83623L	83630B/L	83640B/L 83650B/L
<2.0 GHz					
Standard	-30 ⁷	-25 ⁷	-25 ⁷	-30	-30 ⁷
Option 006	-30 ⁷	-25 ⁷		-30 ⁷	-30 ⁷
\geq2.0 GHz and <26.5 GHz					
Standard	-50	-25	-45	-50	-50
Option 006	-60	-60		-60	-50
\geq26.5 GHz					
Standard					-40
Option 006					-40

Subharmonics

Output Frequencies	83620B 83622B	83623B 83624B	83623L	83630B/L	83640B/L 83650B/L
<7 GHz	None	None	None	None	None
\geq7 and \leq20 GHz	-50	-50	-50	-50	-50
>20 GHz and \leq40 GHz				-50	-40 ⁸
>40 GHz					-35 ⁸



Nonharmonically Related

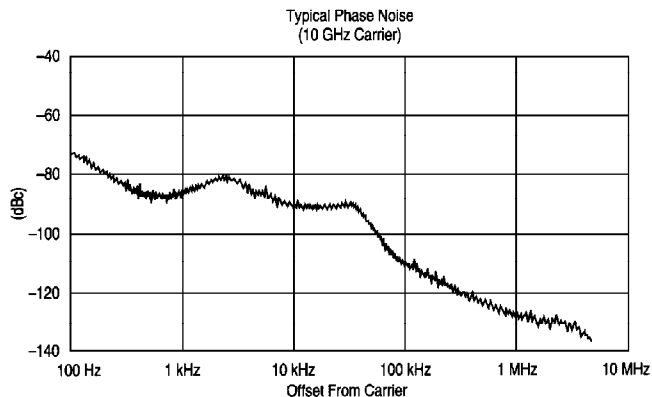
10 MHz to <2.0 GHz ⁹	-60
≥2.0 to <20 GHz	-60
>20 GHz to ≤26.5 GHz	-58
>26.5 to ≤40 GHz	-54
≥40 GHz to ≤50 GHz	-52

Power-line Related (<300 Hz offset from carrier)

10 MHz to <7 GHz	-55
7 GHz to <13.5 GHz	-49
13.5 GHz to 20 GHz	-45
>20 GHz to <26.5 GHz	-43
26.5 GHz to <38 GHz ¹⁰	-39
38 GHz to 50 GHz	-37

Single-Sideband Phase Noise (dBc/Hz)

Frequency Range	Offset from Carrier			
	100 Hz	1 kHz	10 kHz	100 kHz
10 MHz to <7 GHz	-70	-78	-86	-107
7 GHz to <13.5 GHz	-64	-72	-80	-101
13.5 GHz to 20 GHz	-60	-68	-76	-97
>20 GHz to <26.5 GHz	-58	-66	-74	-95
26.5 GHz to <38 GHz ¹⁰	-54	-62	-70	-91
38 GHz to 50 GHz	-52	-60	-68	-89



Residual FM (rms, 50 Hz to 15 kHz bandwidth)

CW Mode or Sweep widths ≤n x 10 MHz: n x 60 Hz, typical
Sweep Widths >n x 10 MHz: n x 15 kHz, typical

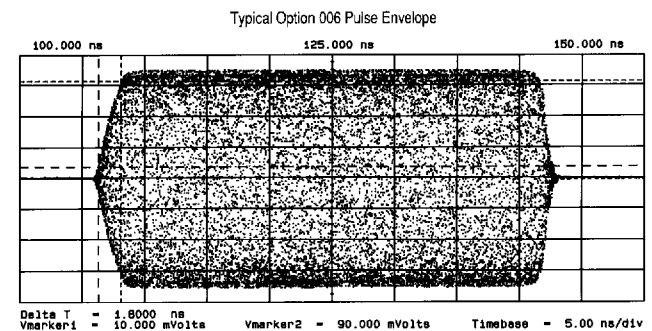
9. Specification applies at output levels 0 dBm and below.
10. Frequency range is 26.5 GHz to 40 GHz on the HP 83640B/L
11. In the HP 83623B/83624B, specification applies at ALC levels 0 dBm and above, and over the 20 to 55°C temperature range. Specification degrades 5 dB below 20°C, and 1 dB per dB below ALC level 0 dBm in those models.
12. With external input. Internal pulses are limited by minimum width of internal pulse generator.
13. Option 002 adds 30 ns delay and ±5 ns pulse compression for external pulse inputs. AM and Scan Bandwidth (3 dB, 30% depth, modulation peaks 3 dB below maximum rated power): DC to 250 kHz.

