Table 1-1. Specifications (1 of 7)

(All specifications apply over the nominal Frequency Ranges and over the top 10 dB of the output level vernier range unless otherwise specified.)

FREQUENCY

Range: 500 kHz to 512 MHz in 10 octave ranges.

Option 002 (Internal Doubler): 500 kHz to 1024 MHz in 11 octave ranges.

Ranges and Range Overlap: Ranges extend approximately 10% below and 7% above the nominal Frequency Ranges shown below:

Frequency Ranges (MHz)	Frequency Range (MHz) (with overlap)
0.5 - 1	0.45 - 1.07
1 - 2	0.90 - 2.14
2 - 4	1.80 - 4.29
4 - 8	3.60 - 8.59
8 - 16	7.20 - 17.1
16 - 32	14.4 - 34.3
32 - 64	28.8 - 68.7
64 - 128	57.5 - 137
128 - 256	115 - 275
256 - 512	230 - 550
512 - 1024[1] (Option 002)	460 - 1100

Internal Counter Resolution (Unlocked):

Frequency Ranges (MHz)	Normal Mode	Expand X10	Expand X100
0.5 - 1	10 Hz	1 Hz	0.1 Hz
1 - 16	100 Hz	10 Hz	1 Hz
16 - 128	1 kHz	100 Hz	10 Hz
128 - 1024	10 kHz	1 kHz	100 Hz

Optimum Counter Resolution When Phase-Locked:

Frequency Ranges (MHz)	With 6 Digits	+½ Digit
0.5 - 0.9999995	1 Hz	0.5 Hz
1.0 - 9.999995	10 Hz	5 Hz
10.0 - 99.99995	100 Hz	50 Hz
100.0 - 999.9995	1 kHz	500 Hz
1000 - 1024	10 kHz	5 kHz

Accuracy: 6-digit LED display[2] with X10 and X100 expand; accuracy depends on internal or external reference used.

[Total Count Accuracy] = [Counter Resolution[3] (±1 count)] + [Reference Error (INT or EXT)]

Internal Reference Error: See counter internal reference characteristics.

Fine Tuning: Unlocked > 1000 ppm total range. Locked mode >±20 ppm by varying internal time base vernier.[4]

Stability:

	Normal	Locked[5]
Time (after 2 h warm-up)	<10 ppm/10 min	<0.05 ppm/h
Temperature	<50 ppm/°C	<±2 ppm drift[6] from 15° to 35°C <±10 ppm drift[6] from 0° to 50°C
Line Voltage[7] (+5% to -10% line voltage change)	<1 ppm	<0.1 ppm
Load (with any passive load change)	<1 ppm	No frequency variation measurable
Level Change (10 dB on output level vernier)	<1 ppm	
Mode Change (CW to FM)	1% of selected peak deviation or 200 Hz (400 Hz for Option 002) whichever is greater.	

[1] 512- 1024 MHz can also be obtained using an external doubler Model 11690A.

[2] A seventh digit is used to increment the frequency, when locked, by ½ the least significant digit (displays a 5 only).

[3] When phase locked, Counter Resolution error is eliminated.

[4] Display is uncalibrated when varying the time base vernier. Uncal annunciator will light.

[5] These specifications are given for the internal reference. When using an external reference, drift in the locked mode will depend on the external reference characteristics.

[6] Phase lock may break due to temperature change (i.e., during warm-up). Simply relock at desired frequency.

[7] This specification is for short term transient line changes.

Table 1-1. Specifications (2 of 7)

FREQUENCY (Cont'd)

Restabilization Time:

	Normal	Locked[1]
After frequency change	<15 min.	<1 min. after relocking to be within 0.1 ppm of steady-state frequency.
After range change	None	

SPECTRAL PURITY

Harmonics (at 1 volt, +10 dBm output range and below):
0.5 to 512 MHz: <−30 dB relative to the carrier (dBc).
512 to 1024 MHz (Option 002): <−12 dBc.

