



Agilent 8902A Measuring Receiver

Product Overview

- 11722A Sensor Module
- 11792A Sensor Module
- 11793A Microwave Converter
- 11812A Verification Kit

The Agilent Technologies 8902A measuring receiver combines six precision measurement functions into one fully automatic, GPIB programmable instrument. It accurately measures **RF power, tuned RF level, carrier noise/adjacent channel power, modulation, and RF frequency**, and characterizes **audio signals**. For precise signal

analysis, the 8902A measuring receiver provides the performance you need, the features you want, and the reliability and serviceability you expect.

- **RF Power:** digital power meter accuracy
- **AM and FM:** $\pm 1\%$ absolute accuracy
 ϕM : $\pm 3\%$ absolute accuracy

- **Tuned RF Level:** 0 dBm to -127 dBm with better than ± 0.03 dB accuracy per 10 dB step
- **Carrier Noise:** AM and phase noise measurements to -140 dBc/Hz
- **RF Frequency:** 1 Hz resolution
- **Audio Characterization:**
AC volts $\pm 4\%$ accuracy
Frequency: 6 digits of resolution
Distortion: ± 1 dB accuracy



Agilent Technologies
Innovating the HP Way

Precise Signal Analysis for Your Applications

RF power delivers the accuracy and resolution of a high performance power meter. The 8902A with the 11722A sensor module measures power from +30 dBm to -20 dBm at frequencies from 100 kHz to 2.6 GHz.

Tuned RF level's minimum sensitivity of -127 dBm with exceptional accuracy is a major contribution of the 8902A. You can make relative level measurements with accuracy you would only expect from a transfer standard: ± 0.02 dB ± 1 digit (worst case) for up to 10 dB steps, increasing to ± 0.30 dB ± 1 digit at 110 dB steps.

Carrier noise, phase noise, and adjacent channel power measurements are simple, fast, and accurate with the 8902A's high selectivity (Options 030 through 037). You select the noise filter bandwidth, measure the carrier power of the source under test, tune the analyzer to the frequency offset desired (5 kHz to 1300 MHz), and measure the noise in seconds. The analyzer's measurement accuracy is better than ± 0.5 dB to -129 dBc/Hz, typically better than ± 1 dB to -140 dBc/Hz. The noise floor is -150 dBc/Hz.

AM and FM measurements offer $\pm 1\%$ accuracy ($\pm 3\%$ accuracy for ϕM) and fast, single-key operation. The 8902A has extremely low internal noise, and very low AM to ϕM and ϕM to AM conversion, for accurately measuring residual and incidental AM, FM, and ϕM 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 8902A. It tunes to the largest input signal or to any user specified frequency. The 8902A counts signals with 1 Hz resolution.

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

Metrology and Calibration

The 8902A measuring receiver makes signal generator and attenuator calibration easier than ever before.

The 8902A accurately measures your signal generator's RF frequency; RF level flatness; output level accuracy to -127 dBm; AM, FM, and phase modulation; phase noise to less than -140 dBc/Hz; and it characterizes the demodulated audio signals.

For attenuator calibration and other relative measurements, the 8902A gives you the accuracy and dynamic range you need. Tuned RF level makes relative measurements with a 127 dB dynamic range and 0.001 dB resolution. The combined dynamic range of tuned RF level and RF power is 157 dB.



The 8902A measuring receiver combines six precision measurement functions into one instrument.

Performance You Need

RF Signal Characterization

The 8902A measuring receiver is an excellent lab and production tool for accurately characterizing RF signals from 150 kHz to 1300 MHz.

