

## HP 8901B Modulation Analyzer

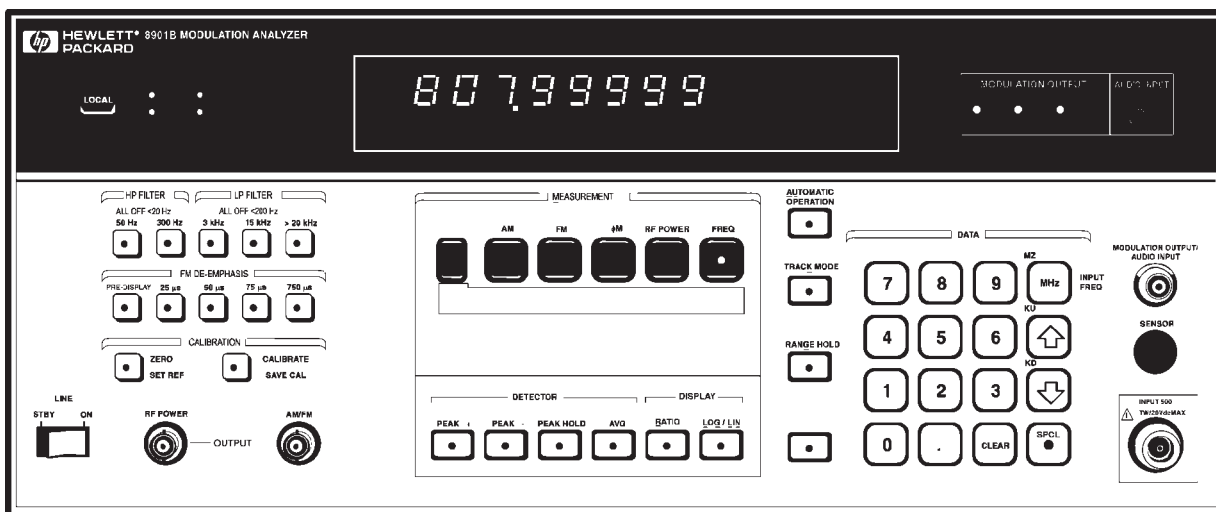
150 kHz - 1300 MHz

## HP 11722A Sensor Module

100 kHz - 2600 MHz

### Technical Specifications

Four Instruments In One



- **RF Power:  $\pm 0.02$  dB instrumentation accuracy**
- **RF Frequency: 10 Hz resolution**
- **AM and FM: 1% accuracy**
- **$\phi$ M: 3% accuracy**
- **Audio Characterization**  
AC Volts:  $\pm 4\%$  accuracy  
Frequency: **6 digits of resolution**  
Distortion:  $\pm 1$  dB accuracy

The HP 8901B Modulation Analyzer combines four precise measurement functions into one fully automatic, HP-IB programmable instrument. It includes a power meter, modulation analyzer, frequency counter, and audio analyzer. For precise signal analysis, the HP 8901B Modulation Analyzer provides the performance you need, the features you want, and the reliability and serviceability you expect.

**RF Power** delivers the accuracy and resolution of a high performance power meter. The HP 8901B with the HP 11722A Sensor Module measures power from +30 dBm to -20 dBm at frequencies from 100 kHz to 2.6 GHz. The HP 8901B accepts all HP 8480 series power sensors for extended measurement capability.

**AM and FM** measurements offer 1% accuracy (3% accuracy for  $\phi$ M) and fast one-key operation. The HP 8901B has extremely low internal noise, and very low AM/ $\phi$ M and  $\phi$ M/AM conversion, for accurately measuring residual and incidental AM, FM and  $\phi$ M on a wide range of simple and complex modulated signals.

**RF Frequency** of complex modulated signals can be difficult to measure, but not with the HP 8901B. Automatically tuning to the largest input signal or to any user specified frequency, the HP 8901B counts with 10 Hz resolution.

**Audio** distortion, frequency and level measurements provide comprehensive characterization of the modulation signal.

# HP 8901B Specifications

## RF Power

The HP 8901B Modulation Analyzer, with HP 11722A Sensor Module, performs RF Power Measurements from  $-20$  dBm ( $10 \mu\text{W}$ ) to  $+30$  dBm ( $1\text{W}$ ) at frequencies from  $100$  kHz to  $2.6$  GHz. The HP 8901B can be used with any of the HP 8480 series power sensors (HP 8481A/1B/1H/2A/2B/2H/3A/4A/5A) to make power measurements from  $-70$  dBm ( $10 \text{pW}$ ) to  $+44$  dBm ( $25\text{W}$ ) at frequencies from  $100$  kHz to  $26.5$  GHz. The HP 8480 series sensors also work with the HP 435A and HP 436A Power Meters. Unless otherwise specified, the specifications shown below refer to the HP 8901B only. A detailed explanation of how the uncertainty specifications provided below affect the absolute power measurement accuracy of the HP 8901B is provided in Application Note 64-1.

