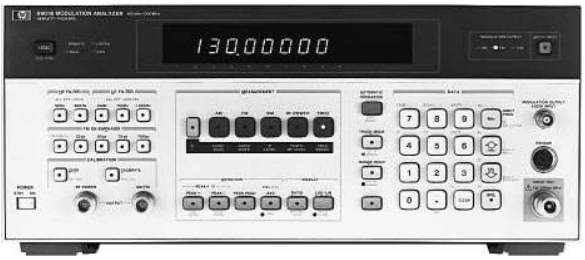
CELLULAR/PCS TRANSMITTER & RECEIVER TEST EQUIPMENT

Modulation Analyzer, 150 kHz to 1300 MHz, AM/FM Test Source

HP 8901A, 8901B, 11715A

- Measures AM and FM to 1% accuracy
- Measures RF frequency
- Measures RF power
- Low internal noise
- Completely automatic

HP 8901A



HP 8901B

HP 8901A and HP 8901B Modulation Analyzers

The HP 8901A and HP 8901B modulation analyzers combine the capabilities of several RF instruments to give complete, accurate characterization of modulated signals in the 150 kHz to 1300 MHz frequency range. Both instruments very accurately measure modulation and recover the modulation signal. They determine RF frequency and measure RF power. The major additional capabilities of the HP 8901B are its improved power-meter accuracy, its ability to use external power sensors, its ability to make adjacent-channel power measurements or carrier-noise measurements (with Options 030 through 037), and its ability to count audio frequencies and measure distortion on 400 Hz and 1 kHz signals. Both instruments are fully automatic and make all major measurements at the press of a key or under HP-IB control.

Transmitter Testing

The HP 8901A/B have the features required to perform standard transmitter measurements. They measure transmitter power, count frequency, and measure the signal modulation very accurately. The HP 8901B also characterizes the demodulated audio signal's frequency, level, and distortion. With Option 030 the HP 8901B can quickly and accurately make adjacent-channel power measurements to CEPT standards.

RF Signal Characterization

The HP 8901A/B are excellent lab and production tools for accurately characterizing RF signals.

Use the HP 8901A/B to make accurate AM/ΦM and FM/AM conversion measurements of phase- and amplitude-sensitive devices such as bandpass filters and multiple-channel receivers. Excellent isolation between AM and FM make it simple to separate the AM and ΦM of AM stereo, the incidental AM of FM transmitters, and the AM, FM, and ΦM components of complex signals.

Automatic Test Systems

The HP 8901A/B are important components of automatic RF test systems. All functions are fully automatic and easily programmed. With these measurements combined into one instrument, interfacing requirements, hardware costs, and software-development time are reduced.

HP 8901A and HP 8901B Specifications

RF Input
Frequency Range: 150 kHz to 1300 MHz
Operating Level: 12 mV rms to 7 V rms
Input Impedance: 50 Ω nominal
Tuning: Manual frequency entry, automatic, or track
Acquisition Time (automatic operation): ~1.5 s
Maximum Safe Input Level (typical): 35 V rms (25 W for source SWR <4), ac; 40 V, dc

Frequency Modulation
Rates: 20 Hz to 200 kHz
Deviations: To 400 kHz
Accuracy:
±2% of reading ±1 digit, 20 Hz to 10 kHz rates, 250 kHz to 10 MHz;
±1% of reading ±1 digit, 50 Hz to 100 kHz rates, 10 to 1300 MHz
Demodulated Output Distortion: <0.1% THD
AM Rejection (for 50% AM at 400 Hz and 1 kHz rates): <20 Hz peak deviation measured in a 50 Hz to 3 kHz BW
Residual FM (50 Hz to 3 kHz BW): <8 Hz rms @1300 MHz, decreasing linearly with frequency to <1 Hz rms for 100 MHz and below
Maximum Deviation Resolution: 1 Hz
Stereo Separation (50 Hz to 15 kHz): >47 dB typical

Phase Modulation
Carrier Frequency: 10 to 1300 MHz
Rates: 200 Hz to 20 kHz; typically usable from 20 Hz to 100 kHz with degraded performance
Deviation: To 400 radians
Maximum Deviation Resolution: 0.001 radian
Accuracy: ±3% of reading ±1 digit
Demodulated Output Distortion: <0.1% THD
AM Rejection (for 50% AM at 1 kHz rate): <0.03 radian peak deviation (50 Hz to 3 kHz BW)

