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# 8540C Series Universal Power Meter

The Spanawave 8540C Series Universal Power Meters combine accuracy, speed, range and measurement capabilities unavailable from any other power meter.

Built-in features such as power sweep calibration and frequency calibration provide an unequalled degree of measurement accuracy.

Only the 8540C Series power meters have the speed and range to meet the throughput demands of high volume manufacturing.

And the meters can measure the CW, peak and true average power of the complex modulated signals used in EW, radar, and communications systems.

## TESTING COMMUNICATIONS SYSTEMS

Only the Spanawave 8540C Series Universal Power Meters have the extensive measurement capabilities required for today's sophisticated communications applications.

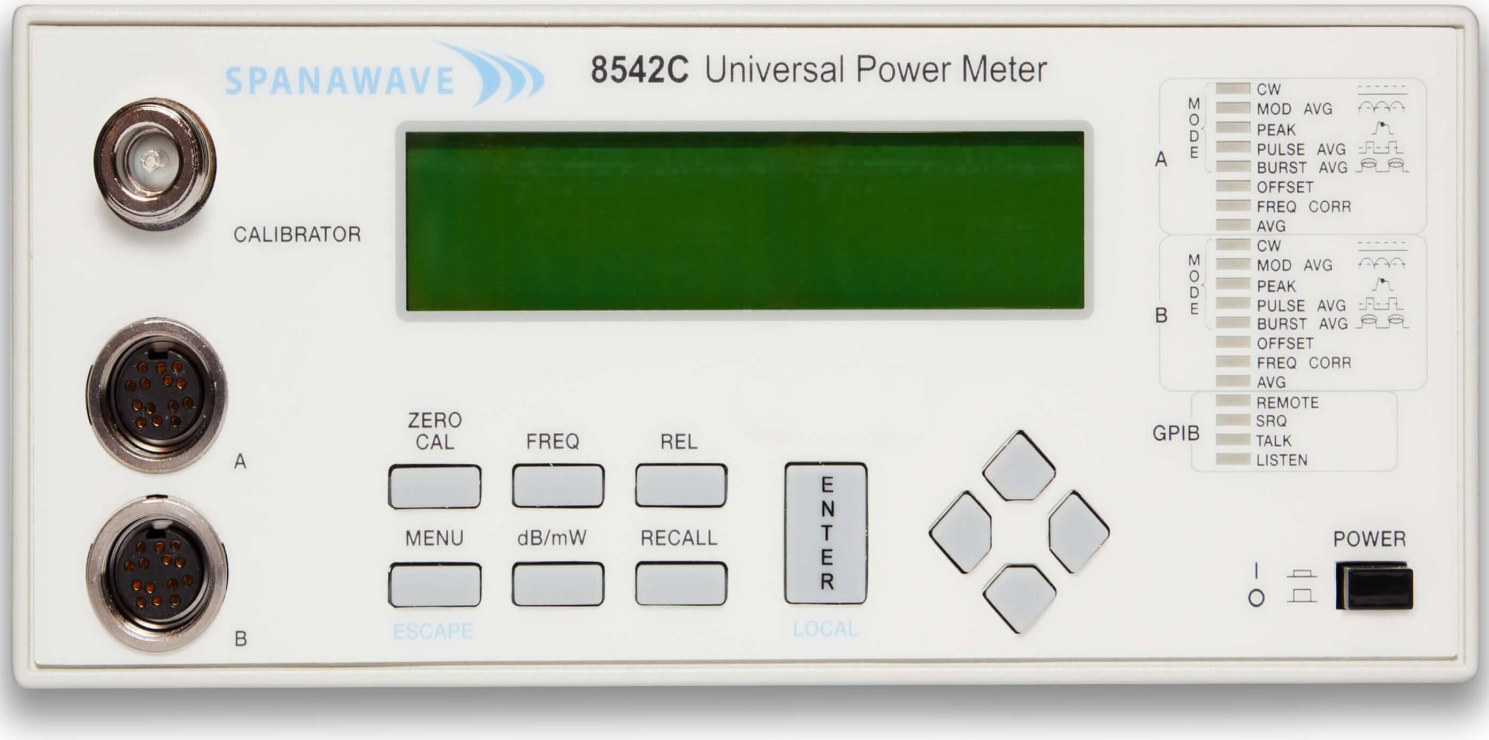
## TDMA

The 8540C can automatically measure the average power of pulse modulated signals or pulse signals that are amplitude modulated during the pulse 'on' period — such as TDMA (time division multiple access) signals.

And the exclusive burst start exclude and burst end exclude capabilities of the 8540C allow you to exclude the beginning or end of a burst when measuring the average burst power. Masking the beginning or end of a burst signal, in order to exclude overshoot or other distortions, can be desirable or even required for certain types of measurements.

