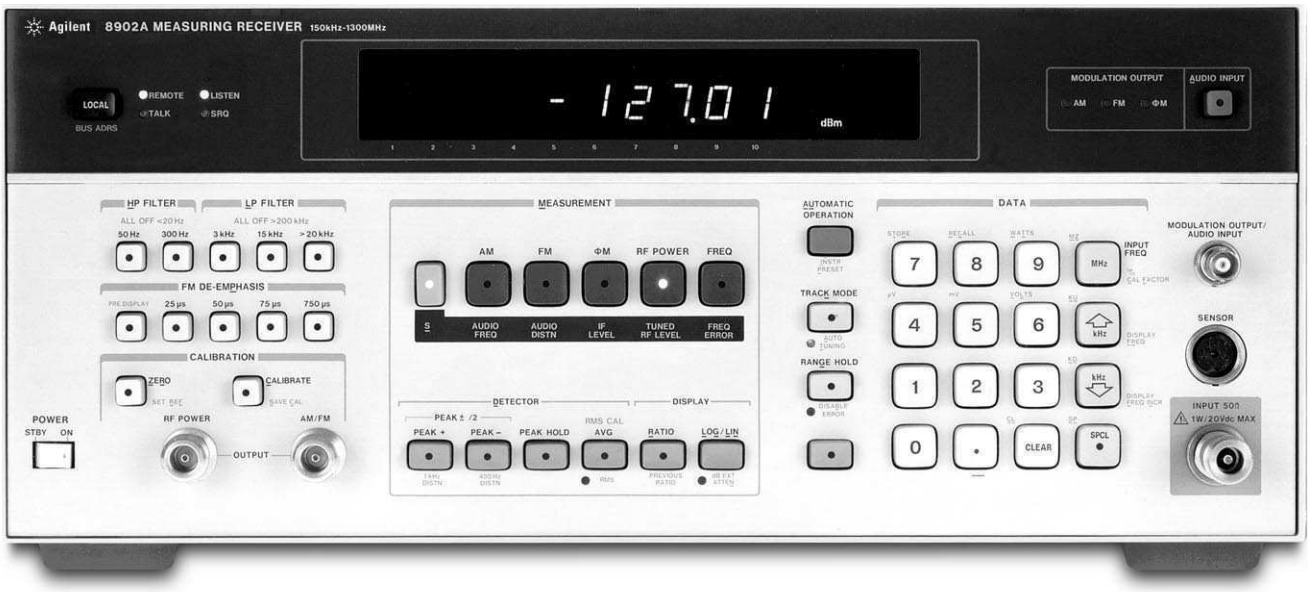
Agilent 8902A
Measuring Receiver

Technical Specifications

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

The Agilent Technologies 8902A measuring receiver delivers the accuracy and resolution of a high performance power meter at frequencies from 150 kHz to 1.3 GHz (50 MHz to 26.5 GHz with the Agilent 11793A microwave converter) and levels from +30 dBm to –127 dBm. It accurately measures AM, FM, and ϕM, including residuals and incidentals, with a single keystroke. The 8902A measuring receiver, with the 11793A, counts RF signals to 26.5 GHz with 10 Hz resolution and excellent long-term frequency stability. The 8902A measuring receiver with Option 050 offers increased power measurement accuracy. This option specifies Tuned RF Level on the 8902A measuring receiver to an accuracy of ±(0.015 dB + 0.005 dB/10 dB step).



Agilent Technologies
Innovating the HP Way

AGILENT 8902A MEASURING RECEIVER* TECHNICAL SPECIFICATIONS

Specifications describe the test set's warranted performance and are valid over the entire operation and environmental ranges unless otherwise noted. All specifications are valid after a 30-minute warm-up period of continuous operation, and within the frequency ranges defined below.

Supplemental characteristics *are intended to provide additional information useful in applying the instrument by giving typical, but non-warranted performance parameters. These characteristics are shown in Italics and labeled as "nominal," "typical," or "supplemental."*

* Shaded text signifies measurements made with the 8902A measuring receiver using the 11793A microwave converter and 11792A sensor module. With this configuration, all standard 8902A specifications apply except where changes are shown as shaded text.

Frequency Modulation

RATES[1]:

20 Hz to 10 kHz, 150 kHz ≤ f_c <10 MHz.
20 Hz to 200 kHz, 10 MHz ≤ f_c ≤1300 MHz.
20 Hz to 200 kHz, 10 MHz ≤ f_c ≤26.5 GHz.

DEVIATIONS[1]:

40 kHz $_{peak}$ maximum, 150 kHz ≤ f_c <10 MHz.
400 kHz $_{peak}$ maximum, 10 MHz ≤ f_c ≤1300 MHz.
400 kHz $_{peak}$ maximum, 10 MHz ≤ f_c ≤26.5 GHz.

ACCURACY [1, 2, 3]:

FM Accuracy	Frequency Range	Rates	Deviations
±2% of reading ±1 digit	250 kHz – 10 MHz	20 Hz – 10 kHz	≤40 kHz$_{peak}$
±1% of reading ±1 digit	10 MHz – 1300 MHz	50 Hz – 100 kHz	≤400 kHz$_{peak}$
±5% of reading ±1 digit	10 MHz – 1300 MHz	20 Hz – 200 kHz	≤400 kHz$_{peak}$
±1% of reading ±1 digit	10 MHz – 26.5 GHz	50 Hz – 100 kHz	≤400 kHz$_{peak}$
±5% of reading ±1 digit	10 MHz – 26.5 GHz	20 Hz – 200 kHz	≤400 kHz$_{peak}$

For rms detector add ±3% of reading.