### RF POWER RESOLUTION<sup>1</sup>:

$0.1\%$  of full scale in watts or volts mode.  
 $0.01$  dB in dBm or  $\text{dB}_{\text{relative}}$  mode.

### LINEARITY (includes sensor nonlinearity):

RF range linearity  $\pm$  RF range-to-range change error.

### RF RANGE LINEARITY (using Recorder Output)<sup>2</sup>:

$\pm 0.02$  dB, RF ranges 2 – 5.  
 $\pm 0.03$  dB, RF range 1.  
Using front-panel display add  $\pm 1$  count of least-significant digit.

### RF RANGE-TO-RANGE CHANGE ERROR:

$\pm 0.02$  dB/RF Range Change from reference range.

INPUT SWR:  $<1.15$ , using HP 11722A Sensor Module.

### ZERO SET (DIGITAL SETTABILITY OF ZERO):

$\pm 0.07\%$  of full scale of lowest range.  
Decrease by a factor of 10 for each higher range.

## Supplemental Characteristics:

### ZERO DRIFT OF METER:

$\pm 0.03\%$  of full scale/ $^{\circ}\text{C}$  of lowest range.

### NOISE (at constant temperature, peak change over any one-minute interval for the HP 11722A Sensor Module and HP 8481A/1B/1H/2A/2B/2H/3A/5A Sensors):

$0.4\%$  of full scale on range 1 (lowest range).  
 $0.13\%$  of full scale on range 2.  
 $0.013\%$  of full scale on range 3.  
 $0.0013\%$  of full scale on range 4.  
 $0.00013\%$  of full scale on range 5.  
For HP 8484A Sensor multiply noise by five on all ranges.

### ZERO DRIFT OF SENSORS (1 HOUR, AT CONSTANT TEMPERATURE AFTER 24-HOUR WARM-UP):

$\pm 0.1\%$  of full scale of lowest range for HP 11722A Sensor Module and HP 8481A/1B/1H/2A/2B/2H/3A/5A sensors.  
 $\pm 2.0\%$  of full scale of lowest range for HP 8484A sensor.  
Decrease by a factor of 10 for each higher range.

### RF POWER RANGES OF 8901B MODULATION ANALYZER WITH HP 11722A SENSOR MODULE:

$-20$  dBm to  $-10$  dBm ( $10 \mu\text{W}$  to  $100 \mu\text{W}$ ), range 1.  
 $-10$  dBm to  $+0$  dBm ( $100 \mu\text{W}$  to  $1 \text{mW}$ ), range 2.  
 $+0$  dBm to  $+10$  dBm ( $1 \text{mW}$  to  $10 \text{mW}$ ), range 3.  
 $+10$  dBm to  $+20$  dBm ( $10 \text{mW}$  to  $100 \text{mW}$ ), range 4.  
 $+20$  dBm to  $+30$  dBm ( $100 \text{mW}$  to  $1\text{W}$ ), range 5.

### RESPONSE TIME (0 to 99% OF READING):

$<10$  seconds, range 1.  
 $<1$  second, range 2.  
 $<100$  milliseconds, ranges 3-5

### DISPLAYED UNITS:

watts, dBm,  $\text{dB}_{\text{relative}}$ ,  $\%_{\text{relative}}$ , volts, mV,  $\mu\text{V}$ , dB V, dB mV, dB  $\mu\text{V}$ .

### INTERNAL NON-VOLATILE CAL-FACTOR TABLES (user-modifiable using special functions):

#### MAXIMUM NUMBER OF CAL FACTOR/FREQUENCY ENTRIES:

Table #1 (Primary): 16 pairs plus Reference Cal Factor.

Table #2 (Frequency Offset): 22 pairs plus Reference Cal Factor.

MAXIMUM ALLOWED FREQUENCY ENTRY:  $42$  GHz.

FREQUENCY ENTRY RESOLUTION:  $50$  kHz.

CAL FACTOR RANGE:  $40$  to  $120\%$ .

CAI FACTOR RESOLUTION:  $0.1\%$ .