## GSM, NADC AND PDC

The exclusive Time Gating feature of the 8540C lets you program a measurement start time and duration to measure the average power during a specific time slot of a burst signal. This is critical for accurately measuring the average power of GSM, NADC and




*The Spanawave 8540C Series combines the speed, range, and capabilities needed to test today's sophisticated communications systems.*

other formats that must control the power trajectory during a specified portion of the burst.

## PHS

PHS (as well as DECT and CT-2) systems use a variation of the TDMA format. Instead of using different frequency channels for the forward and reverse link, these systems use a Time Domain Duplex (TDD) method at the same frequency.

The Time Gating feature of the 8540C can be used in all of the average power measurement modes to accurately measure the average power of the multiplexed time slots.

## CDMA

The 8540C has the speed, accuracy and range to accurately measure the power level of CDMA (code division multiple access) signals for open-loop and closed-loop testing.

The wide dynamic range of the 8540C is ideal for open-loop tests, which can require power verification over an 80 dB range. Because the 8540C can achieve fast measurement speeds over the GPIB bus, you can quickly measure power in I dB steps over the 48 dB range required for closed-loop tests.

And no power meter is as accurate as the 8540C over the wide dynamic range needed for CDMA testing.

## SPEED TO BURN

Fast responding diode sensors plus innovative digital signal processing deliver high-speed measurements.

Achieve 500 readings per second over GPIB. Or use our exclusive fast buffered mode to further reduce processor overhead and capture up to 4,000 readings per second in CW mode.

The 8540C also responds much faster to power level changes than meters using thermocouple sensors. This adds up to a huge reduction in test time and a significant increase in manufacturing throughput.

## PEAK POWER MEASUREMENT

You can also measure the instantaneous peak power level of a pulse modulated signal just by changing sensors. Use the 'sample delay' function of the 8540C to set the desired measurement point on the waveform. An external oscilloscope can be used to view the pulse profile and corresponding measurement point.

The extensive measurement capability of the 8540C is a result of the advanced meter architecture combined with a family of interchangeable sensors. The sensors provide different power measurement functions — CW, peak and modulated — over a wide dynamic range at fast measurement speeds.

## Accuracy Audit

**The Accuracy Audit table lists the significant uncertainties of an absolute power measurement. The accuracy of the 8540C combined with the 80301A sensor is compared to a typical thermocouple sensor/meter combination at +20 dBm, 0 dBm, and –30 dBm (the dynamic limit of the thermocouple sensor). The uncertainty comparison at –30 dBm illustrates the accuracy advantage of a wide dynamic sensor, even when the full 90 dB dynamic range is not utilized.**

| +20 dBm Frequency = 1 GHz; Source Match = 1.5:1 | 8540C with 80301A | Typical Thermocouple Meter/Sensor |
|---|---|---|
| Instrumentation Uncertainty | ± 5.2% | + 2.5% – 4.5% |
| Sensor Power Linearity (>8 GHz) | ± 0% | ± 0% |
| Calibrator Uncertainty | ± 1.2% | ± 1.2% |
| Calibrator/Sensor Mismatch | ± 0.28% | ± 0.23% |
| Calibration Factor Uncertainty | ± 1.04% | ± 1.6% |
| Zero Error | ± 0.00000005% | ± 0.00005% |
| Noise | ± 0.00000005% | ± 0.00005% |
| Mismatch (Sensor/Source) | ± 2.25% | ± 2.0% |
| **% Total Uncertainty** | **± 9.97%** | **+ 7.53 – 9.53%** |
| **dB Total Uncertainty** | **± 0.41 dB** | **+ 0.316 – 0.4 dB** |

| 0 dBm Frequency = 1 GHz; Source Match = 1.5:1 | 8540C with 80301A | Typical Thermocouple Meter/Sensor |
|---|---|---|
| Instrumentation Uncertainty | ± 0% | ± 0.5% |
| Sensor Power Linearity (>8 GHz) | ± 0% | ± 0% |
| Calibrator Uncertainty | ± 1.2% | ± 1.2% |
| Calibrator/Sensor Mismatch | ± 0.28% | ± 0.23% |
| Calibration Factor Uncertainty | ± 1.04% | ± 1.6% |
| Zero Error | ± 0.000005% | ± 0.005% |
| Noise | ± 0.000005% | ± 0.005% |
| Mismatch (Sensor/Source) | ± 2.25% | ± 2.0% |
| **% Total Uncertainty** | **± 4.77%** | **± 5.54%** |
| **dB Total Uncertainty** | **± 0.20 dB** | **± 0.23 dB** |

| –30 dBm Frequency = 1 GHz; Source Match = 1.5:1 | 8540C with 80301A | Typical Thermocouple Meter/Sensor |
|---|---|---|
| Instrumentation Uncertainty | ± 0.925% | ± 0.5% |
| Sensor Power Linearity (>8 GHz) | ± 0% | ± 0% |
| Calibrator Uncertainty | ± 1.2% | ± 1.2% |
| Calibrator/Sensor Mismatch | ± 0.28% | ± 0.23% |
| Calibration Factor Uncertainty | ± 1.04% | ± 1.6% |
| Zero Error | ± 0.005% | ± 5% |
| Noise | ± 0.005% | ± 5% |
| Mismatch (Sensor/Source) | ± 2.25% | ± 2.0% |
| **% Total Uncertainty** | **± 5.71%** | **± 15.53%** |
| **dB Total Uncertainty** | **± 0.24 dB** | **± 0.63 dB** |