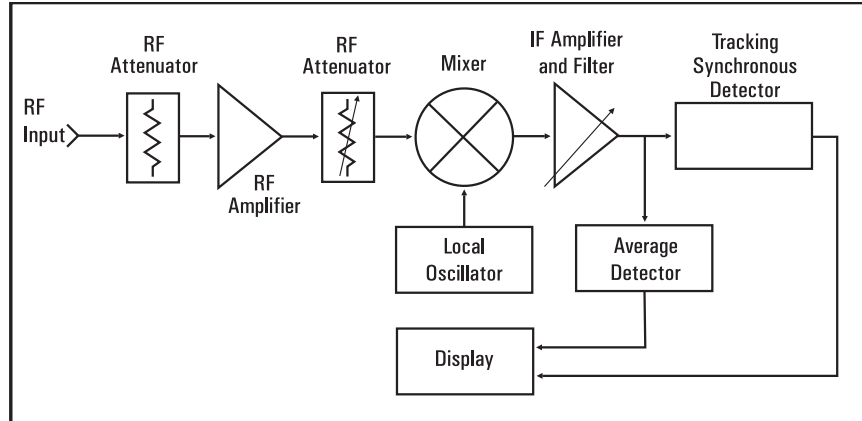
Level measurements down to -127 dBm with superb accuracy make the 8902A ideal for testing devices such as antennas, multiplexers, log/linear amplifiers, filters, and mixers. Unlike diode peak detectors, the 8902A's power meter accurately measures signals with harmonics and spurious.

The 8902A makes accurate AM to ϕ M and FM to AM conversion measurements of phase and amplitude sensitive devices such as bandpass filters and multiple channel receivers. Excellent isolation between AM and FM makes it simple to separate the AM and ϕ M of AM stereo, incidental AM of FM transmitters and the AM, FM, and ϕ M components of complex signals.

Automatic Test Systems

The 8902A is an important component of automatic RF test systems. All functions (power, level, frequency count, carrier noise, modulation, and audio analysis) are fully automatic and easily programmed. With these measurements combined into one instrument, interfacing requirements, hardware costs, and software development time are reduced.

The Agilent 8902A's excellent measurement accuracy and dynamic range also make it a valuable tool for calibrating automatic test systems.



Tuned RF level simplified block diagram

Tuned RF Level: Transfer-standard accuracy at the push of a button

The 8902A measuring receiver delivers unprecedented RF level performance, measuring signal levels down to -127 dBm in only a few seconds with typically better than 0.5 dB_{rms} absolute accuracy. Relative measurement accuracy is even better: ± 0.02 dB ± 1 digit (worst case) up to 10 dB step, increasing to ± 0.30 dB ± 1 digit at 110 dB step.

This level of performance is made possible by a precise IF substitution technique. The 8902A derives its superb accuracy from the highly linear IF amplifiers and Agilent's IF synchronous detector, while calibrating out many of the uncertainties of the RF attenuators and RF amplifier.

Achieving the utmost accuracy requires a simple calibration. The RECAL indicator on the front panel prompts you to push the CALIBRATE key whenever an absolute level or RF range calibration may be performed. Complete calibration to -127 dBm requires at most three steps, and you only perform this process once at any frequency. The three resulting calibration factors are stored in non-volatile memory. Using an external GPIB controller, you can calibrate the instrument at several frequencies, store the cal factors in the controller, and recall them later as needed.

The Agilent 8902A measuring receiver gives you the accuracy and dynamic range you need when you make level measurements. Using tuned RF level and RF power together, you can measure levels from $+30$ dBm to -127 dBm (157 dB dynamic range) with state-of-the-art accuracy.

Performance You Need

Carrier Noise: Simple and accurate phase noise measurements

The Agilent 8902A measuring receiver offers optional selective power measurement capability (Options 030 through 037). Used with a low-noise external LO, the 8902A performs fast, accurate single-sideband (SSB) carrier noise measurements to 1.3 GHz. To make a carrier-noise (AM noise and phase noise) measurement, you select the noise filter (2.5 kHz noise bandwidth), measure the carrier power of the source under test, tune the analyzer to the frequency offset desired (5 kHz to 1300 MHz), and measure the noise. The data is displayed in real time, either as dBc in a 1 Hz bandwidth or as total power in the 2.5 kHz filter bandwidth.