Modulation

All modulation specifications are only applicable to the HP 8360B series. Pulse modulation specifications apply for output frequencies 400 MHz and above.

Pulse (HP 8360B only)

	Standard	Option 006
On/Off Ratio ¹¹	80 dB	80 dB
Rise/Fall Times	25 ns	10 ns
Minimum Width ¹²		
Internally Leveled	1 μs	1 μs
Search Mode		
Output Frequencies <2.0 GHz	50 ns	50 ns
Output Frequencies ≥2.0 GHz	50 ns	15 ns
ALC Off Mode		
Output Frequencies <2.0 GHz	50 ns	50 ns
Output Frequencies ≥2.0 GHz	50 ns	15 ns
Minimum Repetition Frequency		
Internally Leveled	10 Hz	10 Hz
Search Mode	DC	DC
ALC Off Mode	DC	DC
Level Accuracy (dB, relative to CW level)		
Widths ≥1 μs	±0.3	±0.3
Widths <1 μs (Search Mode)	±0.5, typical	±0.5, typical
Video Feedthrough		
Output Frequencies <2.0 GHz		
Power Levels ≤10 dBm	2%	2%
Power Levels >10 dBm	5%	5%
Output Frequencies ≥2.0 GHz		
HP 83620B, 83622B, 83630B	0.1%	1%
HP 83623B, 83624B, 83640B, 83650B	1%	1%
Overshoot, Ringing	15%, typical	10%, typical
Delay ¹³		
Output Frequencies <2.0 GHz	80 ns, typical	80 ns, typical
Output Frequencies ≥2.0 GHz	80 ns, typical	40 ns, typical
Compression	±10 ns, typical	±5 ns, typical



Internal Pulse Generator

Width Range: 1 μs to 65 ms
Period Range: 2 μs to 65 ms
Resolution: 1 μs

AM and Scan

Bandwidth (3 dB, 30% depth, modulation peaks 3 dB below maximum rated power): DC to 100 kHz

Modulation Depth

(ALC levels noted, can be offset using step attenuator)

Normal Mode: -20 dBm to maximum available power

Deep Mode¹⁴: 50 dB below maximum available power

Unleveled Mode¹⁵: 50 dB below maximum available power

Sensitivity

Linear: 100%/volt

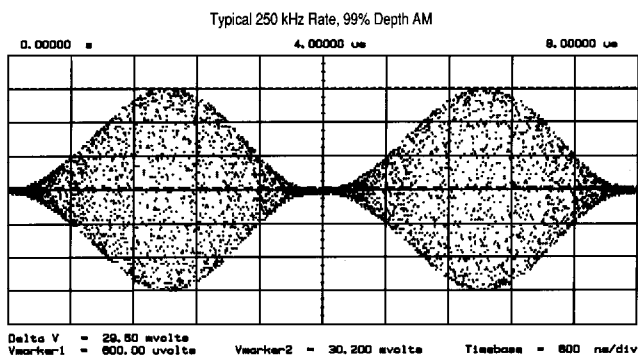
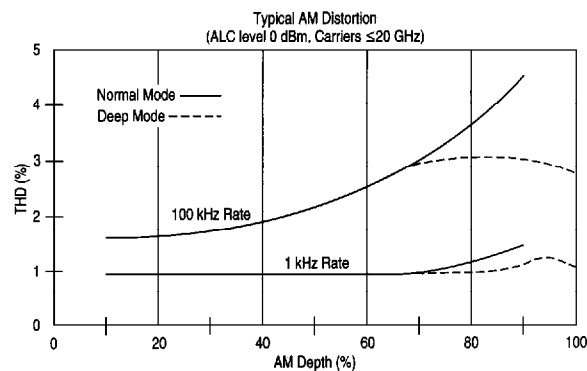
Accuracy (1 kHz rate, 30% depth, normal mode): 5%

Exponential: 10 dB/volt

Accuracy (normal mode): 0.25 dB \pm 5% of depth in dB

Incidental Phase Modulation (30% depth): 0.2 radians peak, typical

Incidental FM: Incidental phase modulation x modulation rate



14. Deep mode offers reduced distortion for very deep AM. Waveform is DC-coupled and feedback-leveled at ALC levels above -13 dBm. At ALC levels below -13 dBm, output is DC-controllable, but subject to sample-and-hold drift of 0.25 dB/second.