DEMODULATED OUTPUT DISTORTION [1, 4]:

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
<0.1%	10 MHz – 26.5 GHz	20 Hz – 100 kHz	<100 kHz

AM REJECTION (50 Hz to 3 kHz BW)[3]:

AM Rejection	Frequency Range	Rates	AM Depths
<20 Hz peak deviation	150 kHz – 1300 MHz	400 Hz or 1 kHz	≤50%
<20 Hz peak deviation	150 kHz – 26.5 GHz	400 Hz or 1 kHz	≤50%

RESIDUAL FM (50 Hz to 3 kHz BW):

<8 Hz$_{rms}$ at 1300 MHz, decreasing linearly with frequency to <1 Hz$_{rms}$ for 100 MHz and below.

<17 Hz$_{rms}$, 1300 MHz <f_c ≤6.2 GHz.
<33 Hz$_{rms}$, 6.2 GHz <f_c ≤12.4 GHz.
<49 Hz$_{rms}$, 12.4 GHz <f_c ≤18.6 GHz.
<65 Hz$_{rms}$, 18.6 GHz <f_c ≤26.5 GHz.

Supplemental Characteristics:

MAXIMUM FM DEVIATION, RESOLUTION, AND MAXIMUM DEMODULATED OUTPUT SENSITIVITY ACROSS AN OPEN CIRCUIT (600 Ω output impedance)[5]:

Maximum Resolution	*Maximum Demodulated Output Sensitivity*	*Deviations (D F)*
100 Hz	*0.01 mV/Hz*	*DF_{peak} ≥ 40 kHz*
10 Hz	*0.1 mV/Hz*	*4.0 kHz ≤ DF_{peak} <40 kHz*
1 Hz	*1.0 mV/Hz*	*DF_{peak} < 4 kHz*
0.1 Hz (rms detector only)	*1.0 mV/ Hz*	*DF_{rms} < 0.3 kHz*

Resolution is increased one digit with 750 µs 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 µs de-emphasis.

DEMODULATED OUTPUT DISTORTION [1, 4]:

THD	*Frequency Range*	*Rates*	*Deviations*
<0.3%	*150 kHz – 400 kHz*	*20 Hz – 10 kHz*	*<10 kHz*
<0.1%	*400 kHz – 10 MHz*	*20 Hz – 10 kHz*	*<10 kHz*
<0.1%	*10 MHz – 26.5 GHz*	*20 Hz – 100 kHz*	*<100 kHz*

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

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

1. But not to exceed: 20 kHz rates and 40 kHz peak deviations with 750 µs de-emphasis filter.
2. Not to exceed for stated accuracy: 50 Hz to 40 kHz rates with rms detector.
3. Peak residuals must be accounted for in peak readings.
4. With 750 µs 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.
5. For optimum flatness, cables should be terminated with their characteristic impedance.

Amplitude Modulation

RATES:

20 Hz to 10 kHz, 150 kHz ≤f_c<10 MHz.
20 Hz to 100 kHz, 10 MHz ≤f_c≤1300 MHz.

DEPTH: to 99%.

ACCURACY [2, 3, 6]:

AM Accuracy	Frequency Range	Rates	Depths
±2% of reading ±1 digit	150 kHz – 10 MHz	50 Hz – 10 kHz	5% – 99%
±3% of reading ±1 digit	150 kHz – 10 MHz	20 Hz – 10 kHz	to 99%
±1% of reading ±1 digit	10 MHz – 1300 MHz	50 Hz – 50 kHz	5% – 99%
±3% of reading ±1 digit	10 MHz – 1300 MHz	20 Hz – 100 kHz	to 99%
±1.5% of reading ±1 digit	1300 MHz – 26.5 GHz	50 Hz – 50 kHz	5% – 99%
±3% of reading ±1 digit	10 MHz – 26.5 GHz	20 Hz – 100 kHz	to 99%

For rms detector add ±3% of reading.

FLATNESS [5, 7]:

Flatness	Frequency Range	Rates	Depths
±0.3% of reading ±1 digit	10 MHz – 1300 MHz	90 Hz – 10 kHz	20% – 80%
±0.3% of reading ±1 digit	10 MHz – 26.5 GHz	90 Hz – 10 kHz	20% – 80%

DEMODULATED OUTPUT DISTORTION:

<0.3% THD for ≤50% depth.
<0.6% THD for ≤95% depth.
For f_c >1300 MHz add 0.4% THD.

FM REJECTION (50 Hz to 3 kHz BW)[3]:

FM Rejection	Frequency Range	Rates	Deviations
<0.2% AM	250 kHz – 10 MHz	400 Hz or 1 kHz	<5 kHz_{peak}
<0.2% AM	10 MHz – 1300 MHz	400 Hz or 1 kHz	<50 kHz_{peak}
<0.2% AM	10 MHz – 26.5 GHz	400 Hz or 1 kHz	<50 kHz_{peak}

RESIDUAL AM (50 Hz to 3 kHz BW): <0.01%$_{rms}$.

Supplemental Characteristics:

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

MAXIMUM DEPTH, RESOLUTION, AND MAXIMUM DEMODULATED OUTPUT SENSITIVITY ACROSS AN OPEN CIRCUIT (600 Ω output impedance)[5]:

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

Phase Modulation

RATES:

200 Hz to 10 kHz, 150 kHz ≤f_c <10 MHz.
200 Hz to 20 kHz, 10 MHz ≤f_c ≤1300 MHz.
200 Hz to 20 kHz, 10 MHz ≤f_c ≤26.5 GHz.