Phase noise usually dominates the carrier-noise measurement at most offsets of interest, so direct-spectrum noise measurements provide a convenient and simple way to measure phase noise of many sources. This measurement technique is relatively insensitive to many common pitfalls encountered in making phase noise measurements. There is no need to phase-lock signals. Testing can be fully automated using an external controller. Most important, selective signal and noise measurements are fast (five readings per second). The analyzer's measurement accuracy is better than ± 0.5 dB to -129 dBc/Hz, typically better than ± 1 dB to -140 dBc/Hz. The noise floor is -150 dBc/Hz.

Many applications require spectral purity to be expressed as residual AM, FM, or phase modulation. With the 8902A's convenient modulation capabilities you make these measurements with one keystroke, in a variety of common bandwidths.

To extend the measurement range to 26.5 GHz, add the 11793A microwave converter and a low-noise microwave source. With this system you can test high-performance sources from 10 MHz to 26.5 GHz.

Adjacent Channel Power Measurements:

Meet CEPT's stringent standards

The 8902A measuring receiver's easy-to-use selective power measurement option also saves you time and money, speeding adjacent-channel power testing on your RF communications transmitters. These selective measurements meet the stringent CEPT standards for adjacent-channel power with superb accuracy: ± 0.5 dB; dynamic range >115 dB; and selectivity >90 dB.

Making an adjacent channel power measurement is simple. You first select the appropriate filter for 12.5, 25, or 30 kHz channel spacing and measure the transmitter carrier power. Then, tune the analyzer to any offset desired, and measure the channel power. The analyzer displays the results in dBc (dB relative to the carrier power).

To meet the CEPT noise-floor requirements at frequencies greater than 300 MHz, the 8902A requires an external local oscillator (LO). Selecting an external LO with the fine frequency resolution also improves the analyzer's tuning resolution, which can be as coarse as 2 kHz at 1300 MHz. Dedicating a signal generator as the external LO is not necessary. When not being used as the LO, a built-in RF switch in the 8902A routes the signal generator's output to the rear panel of the analyzer.

RF Power: As accurate as the best power meter

The 8902A performs your power measurements with superb accuracy and measurement ease. Power meter linearity is ± 0.02 dB, ± 0.02 dB per range change. With a single key stroke the 8902A automatically senses the power sensor type, autoranges to the input signal, measures its power, compensates for the sensor flatness, and displays the results in the units you desire. In addition to the 11722A sensor module, the 8902A accepts the 11792A sensor module for power measurements from -20 to $+30$ dBm at frequencies from 100 kHz to 26.5 GHz.

If you change sensors, just enter the new calibration factors into the instrument's non-volatile memory, either from the keyboard, via GPIB, or recall them from non-volatile memory. You can store two complete sets of sensor calibration factors.

The front-panel power reference enables precise calibration of your power sensor at the reference calibration factor frequency. This 50 MHz reference is set to 1.00 mW $\pm 0.7\%$, traceable to the U.S. National Bureau of Standards.

AM, FM and ϕ M: Superb accuracy

Precise AM, FM, and ϕ M measurements are a major contribution of the 8902A measuring receiver. Basic measurement accuracy is $\pm 1\%$ for AM and FM and $\pm 3\%$ for ϕ M. With excellent separation between the FM discriminator and AM detector, incidental AM and FM measurements are made easily and accurately.

Residual AM in a 50 Hz to 3 kHz bandwidth is $<0.01\%$. The very low noise FM discriminator makes residual FM measurements of <1 Hz at 100 MHz, increasing linearly with frequency to <8 Hz at 1300 MHz.

Select from six detectors for modulation measurements. In addition to positive and negative peak detectors, the 8902A provides a \pm peak/2 detector. For residual noise measurements, choose from an average responding detector which is rms sinewave calibrated or a true rms detector. The PEAK HOLD detector captures and holds the maximum positive or negative peak modulation.