15. The HP 8360 has two unleveled modes, ALC Off and Search. In ALC Off mode, the modulator drive can be controlled from the front panel to vary quiescent RF output level. In Search mode, the instrument microprocessor momentarily closes the ALC loop to find the modulator drive setting necessary to make the quiescent RF output level equal to an entered value, then opens the ALC loop while maintaining that modulator drive setting. Neither of these modes is feedback leveled.

FM (HP 8360B only)

Locked Mode

Maximum Deviation: \pm 8 MHz

Rates (3 dB bandwidth, 500 kHz deviation): 100 kHz to 8 MHz

Maximum Modulation Index (deviation/rate): $n \times 5$

Unlocked Mode

Maximum Deviation

At rates \leq 100 Hz: \pm 75 MHz

At rates $>$ 100 Hz: \pm 8 MHz

Rates (3 dB bandwidth, 500 kHz deviation): DC to 8 MHz

Sensitivity

100 kHz, 1 MHz, or 10 MHz/volt, switchable.

Accuracy (1 MHz rate, 1 MHz deviation): 10%

Simultaneous Modulations (HP 8360B only)

Full AM bandwidth and depth is typically available at any pulse rate or width. FM is completely independent of AM and pulse modulation.

Internal Modulation Generator

(Option 002)

AM, FM Modulation Signals

Internal Waveforms: Sine, square, triangle, ramp, noise

Rate:

Range:

Sine: 1 Hz to 1 MHz

Square, triangle, ramp: 1 Hz to 100 kHz

Resolution: 1 Hz

Depth, deviation

Range: same as the base instrument

Resolution: 0.1%

Accuracy: same as base instrument

Pulse

Modes: free-run, gated, triggered, delayed

Period range: 300 ns to 400 ms

Width range: 25 ns to 400 ms

Resolution: 25 ns

Accuracy: 5 ns

Video Delay

Internal sync pulse: 0 to 400 ms

Externally supplied sync pulse: 225 ns to 400 ms

Modulation Meter

Accuracy (rates \leq 100 kHz): 5% of range)

General

Storage Temperature Range: –40 to 75°C

Operating Temperature Range: 0 to 55°C

Environmental

EMC: Within limits of CISPR Pub.11/1990 Group 1, Class A, and Mil-Std-461C Part 7 RE02

Warm-Up Time

Operation: Requires 30-minute warm-up from cold start at 0 to 55°C. Internal temperature equilibrium reached after two-hour warm-up at stable ambient temperature.

Frequency Reference: Reference time base is kept at operating temperature with the instrument connected to AC power. Instruments disconnected from AC power for more than 24 hours require 30 days to achieve time base aging specification. Instruments disconnected from AC power for less than 24 hours require 24 hours to achieve time base aging specification.

Power Requirements

48 to 66 Hz; 115 volts (+10/–25%) or 230 volts (+10/–15%); 400 VA maximum (30 VA in STANDBY)

Weight and Dimensions

Net Weight: 27 kg (60 lb)

Shipping Weight: 36 kg (80 lb)

Dimensions: 178 H x 425 W x 648 mm D
(7.0 x 16.75 x 22.5 inches)

Adapters Supplied

HP 83620B, 83622B, 83623B/L, 83624B, 83630B/L

Type N (female) – 3.5 mm (female)	Part Number 1250-1745
3.5 mm (female) – 3.5 mm (female)	Part Number 5061-5311

HP 83640B/L, 83650B/L

2.4 mm (female) – 2.92 mm (female)	Part Number 1250-2187
2.4 mm (female) – 2.4 mm (female)	Part Number 1250-2188

Inputs and Outputs

Auxiliary Output

Provides an unmodulated reference signal from 2 to 26.5 GHz at a typical minimum power level of –10 dBm. Nominal output impedance 50 ohms. (SMA female, rear panel.)