ACCURACY[3]:

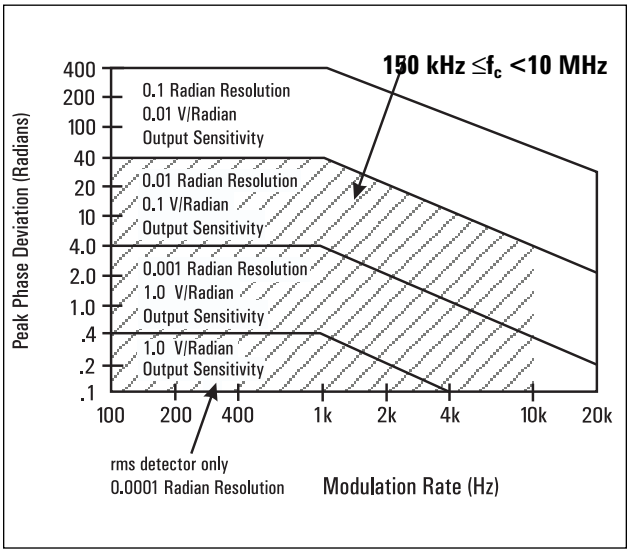
±4% of reading ±1 digit, 150 kHz ≤f_c <10 MHz.
±3% of reading ±1 digit, 10 MHz ≤f_c ≤1300 MHz.
±3% of reading ±1 digit, 10 MHz ≤f_c ≤26.5 GHz.
For rms detector add ±3% of reading.

DEMODULATED OUTPUT DISTORTION: <0.1% THD.

AM REJECTION (for 50% AM at 1 kHz rate)[3]:

<0.03 radians peak (50 Hz to 3 kHz BW).

MAXIMUM DEVIATION, RESOLUTION, AND MAXIMUM DEMODULATED OUTPUT SENSITIVITY ACROSS AN OPEN CIRCUIT (600 Ω output impedance)[5]:



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.*

2. Not to exceed for stated accuracy: 50 Hz to 40 kHz rates with rms detector.
3. Peak residuals must be accounted for in peak readings.
5. For optimum flatness, cables should be terminated with their characteristic impedance.
6. For peak measurements only: AM accuracy may be affected by distortion generated by the measuring receiver. In the worst case this distortion can decrease accuracy by 0.1% of reading for each 0.1% of distortion.
7. Flatness is the variation in indicated AM depth for constant depth on input signal.

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.
150 kHz to 26.5 GHz.

SENSITIVITY:
12 mV_{rms} (–25 dBm), 150 kHz ≤f_c ≤650 MHz.
22 mV_{rms} (–20 dBm), 650 MHz ≤f_c ≤1300 MHz.
40 mV_{rms} (–15 dBm), 150 kHz ≤f_c ≤650 MHz.
71 mV_{rms} (–10 dBm), 650 MHz <f_c ≤1300 MHz.
40 mV_{rms} (–15 dBm), 1300 MHz <f_c ≤26.5 GHz.

MAXIMUM RESOLUTION:
1 Hz.
10 Hz.

ACCURACY:
± reference accuracy ± 3 counts of least-significant digit, f_c <100 MHz.
± reference accuracy ± 3 counts of least-significant digit, or 30 Hz, whichever is larger, f_c ≥100 MHz.

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:
Approximate frequency must be entered from keyboard.
0.22 mV_{rms} (–60 dBm).
0.71 mV_{rms} (–50 dBm).

Using the RF amplifier and the IF amplifiers, sensitivity can be increased to approximately:
–100 dBm.
–90 dBm, f_c ≤1300 MHz.
–75 dBm, 1300 MHz <f_c ≤26.5 GHz.

8. After 30-day warm-up.
9. The 8902A fundamental RF power measurement units are watts. Further internal processing is done on this number to display all other units.
10. When using a power 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's linearity percentages found in the power sensor's specifications.

Internal Time Base Reference

FREQUENCY: 10 MHz.

AGING RATE:
<1 x 10^{-6}/month.
<1 x 10^{-9}/day (Option 002)[8].

Supplemental Characteristics:

INTERNAL REFERENCE ACCURACY:
Overall accuracy is a function of timebase calibration, aging rate, temperature effects, line voltage effects, and short-term stability.

	Standard	***Option 002***
Aging Rate	*<1 x 10^{-6}/mo.*	*<1 x 10^{-9}/day*
Temperature Effects	*<2 x 10^{-7}/°C*	*<2 x 10^{-10}/°C*
Line Voltage Effects (+5%, –10% Line Voltage Change)	*<1 x 10^{-6}*	*<6 x 10^{-10}*
Short-Term Stability	—	*<1 x 10^{-9} for 1 second average*

RF Power

The Agilent 8902A measuring receiver, with 11722A sensor module, performs RF power measurements from –20 dBm (10 µW) to +30 dBm (1 W) at frequencies from 100 kHz to 2.6 GHz.

The 8902A measuring receiver, with 11792A sensor module, performs RF power measurements from –20 dBm (10 µW) to +30 dBm (1 W) at frequencies from 50 MHz to 26.5 GHz.

RF POWER RESOLUTION[9]:
0.01% of full scale in watts or volts mode.
0.01 dB in dBm or $dB_{relative}$ mode.

LINEARITY (includes sensor non-linearity):
RF range linearity ± RF range-to-range change error.

RF RANGE LINEARITY (using recorder output)[10]:
±0.02 dB, RF ranges 2 through 5.
±0.03 dB, RF range 1.
Using front-panel display add ±1 count of least-significant digit.

RF RANGE-TO-RANGE CHANGE ERROR (using recorder output):
±0.02 dB/RF range change from reference range.
Using front-panel display add ±1 count of least-significant digit.