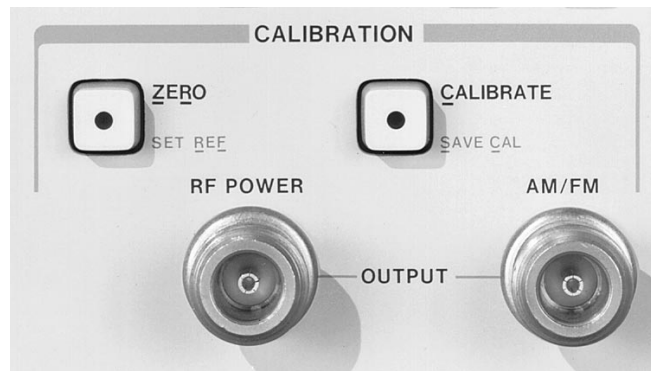
The AM/FM calibrator provides extremely accurate modulated signals with $\pm 0.1\%$ accuracy for easy self-check and recalibration of the instrument's AM and FM calibration factors.

RF Frequency: High resolution

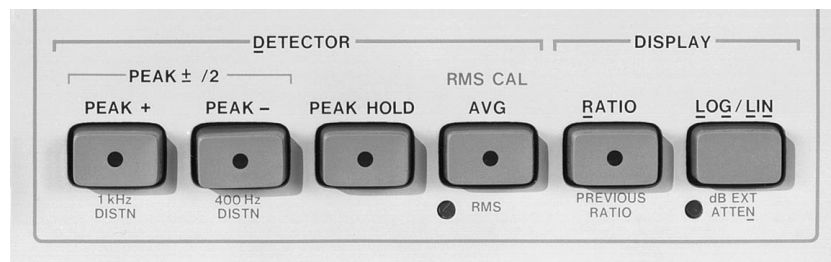
The 8902A measuring receiver counts all types of modulated signals with 1 Hz resolution. There is a high stability reference option with an aging rate of $<1 \times 10^{-9}$ /day. For selectively counting signals, use the 8902A's manual tune mode, or for extended sensitivity use the instrument special functions to count signals to -100 dBm.

Audio: Built-in convenience

The 8902A's audio capabilities often eliminate the need for external equipment when measuring demodulated signals or external audio signals. The 8902A counts audio frequencies with 6 digits of resolution, measures distortion of 400 Hz and 1000 Hz signals, and measures rms levels from 100 mV to 3 V with $\pm 4\%$ accuracy.



RF power and AM/FM calibrators



Features

Agilent 8902A Measuring Receiver

1. Indicators display current GPIB status.
2. Independently selectable high-pass and low-pass filters match the post-detection bandwidth to the application.
3. Four standard de-emphasis networks are available for FM measurements. Using the pre-display key, the de-emphasis networks are positioned before the displayed measurement circuit, to display "de-emphasized" FM deviation.
4. Zero the 11722A sensor module without removing it from the device under test.
5. RF power calibrator supplies an accurate 1 mW reference for RF power calibration.
6. AM/FM calibrator provides extremely accurate signals for modulation calibration. AM depth and FM deviation are calibrated to 0.1% accuracy.
7. Modulation detector keys select positive peak, negative peak, \pm peak/2, average, or rms detectors. Peak hold is used with either peak detector for measuring transients.
8. The large 10-digit LED displays all measured results and error messages.
9. In track mode, the measuring receiver continuously tracks a drifting or swept signal, even at low signal levels. Range hold freezes the instrument settings at their current value.
10. Selectable formats display results in the units desired.
11. Store and recall instrument settings in eight non-volatile memory locations.
12. Enter RF power calibration factors into non-volatile memory for automatic compensation of power sensor efficiency and mismatch loss.



13. This connector has two functions. It serves as a recovered modulation output for external measurements, or external audio input for ac level, frequency, or distortion measurements.