Spanawave uses diode sensors exclusively to provide speed, range, capability and accuracy unavailable from any other power meter.

## ACCURACY OVER A 90 dB RANGE

Spanawave has solved the challenge that previously limited the use of diode sensors to below –20 dBm — the 'square law' region — by utilizing a built-in power sweep calibration system.

The power sweep calibrator uses a 50 MHz amplitude controlled oscillator to step from –30 to +20 dBm in 1 dB increments. Each step is set using an internal thermistor — the standard for accuracy and traceability. You get thermistor accuracy, plus diode speed and dynamic range, for measuring signals accurately over a full 90 dB power range.

## THE FASTEST CW MEASUREMENTS

Spanawave 80300A Series CW Power Sensors let you measure CW power from10 MHz to 40 GHz at speeds up to 500 readings per second over GPIB.

Measure up to 90 dB with a single sensor, and select from a variety of high power sensors, up to 50 W.

## PEAK POWER MEASUREMENTS

Attach a Spanawave 80350A Series Peak Power Sensor to an 8540C meter and directly measure the instantaneous peak power level of a pulse modulated signal.

Use the 'sample delay' function to set the desired measurement point on the waveform. An external scope can be used to view the profile and see the exact measurement point on the pulse.

## TRUE AVERAGE POWER MEASUREMENTS

The Spanawave 80400A Series Modulated Power Sensors let you measure the true average power of amplitude modulated, burst modulated and other complex modulated signals — such as TDMA signals — at modulation bandwidths up to 40 kHz.

When greater bandwidth is needed — for formats such as CDMA and PHS — Spanawave 80600A Series Modulated Power Sensors provide bandwidth up to 1.5 MHz to measure the true average power of complex modulated signals.

Spanawave 80400A and 80600A Series Modulated Power Sensors can accurately and directly measure signals over a dynamic range up to 87 dB and at power levels up to 50 W.

## BUILT-IN FREQUENCY RESPONSE CALIBRATION

Configuring the power meter for measurements is easy with calibration factors programmed into the sensor.

When the measurement frequency is entered, the meter automatically applies the correct calibration factor from the sensor EEPROM. And the meter automatically reads a new set of cal factors whenever a sensor is changed.

This avoids the chance of measurement error from using invalid calibration factors when you change sensors, or from forgetting to enter new calibration factors. You not only avoid measurement errors; you also save yourself test time.