Spurious Output Signals (excluding frequencies within 15 kHz of the signal whose effects are specified in residual AM and FM):

Frequency Range (MHz)	Subharmonically Related[2] (dBc)	Non-harmonically Related (dBc)
0.5 to 512	<−100	<−100
512 to 1024 (Option 002)	<−20	

Noise: [averaged rms noise level relative to the carrier (dBc) stated in a 1 Hz bandwidth]: (Single Sideband)
Phase Noise at 20 kHz offset from carrier.
512 to 1024 MHz (Option 002): <−124 dBc from 460 to 900 MHz increasing linearly to <−116 dBc at 1100 MHz.
256 to 512 MHz: <−130 dBc from 230 to 450 MHz increasing linearly to <−122 dBc at 550 MHz.
0.5 to 256 MHz: Decreases approximately 6 dB for each divided frequency range until it reaches SSB Broadband Noise Floor of <−140 dBc.

SSB Broadband Noise Floor at maximum output vernier and offset greater than 500 kHz from carrier:
512 to 1024 MHz (Option 002): <−137 dBc.
0.5 to 512 MHz: <−140 dBc.

Residual AM (averaged rms):

Post-Detection Noise Bandwidth	
300 Hz to 3 kHz	20 Hz to 15 kHz
<−85 dBc	<−78 dBc

Residual FM (averaged rms; after 2 h warm-up and excluding expand X10 mode):

Frequency Range (MHz)	Post-Detection Noise Bandwidth			
	CW and up to 1/8 maximum allowable peak deviation		Up to maximum allowable peak deviation	
	300 Hz to 3 kHz	20 Hz to 15 kHz	300 Hz to 3 kHz	20 Hz to 15 kHz
256 to 512	<5 Hz	<15 Hz	<15 Hz	<30 Hz
512 to 1024 (Option 002)	<10 Hz	<30 Hz	<30 Hz	<60 Hz

Note: Residual FM for ranges below 256—512 MHz decreases by approximately ½ for each divided frequency range until limited by the broadband noise floor. This limit for 300 Hz to 3 kHz bandwidth is ≈1 Hz and for 20 Hz to 15 kHz bandwidth is ≈4 Hz. In lock expand X10 mode, residual FM may increase approximately 2 Hz.

[1] These specifications are given for the internal reference. When using an external reference, drift in the locked mode will depend on the external reference characteristics.

[2] In the 512-1024 MHz range (Option 002), subharmonically related signals are 1/2F, (i.e., oscillator fundamental), 3/2F, 5/2F, etc.

Table 1-1. Specifications (3 of 7)

OUTPUT

Range: 10 dB steps and 18 dB vernier provide the following output power settings into 50Ω.

Frequency Range (MHz)	Standard	Option Combination		
		002	003	002/003
0.5–512	+19 to −145 dBm (2V to 0.013 μV)	+18.5to −145 dBm (1.9V to 0.013 μV)	+18.5 to −145 dBm (1.9V to 0.013 μV)	+18 to −145 dBm (1.8V to 0.013 μV)
512–1024 (Option 002)	–	+13 to −145 dBm (1V to 0.013 μV)	–	+12 to −145 dBm (0.9V to 0.013 μV)

Reverse Power Damage Level (without Reverse Power Protection, Option 003):
40 Vdc maximum or RF power level shown below:

Frequency Range (MHz)	Output Range			
	3V	1V	0.3V	All Others
0.5–512	100 mW (20 dBm)	100 mW (20 dBm)	500 mW (27 dBm)	500 mW (27 dBm)
512–1024 (Option 002)	20 mW (13 dBm)	20 mW (13 dBm)	200 mW (23 dBm)	500 mW (27 dBm)

Reverse Power Protection (Option 003): Protects Signal Generator from accidental application of up to 50W (+47 dBm) of RF power (between dc and 1100 MHz) into generator output.

Leakage (with all unused outputs terminated properly):
Leakage limits are below those specified in MIL-I-6181D. Furthermore, less than 3 μV is induced in a 2-turn, 25.4 mm (1 inch) diameter loop 25.4 mm (1 inch) away from any surface and measured into a 50Ω receiver. This permits receiver sensitivity measurements to at least <0.03 μV in a shielded system.

Auxiliary Output: Rear panel BNC output is >-5 dBm into 50Ω; source impedance is approximately 500Ω. This output is not doubled on the 512–1024 MHz range (Option 002).