Amplitude Modulation
Rates: 20 Hz to 100 kHz
Depth: To 99%
Accuracy
±2% of reading ±1 digit, 50 Hz to 10 kHz rates, 150 kHz to 10 MHz;
±1% of reading ±1 digit, 50 Hz to 50 kHz rates, 10 to 1300 MHz
Flatness (variation in indicated AM depth for constant depth on input signal): ±0.3% of reading ±1 digit
Demodulated Output Distortion: <0.3% THD
FM Rejection (at 400 Hz and 1 kHz rates, 50 Hz to 3 kHz BW): <0.2% AM
Residual AM (50 Hz to 3 kHz BW): <0.01% rms
Maximum Depth Resolution: 0.01%

Frequency Counter
Range: 150 kHz to 1300 MHz
Accuracy: ±3 counts of least significant digit ± reference accuracy
Internal Reference
Frequency: 10 MHz
Aging rate: <1 x 10^{-6}/month (optional: 1 x 10^{-9}/day)
Maximum Resolution
HP 8901A: 10 Hz for frequencies <1 GHz; 100 Hz for frequencies ≥1 GHz
HP 8901B: 1 Hz

HP 8901A RF Level (Peak Voltage Responding, RMS Sine Wave Power Calibrated)

Range: 1 mW to 1 W
Instrumentation Accuracy: ±1.5 dB
SWR: ≤1.3, 150 kHz to 650 MHz; ≤1.5, 650 to 1300 MHz
Maximum Resolution: 0.001 mW for levels <0.01 W

HP 8901B RF Level (True RMS)

Frequency Range with HP 11722A: 100 kHz to 2.6 GHz
Power Range: –20 to +30 dBm
RF Range-to-Range Change Error: ±0.02 dB/RF range change from reference range
Input SWR: <1.15, using HP 11722A sensor module
Zero Set (digital settability of zero): ±0.5% ±1 digit of full scale on lowest range (decrease by a factor of 10 for each high range)
RF Power Resolution:
0.1% of full scale in watts or volts mode;
0.001 in dBm or dB relative mode

HP 8901B Selective Power Measurements (Options 030 through 037)

Frequency Range: 10 MHz to 1.3 GHz
Carrier Power Range: +30 to –20 dBm, 12.5, 25 and 30 kHz filters; +30 to –10 dBm, carrier noise filter
Dynamic Range: 115 dB
Carrier Rejection (temp. ≤35° C): >90 dB for offsets ≥1 channel spacing or 5 kHz, whichever is larger
Relative Accuracy: ±0.5 dB, levels ≥–95 dBc or levels ≥–129 dBc/Hz

Power Reference
Power Output: 1.00 mW, factory set to ±0.7%, traceable to the U.S. National Institute of Standards and Technology
Accuracy: ±1.2% worst case (±0.9% rss) for one year (0° to 55° C)

Audio Filters
High-Pass (3 dB cutoff frequency): 50 Hz and 300 Hz
Low-Pass (3 dB cutoff frequency except >20 kHz filter): 3 kHz, 15 kHz, >20 kHz
De-emphasis Filters: 25 μs, 50 μs, 75 μs, and 750 μs

Calibrators (Standard HP 8901B, Option 010 HP 8901A)
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%

General Characteristics

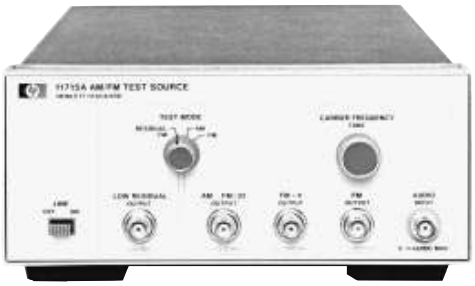
Operating Temperature Range: 0° to 55° C
Power Requirements: 100, 120, 220, or 240 V (+5%, –10%); 48 to 66 Hz; 200 VA max.
Size: HP 8901A: 425 mm W x 190 mm H x 468 mm D (16.8 in x 7.5 in x 18.4 in); HP 8901B: 425 mm W x 190 mm H x 551 mm D (16.8 in x 7.5 in x 21.7 in)
Weight: HP 8901A: Net, 20 kg (44 lb); shipping, 25 kg (55 lb); HP 8901B: Net, 23 kg (52 lb); shipping, 31 kg (69 lb)