## Spanawave CW Power Sensor Selection Guide

| | Frequency Range/ Power Range | Maximum Power | Power Linearity [4] (Frequency > 8 GHz) | RF Connector | Length | Diameter | Weight | VSWR |
|---|---|---|---|---|---|---|---|---|
| **200 mW CW Power Sensors** | | | | | | | | |
| 80301A | 10 MHz to 18 GHz<br>–70 to +20 dBm | +23 dBm (200 mW) | –70 to –20 dBm: ±0.00 dB<br>–20 to +20 dBm: ±0.05 dB/10 dB | Type N(m)<br>50Ω | 114.5 mm<br>(4.5 in) | 32 mm<br>(1.25 in) | 0.18 kg<br>(0.4 lb) | 1.12: 0.01 - 2 GHz<br>1.22: 2 - 12.4 GHz |
| 80302A | 10 MHz to 18 GHz<br>–70 to +20 dBm | +23 dBm (200 mW) | –70 to –20 dBm: ±0.00 dB<br>–20 to +20 dBm: ±0.05 dB/10 dB | APC-7<br>50Ω | 114.5 mm<br>(4.5 in) | 32 mm<br>(1.25 in) | 0.18 kg<br>(0.4 lb) | 1.29: 12.4 - 18 GHz |
| 80303A | 10 MHz to 26.5 GHz<br>–70 to +20 dBm | +23 dBm (200 mW) | –70 to –20 dBm: ±0.00 dB<br>–20 to +20 dBm: ±0.1 dB/10 dB | Type K(m) [1]<br>50Ω | 114.5 mm<br>(4.5 in) | 32 mm<br>(1.25 in) | 0.18 kg<br>(0.4 lb) | 1.12: 0.01 - 2 GHz<br>1.22: 2 - 12.4 GHz |
| 80304A | 10 MHz to 40 GHz<br>–70 to 0 dBm | +23 dBm (200 mW) | –70 to –20 dBm: ±0.00 dB<br>–20 to 0 dBm: ±0.2 dB/10 dB | Type K(m) [1]<br>50Ω | 114.5 mm<br>(4.5 in) | 32 mm<br>(1.25 in) | 0.18 kg<br>(0.4 lb) | 1.38: 12.4 - 18 GHz<br>1.43: 18 - 26.5 GHz<br>1.92: 26.5 - 40 GHz |
| **Low VSWR CW Power Sensors** | | | | | | | | |
| 80310A | 10 MHz to 18 GHz<br>–64 to +26 dBm | +29 dBm (800 mW) | –64 to –14 dBm: ±0.00 dB<br>–14 to +26 dBm: ±0.05 dB/10 dB | Type K(m) [1]<br>50Ω | 127 mm<br>(5.0 in) | 32 mm<br>(1.25 in) | 0.23 kg<br>(0.5 lb) | 1.13: 0.01 - 2 GHz<br>1.16: 2 - 12 GHz |
| 80313A | 10 MHz to 26.5 GHz<br>–64 to +26 dBm | +29 dBm (800 mW) | –64 to –14 dBm: ±0.00 dB<br>–14 to +26 dBm: ±0.1 dB/10 dB | | | | | 1.23: 12 - 18 GHz<br>1.29: 18 - 26.5 GHz |
| 80314A | 10 MHz to 40 GHz<br>–64 to +6 dBm | +29 dBm (800 mW) | –64 to –14 dBm: ±0.00 dB<br>–14 to +6dBm: ±0.2 dB/10 dB | | | | | 1.50: 26.5 - 40 GHz |
| **1 W CW Power Sensors** | | | | | | | | |
| 80320A | 10 MHz to 18 GHz<br>–60 to +30 dBm | +30 dBm (1 W) | –60 to –10 dBm:±0.00 dB<br>–10 to +30 dBm: ±0.05 dB/10 dB | Type K(m) [1]<br>50Ω | 127 mm<br>(5.0 in) | 32 mm<br>(1.25 in) | 0.23 kg<br>(0.5 lb) | 1.11: 0.01 - 2 GHz<br>1.12: 2 - 12 GHz |
| 80323A | 10 MHz to 26.5 GHz<br>–60 to +30 dBm | +30 dBm (1 W) | –60 to –10 dBm: ±0.00 dB<br>–10 to +30 dBm: ±0.1 dB/10 dB | | | | | 1.18: 12 - 18 GHz<br>1.22: 18 - 26.5 GHz |
| 80324A | 10 MHz to 40 GHz<br>–60 to +10 dBm | +30 dBm (1 W) | –60 to –10 dBm: ±0.00 dB<br>–10 to +10 dBm: ±0.2 dB/10 dB | | | | | 1.36: 26.5 - 40 GHz |
| **5 W CW Power Sensor [2]** | | | | | | | | |
| 80321A | 10 MHz to 18 GHz<br>–50 to +37 dBm | +37 dBm (5 W) | –50 to 0 dBm: ±0.00 dB<br>0 to +37 dBm: ±0.05 dB/10 dB | Type N(m)<br>50Ω | 150 mm<br>(5.9 in) | 32 mm<br>(1.25 in) | 0.23 kg<br>(0.5 lb) | 1.20: 0.01 - 6 GHz<br>1.25: 6 - 12.4 GHz<br>1.35: 12.4 - 18 GHz |
| **25 W CW Power Sensor [3]** | | | | | | | | |
| 80322A | 10 MHz to 18 GHz<br>–40 to +44 dBm | +44 dBm (25 W) | –40 to +10 dBm: ±0.00 dB<br>+10 to +44 dBm: ±0.05 dB/10 dB | Type N(m)<br>50Ω | 230 mm<br>(9.0 in) | 104 mm<br>(4.1 in) | 0.3 kg<br>(0.6 lb) | 1.20: 0.01 - 6 GHz<br>1.30: 6 - 12.4 GHz<br>1.40: 12.4 - 18 GHz |
| **50 W CW Power Sensor [3]** | | | | | | | | |
| 80325A | 10 MHz to 18 GHz<br>–40 to +47 dBm | +47 dBm (50 W) | –40 to +10 dBm: ±0.00 dB<br>+10 to +47 dBm: ±0.05 dB/10 dB | Type N(m)<br>50Ω | 230 mm<br>(9.0 in) | 104 mm<br>(4.1 in) | 0.3 kg<br>(0.6 lb) | 1.25: 0.01 - 6 GHz<br>1.35: 6 - 12.4 GHz<br>1.45: 12.4 - 18 GHz |