## Power Reference

### POWER OUTPUT:

$1.00$  mW. Factory set to  $\pm 0.7\%$ , traceable to the U.S. National Bureau of Standards.

ACCURACY:  $\pm 1.2\%$  worst case ( $\pm 0.9\%$  rss) for one year ( $0^{\circ}\text{C}$  to  $55^{\circ}\text{C}$ ).

## Supplemental Characteristics:

FREQUENCY:  $50$  MHz nominal.

SWR:  $1.05$  nominal.

FRONT PANEL CONNECTOR: Type-N female

1 The HP 8901B fundamental RF Power measurement units are watts. Further internal processing is done on this number to display all other units.

2 When using HP 8484A sensor the noise specification may mask the linearity specification and become the predominant error. When operating on the top RF power range, add the Power Sensor Linearity percentages found in the power sensor specifications.

All parameters describe performance in automatic operation or properly set manual conditions. **Specifications** describes the instrument's warranted performance.

**Supplement Characteristics** (shown in italics) are intended to provide information useful in applying the instrument by giving typical, but non-warranted, performance parameters.

## Amplitude Modulation

### RATES:

20 Hz to 10 kHz, 150 kHz  $\leq f_c < 10$  MHz.  
20 Hz to 100 kHz, 10 MHz  $\leq f_c \leq 1300$  MHz.

### DEPTH: to 99%

### ACCURACY<sup>3,4,5</sup>:

AM Accuracy	Frequency Range	Rates	Depths
$\pm 2\%$ of reading $\pm 1$ digit	150 kHz - 10 MHz	50 Hz - 10 kHz	5% - 99%
$\pm 3\%$ of reading $\pm 1$ digit	150 kHz - 10 MHz	20 Hz - 10 kHz	to 99%
$\pm 1\%$ of reading $\pm 1$ digit	10 MHz - 1300 MHz	50 Hz - 50 kHz	5% - 99%
$\pm 3\%$ of reading $\pm 1$ digit	10 MHz - 1300 MHz	20 Hz - 100 kHz	to 99%

For rms detector add  $\pm 3\%$  of reading.

### FLATNESS<sup>6,7</sup>:

AM Accuracy	Frequency Range	Rates	Depths
$\pm 0.3\%$ of reading $\pm 1$ digit	10 MHz - 1300 MHz	90 Hz - 10 kHz	20% - 80%

### DEMODULATED OUTPUT DISTORTION:

$< 0.3\%$  THD for  $\leq 50\%$  depth.  
 $< 0.6\%$  THD for  $\leq 95\%$  depth.

### FM REJECTION (50 Hz TO 3 kHz BW)<sup>4</sup>:

FM Rejection	Frequency Range	Rates	Deviations
$< 0.2\%$ AM	250 kHz - 10 MHz	400 Hz or 1 kHz	$< 5$ kHz <sub>peak</sub>
$< 0.2\%$ AM	10 MHz - 1300 MHz	400 Hz or 1 kHz	$< 50$ kHz <sub>peak</sub>

RESIDUAL AM (50 Hz to 3 kHz BW):  $< 0.01\%$ <sub>rms</sub>

## Supplemental Characteristics:

**DETECTORS:** +peak, -peak,  $\pm$ peak/2, peak hold, average  
(rms sine wave calibrated), rms.

### MAXIMUM DEPTH, RESOLUTION, AND MAXIMUM DEMODULATED OUTPUT SENSITIVITY ACROSS AN OPEN CIRCUIT (600 $\Omega$ OUTPUT IMPEDANCE)<sup>7</sup>:

Maximum Resolution	Maximum Demodulated Output Sensitivity	Depths
0.1%	0.01V / percent	$AM_{peak} \geq 40.0\%$
0.01%	0.1V / percent	$AM_{peak} < 40.0\%$
0.001% (rms detector only)	0.1V / percent	$AM_{rms} < 3.0\%$

<sup>3</sup> But not to exceed: 50 Hz to 40 kHz rates for stated accuracy with rms detector.

<sup>4</sup> Peak residuals must be accounted for in peak readings.  
<sup>5</sup> For peak measurements only: AM accuracy may be affected by distortion generated by the Analyzer. In the worst case this distortion can decrease accuracy by 0.1% of reading for each 0.1% of distortion.

<sup>6</sup> Flatness is the variation in indicated AM depth for constant depth on input signal.

<sup>7</sup> For optimum flatness, cables should be terminated with their characteristic impedance.