RF Output

Nominal output impedance 50 ohms. (precision 3.5 mm male on 20 and 26.5 GHz models, 2.4 mm male on 40 and 50 GHz models, front panel.)

External ALC Input

Used for negative external detector or power meter leveling. Nominal input impedance 120 kohms, damage level ± 15 volts. See *RF Output* specifications. (BNC female, front panel.)

Pulse Input/Output (HP 8360B models only)

TTL-low-level signal turns RF off. When using standard internal pulse generator a TTL-level pulse sync signal preceding the RF pulse by nominally 80 ns is output at this connector. Nominal input impedance 50 ohms, damage level +5.5, –0.5 volts. See *Modulation* specifications. (BNC female, front panel.)

AM Input (HP 8360B models only)

Nominal input impedance 50 ohms (internally switchable to 2 kohms), damage level ± 15 volts. See *Modulation* specifications. (BNC female, front panel.)

FM Input (HP 8360B models only)

Nominal input impedance 50 ohms (internally switchable to 600 ohms), damage level ± 15 volts. See *Modulation* specifications. (BNC female, front panel.)

Trigger Input

Activated on TTL rising edge. Used to externally activate an analog sweep or to advance to the next point in step or list mode. Damage level +5.5, –0.5 volts. (BNC female, rear panel.)

Trigger Output

Outputs a one-microsecond-wide TTL pulse at 1601 points evenly spaced across an analog sweep, or at each point in step or list mode. (BNC female, rear panel.)

10 MHz Reference Input

Accepts 10 MHz ± 100 Hz, 0 to +10 dBm reference signal for operation from external time base. Nominal input impedance 50 ohms. Damage level +10, –5 volts. (BNC female, rear panel.)

10 MHz Reference Output

Nominal signal level 0 dBm, nominal output impedance 50 ohms. (BNC female, rear panel.)

Sweep Output

Supplies a voltage proportional to the sweep ranging from 0 volts at start of sweep to 10 volts at end of sweep, regardless of sweep width. In CW mode, voltage is proportional to percentage of full instrument frequency range. Minimum load impedance 3 kohms. Accuracy $\pm 0.25\%$, ± 10 mv, typical. (BNC female, rear panel.)

Stop Sweep Input/Output

Sweep will stop when grounded externally. TTL-high while sweeping, TTL-low when HP 8360 stops sweeping. Damage level +5.5, –0.5 volts. (BNC female, rear panel.)

Z-Axis Blanking/Markers Output

Supplies positive rectangular pulse (approximately +5 volts into 2 kohms) during the retrace and band switchpoints of the RF output. Also supplies a negative pulse (–5 volts) when the RF is at a marker frequency (intensity markers only.) (BNC female, rear panel.)

Volts/GHz Output

Supplies a voltage proportional to output frequency at 0.25 volts/GHz, 0.5 volts/GHz, or 1 volt/GHz (model dependant and internally switchable.) Maximum output 18 volts. Minimum load impedance 2 kohms. Accuracy $\pm 0.5\%$, ± 10 mv, typical. (BNC female, rear panel.)

Source Module Interface

Provides bias, flatness correction, and leveling connections for the HP 83550-series of millimeter-wave source modules. (Special, front and rear panels.)

Auxiliary Interface

Provides control signal connections to the HP 8516A S-parameter test set. Also used when two HP 8360 series synthesized sweepers are operated in master/slave mode. (25-pin D-subminiature receptacle, rear panel.)

Pulse Video Output (Option 002 only.) Outputs the pulse modulation waveform that is supplied to the modulator. This can be either the internally or externally generated pulse modulation signal. (BNC female, rear panel.)

Pulse Sync Out (Option 002 only.) Outputs a 50 ns wide TTL pulse synchronized to the leading edge of the internally-generated pulse. (BNC female, rear panel.)

AM/FM Output (Option 002 only.) Outputs the internally-generated AM or FM waveform. This output can drive 50 ohms or greater. The AM output is scaled the same as it is generated, either 100%/V or 10 dB/V. The FM scaling depends on the FM deviation selected. (BNC female, rear panel.)