INPUT SWR:
Using 11722A sensor module: <1.15.

Using 11792A sensor module:
<1.15, 1300 MHz ≤f_c.
<1.25, 1300 MHz <f_c ≤18.0 GHz.
<1.40, 18.0 GHz <f_c ≤26.5 GHz.

ZERO SET (digital settability of zero):
±0.07% of full scale on lowest range.
Decrease by a factor of 10 for each higher range.

Supplemental Characteristics:

ZERO DRIFT OF METER:
±0.03% of full scale/°C on lowest range. Decrease by a factor of 10 for each higher range.

NOISE (at constant temperature, peak change over any one-minute interval for the 11722A or 11792A sensor modules):
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.

ZERO DRIFT OF SENSORS (1 hour, at constant temperature after 24-hour warm-up):
±0.1% of full scale on lowest range for 11722A and 11792A sensor modules.

RF POWER RANGES OF AGILENT 8902A MEASURING RECEIVER WITH 11722A AND 11792A SENSOR MODULES:
–20 dBm to –10 dBm (10 µW to 100 µW), range 1.
–10 dBm to 0 dBm (100 µW to 1 mW), range 2.
0 dBm to +10 dBm (1 mW to 10 mW), range 3.
+10 dBm to +20 dBm (10 mW to 100 mW), range 4.
+20 dBm to +30 dBm (100 mW to 1 W), range 5.

RESPONSE TIME (0 to 99% of reading):
<10 seconds, range 1.
<1 second, range 2.
<100 milliseconds, ranges 3 through 5.

DISPLAYED UNITS:
Watts, dBm, $dB_{relative}$, $\%_{relative}$, volts, mV, µV, dB V, dB mV, dB µV.

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%.*
Cal Factor Resolution: *0.1%.*

Power Reference

POWER OUTPUT:
1.00 mW. Factory set to ±0.7%, traceable to the U.S. National Bureau of Standards.

ACCURACY: ±1.2% worst case (±0.9% rss) for one year (0 °C to 55 °C).

Supplemental Characteristics:

FREQUENCY: *50 MHz nominal.*

SWR: *1.05 nominal.*

FRONT PANEL CONNECTOR: *N-type female.*

Tuned RF Level

POWER RANGE: –127 dBm to 0 dBm, using IF synchronous detector (200 Hz BW).
–100 dBm to 0 dBm, using IF average detector (30 kHz BW).

POWER RANGE (Using 11792A Sensor Module):
For IF Synchronous Detector:
+10 dBm to –117 dBm, 2.5 MHz ≤f_c ≤1300 MHz.
+5 dBm to –105 dBm, 1300 MHz ≤f_c ≤12.4 GHz.
+5 dBm to –100 dBm, 12.4 GHz ≤f_c ≤18.0 GHz.
+5 dBm to –95 dBm, 18.0 GHz ≤f_c ≤26.5 GHz.

For IF Average Detector:
+10 dBm to –90 dBm, 2.5 MHz ≤f_c ≤1300 MHz.
+5 dBm to –80 dBm, 1300 MHz ≤f_c ≤12.4 GHz.
+5 dBm to –75 dBm, 12.4 GHz ≤f_c ≤18.0 GHz.
+5 dBm to –70 dBm, 18.0 GHz ≤f_c ≤26.5 GHz.

1.9 Special Function degrades Tuned RF Level minimum sensitivity by 10 dB.

FREQUENCY RANGE:
2.5 MHz to 1300 MHz.
2.5 MHz to 26.5 GHz.

DISPLAYED RESOLUTION[11]:
4 digits in watts or volts mode.
0.01 dB or 0.001 dB in dBm or $dB_{relative}$ mode.

4 digits in watts or volts mode.
0.01 dB in dBm or $dB_{relative}$ mode.

RELATIVE MEASUREMENT ACCURACY (at constant temperature and after RF range calibration is completed)[12]:

Detector linearity + IF range-to-range error + RF range-to-range error + frequency drift error + noise error ± 1 digit.

Detector linearity + mixer linearity + IF range-to-range error + RF range-to-range error + frequency drift error + noise error ± 1 digit.

11. The 8902A fundamental Tuned RF Level measurement units are volts. Further internal processing is done on this number to display all other units.
12. Tuned RF Level accuracy will be affected by residual FM of the source-under-test. If the residual FM_{peak} is >50 Hz measured over a 30 second period in a 3 kHz BW. Tuned RF Level measurements should be made using the IF average detector (30 kHz BW) by using Special Function 4.4. The Tuned RF Level measurement sensitivity when using the IF average detector is –100 dBm.

DETECTOR LINEARITY:

For IF Synchronous Detector:

±0.007 dB/dB change, but not more than ±0.02 dB/10 dB change.
Typically <±0.004 dB/dB change and <±0.01 dB/10 dB change.

For IF Average Detector (0 °C to +35 °C):

±0.013 dB/dB change, but not more than±0.04 dB/10 dB change, but not more than ±0.06 dB/10 dB change.
Typically <±0.008 dB/dB change and <±0.02 dB/10 dB change.

MIXER LINEARITY:

Negligible, levels ≤–5 dBm.
±0.04 dB, levels >–5 dBm and frequencies >1300 MHz.

IF RANGE-TO-RANGE ERROR (see Tuned RF Level range plot)[13]:

±0.02 dB/IF range change, IF ranges 1 through 5.
±0.05 dB/IF range change, IF ranges 6 through 7.