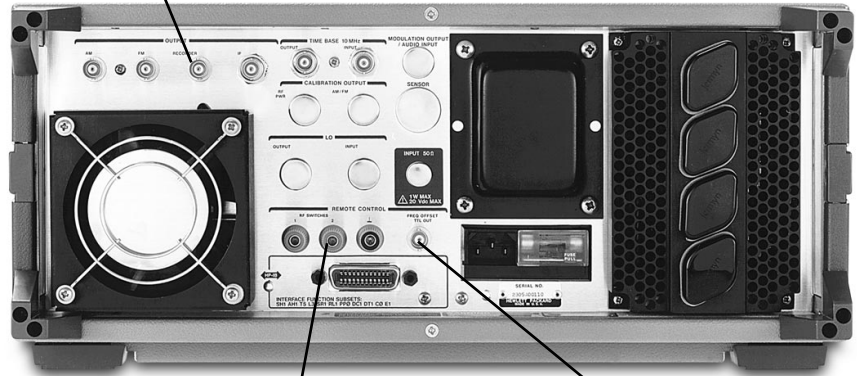
14. The measuring receiver automatically recognizes which power sensor is used and sets the appropriate power ranges.

15. RF input accepts signals from +30 dBm to -127 dBm, and 150 kHz to 1300 MHz.

16. Special function key for complete control of measuring receiver functions. This key also executes many built-in troubleshooting routines.

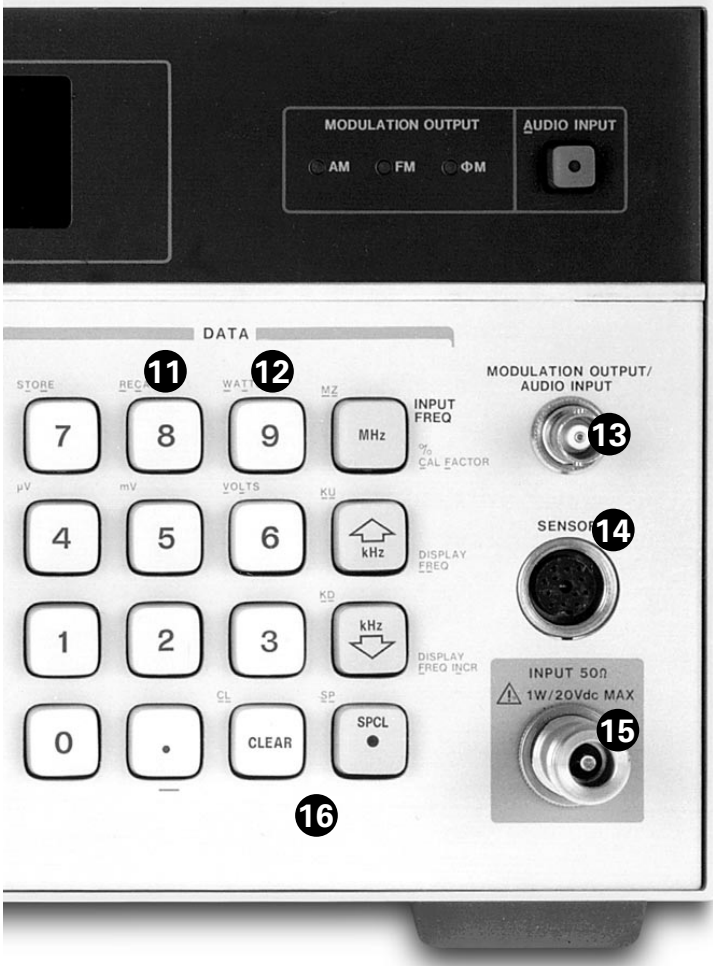
Rear Panel

Recorder output provides a dc voltage proportional to the measured result.



Remote control provides output for user configured power sensor/receiver input switch.