Models

HP 83620B 10 MHz to 20 GHz
HP 83622B 2 GHz to 20 GHz
HP 83623B 10 MHz to 20 GHz (high power)
HP 83624B 2 GHz to 20 GHz (high power)
HP 83630B 10 MHz to 26.5 GHz
HP 83640B 10 MHz to 40 GHz
HP 83650B 10 MHz to 50 GHz

HP 83623L 10 MHz to 20 GHz
HP 83630L 10 MHz to 26.5 GHz
HP 83640L 10 MHz to 40 GHz
HP 83650L 10 MHz to 50 GHz

Options**Option 001 Adds Step Attenuator**

With this option, minimum settable output power is -110 dBm. Maximum leveled output power is reduced by 1.5 dB to 20 GHz, 2 dB above 20 GHz, and 2.5 dB above 40 GHz.

Option 002 Adds Internal Modulation Generator (HP 8360B only – not available on HP 8360L)

Adds a digitally-synthesized modulation waveform source-on-a-card to the HP 8360. Provides signals that would otherwise be applied to the external modulation inputs.

Option 004 Rear Panel RF Output

Moves RF Output, External ALC Input, Pulse Input/Output, AM Input, and FM Input connectors to the rear panel.

Option 006 Fast Pulse Modulation

(HP 8360B only – not available on HP 8360L) Improves pulse rise/fall time to 10 ns. Also improves harmonic performance.

Option 008 1 Hz Frequency Resolution

Provides frequency resolution of 1 Hz.

Option 700 MATE System Compatibility

Provides CIIL programming commands for MATE system compatibility.

Option 806 Rack Slide Kit

Used to rack mount HP 8360 while permitting access to internal spaces.

Option 908 Rack Flange Kit

Used to rack mount HP 8360 without front handles.

Option 910 Extra Operating and Service Manuals

Provides a second copy of Operating and Service manuals.

Option 913 Rack Flange Kit

Used to rack mount HP 8360 with front handles. Front handles are standard on the HP 8360.

ISO 9002 Compliant

These models are manufactured in an ISO 9002 registered facility in concurrence with Hewlett-Packard's commitment to quality.

Upgrades

Model and frequency upgrades are available. Please contact your Hewlett-Packard sales representative for details.

Dedicated HP 8510 System Source Models

Dedicated source are optimized for use as HP 8510 network analyzer system components. They are configured without modulation capabilities or front panel keyboard/displays, and with rear connectors and with one-year on-site service (where available). Specifications for these models are the HP 8510 specifications, plus the following:

Frequency Range

HP 83621B 45 MHz to 20 GHz

HP 83631B 45 MHz to 26.5 GHz

HP 83651B 45 MHz to 50 GHz

Resolution: 1 Hz

Accuracy

CW Mode: Same as time base¹⁶

Swept Mode (at frequencies ≤ 26.5 GHz):

Sweep Widths $\leq n \times 10$ MHz: 0.1% of sweep width \pm time base accuracy

Sweep Widths $> n \times 10$ MHz and ≤ 400 MHz: 1% of sweep width

Sweep Widths > 400 MHz and ≤ 4 GHz: 4 MHz

Sweep Widths > 4 GHz: 0.1% of sweep width

Swept Mode (at frequencies > 26.5 GHz):

Sweep Widths $\leq n \times 10$ MHz: 0.1% of sweep width \pm time base accuracy

Sweep Widths $> n \times 10$ MHz and ≤ 800 MHz: 1% of sweep width

Sweep Widths > 800 MHz and ≤ 8 GHz: 8 MHz

Sweep Widths > 8 GHz: 0.1% of sweep width

Output Power

Maximum Levelled

Frequencies ≤ 20 GHz: +10 dBm

Frequencies > 20 GHz and ≤ 26.5 GHz: +4 dBm

Frequencies > 26.5 GHz and ≤ 40 GHz: +3 dBm

Frequencies > 40 GHz: 0 dBm

Minimum Settable: -20 dBm

Specifications describe warranted instrument performance over the 0 to 55°C temperature range, except as noted otherwise. **Supplemental characteristics**, denoted as typical or nominal, are intended to provide information useful in applying the instrument, but are non-warranted parameters.

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16. Internal time base verified to 1 ppm with standard on-site verification procedure.