Level Flatness (referred to output at 50 MHz and applies to 1V range and for top 10 dB of vernier range):

Frequency Range (MHz)	Standard	Option Combination		
		002	003	002/003
0.5–64	±0.5 dB	±0.5 dB	+0.75 dB −1.25 dB	+1.0 dB −2.0 dB
64–512		±1.0 dB		
512–1024 (Option 002)	–	±1.5 dB	–	±2.0 dB

Table 1-1. Specifications (4 of 7)

OUTPUT (Cont'd)

Impedance: 50Ω, ac coupled, SWR less than:

Frequency Range (MHz)	Output Level Range	Standard SWR	Option Combination		
			002 SWR	003 SWR	002/003 SWR
0.5–512	3V and 1V	2.0	2.5	2.5	2.5
	0.3V and below	1.3	1.3	1.5	1.7
512–1024 (Option 002)	1V	–	2.5	–	2.5
	0.3V and below	–	1.5	–	1.7

Level Accuracy (total accuracy as indicated on Level Meter):[1]

Frequency Range (MHz)	Output Level (dBm)			
	Using Top 10 dB of Vernier Range[2]			With Reverse Power Protection (Option 003)
	+19 to –7	–7 to –47	–47 to –137	+18.5 to –137
0.5–512	±1.5 dB	±2.0 dB	±2.5 dB	Add +0.25 dB –0.75 dB

With Internal Doubler (Option 002):

Frequency Range (MHz)	Output Level (dBm)			
	Using Top 10 dB of Vernier Range[2]			With Reverse Power Protection (Option 003)
	+18.5 to –7	–7 to –47	–47 to –137	+18 to –137
0.5–64	±1.5 dB	±2.0 dB	±2.5 dB	Add +0.5 dB –1.5 dB
64–512	±2.0 dB	±2.5 dB	±3.0 dB	Add +0.0 dB –1.0 dB
512–1024	±3.0 dB (+13 to –7 dBm)	±3.5 dB	±4.0 dB (–47 to –127 dBm)	Add ±0.5 dB (+12 to –128 dBm)

[1] Level Accuracy error consists of allowances for: meter accuracy, detector linearity, flatness, attenuator accuracy, and twice the measurement error. All but the attenuator accuracy and the measurement error can be calibrated out with a power meter at a fixed setting. See HP Application Note 170-1.

[2] When below top 10 dB of Vernier Range, add ±0.5 dB.

Table 1-1. Specifications (5 of 7)

MODULATION

General

Types: Internal AM and FM.
External AM, FM, and PULSE.
Simultaneous AM and FM or PULSE and FM.

Internal Modulation Sources (independently adjustable output is available at front panel):

Standard:
Frequency: fixed 400 Hz and 1 kHz ±3%.
Output Level: indicated 10 mV to 1 Vrms into 600Ω.

Optional (internal Variable Audio Oscillator Option 001):
Frequency: continuously variable from 20 Hz to 600 kHz ±15% in 5 decade ranges plus fixed 400 Hz and 1 kHz ±3%.
Output Level: indicated 1 mV to 3V into 600Ω.
Total Harmonic Distortion:
<0.5 % 400 Hz and 1 kHz fixed tones.
<0.5 % 20 Hz to 2 kHz.
<1.0 % 2 kHz to 200 kHz.
<2.0 % 200 kHz to 600 kHz.

Amplitude Modulation

(AM specifications apply to the top 10 dB of output vernier range unless otherwise specified.)

Depth:
0.5 to 512 MHz: 0 to 100% for output levels of +13 dBm and below.[1]
512 to 1024 MHz (Option 002): 0 to 100% for output levels of +7 dBm and below, excluding the top 6 dB of vernier range.[2]

AM Rates: Internal and External ac; 20 Hz to AM 3 dB bandwidth. External dc; dc to AM 3 dB bandwidth.