## Frequency Modulation

### RATES<sup>8</sup>:

20 Hz to 10 kHz, 150 kHz  $\leq f_c < 10$  MHz.  
20 Hz to 200 kHz, 10 MHz  $\leq f_c \leq 1300$  MHz.

### DEVIATIONS:

40 kHz<sub>peak</sub> maximum, 150 kHz  $\leq f_c < 10$  MHz.  
400 kHz<sub>peak</sub> maximum, 10 MHz  $\leq f_c \leq 1300$  MHz.

### ACCURACY<sup>3,4,8</sup>:

FM Accuracy	Frequency Range	Rates	Deviations
$\pm 2\%$ of reading $\pm 1$ digit	250 kHz - 10 MHz	20 Hz - 10 kHz	$\leq 40$ kHz <sub>peak</sub>
$\pm 1\%$ of reading $\pm 1$ digit	10 MHz - 1300 MHz	50 Hz - 100 kHz	$\leq 400$ kHz <sub>peak</sub>
$\pm 5\%$ of reading $\pm 1$ digit	10 MHz - 1300 MHz	20 Hz - 200 kHz	$\leq 400$ kHz <sub>peak</sub>

For rms detector add  $\pm 3\%$  of reading.

### DEMODULATED OUTPUT DISTORTION<sup>8,9</sup>:

THD	Frequency Range	Rates	Deviations
$< 0.1\%$	400 kHz - 10 MHz	20 Hz - 10 kHz	$< 10$ kHz
$< 0.1\%$	10 MHz - 1300 MHz	20 Hz - 100 kHz	$< 100$ kHz

### AM REJECTION (50 Hz TO 3 kHz BW)<sup>4</sup>:

AM Rejection	Frequency Range	Rates	Depths
$< 20$ Hz peak deviation	150 kHz - 1300 MHz	400 Hz or 1 kHz	$\leq 50\%$

### RESIDUAL FM (50 Hz to 3 kHz BW):

$< 8$  Hz<sub>rms</sub> at 1300 MHz, decreasing linearly with frequency to  $< 1$  Hz<sub>rms</sub> for 100 MHz and below.

## Supplemental Characteristics

### MAXIMUM FM DEVIATION, RESOLUTION, AND MAXIMUM DEMODULATED OUTPUT SENSITIVITY ACROSS AN OPEN CIRCUIT (600 $\Omega$ OUTPUT IMPEDANCE)<sup>7</sup>:

Maximum Resolution	Maximum Demodulated Output Sensitivity	Deviations
100 Hz	0.01 mV/Hz	$\Delta F_{peak} \geq 40$ kHz
10 Hz	0.1 mV/Hz	$4.0$ kHz $\leq \Delta F_{peak} < 40$ kHz
1 Hz	1.0 mV/Hz	$\Delta F_{peak} < 4$ kHz
0.1 Hz (rms detector only)	1.0 mV/Hz	$\Delta F_{rms} < 0.3$ kHz

Resolution is increased one digit with 750  $\mu$ s de-emphasis and pre-display on.

The demodulated output signal present at the Modulation Out/Audio In connector is increased in amplitude by a factor of 10 with 750  $\mu$ s de-emphasis.

<sup>8</sup> But not to exceed: 20 kHz rates and 40 kHz peak-deviations with 750  $\mu$ s de-emphasis filter.

<sup>9</sup> With 750  $\mu$ s de-emphasis and pre-display "off," distortion is not specified for modulation outputs  $> 4V$  peak. This condition can occur near maximum deviation for a measurement range, at rates  $< 2$  kHz.

**DEMODULATED OUTPUT DISTORTION:**

THD	Frequency Range	Rates	Deviations
<0.3%	150 kHz - 400 kHz	20 Hz - 10 kHz	<10 kHz