## Spanawave Peak Power Sensor Selection Guide

| | Frequency Range/ Power Range | Maximum Power | Power Linearity [4] (Frequency > 8 GHz) | RF Connector | Length | Diameter | Weight | VSWR |
|---|---|---|---|---|---|---|---|---|
| **200 mW Peak Power Sensors** | | | | | | | | |
| 80350A | 45 MHz to 18 GHz<br>–20 to +20 dBm, Peak<br>–30 to +20 dBm, CW | +23 dBm (200 mW)<br>CW or Peak | –30 to –20 dBm: ±0.00 dB<br>–20 to +20 dBm: ±0.05 dB /10 dB | Type N(m)<br>50Ω | 165 mm<br>(6.5 in) | 37 mm<br>(1.25 in) | 0.3 kg<br>(0.7 lb) | 1.12: 0.045 - 2 GHz<br>1.22: 2 - 12.4 GHz<br>1.37: 12.4 - 18 GHz<br>1.50: 18 - 26.5 GHz<br>1.92: 26.5 - 40 GHz |
| 80353A | 45 MHz to 26.5 GHz<br>–20 to +20 dBm, Peak<br>–30 to +20 dBm, CW | +23 dBm (200 mW)<br>CW or Peak | –30 to –20 dBm: ±0.00 dB<br>–20 to +20 dBm: ±0.1 dB /10 dB | Type K(m) [1]<br>50Ω | 165 mm<br>(6.5 in) | 37 mm<br>(1.25 in) | 0.3 kg<br>(0.7 lb) | |
| 80354A | 45 MHz to 40 GHz<br>–20 to +0.0 dBm, Peak<br>–30 to +0.0 dBm, CW | +23 dBm (200 mW)<br>CW or Peak | –30 to –20 dBm: ±0.00 dB<br>–20 to 0.0 dBm: ±0.2 dB /10 dB | Type K(m) [1]<br>50Ω | 165 mm<br>(6.5 in) | 37 mm<br>(1.25 in) | 0.3 kg<br>(0.7 lb) | |
| **5 W Peak Power Sensor [5, 7]** | | | | | | | | |
| 80351A | 45 MHz to 18 GHz<br>0 to +40 dBm, Peak<br>–10 to +37 dBm, CW | CW: +37 dBm<br>(5 W Average)<br>Peak: +43 dBm | –10 to +0 dBm: ±0.00 dB<br>+0 to +40 dBm: ±0.05 dB /10 dB | Type N(m)<br>50Ω | 200 mm<br>(7.9 in) | 37 mm<br>(1.25 in) | 0.3 kg<br>(0.7 lb) | 1.15: 0.045 - 4 GHz<br>1.25: 4 - 12.4 GHz<br>1.35: 12.4 - 18 GHz |
| **25 W Peak Power Sensor [6, 7]** | | | | | | | | |
| 80352A | 45 MHz to 18 GHz<br>+10 to +50 dBm, Peak<br>0.0 to +44 dBm, CW | CW: +44 dBm<br>(25 W Average)<br>Peak: +53 dBm | 0.0 to +10 dBm: ±0.00 dB<br>+10 to +50 dBm: ±0.05 dB /10 dB | Type N(m)<br>50Ω | 280 mm<br>(11.0 in) | 104 mm<br>(4.1 in) | 0.3 kg<br>(0.7 lb) | 1.20: 0.045 - 6 GHz<br>1.30: 6 - 12.4 GHz<br>1.40: 12.4 - 18 GHz |
| **50 W Peak Power Sensor [6, 7]** | | | | | | | | |
| 80355A | 45 MHz to 18 GHz<br>+10 to +50 dBm, Peak<br>0.0 to +47 dBm, CW | CW: +47 dBm<br>(50 W Average)<br>Peak: +53 dBm | 0.0 to +10 dBm: ±0.00 dB<br>+10 to +50 dBm: ±0.05 dB /10 dB | Type N(m)<br>50Ω | 280 mm<br>(11.0 in) | 104 mm<br>(4.1 in) | 0.3 kg<br>(0.7 lb) | 1.25: 0.045 - 6 GHz<br>1.35: 6 - 12.4 GHz<br>1.45: 12.4 - 18 GHz |