AM 3 dB Bandwidth:

Frequency Ranges (MHz)	0 to 50% AM	50 to 90% AM
0.5–2	20 kHz	12.5 kHz
2–8	40 kHz	25 kHz
8–512	60 kHz	50 kHz
512–1024 (Option 002)	60 kHz	50 kHz

AM Distortion (at 400 Hz and 1 kHz rates):

Frequency Range (MHz)	0 to 50% AM	50 to 90% AM
0.5–512	<1%	<3%
Frequency Range (MHz)	**0 to 30% AM**	**30 to 90% AM**
512–1024 (Option 002)	<10%	<20%

External AM Sensitivity (400 Hz and 1 kHz rates):
0.5 to 512 MHz: (0.100±0.005)% AM per mV peak into 600Ω with AM vernier at fully clockwise (cw) position.
512 to 1024 MHz (Option 002):
Nominal 0.1% AM per mV peak into 600Ω with AM vernier at fully cw position.

Indicated AM Accuracy (400 Hz and 1 kHz rates using internal meter):
0.5 to 512 MHz: ± (5.5% of reading +1.5% full scale) from 0 to 50°C.
512 to 1024 MHz (Option 002):
Not specified; each generator can be individually calibrated using operating manual procedure.

Peak Incidental Phase Modulation (at 30% AM):
0.5 to 128 MHz: <0.15 radians.
128 to 512 MHz: <0.3 radians.
512 to 1024 MHz (Option 002): <0.6 radians.

Peak Incidental Frequency Deviation: Equals peak incidental phase modulation X modulation rate.

[1] AM is possible above +13 dBm as long as the peak envelope power (carrier output plus AM depth) does not exceed +19 dBm (+18.5 dBm with Option 003).

[2] AM is possible above +7 dBm as long as the peak envelope power (carrier output plus AM depth) does not exceed +13 dBm (+12 dBm with Option 002/003). Also, the peak envelope power (carrier plus AM depth) may not exceed the maximum level of any output level range. For example, if the output level control is set to the −20 dBm position (maximum output level is −17 dBm), the peak envelope power may not exceed −17 dBm. The REDUCE PEAK POWER annunciator lights when peak envelope power has been exceeded.

Table 1-1. Specifications (6 of 7)

MODULATION (Cont'd)

Pulse Modulation

(Specifications apply for top 10 dB of output vernier range)

Frequency Ranges (MHz)	0.5 to 1	1 to 2	2 to 8	8 to 32	32 to 512	512 to 1024 (Option 002)
Rise and Fall Times	<9 μs	<4 μs	<2 μs	<1 μs		<1 μs typical
Pulse Repetition Rate[2]	50 Hz to 50 kHz		50 Hz to 100 kHz	50 Hz to 250 kHz	50 Hz to 500 kHz	
Pulse Width Minimum for Level Accuracy Within 1 dB of CW (>0.1% duty cycle)	10 μs		5 μs	2 μs		
Pulse ON/OFF Ratio at Maximum Vernier	>40 dB					>60 dB
Peak Input Required	Nominally >+0.5V (5V max.) sinewave or pulse return to zero, into 50Ω.					

Frequency Modulation

Deviation: Maximum allowable deviation equals 1% of lowest frequency in each range as shown below.

Frequency Range (MHz)	Maximum Peak Deviation (kHz)
0.5 - 1	5
1 - 2	10
2 - 4	20
4 - 8	40
8 - 16	80
16 - 32	160
32 - 64	320
64 - 128	640
128 - 256	1280
256 - 512	2560
512 - 1024 (Option 002)	5120

FM 3 dB Bandwidth:[1]

Internal and External ac: 20 Hz to 250 kHz.
External dc: dc to 250 kHz.

FM Distortion (at 400 Hz and 1 kHz rates):

<1% for deviations up to 1/8 maximum allowable.
<3% for deviations up to maximum allowable.

External FM Sensitivity: 1 volt peak into 600Ω yields maximum deviation indicated on PEAK DEVIATION switch with FM vernier at fully cw position.

External FM Sensitivity Accuracy (400 Hz and 1 kHz rates from 15° to 35°C):

Excluding maximum peak deviation position: ±6%.
Maximum peak deviation position: ±9% typically.

Indicated FM Accuracy (400 Hz and 1 kHz rates from 15° to 35°C, using internal meter):

Excluding maximum peak deviation position: ± (7% of reading +1.5% full scale).
Maximum peak deviation position: ± (10% of reading +1.5% full scale), typically.