TTL level indicates frequency offset mode.



Features You Want for Reliability

Single-Key Measurements

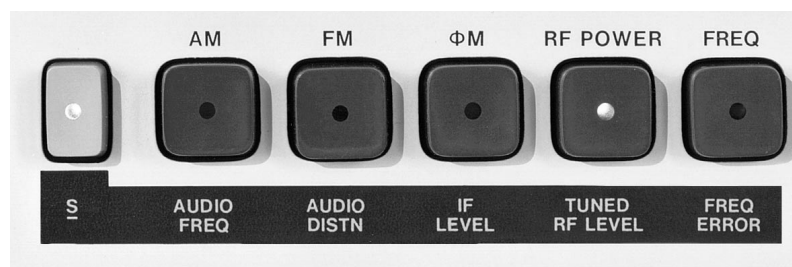
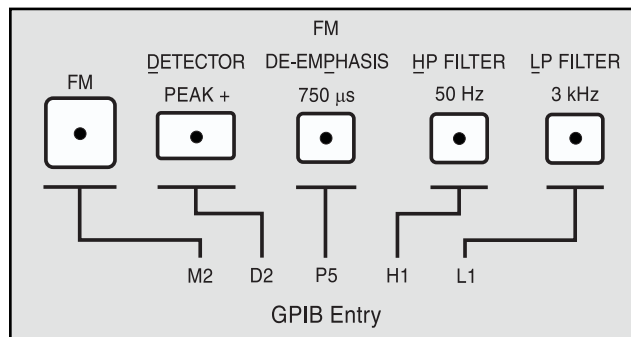
The Agilent 8902A is very easy to use. In automatic operation, major functions are selected with a single key. No manual tuning or range selection is needed. The front panel is simple, uncluttered, and easy to use.

Display Flexibility

The 8902A offers numerous data display formats. For example, RF power and tuned RF level can be displayed in watts, dBm, volts, dBV, mV, dB mV, μ V, and dB μ V. Use the RATIO and LOG/LIN keys to display results in dB or % relative to either a measured value or a value entered from the keyboard. These features eliminate the need for recalculating measurement results.

Flexible Tuning Modes

In normal operation, the 8902A measuring receiver is fully automatic. You select the measurement and the 8902A tunes to the largest signal present. If selective tuning is needed, enter the approximate frequency on the keyboard. Use track mode to follow signals which vary in frequency.



Tracks Drifting Signals

Drifting signals are not hard to track for the 8902A. The 8902A measuring receiver offers two track mode functions optimized for your measurement needs. For modulation and frequency measurements, the wide-IF-bandwidth track mode function tracks and measures drifting signals without sacrificing measurement bandwidth or level sensitivity. For level measurements, the narrow-IF-bandwidth track mode function tracks and selectivity measures low-level drifting signals.

Using the average detector, the 8902A makes accurate level measurements on drifting signals down to -100 dBm in a 30 kHz bandwidth and down to -90 dBm in a 200 kHz bandwidth.

Fully Programmable

All 8902A functions are fully programmable via the General Purpose Interface Bus (GPIB).

Special Functions

The 8902A's keyboard special functions extend your control over the instrument. Some examples of this include measuring SINAD and external audio signals, selecting frequency count resolution, and signaling when a measured value exceeds a previously entered limit.

Special functions also allow you to extend measurement ranges. For example, you can insert RF gain to increase input sensitivity for modulation and RF frequency measurements to approximately -100 dBm. For verifying instrument operation or assisting in servicing, use the special functions to display internal signal voltages and frequencies.

Selectable Filters

Independently selectable high-pass and low-pass audio filters remove undesired signals such as harmonics, noise, and spurious from the recovered modulation signal. The >20 kHz Bessel filter minimizes overshoot with square-wave modulation. There are also four de-emphasis networks for common FM communication and broadcast applications.