**DETECTORS:** +peak, - peak, ±peak/2, peak hold, average (rms sinewave calibrated), rms.

**STEREO SEPARATION (50 Hz to 15 kHz):** >47 dB.

**Phase Modulation**

**RATES:**

200 Hz to 10 kHz, 150 kHz ≤ f<sub>c</sub> < 10 MHz.  
200 Hz to 20 kHz, 10 MHz ≤ f<sub>c</sub> ≤ 1300 MHz.

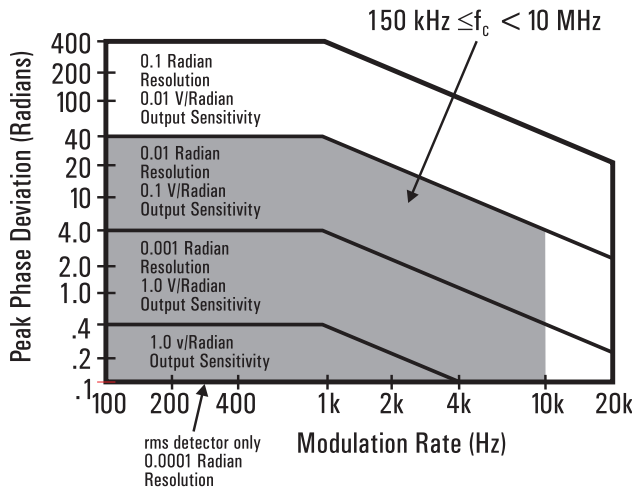
**ACCURACY<sup>4</sup>:**

±4% of reading ±1 digit, 150 kHz ≤ f<sub>c</sub> < 10 MHz.  
±3% of reading ±1 digit, 10 MHz ≤ f<sub>c</sub> ≤ 1300 MHz  
For rms detector add ±3% of reading.

**DEMODULATED OUTPUT DISTORTION:** <0.1% THD.

**AM REJECTION (FOR 50% AM AT 1 kHz RATES)<sup>4</sup>:**  
<0.03 radians peak (50 Hz to 3 kHz BW).

**MAXIMUM DEVIATION, RESOLUTION, AND MAXIMUM DEMODULATED OUTPUT SENSITIVITY ACROSS AN OPEN CIRCUIT (600Ω OUTPUT IMPEDANCE)<sup>7</sup>:**



**Supplemental Characteristics:**

**MODULATION RATES:** usable from 20 Hz to 100 kHz with degraded performance.

**DETECTORS:** +peak, - peak, ±peak/2, peak hold, average (rms sinewave calibrated), rms.

**Modulation Reference**

**AM CALIBRATOR DEPTH AND ACCURACY:**  
33.33% depth nominal, internally calibrated to an accuracy of ±0.1%.

**FM CALIBRATOR DEVIATION AND ACCURACY:**  
34 kHz peak deviation nominal, internally calibrated to an accuracy of ±0.1%.

**Supplemental Characteristics:**

**CARRIER FREQUENCY:** 10.1 MHz.

**MODULATION RATE:** 10 kHz.

**OUTPUT LEVEL:** - 25 dBm.

**Frequency Counter**

**RANGE:** 150 kHz to 1300 MHz.

**MAXIMUM RESOLUTION:** 10 Hz.

**DEMODULATED OUTPUT DISTORTION:** <0.1% THD.

**ACCURACY:** ±3 counts of least-significant digit ± Reference accuracy.

**Supplemental Characteristics:**

**MODES:** Frequency and Frequency Error [displays the difference between the frequency entered via the keyboard and the actual RF input frequency].

**SENSITIVITY IN MANUAL TUNING MODE:**  
0.22 mV<sub>rms</sub> (- 60 dBm). (Approximate frequency must be entered from keyboard.)

**Internal Reference**

**FREQUENCY:** 10 MHz.

**AGING RATE:**  
<1 X 10<sup>-6</sup>/month.  
<1 X 10<sup>-9</sup>/day (Option 002)<sup>10</sup>.

**Supplemental Characteristics:**

**INTERNAL REFERENCE ACCURACY:**  
Overall accuracy is a function of time base calibration ± aging rate ± temperature effects ± line voltage effects ± short-term stability.

	Standard	Option 002
Aging Rate	< 1 x 10 <sup>-6</sup> /mo	< 1 x 10 <sup>-9</sup> /day
Temperature Effects	< 2 x 10 <sup>-7</sup> /C <sup>0</sup>	< 2 x 1-10 <sup>-10</sup> /C <sup>0</sup>
Line Voltage Effects (+ 5%, -10% Line Voltage Change)	< 1 x 10 <sup>-6</sup>	< 6 x 10 <sup>-10</sup>
Short Term Stability	-	< 1 x 10 <sup>-9</sup> for 1 s average

<sup>10</sup> After 30 day warm-up.