## Spanawave Bridge Selection Guide

| | Frequency Range/ Power Range | Maximum Power | Power Linearity [4] (Frequency > 8 GHz) | Input | Test Port | Directivity | Weight | VSWR |
|---|---|---|---|---|---|---|---|---|
| **Precision CW Return Loss Bridges** | | | | | | | | |
| 80501 | 10 MHz to 18 GHz<br>–35 to +20 dBm | +27 dBm (0.5 W) | –35 to +10 dBm: ±0.1 dB<br>+10 to +20 dBm: ±0.1 dB<br>±0.005 dB/dB | Type N(f)<br>50Ω | Type N(f)<br>50Ω | 38 dB | 0.340 kg | < 1.17: 0.01 - 8 GHz<br>< 1.27: 8 - 18 GHz |
| 80502 | 10 MHz to 18 GHz<br>–35 to +20 dBm | +27 dBm (0.5 W) | –35 to +10 dBm: ±0.1 dB<br>+10 to +20 dBm: ±0.1 dB<br>±0.005 dB/dB | Type N(f)<br>50Ω | APC-7(f)<br>50Ω | 40 dB | 0.340 kg | < 1.13: 0.01 - 8 GHz<br>< 1.22: 8 - 18 GHz |
| 80503B | 10 MHz to 26.5 GHz<br>–35 to +20 dBm | +27 dBm (0.5 W) | –35 to +10 dBm: ±0.1 dB<br>+10 to +20 dBm: ±0.1 dB<br>±0.005 dB/dB | SMA(f)<br>50Ω | SMA(f)<br>50Ω | 35 dB | 0.340 kg | < 1.22: 0.01 - 18 GHz<br>< 1.27: 18 - 26.5 GHz |
| 80504 | 10 MHz to 40 GHz<br>–35 to +20 dBm | +27 dBm (0.5 W) | –35 to +10 dBm: ±0.1 dB<br>+10 to +20 dBm: ±0.1 dB<br>±0.005 dB/dB | Type K(f)<br>50Ω | Type K(f)<br>50Ω | 30 dB | 0.198 kg | < 1.35: 0.01 - 26.5 GHz<br>< 1.44: 26.5 - 40 GHz |

[1] The K connector is electrically and mechanically compatible with the APC-3.5 and SMA connectors. Note: Use a Type N(m) to SMA(f) adapter (part no. 29835) for calibration of power sensors with Type K(m) connectors. [2] Power coefficient equals <0.01 dB/Watt. [3] Power coefficient equals <0.015 dB/Watt. [4] For frequencies above 8 GHz, add power linearity to system linearity. [5] Power coefficient equals <0.01 dB/Watt (Average). [6] Power coefficient equals <0.015 dB/Watt (Average). [7] Peak operating range above CW maximum range is limited to <10% duty cycle. [8] Square root of the sum of the individual uncertainties squared (RSS). [9] Cal Factor numbers allow for 3% repeatability when reconnecting attenuator to sensor and 3% for attenuator measurement uncertainty and mismatch of sensor/pad combination.

## Spanawave Modulation Power Sensor Selection Guide ($f_m \leq 40$ kHz)

| | Frequency Range/ Power Range | Maximum Power | Power Linearity [4] (Frequency > 8 GHz) | RF Connector | Length | Diameter | Weight | VSWR |
|---|---|---|---|---|---|---|---|---|
| **200 mW Modulation Power Sensors** | | | | | | | | |
| 80401A | 10 MHz to 18 GHz<br>–67 to +20 dBm | +23 dBm (200 mW) | –67 to –20 dBm: ±0.00 dB<br>–20 to +20 dBm: ±0.05 dB/10 dB | Type N(m)<br>50Ω | 114.5 mm<br>(4.5 in) | 32 mm<br>(1.25 in) | 0.18 kg<br>(0.4 lb) | 1.12: 0.01 - 2 GHz<br>1.22: 2 - 12.4 GHz<br>1.29: 12.4 - 18 GHz |
| 80402A | 10 MHz to 18 GHz<br>–67 to +20 dBm | +23 dBm (200 mW) | –67 to –20 dBm: ±0.00 dB<br>–20 to +20 dBm: ±0.05 dB/10 dB | APC-7<br>50Ω | | | | |
| **Low VSWR Modulation Power Sensor** | | | | | | | | |
| 80410A | 10 MHz to 18 GHz<br>–64 to +26 dBm | +29 dBm (800 mW) | –64 to –14 dBm: ±0.00 dB<br>–14 to +26 dBm: ±0.05 dB/10 dB | Type K [1](m)<br>50Ω | 127 mm<br>(5.0 in) | 32 mm<br>(1.25 in) | 0.23 kg<br>(0.5 lb) | 1.13: 0.01 - 2 GHz<br>1.16: 2 - 12 GHz<br>1.23: 12 - 18 GHz |
| **1 W Modulation Power Sensor** | | | | | | | | |
| 80420A | 10 MHz to 18 GHz<br>–57 to +30 dBm | +30 dBm (1 W) | –57 to–10 dBm: ±0.00 dB<br>–10 to +30 dBm: ±0.05 dB/10 dB | Type K [1](m)<br>50Ω | 127 mm<br>(5.0 in) | 32 mm<br>(1.25 in) | 0.23 kg<br>(0.5 lb) | 1.11: 0.01 - 2 GHz<br>1.12: 2 - 12 GHz<br>1.18: 12 - 18 GHz |
| **5 W Modulation Power Sensor** [2] | | | | | | | | |
| 80421A | 10 MHz to 18 GHz<br>–47 to +37 dBm | +37 dBm (5 W) | –47 to 0 dBm: ±0.00 dB<br>0 to +37 dBm: ±0.05 dB/10 dB | Type N(m)<br>50Ω | 150 mm<br>(5.9 in) | 32 mm<br>(1.25 in) | 0.23 kg<br>(0.5 lb) | 1.20: 0.01 - 6 GHz<br>1.25: 6 - 12.4 GHz<br>1.35: 12.4 - 18 GHz |
| **25 W Modulation Power Sensor** [3] | | | | | | | | |
| 80422A | 10 MHz to 18 GHz<br>–37 to +44 dBm | +44 dBm (25 W) | –37 to +10 dBm: ±0.00 dB<br>+10 to +44 dBm: ±0.05 dB/10 dB | Type N(m)<br>50Ω | 230 mm<br>(9.0 in) | 104 mm<br>4.1 in) | 0.3 kg<br>(0.6 lb) | 1.20: 0.01 - 6 GHz<br>1.30: 6 - 12.4 GHz<br>1.40: 12.4 - 18 GHz |
| **50 W Modulation Power Sensor** [3] | | | | | | | | |
| 80425A | 10 MHz to 18 GHz<br>–34 to +47 dBm | +47 dBm (50 W) | –34 to +10 dBm: ±0.00 dB<br>+10 to +47 dBm: ±0.05 dB/10 dB | Type N(m)<br>50Ω | 230 mm<br>(9.0 in) | 104 mm<br>(4.1 in) | 0.3 kg<br>(0.6 lb) | 1.25: 0.01 - 6 GHz<br>1.35: 6 - 12.4 GHz<br>1.45: 12.4 - 18 GHz |