Store and Recall

You can store eight complete instrument settings in non-volatile memory and recall them as needed. With this feature for example you can save eight sets of AM, FM, and tuned RF level calibration factors.

Option 050

Increased Power Measurement Accuracy

The Agilent 8902A Option 050 measuring receiver offers $\pm(0.015 \text{ dB} + 0.005 \text{ dB}/10 \text{ dB step})$ relative power accuracy and $\pm(0.120 \text{ dB} + 0.005 \text{ dB}/10 \text{ dB})$ absolute power accuracy.

Along with increased power measurement accuracy, Option 050 also provides a certificate of calibration. This certifies that your 8902A has been calibrated in compliance with MIL-STD-45662 and that the calibration standards are traceable to the National Bureau of Standards.

Reliability and Servicability You Expect

Designed-in Reliability

Your 8902A will operate properly even under harsh environmental conditions. Extensive environmental stress testing has been performed on production instruments and the instrument is periodically requalified, ensuring you the highest quality.

Built-in Diagnostics

Many features of the 8902A aid in troubleshooting and repair. You can check many internal circuits with the covers on. Front panel special functions perform extensive self-diagnostics and display internal signal voltages and frequencies. Remove the top cover and you gain access to the RF cables, test points, indicators and adjustments. If repair should become necessary, you can remove any circuit or assembly in seconds with only a screwdriver and connector wrench.

Accuracy

Agilent 11722A Sensor Module

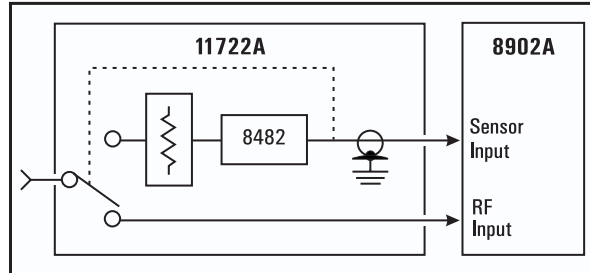
A Single RF Connection for All Measurements

With the 11722A sensor module, you get all the performance of the measuring receiver, plus superb power measurement accuracy, at a single connector. Now, you can characterize a signal without switching back and forth between the power sensor and the analyzer's RF input.

Very Low Input SWR and Insertion Loss
Special care is taken with each sensor module to minimize input SWR and resulting errors. A low-SWR attenuator isolates the power sensor from the source under test, reducing mismatch. Microwave hardware and a selected RF input cable further improve SWR and insertion loss.

Zero the Sensor with One Keystroke

You can zero the 11722A's power sensor without removing it from the source under test. Just push the ZERO key. After eight seconds, zeroing completes and the new zero offsets are stored automatically.



Agilent 11722A block diagram

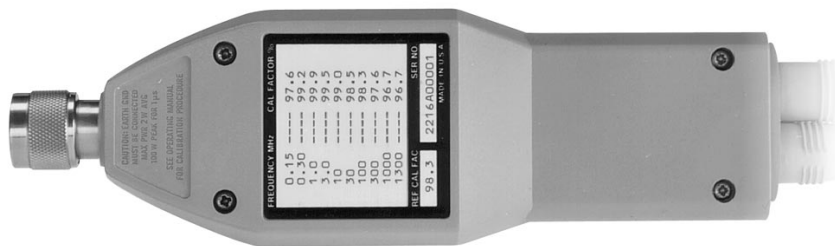
Individually Calibrated

Each 11722A sensor module is individually calibrated, traceable to the U.S. National Bureau of Standards. The calibration factors are printed on the sensor module for easy reference. Enter these factors into the 8902A's non-volatile memory and the instrument automatically compensates for the power sensor's efficiency and mismatch loss at each frequency.

Agilent 11812A Verification Kit

Calibrating the 8902A Option 050 increased power measurement accuracy requires performance that is only available from a primary standard. This entails using a precise piston attenuator to calibrate the 8902A Option 050 to its specified power measurement accuracy.