## Audio Frequency Counter

### FREQUENCY RANGE:

20 Hz to 250 kHz. (Usable to 600 kHz.)

**MAXIMUM EXTERNAL INPUT VOLTAGE:**  $3V_{\text{rms}}$

**Accuracy (For Demodulated Signals)<sup>11</sup>:**

Accuracy	Frequency	Modulation (Peak)
$\pm 3$ counts of least significant digit $\pm$ Internal Reference Accuracy	$> 1$ kHz	AM $\geq 10\%$ FM $\geq 1.0$ kHz $\phi M \geq 1.5$ radians
$\pm 0.02$ Hz $\pm$ Internal Reference Accuracy	$\leq 1$ kHz	AM $\geq 10\%$ FM $\geq 1.0$ kHz $\phi M \geq 1.5$ radians
$\pm 0.2$ Hz $\pm$ Internal Reference Accuracy (3 kHz low-pass filter inserted)	$\leq 3$ kHz	$1.5\% \leq \text{AM} < 10\%$ $0.15 \text{ kHz} \leq \text{FM}$ $< 1.0$ kHz $0.15 \text{ radian} \leq \phi M$ $< 1.5$ radians

**Accuracy (For External Signals)<sup>11</sup>:**

Accuracy	Frequency	Level
$\pm 3$ counts of least-significant digit $\pm$ Internal Reference	$> 1$ kHz	$\geq 100 \text{ mV}_{\text{rms}}$
$\pm 0.02$ Hz $\pm$ Internal Reference Accuracy	$\leq 1$ kHz	$\geq 100 \text{ mV}_{\text{rms}}$

### Supplemental Characteristics:

**DISPLAYED RESOLUTION:** 6 digits.

**MEASUREMENT RATE:** 2 readings/s.

### COUNTING TECHNIQUE:

Reciprocal with internal 10 MHz time base.

**AUDIO INPUT IMPEDANCE:** 100 k $\Omega$  nominal.

### Audio Distortion

#### FUNDAMENTAL FREQUENCIES:

400 Hz  $\pm 5\%$  and 1 kHz  $\pm 5\%$ .

**MAXIMUM EXTERNAL INPUT VOLTAGE:** 3V.

#### DISPLAY RANGE:

0.01% to 100.0% (-80.00 dB to 0.00 dB).

**DISPLAYED RESOLUTION:** 0.01% or 0.01 dB.

**ACCURACY:**  $\pm 1$  dB of reading.

#### SENSITIVITY:

**Modulation:** 0.15 kHz peak FM, 1.5% peak AM  
or 0.6 radian peak  $\phi M$ .

**External:**  $100 \text{ mV}_{\text{rms}}$ .

#### RESIDUAL NOISE AND DISTORTION<sup>12</sup>:

0.3% (-50 dB), temperature  $< 40^\circ\text{C}$ .

### Supplemental Characteristics:

**MEASUREMENT 3 dB BANDWIDTH:** 20 Hz to 50 kHz.

**DETECTION:** True rms.

**MEASUREMENT RATE:** 1 reading/s.

**AUDIO INPUT IMPEDANCE:** 100 k $\Omega$  nominal.

### Audio RMS Level

**FREQUENCY RANGE:** 50 Hz to 40 kHz.

**VOLTAGE RANGE:** 100 mV to 3V.

**ACCURACY:**  $\pm 4.0\%$  of reading.

### Supplemental Characteristics:

**FULL RANGE DISPLAY:** .3000V, 4.000V.

**AC CONVERTER:** true-rms responding for signals with crest factor of  $\leq 3$ .

**MEASUREMENT RATE:** 2 readings/s.

**AUDIO INPUT IMPEDANCE:** 100 k $\Omega$  nominal.

### Audio Filters

**DE-EMPHASIS FILTERS:** 25  $\mu\text{s}$ , 50  $\mu\text{s}$ , 75  $\mu\text{s}$ , and 750  $\mu\text{s}$ . De-emphasis filters are single-pole, low-pass filters with 3 dB frequencies of: 6366 Hz for 25  $\mu\text{s}$ , 3183 Hz for 50  $\mu\text{s}$ , 2122 Hz for 75  $\mu\text{s}$ , and 212 Hz for 750  $\mu\text{s}$ .