RF RANGE-TO-RANGE ERROR:

±0.04 dB/IF range change (Tuned RF Level only).
±0.06 dB/IF range change, RF Power to Tuned RF Level.

FREQUENCY DRIFT ERROR: ±0.05 dB/kHz frequency drift from center of IF (using IF synchronous detector).

NOISE ERROR: ±0.18 dB for levels <–120 dBm, or for levels <–110 dBm if Special Function 1.9 is selected.

±0.18 dB, levels <–110 dBm, 2.5 MHz ≤f_c ≤1300 MHz.
±0.18 dB, levels <–98 dBm, 1300 MHz ≤f_c ≤12.4 GHz.
±0.18 dB, levels <–93 dBm, 12.4 GHz ≤f_c ≤18.0 GHz.
±0.18 dB, levels <–88 dBm, 18.0 GHz ≤f_c ≤26.5 GHz.
Negligible elsewhere.

INPUT SWR:

<1.18, at 8902A RF input, RF range 1 and 2.
<1.40, at 8902A RF input, RF range 3.
<1.33, at 11722A RF input, RF range 1 and 2.
<1.50, at 11722A RF input, RF range 3.
<1.33, at 11722A RF input, RF range 3 with Special Function 1.9.

Using 11792A sensor module:

<1.15, 1300 MHz ≤f_c.
<1.25, 1300 MHz ≤f_c ≤18.0 GHz.
<1.40, 18.0 GHz ≤f_c ≤26.5 GHz.

Supplemental Characteristics:

ABSOLUTE LEVEL MEASUREMENT ACCURACY AT LOW LEVELS (at constant temperature and after RF range calibration is completed)[12]:

Absolute level measurement accuracy is a function of the RF Power and Tuned RF Level measurement accuracy. For a source with an output SWR of 1.7 and level of –110 dBm the typical absolute level measurement accuracy is 0.46 dB rss and 1.02 dB worst case.

IF FREQUENCY: *455 kHz.*

ACQUISITION TIME:

<4 seconds, ≥–110 dBm.
<10 seconds, ≥–127 dBm.

<4 seconds, levels ≥–85 dBm.
<10 seconds, levels <–85 dBm.

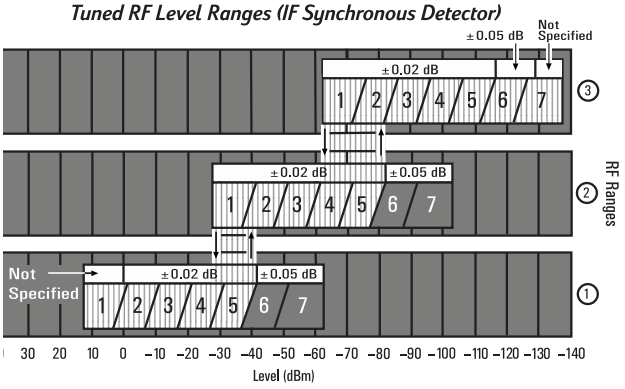
RESPONSE TIME (responding to changes in level of an acquired signal):

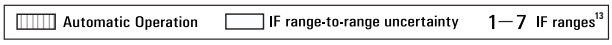
<2 seconds, ≥–110 dBm.
<5 seconds, ≥–127 dBm.

<2 seconds, ≥–85 dBm.
<5 seconds, <–85 dBm.

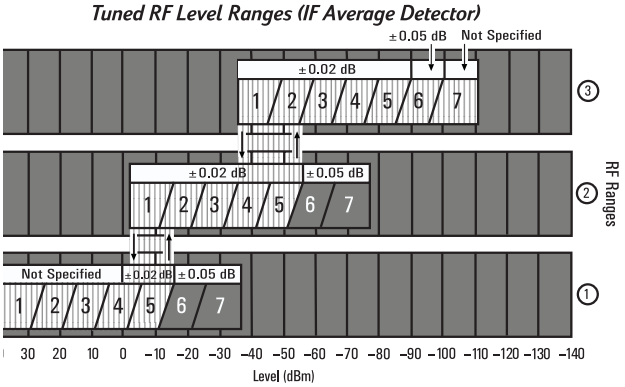
DISPLAYED UNITS: *Watts, dBm, $dB_{relative}$, $\%_{relative}$, volts, mV, µV, dB V, dB mV, dB µV.*

Tuned RF Level Ranges (IF Synchronous Detector)



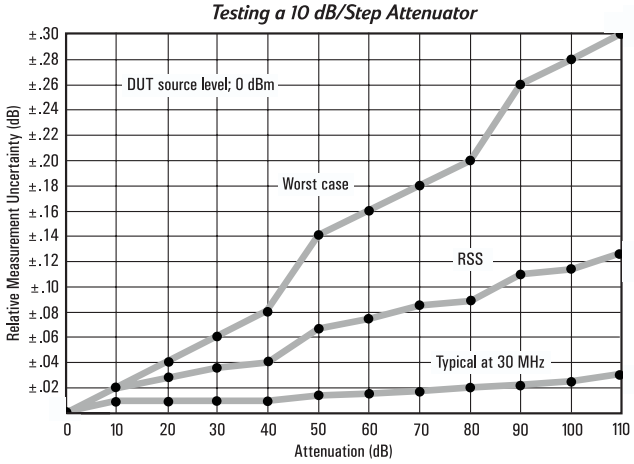


Tuned RF Level Ranges (IF Average Detector)



12. Tuned RF Level accuracy will be affected by residual FM of the source-under-test. If the residual FMpeak is >50 Hz measured over a 30 second period in a 3 kHz BW, Tuned RF Level measurements should be made using the IF average detector (30 kHz BW) by using Special Function 4.4. The Tuned RF Level measurement sensitivity when using the IF average detector is –100 dBm.
13. IF Ranges 6 and 7 (see Tuned RF Level range plots) are only used in automatic operation for Tuned RF Level measurements below approximately –110 dBm for the IF synchronous detector, and below approximately –85 dBm for the IF average detector.