Incidental AM (at 400 Hz and 1 kHz rates):

0.5 to 512 MHz:
<0.5% AM for FM deviations up to 1/8 maximum allowable.
<1.0% AM for FM deviations up to maximum allowable.

512 to 1024 MHz (Option 002):
<1.0% AM for FM deviations up to 1/8 maximum allowable.
<7% AM for FM deviations up to maximum allowable.

[1]When in locked mode, FM is possible only for rates greater than 50 Hz.

[2]Pulse performance degrades below 500 Hz repetition rates.

Table 1-1. Specifications (7 of 7)

COUNTER

External RF Input:
Frequency Range: 1 Hz to 550 MHz.
Sensitivity: ≥100 mVrms, ac only, into 50Ω (≥ −7 dBm).
Input level may not exceed +15 dBm (1.3 Vrms).

External Count Resolution: 6-digit LED display.

MODE (MHz)	Normal	Expand X10	Expand X100
0 - 10	100 Hz	10 Hz	1 Hz
10 - 550	10 kHz	1 kHz	100 Hz

External Reference Input: 5 MHz, nominally >0.5V peak-to-peak (5V maximum) into 1000Ω.

Internal Reference (after 2 h warm-up and calibration at 25°C):
Aging Rate:
<0.05 ppm/h; <2 ppm/90 days.
Temperature Drift:
<±2 ppm from 15° to 35°C.
<±10 ppm from 0° to 50°C.
Line Voltage Variations:
<0.1 ppm for +5% to −10% line voltage change.
Typical Overall Accuracy (within 3 months calibration and from 15° to 35°C): ± 2 ppm.

Frequency Tuning: typically >±20 ppm using internal time base vernier.

Rear Output: nominally >0.5V peak-to-peak into 500Ω. This will drive another 8640B.

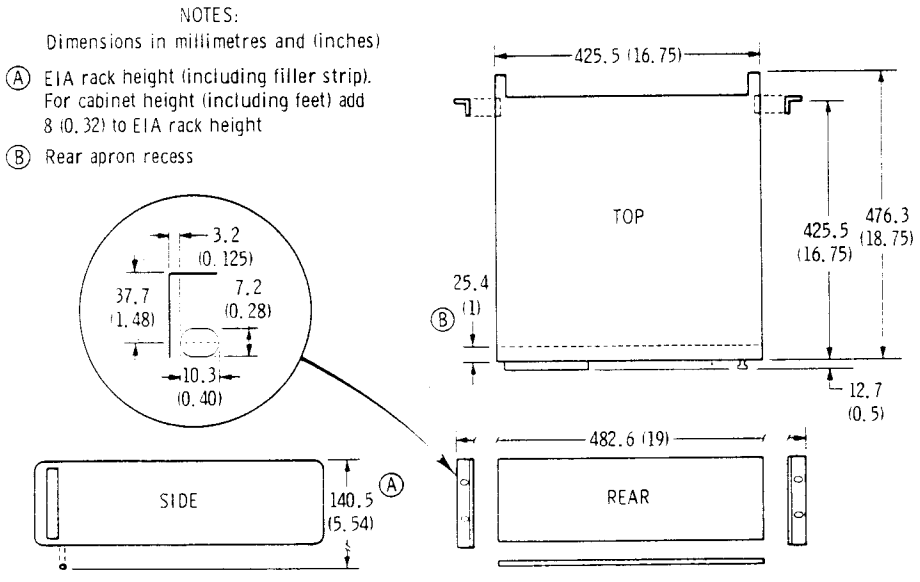
GENERAL

Operating Temperature Range: 0° to 55°C.

Power Requirements: 100 or 120 volts (+5%, −10%) from 48 to 440 Hz; or 220 or 240 volts (+5%, −10%) from 48 to 66 Hz. 175 VA max (Option 002:190 VA max). 2.3 m (7.5 ft) power cable furnished with mains plug to match destination requirements.

Weight:
Net 20.8 kg (45 lb 14 oz).

Dimensions:[1]



[1] Dimensions are for general information only. If dimensions are required for building special enclosures, contact your HP office. Dimensions for Option 908 Rack Flange Kit are also shown.