**50 Hz HIGH-PASS FILTER (2 POLE):**

**Flatness:**  $< 1\%$  at rates  $\geq 200$  Hz.

**300 Hz HIGH-PASS FILTER (2 POLE):**

**Flatness:**  $< 1\%$  at rates  $\geq 1$  kHz.

**3 kHz LOW-PASS FILTER (5 POLE):**

**Flatness:**  $< 1\%$  at rates  $\leq 1$  kHz.

**15 kHz LOW-PASS FILTER (5 POLE):**

**Flatness:**  $< 1\%$  at rates  $\leq 10$  kHz.

**$> 20$  kHz LOW-PASS FILTER (9 POLE BESSEL)<sup>13</sup>:**

**Flatness:**  $< 1\%$  at rates  $\leq 10$  kHz.

### Supplemental Characteristics:

**DE-EMPHASIS FILTER TIME CONSTANT ACCURACY:**  $\pm 3\%$ .

**HIGH PASS AND LOW PASS FILTER:** 3 dB

**FREQUENCY ACCURACY:**  $\pm 3\%$ .

**$> 20$  kHz LOW PASS FILTER:**

3 dB Cutoff Frequency: 100 kHz nominal,

**OVERSHOOT ON SQUARE WAVE MODULATION<sup>13</sup>:**  $< 1\%$ .

<sup>11</sup> With the low-pass and high-pass audio filters used to stabilize frequency readings.

<sup>12</sup> For demodulated signals, the residual noise generated by the HP 8901B must be accounted for in distortion measurements. (that is residual AM, FM or  $\phi M$ .)

<sup>13</sup> The  $> 20$  kHz low-pass filter is intended for minimum overshoot with squarewave modulation.

## RF Input

**FREQUENCY RANGE:** 150 kHz to 1300 MHz

**OPERATING LEVEL:**

Minimum Operating Level	Maximum Operating Level	Frequency Range
12 mV <sub>rms</sub> (-25 dBm)	7 V <sub>rms</sub> (1 W <sub>peak</sub> ) Source SWR < 4	150 kHz - 650 MHz
22 mV <sub>rms</sub> (-20 dBm)	7 V <sub>rms</sub> (1 W <sub>peak</sub> ) Source SWR < 4	650 MHz - 1300 MHz

### Supplemental Characteristics:

#### TUNING:

**Normal Mode:** Automatic and Manual frequency entry.

**Track Mode:** Automatic and Manual frequency entry,  $f_c \geq 10$  MHz.

**Acquisition Time (Automatic Operation):** ~1.5s

**INPUT IMPEDANCE:** 50  $\Omega$  nominal.

**MAXIMUM SAFE DC INPUT LEVEL:** 5V.

## General Specifications

**TEMPERATURE:** Operating: 0 °C to 55 °C.  
Storage: -55 °C to 75 °C.

**REMOTE OPERATION:** HP-IB; all functions except the line switch are remotely controllable.

**HP-IB COMPATIBILITY:** (Defined in IEEE 488-1978)  
SH1, AH1, T5, TE0, L3, LE0, SR1, RL1, PP0, DC1,  
DT1, C0, E1

**EMI:** Conducted and radiated interference is within the requirements of VDE 0871 (Level B), and CISPR publication 11.

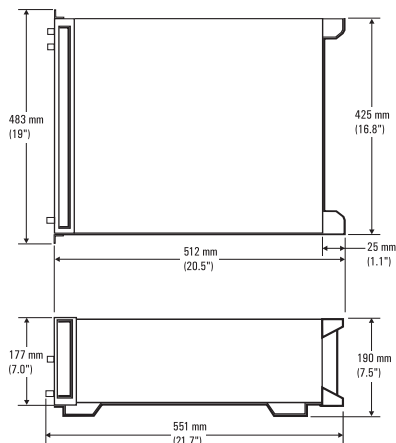
**POWER:** 200 VA maximum; 100, 120, 220, or 240V (+5%, -10%); 48-66 Hz.

**WEIGHT:** Net 23.4 kg. (51.5 lb.); Shipping 31.1 kg. (68.5 lb.).

**HP SYSTEM II MODULE SIZE:** 7 H X 1 MW X 20 D.

**HP SYSTEM II MODULE SIZE:** 7 H X 1 MW X 20 D

#### DIMENSIONS:



## HP 11722A Sensor Module

**FREQUENCY RANGE:** 100 kHz to 2.6 GHz.

**POWER RANGE:** +30 dBm (1 watt) to -20 dBm (10  $\mu$ W).

**INPUT SWR (CONNECTED TO AN HP 8901B):**  
<1.15, for RF Power Measurements.

**POWER SENSOR LINEARITY:**  
+2%, -4%; +30 dBm to +20 dBm.  
Negligible deviation, levels <+20 dBm.

#### CALIBRATION FACTORS:

Each HP 11722A Sensor Module is individually calibrated. The calibration factors are printed on the HP 11722A Sensor Module for easy reference.