Testing a 10 dB/Step Attenuator



Carrier Noise (Options 030-037)

FREQUENCY RANGE: 10 MHz to 1300 MHz.

CARRIER POWER RANGE: +30 dBm to –20 dBm;
12.5 kHz, 25 kHz and 30 kHz filters.
+30 dBm to –10 dBm; carrier noise filter.

DYNAMIC RANGE: 115 dB.

CARRIER REJECTION (temp. ≤35 °C): >90 dB; for offsets of at least 1 channel spacing or 5 kHz, whichever is greater.

RELATIVE MEASUREMENT ACCURACY:
±0.5 dB; levels ≥–95 dBc; 12.5 kHz, 25 kHz and 30 kHz filters.
±0.5 dB; levels ≥–129 dBc/Hz; carrier noise filter.

CARRIER NOISE FILTER:
Filter Noise Bandwidth: 2.5 kHz nominal.
Noise Bandwidth Correction Accuracy (stored in non-volatile memory): ±0.2 dB.

Supplemental Characteristics:

ADJACENT/ALTERNATE CHANNEL FILTERS:
6 dB Filter Bandwidth:
8.5 kHz, 12.5 kHz adjacent-channel filter.
16.0 kHz, 25 kHz adjacent-channel filter.
30.0 kHz, 30 kHz (cellular radio) alternate-channel filter.

TYPICAL NOISE FLOOR: *–150 dBc/Hz, 0 dBm carrier power level. For system noise performance add LO contribution.*

Audio Frequency Counter

FREQUENCY RANGE:
20 Hz to 250 kHz. (Usable to 600 kHz.)

MAXIMUM EXTERNAL INPUT VOLTAGE: $3V_{rms}$.

ACCURACY (for demodulated signals)[14]:

Accuracy	Frequency	Modulation (Peak)
±3 counts of least-significant digit ±Internal Reference Accuracy	>1 kHz	AM ≥10% FM ≥1.0 kHz fM≥1.5 radians
±0.02 Hz ±Internal Reference Accuracy	≤1 kHz	AM≥10% FM≥1.0 kHz fM≥1.5 radians
±0.2 Hz ±Internal Reference Accuracy (3 kHz low-pass filter inserted)	≤3 kHz	1.5%≤AM<10% 0.15 kHz≤FM <1.0 kHz 0.15 radian≤fM <1.5 radians

ACCURACY (for external signals)[14]:

Accuracy	Frequency	Level
±3 counts of least-significant digit ±Internal Reference	>1 kHz	≥100 mV_{rms}
±0.02 Hz ±Internal Reference Accuracy	≤1 kHz	≥100 mV_{rms}

Supplemental Characteristics:

DISPLAYED RESOLUTION: *6 digits.*

MEASUREMENT RATE: *2 readings per second.*

COUNTING TECHNIQUE: *Reciprocal with internal 10 MHz timebase.*

AUDIO INPUT IMPEDANCE: *100 kΩ nominal.*

Audio RMS Level

FREQUENCY RANGE: 50 Hz to 40 kHz.

VOLTAGE RANGE: 100 mV to 3 V.

ACCURACY: ± 4.0% of reading.

Supplemental Characteristics:

FULL RANGE DISPLAY: 0.3000 V, 4.000 V.

AC CONVERTER: *True-rms responding for signals with crest factor of ≤ 3.*

MEASUREMENT RATE: *2 readings per second.*

AUDIO INPUT IMPEDANCE: *100 kΩ nominal.*

14. With the low-pass and high-pass audio filters used to stabilize frequency readings.

Audio Distortion

FUNDAMENTAL FREQUENCIES: 400 Hz ±5% and 1 kHz ±5%.

MAXIMUM EXTERNAL INPUT VOLTAGE: 3 V.

DISPLAY RANGE: 0.01% to 100.0% (–80.00 dB to 0.00 dB).

DISPLAYED RESOLUTION: 0.01% or 0.01 dB.

ACCURACY: ±1 dB of reading.

SENSITIVITY:
Modulation: 0.15 kHz peak FM, 1.5% peak AM or 0.6 radian peak ƒM.
External: 100 mV_{rms}.

RESIDUAL NOISE AND DISTORTION[15]:
0.3% (–50 dB), temperature <40 °C.

Supplemental Characteristics:

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

DETECTION: *True rms.*

MEASUREMENT RATE: *1 reading per second.*

AUDIO INPUT IMPEDANCE: *100 kΩ nominal.*

Audio Filters

DE-EMPHASIS FILTERS: 25 ms, 50 ms, 75 ms, and 750 ms. De-emphasis filters are single-pole, low-pass filters with 3 dB frequencies of: 6366 Hz for 25 ms, 3183 Hz for 50 ms, 2122 Hz for 75 ms, and 212 Hz for 750 ms.

50 Hz HIGH-PASS FILTER (2 pole):
Flatness: <1% at rates ≥200 Hz.

300 Hz HIGH-PASS FILTER (2 pole):
Flatness: <1% at rates ≥1 kHz.

3 kHz LOW-PASS FILTER (5 pole):
Flatness: <1% at rates ≤1 kHz.

15 kHz LOW-PASS FILTER (5 pole):
Flatness: <1% at rates ≤10 kHz.