For those customers that cannot tolerate the turnaround time associated with returning the instrument to the factory for calibration or the expense of purchasing a primary standard, Agilent is offering the 11812A verification kit. The 11812A consists of a step attenuator, two 10 dB pads semi-permanently attached, a cable, and a carrying case. The 11812A is calibrated against the piston attenuator and is specified to verify the performance of the 8902A Option 050 tuned RF level function to $\pm(0.015 \text{ dB} + 0.010 \text{ dB}/10 \text{ dB step})$.



Agilent 11793A Microwave Converter

The 11793A microwave converter down converts microwave signals to the frequency range of the 8902A measuring receiver. When you want to make a tuned RF level, modulation or frequency measurement above 1.3 GHz, the 11793A microwave converter routes the signal through its internal mixer. Below 1.3 GHz, signals are routed directly to the input of the 8902A.

The 11793A requires +8 dBm leveled output from the local oscillator. For LOs with insufficient power above 18 GHz, the 11793A offers an optional 18 to 26.5 GHz amplifier.



Standard 3.5 mm male input connector

Option 001 N-type male input connector (frequency range to 18 GHz)

Agilent 11792A Sensor Module 50 MHz to 26.5 GHz

When used with the 11793A microwave converter, the 11792A sensor module gives you superb power measurement accuracy, at a single connector. You can characterize a signal without manually switching back and forth between the power sensor and the receiver input.

Each 11792A sensor module is individually calibrated, traceable to the U.S. National Bureau of Standards. The calibration factors are printed on the sensor module for easy reference. Enter these factors into the 8902A's non-volatile memory and the instrument automatically compensates for the power sensor's efficiency and mismatch loss at each frequency. The 11792A is available with either a 3.5 mm precision or N-type connector.

Ordering Information

8902A	Measuring receiver	11722A	Sensor module
Opt 001	Rear panel instead of front panel connections for input, modulation output, and calibrators	Opt 910	Extra manual
Opt 002	1 x 10 ⁻⁹ /day internal reference oscillator	11792A	Sensor module (3.5 mm male input connector, frequency range to 26.5 GHz)
Opt 003	Rear panel connections which allow use with an external local oscillator	Opt 001	N-type male input connector (frequency range to 18 GHz)
Opt 004	Operation from 48 Hz to 440 Hz power line (temp. <40 °C)	11793A	Microwave converter
Opt 021	Add 11722A sensor module	Opt 001	Adds 18 GHz to 26.5 GHz amplifier (required in 26.5 GHz systems which use local oscillators with less than +7 dBm from 18 GHz to 26.5 GHz)
Opt 030	High selectivity Option 030 includes rear-panel external local oscillator connections. 8902A Option 003, rear-panel external local oscillator connections may not be ordered with 8902A Option 030. Two filter options (032 through 037) must be selected with Option 030. Opt 032: 12.5 kHz adjacent channel filter Opt 033: 25 kHz adjacent channel filter Opt 035: 30 kHz (cellular radio) alternate channel filter Opt 037: Carrier noise filter (2 kHz band pass filter)	Opt 010	Front right LO connector (required for systems using a LO with an output connector on the front right side)
Opt 050	Increased power measurement accuracy	Opt 011	Adds 18 GHz to 26.5 GHz amplifier and front right LO connector (Option 001 and Option 010)
Opt 907	Front panel handle kit	Opt 020	Rear panel connectors
Opt 908	Rack mounting flange kit	Opt 021	Adds 18 GHz to 26.5 GHz amplifier and rear panel connections (Option 001 and Option 020)
Opt 909	Front panel handle plus rack mounting flange kit	11812A	Verification kit
Opt 910	Extra manuals		

For more information about the Agilent 8902A Measuring Receiver, visit our web site at: www.agilent.com/find/wireless

Agilent Technologies' Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise

"Our Promise" means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

"Your Advantage" means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

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