

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 X 10	Expand X 100
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 display² with X10 and X100 expand; accuracy depends on internal or external reference used.

$$\left[\begin{array}{c} \text{Total} \\ \text{Count} \\ \text{Accuracy} \end{array} \right] = \left[\begin{array}{c} \text{Counter} \\ \text{Resolution}^3 \\ (\pm 1 \text{ count}) \end{array} \right] + \left[\begin{array}{c} \text{Reference} \\ \text{Error} \\ (\text{INT or EXT}) \end{array} \right]$$

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 Voltage⁷ (+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	
	300Hz 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 1/2 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)	+18.5 to -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-1-6181D. 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	+1.0 dB
64-512		±1.0 dB	-1.25 dB	-2.0 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 $\pm 3\%$.
Output Level: indicated 10 mV to 1 Vrms into 600 Ω .

Optional (internal Variable Audio Oscillator Option 001):
Frequency: continuously variable from 20 Hz to 600 kHz $\pm 15\%$ in 5 decade ranges plus fixed 400 Hz and 1 kHz $\pm 3\%$.

Output Level: indicated 1 mV to 3V into 600 Ω .
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 \pm 0.005)% AM per mV peak into 600 Ω with AM vernier at fully clockwise (cw) position.

512 to 1024 MHz (Option 002):
Nominal 0.1% AM per mV peak into 600 Ω with AM vernier at fully cw position.

Indicated AM Accuracy (400 Hz and 1 kHz rates using internal meter):

0.5 to 512 MHz: \pm (5.5% of reading +1.5% full scale) from 0 to 50 $^{\circ}$ 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 μ s	< 4 μ s	< 2 μ s	< 1 μ s		< 1 μ s 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 μ s		5 μ s	2 μ s		
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 50 Ω .					

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 600 Ω 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: \pm 6%.
Maximum peak deviation position: \pm 9% typically.

Indicated FM Accuracy (400 Hz and 1 kHz rates from 15° to 35°C, using internal meter):
Excluding maximum peak deviation position: \pm (7% of reading +1.5% full scale).
Maximum peak deviation position: \pm (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.

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

²Pulse 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

Internal Reference (after 2 h warm-up and calibration at 25°C):

Aging Rate:
 < 0.05 ppm/h; < 2 ppm/90 days.
 Temperature Drift:
 $< \pm 2$ ppm from 15° to 35°C.
 $< \pm 10$ 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 $\geq \pm 20$ ppm using internal time base vernier.

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

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

GENERAL

Operating Temperature Range: 0° to 55°C.

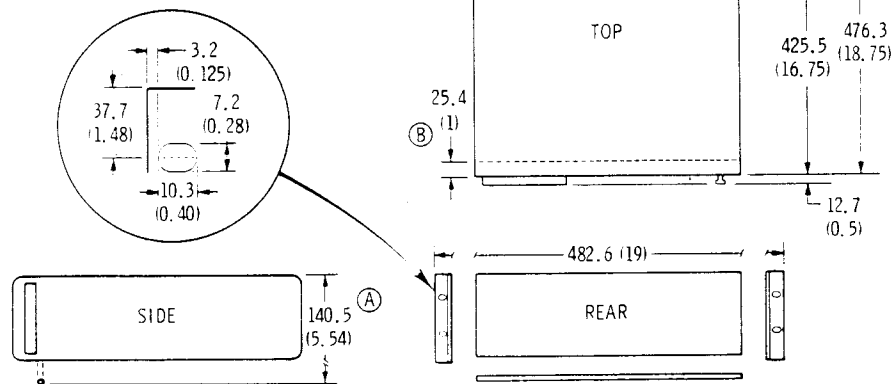
Power Requirements: 100 or 120 volts (+5%, -10%) from 48 to 440 Hz; or 220 or 240 volts (+5%, -10%) from 48 to 66 Hz. 175 VA max (Option 002:190 VA max). 2.3 m (7.5 ft) power cable furnished with mains plug to match destination requirements.

Weight:

Net 20.8 kg (45 lb 14 oz).

Dimensions:¹

- NOTES:
 Dimensions in millimetres and (inches)
- (A) EIA rack height (including filler strip). For cabinet height (including feet) add 8 (0.32) to EIA rack height
 - (B) Rear apron recess



¹Dimensions 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.