>20 kHz LOW-PASS FILTER (9 pole bessel)[16]:
Flatness: <1% at rates ≤10 kHz.

Supplemental Characteristics:

DE-EMPHASIS FILTER TIME CONSTANT ACCURACY: *±3%.*

HIGH PASS AND LOW PASS FILTER 3 dB CUTOFF FREQUENCY ACCURACY: *±3%.*

>20 kHz LOW PASS FILTER 3 dB CUTOFF FREQUENCY:
100 kHz nominal.

OVERSHOOT ON SQUARE WAVE MODULATION[16]: *<1%.*

RF Input

FREQUENCY RANGE: 150 kHz to 1300 MHz.

150 kHz to 26.5 GHz when using the 11793A sensor module.

OPERATING LEVEL:

Minimum Operating Level	Maximum Operating Level	Frequency Range
12 mV_{rms} (–25 dBm)	7 V_{rms} (1 W_{peak}) Source SWR <4	150 kHz – 650 MHz
22 mV_{rms} (–20 dBm)	7 V_{rms} (1 W_{peak}) Source SWR <4	650 MHz – 1300 MHz
40 mV_{rms} (–15 dBm)	7V_{rms} (1 W_{peak})	150 kHz – 650 MHz
71 mV_{rms} (–10 dBm)	7V_{rms} (1 W_{peak})	650 MHz – 1300 MHz
40 mV_{rms} (–15 dBm)	7V_{rms} (1 W_{peak})	1300 MHz – 26.5 GHz

Supplemental Characteristics:

TUNING:
Normal Mode: *Automatic and manual frequency entry.*
Track Mode: *Automatic and manual frequency entry, $f_c \geq$ 10 MHz.*
Normal and Track Mode: *Manual entry of approximate frequency.*
Acquisition Time (automatic operation): *~1.5 seconds.*
INPUT IMPEDANCE: *50 Ω nominal.*
MAXIMUM SAFE DC INPUT LEVEL: *5 V dc.*

General Specifications

TEMPERATURE:
Operating: 0 °C to 55 °C.
Storage: – 55 °C to 75 °C.

REMOTE OPERATION: GPIB; all functions except the line switch are remotely controllable.

DEFINED IN IEEE-488.2 GPIB COMPATIBILITY: 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: 100, 120, 220, or 240V (+5%, –10%); 48 to 66 Hz; 200 VA maximum.

WEIGHT: Net 23.4 kg (52 lb); Shipping 31.4 kg (69 lb).

DIMENSIONS: 190 mm H x 426 mm W x 551 mm D (7.5" x 16.8" x 21.7").

15. For demodulated signals, the residual noise generated by the 8902A must be accounted for in distortion measurements (that is residual AM, FM or ƒM).
16. The >20 kHz low-pass filter is intended for minimum overshoot with squarewave modulation.

OPTION 050 SPECIFICATIONS

FREQUENCY RANGE: 2.5 MHz to 26.5 GHz.

TUNED RF LEVEL DYNAMIC RANGE:
–120 dBm to 0 dBm.
–110 dBm to –15 dBm.

POWER ACCURACY:
Using an Agilent 8902A Option 050 with 11722A sensor module (10 to 1300 MHz)**:**

Relative accuracy:
±0.005 dB/10 dB step (0 to –100 dBm).
±0.050 dB/10 dB step (–100 to –120 dBm).
±0.015 dB ± 1 digit.

Absolute accuracy:
±0.005 dB/10 dB step (0 to –100 dBm).
±0.050 dB/10 dB step (–100 to –120 dBm).
±0.120 dB ± 1 digit.

Using an Agilent 8902A Option 050 with 11722A sensor module and 11793A microwave converter
(1300 to 2600 MHz, –15 to –110 dBm)**:**

Relative accuracy, 85 dB dynamic range:
±0.005 dB/10 dB step (0 to 60 dB).
±0.050 dB/10 dB step (60 to 85 dB).
±0.015 dB ± 1 digit.

Absolute accuracy:
±0.005 dB/10 dB step (–15 to –100 dBm).
±0.050 dB/10 dB step (–100 to –110 dBm).
±0.120 dB ± 1 digit.

Using an Agilent 8902A Option 050 with 11792A sensor module and 11793A microwave converter
(1300 MHz to 26.5 GHz, –15 to –100 dBm)**:**

Relative accuracy, 85 dB dynamic range:
±0.005 dB/10 dB step (0 to 60 dB).
±0.050 dB/10 dB step (60 to 85 dB).
±0.015 dB ± 1 digit.

Absolute accuracy:
±0.005 dB/10 dB step (–15 to –100 dBm).
±0.120 dB ± 1 digit.

INPUT SWR:
<1.18, RF range 1 and 2.
<1.40, RF range 3.

TEMPERATURE:
Operating: 15 °C to 30 °C.
Storage: –55 °C to 74 °C.

Supplemental Characteristics:

MEASUREMENT TIME:
10 to 30 seconds.

AGILENT 11793A MICROWAVE CONVERTER SPECIFICATIONS

LO AMPLITUDE RANGE:
+8 dBm to +13 dBm, 2 GHz to 18 GHz.
+7 dBm to +13 dBm, 18 GHz to 26.5 GHz.
0 dBm to + 5 dBm, 18 GHz to 26.5 GHz with Option 001, 011, or 021.

TEMPERATURE:
Operation: 0 °C to 55 °C.
Storage: –55 °C to 75 °C.
–25 °C to 75 °C (Options 001, 011, and 021).

POWER: 100, 120, 220, or 240 (+5%, –10%); 48 to 66 Hz; 20 VA maximum.