## Spanawave Modulation Power Sensor Selection Guide ($f_m \leq 1.5$ MHz)

| | Frequency Range/ Power Range | Maximum Power | Power Linearity [4] (Frequency > 8 GHz) | RF Connector | Length | Diameter | Weight | VSWR |
|---|---|---|---|---|---|---|---|---|
| **200 mW Modulation Power Sensors** | | | | | | | | |
| 80601A | 10 MHz to 18 GHz<br>–67 to +20 dBm, CW | +23 dBm (200 mW) | –67 to –20 dBm: ±0.00 dB<br>–20 to +20 dBm: ±0.05 dB/10 dB | Type N(m)<br>50Ω | 137 mm<br>(5.39 in) | 41 mm<br>(1.62 in) | 0.23 kg<br>(0.5 lb) | 1.12: 0.01 - 2 GHz<br>1.22: 2 - 12.4 GHz<br>1.29: 12.4 - 18 GHz |
| **5 W Peak Power Sensor** [5,7] | | | | | | | | |
| 80621A | 10 MHz to 18 GHz<br>–47 to +37 dBm | +37 dBm (5 W) | –47 to 0 dBm: ±0.00 dB<br>0 to +37 dBm: ±0.05 dB/10 dB | Type N(m)<br>50Ω | 175 mm<br>(6.90 in) | 41 mm<br>(1.62 in) | 0.28 kg<br>(0.6 lb) | 1.20: 0.01 - 6 GHz<br>1.25: 6 - 12.4 GHz<br>1.35: 12.4 - 18 GHz |

## Spanawave True RMS Sensors Selection Guide ($f_m > 1.5$ MHz)

| | Frequency Range/ Power Range | Maximum Power | Power Linearity [4] (Frequency > 8 GHz) | RF Connector | Length | Diameter | Weight | VSWR |
|---|---|---|---|---|---|---|---|---|
| **True RMS Sensors (-30 dBm to +20 dBm)** | | | | | | | | |
| 80330A<br>80333A<br>80334A | 10 MHz to 18 GHz<br>10 MHz to 26.5 GHz<br>10 MHz to 40 GHz | +33 dBm (2 W) | –30 to +20 dBm: ±0.00 dB | Type K(m) [1]<br>50Ω | 152 mm<br>(6.0 in) | 32 mm<br>(1.25 in) | 0.27 kg<br>(0.6 lb) | 1.12: 0.01 - 12 GHz<br>1.15: 12 - 18 GHz<br>1.18: 18 - 26.5 GHz<br>1.29: 26.5 - 40 GHz |