#### CAL FACTOR UNCERTAINTY:

Frequency	RSS Uncertainty	Worst Case Uncertainty
0.1 MHz	0.7 %	1.6%
0.3 MHz	0.7%	1.6%
1.0 MHz	0.8%	1.7%
3.0 MHz	0.8%	1.7%
10.0 MHz	0.9%	2.0%
30.0 MHz	0.9%	2.0%
50.0 MHz	0.0% (ref)	0.0% (ref)
100.0 MHz	1.1%	2.2%
300.0 MHz	1.1%	2.2%
1000.0 MHz	1.1%	2.2%
2600.0 MHz	1.2%	2.3%

### Supplemental Characteristics:

**MAXIMUM PEAK POWER:**  
100W<sub>peak</sub> or 300W  $\mu$ s per pulse.

**INPUT IMPEDANCE:** 50  $\Omega$  nominal.

**INPUT CONNECTOR:** Type N male.

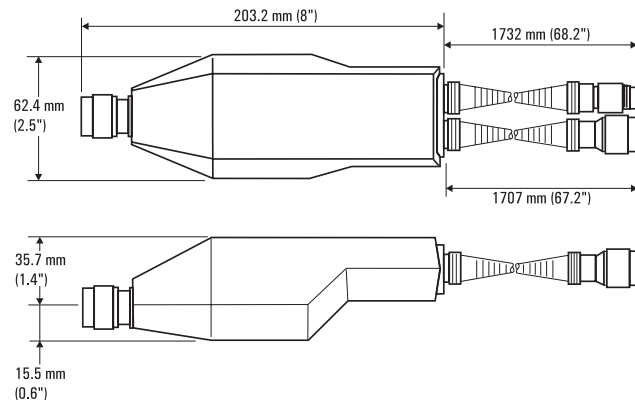
**SWITCH LIFE:** >1,000,000 switchings.

**SWITCH Isolation:** >90 dB.

#### WEIGHT:

Net 0.8 kg. (1.75 lb.); Shipping 1.2 kg. (2.6 lb.);  
Gross without manual 1050g.

#### DIMENSIONS:



### ***Supplemental Characteristics:***

#### **FM OUTPUT:**

10 k $\Omega$  impedance, -9V to 6V into an open circuit: ~6V/MHz, dc coupled, 16 kHz bandwidth (one pole).

#### **AM OUTPUT:**

10 k $\Omega$  impedance, -4V to 0V into an open circuit, ~8 mV/%, dc coupled, 16 kHz bandwidth (one pole).

#### **RECORDER OUTPUT:**

DC voltage proportional to the measured result, 1 k $\Omega$  impedance, 0V to 4V for each resolution range, into an open circuit.

#### **IF OUTPUT:**

50 $\Omega$  impedance, 150 kHz to 2.5 MHz, -27 dBm to -3 dBm.

#### **10 MHz REFERENCE OUTPUT:**

50 $\Omega$  impedance, TTL levels (0V to >2.2V into an open circuit), available only with Option 002 1X10<sup>-9</sup>/day internal reference, outputs internal reference only.

#### **10 MHz REFERENCE INPUT<sup>14</sup>:**

>500 $\Omega$  impedance, 0.5 V<sub>peak-to-peak</sub> minimum input level.

**LO INPUT (Option 003):** 50 $\Omega$  impedance, ~1.27 MHz to 1301.5 MHz, 0 dBm.

#### **RF SWITCH REMOTE CONTROL OUTPUT:**

Provides output signals to remotely control either an HP 33311B Option 011 or an HP 8761A RF switch.

#### **FREQUENCY OFFSET MODE REMOTE CONTROL OUTPUT:**

TTL high output if in frequency offset mode (Special Function 27.1 or 27.3) with an external L.O. frequency >0, TTL low output for all other cases.

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<sup>14</sup> External reference accuracy affects accuracy of all measurements.

## **Ordering Information**

### **HP 8901B Modulation Analyzer**

- Option 001:** Rear panel instead of front panel connections for input, modulation output, and calibrators
- Option 002:** 1X10<sup>-9</sup>/day internal reference oscillator
- Option 003:** Rear panel instead of front panel connections which allows use with an external local oscillator
- Option 004:** Operation from 48 Hz to 400 Hz power line (Temp. <40°C)
- Option 021:** Add HP 11722A Sensor Module
- Option 907:** Front panel handle kit
- Option 908:** Rack mounting flange kit
- Option 909:** Front panel handle plus rack mounting flange kit
- Option 910:** Extra manuals

### **HP 11722A Sensor Module**

- Option 910:** Extra manual

**Data subject to change**  
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