WEIGHT: Net 7.5 kg (16.5 lb); shipping 10.9 kg (24 lb).

DIMENSIONS: 88 mm H x 425 mm W x 528 mm D.

Supplemental Characteristics:

RF INPUT CONNECTOR: *3.5 mm male.*

LO INPUT CONNECTOR: *3.5 mm male.*

IF OUTPUT CONNECTOR: *N-type female.*

REAR PANEL CONTROL CONNECTOR: *BNC female.*

INCLUDED ACCESSORIES:
Control Cable: *11170A BNC cable.*
LO Output to 11793A LO Input Cable: *3.5 mm female to 3.5 mm female flexible cable and 3.5 mm male to N-type male adapter; Options 001, 011, and 021 delete the 3.5 mm to N-type adapter.*

8902A RF input to 11793A IF output cable: *N-type male to N-type male flexible cable.*

AGILENT 11722A SENSOR MODULE SPECIFICATIONS

FREQUENCY RANGE: 100 kHz to 2.6 GHz.

POWER RANGE: +30 dBm (1 watt) to – 20 dBm (10 mW).

INPUT SWR (connected to an 8902A):
<1.15, for RF Power measurements.
<1.33, for Tuned RF Level measurements, RF range 1 and 2.
<1.5, for Tuned RF Level measurements, RF range 3.
<1.33, for Tuned RF Level measurements, RF range 3 with Special Function 1.9.

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

CALIBRATION FACTORS:
Each 11722A sensor module is individually calibrated. The calibration factors are printed on the 11722A sensor module for easy reference.

CAL FACTOR UNCERTAINTY:

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

Supplemental Characteristics:

MAXIMUM PEAK POWER: *100 Wpeak or 300 W ms per pulse.*

INPUT IMPEDANCE: *50 Ω nominal.*

INPUT CONNECTOR: *N-type 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).*

DIMENSIONS: *51.2 mm H x 62.4 mm W x 1935 mm D (2" x 2.5" x 76.2").*

AGILENT 11792A SENSOR MODULE SPECIFICATIONS

FREQUENCY RANGE:
RF Power measurements:
50 MHz to 26.5 GHz.
50 MHz to 18.0 GHz, Option 001.

POWER RANGE: +30 dBm (1 watt) to – 20 dBm (10 mW).

INPUT SWR (connected to an Agilent 11793A):
<1.15, 1300 MHz $\leq f_c$.
<1.25, 1300 MHz $< f_c \leq$ 18.0 GHz.
<1.40, 18.0 GHz $< f_c \leq$ 26.5 GHz.

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

CALIBRATION FACTORS:
Each 11792A sensor module is individually calibrated. The calibration factors are printed on the 11792A sensor module for easy reference.

CAL FACTOR UNCERTAINTY:

Frequency	RSS Uncertainty	Worst Case Uncertainty
2.0 GHz	2.3	4.6%
6.0 GHz	2.5	5.0%
10.0 GHz	2.9	5.7%
14.0 GHz	3.4	6.6%
18.0 GHz	3.7	6.9%
22.0 GHz	3.8	7.8%
26.5 GHz	4.1	8.3%

Supplemental Characteristics:

INPUT CONNECTOR: *3.5 mm male (N-type male, Option 001).*

INPUT IMPEDANCE: *50 Ω nominal.*

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

WEIGHT: *Net 0.8 kg (1.75 lb); Shipping 1.2 kg (2.6 lb).*

DIMENSIONS: *51.2 mm H x 62.4 mm W x 1935 mm D (2" x 2.5" x 76.2").*

AGILENT 11812A VERIFICATION KIT SPECIFICATIONS

FREQUENCY: 30 MHz.

11812A ACCURACY: ±(0.003 dB + 0.003 dB/10 dB step).

OPTION 050 WORST CASE CUMULATIVE TUNED RF LEVEL ACCURACY VERIFIED WITH 11812A:

±0.010 dB/10 dB step (0 to –100 dBm).
±0.050 dB/10 dB step (–100 to –120 dBm).
±0.015 dB ± 1 digit.

TEMPERATURE:

Operation: 15 °C to 30 °C.
Storage: –55 °C to 74 °C.

AGILENT 8902A REAR PANEL INPUTS/OUTPUTS

Supplemental Characteristics:

FM OUTPUT: *10 kΩ impedance, –9 V to 6 V into an open circuit, ~6 V/MHz, dc coupled, 16 kHz bandwidth (one pole).*

AM OUTPUT: *10 kΩ impedance, –4 V to 0 V into an open circuit, ~8 mV/%, dc coupled, 16 kHz bandwidth (one pole).*

RECORDER OUTPUT: *DC voltage proportional to the measured results, 1 kΩ impedance, 0 V to 4 V for each resolution range into an open circuit.*

IF OUTPUT: *50 Ω impedance, 150 kHz to 2.5 MHz, –27 dBm to –3 dBm.*

10 MHz REFERENCE OUTPUT: *50 Ω impedance, TTL levels (0 V to >2.2 V into an open circuit). Available only with Option 002 $1x10^{-9}$/day internal reference.*

10 MHz REFERENCE INPUT [17] *>500 Ω impedance, 0.5 $V_{peak\text{-}to\text{-}peak}$ minimum input level.*

LO INPUT (Option 003): *50 Ω impedance, ~1.27 MHz to 1301.5 MHz, 0 dBm nominal.*

RF SWITCH REMOTE CONTROL OUTPUT: *Provides output signals necessary to remotely control either an Agilent 33311B,C Option 011 or an 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 LO frequency >0, TTL low output for all other cases.*

17. External reference accuracy affects accuracy of all measurements.

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