Ordering Information

HP 8901A Modulation Analyzer[1]
- **Opt 001** RF Connectors on Rear Panel Only
- **Opt 002** 1x10^{-9}/Day Internal Reference
- **Opt 003** Connections for External Local Oscillator
- **Opt 004** Operation from 48 to 440 Hz Power (temp. <40° C)
- **Opt 010** AM and FM Calibrators
- **Opt 907** Front Handle Kit (5061-9690)
- **Opt 908** Rack Flange Kit (5061-9678)
- **Opt 909** Front Handle and Rack Flange Kit (5061-9684)
- **Opt 910** Two Sets of Operating (08901-90135) and Service Manuals (08901-90136)
- **Opt 915** Service Manual (08901-90136)
- **Opt W30** Extended Repair Service
- **Opt W32** Calibration Service

HP 8901B Modulation Analyzer[1]
- **Opt 021** Add HP 11722A Sensor Module
- **Opt 030** High Selectivity (select only 2 filter options) (Options 032 through 037 require Option 030; Option 030 includes Option 003 connections for external local oscillators)
- **Opt 032** 12.5 kHz Adjacent Channel Filter
- **Opt 033** 25.0 kHz Adjacent Channel Filter
- **Opt 034** 30.0 kHz Adjacent Channel Filter
- **Opt 037** Carrier Noise Filter
- **Opt 910** Two Sets of Operation/Calibration (08901-90113) and Service Manuals (08901-90114)
- **Opt 915** Service Manual (08901-90114)
- **Opt W30** Extended Repair Service
- **Opt W32** Calibration Service

[1]HP-IB cables not included.



HP 11715A

HP 11715A AM/FM Test Source

The HP 11715A AM/FM test source provides very flat, wide-bandwidth, and low-distortion amplitude- or frequency-modulated RF signals. Designed primarily for performance tests and adjustments of the HP 8901A/B modulation analyzer and HP 8902A measuring receiver, it will also serve as a high-quality modulated test oscillator where its frequency ranges apply.

The major components of the HP 11715A are a low-noise voltage-controlled oscillator (VCO), 2 digital dividers, and a double-balanced mixer. The VCO is the primary signal source, with a typical frequency range of 330 to 470 MHz at the FM output. FM is produced by directly coupling the external modulation source to the VCO's tune input, providing very wide bandwidth modulation with low phase shift. This design also ensures very little incidental AM.

The HP 11715A can also be used in conjunction with an HP 8901A/B and an HP 8902A as a calibrated signal source for special applications. In particular, the U.S. commercial FM broadcast band of 88 to 108 MHz is covered by the FM ÷ 4 output of the HP 11715A.

HP 11715A Specifications

FM Outputs
Frequency Range:
11 to 13.5 MHz, AM FM ÷ 32 output
88 to 108 MHz, FM ÷ 4 output
352 to 432 MHz, FM output
Peak Deviation:
>12.5 kHz, 11 to 13.15 MHz carrier
>100 kHz, 88 to 108 MHz carrier
>400 kHz, 352 to 432 MHz carrier
Distortion: <0.025% THD (<–72 dB) for

Carrier frequency	Peak deviation	Modulation rate
12.5 MHz	12.5 kHz	<10 kHz
100 MHz	100 kHz	<100 kHz
400 MHz	400 kHz	<100 kHz

Flatness: ±0.1%, dc to 100 kHz rates ±0.25%, dc to 200 kHz rates
Stereo Separation (88 to 108 MHz carrier, 75 kHz peak deviation, 1 kHz rate): >60 dB typical

AM Output
Frequency Range (AM/FM ÷ 32 output): 11 to 13.5 MHz
Depth: To 99%
Distortion:
<0.05% THD (<–66 dB), 50% AM, 20 Hz to 100 kHz rates;
<0.1% THD (<–60 dB), 95% AM, 20 Hz to 100 kHz rates
Flatness: ±0.1%, 50 Hz to 50 kHz rates; ±0.25%, 20 Hz to 100 kHz rates
Linearity: ±0.1%, <95% AM; ±0.2%, <99%

Ordering Information

HP 11715A AM/FM Test Source
- **Opt 910** A Total of Two Sets of Operating and Service Manuals (11715-90004)