## Sensor Measurement Capabilities

| | Sensor Model | | | |
|---|---|---|---|---|
| **Signal Type** | **80301A** | **80350A** | **80401A** | **80601A** |
| CW Power Level | –70 to +20 dBm | –30 to 20 dBm | –67 to +20 dBm | –67 to 20 dBm |
| Amplitude Modulation Rate, Power Range | N/A | N/A | $f_m \leq 40$ kHz, –60 to +20 dBm<br>$f_m > 40$ kHz, –60 to –20 dBm | $f_m \leq 1.5$ MHz, –55 to +20 dBm<br>$f_m > 1.5$ MHz, –55 to –20 dBm |
| Two-Tone Maximum Separation Between Carriers | N/A | N/A | ≤ 40 kHz, –60 to +20 dBm<br>> 40 kHz, –60 to –20 dBm | ≤ 1.5 MHz, –55 to +20 dBm<br>> 1.5 MHz, –55 to –20 dBm |
| Pulse Modulation | N/A | > 350 ns Pulse Width | > 200 µs Pulse Width | > 300 µs Pulse Width |
| Burst with Modulation | N/A | N/A | $f_m \leq 40$ kHz, > 200 µs Pulse Width; –60 to +20 dBm<br>$f_m > 40$ kHz, > 200 µs Pulse Width; –60 to –20 dBm | $f_m \leq 1.5$ MHz,> 300 µs Pulse Width; –35 to +20 dBm<br>$f_m > 1.5$ MHz, > 300 µs Pulse Width; –35 to –20 dBm |

## Sensor Calibration Factor Uncertainties

| Frequency (GHz) | | Root Sum of Squares (RSS) Uncertainties(%) [8] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 80301A<br>80302A<br>80350A<br>80401A<br>80402A | 80303A<br>80304A<br>80353A<br>80354A | 80310A<br>80313A<br>80314A<br>80410A | 80320A<br>80323A<br>80324A<br>80420A | 80321A[9]<br>80322A[9]<br>80325A[9]<br>80421A[9]<br>80422A[9]<br>80425A[9]<br>80621A[9] | 80330A<br>80333A<br>80334A | 80351A[9]<br>80352A[9]<br>80355A[9] |
| **Lower** | **Upper** | | | | | | | |
| 0.01 | 1 | 1.04 | 1.64 | 1.58 | 1.58 | 4.54 | 1.58 | 4.92 |
| 1 | 2 | 1.20 | 1.73 | 1.73 | 1.73 | 4.67 | 1.73 | 5.04 |
| 2 | 4 | 1.33 | 1.93 | 1.91 | 1.91 | 4.89 | 1.90 | 7.09 |
| 4 | 6 | 1.41 | 2.03 | 2.02 | 2.01 | 5.01 | 2.01 | 7.17 |
| 6 | 8 | 1.52 | 2.08 | 2.07 | 2.06 | 5.12 | 2.06 | 7.25 |
| 8 | 12.4 | 1.92 | 2.55 | 2.54 | 2.53 | 5.56 | 2.53 | 7.56 |
| 12.4 | 18 | 2.11 | 2.83 | 2.80 | 2.79 | 5.89 | 2.78 | 12.37 |
| 18 | 26.5 | — | 3.63 | 3.68 | 3.62 | — | 3.59 | — |
| 26.5 | 40 | — | 6.05 | 5.54 | 5.39 | — | 5.30 | — |

[1] The K connector is electrically and mechanically compatible with the APC-3.5 and SMA connectors. Note: Use a Type N(m) to SMA(f) adapter (part no. 29835) for calibration of power sensors with Type K(m) connectors. [2] Power coefficient equals <0.01 dB/Watt. [3] Power coefficient equals <0.015 dB/Watt. [4] For frequencies above 8 GHz, add power linearity to system linearity. [5] Power coefficient equals <0.01 dB/Watt (Average). [6] Power coefficient equals <0.015 dB/Watt (Average). [7] Peak operating range above CW maximum range is limited to <10% duty cycle. [8] Square root of the sum of the individual uncertainties squared (RSS). [9] Cal Factor numbers allow for 3% repeatability when reconnecting attenuator to sensor and 3% for attenuator measurement uncertainty and mismatch of sensor/pad combination.

Specifications describe the instrument's warranted performance, and apply when using 80300A, 80400A, and 80600A Series sensors. Typical performance, (shown in italics), is non-warranted.

## METER

**Frequency Range:** 10 MHz to 40 GHz [10]

**Power Range:** -70 dBm to +47 dBm (100 pW to 50 Watt) [10]

**Single Sensor Dynamic Range:**[10]

| | |
|---|---|
| CW Power Sensors: | 90 dB |
| Peak Power Sensors: | 40 dB, Peak 50 dB, CW |
| Modulation Power Sensors: | 87 dB, CW |
| | 80 dB, MAP/PAP [11] |
| | 60 dB, BAP [11] |

**Display Resolution:** User selectable from 1 dB to 0.001 dB in Log mode, and from 1 to 4 digits of display resolution in Linear mode.

### Meter Functions

**Measurement Modes (Sensors):**
CW (80300A, 80350A, 80400A, 80600A, and Series)
Peak (80350A Series)
MAP/PAP/BAP [11] (80400A and 80600A Series)

**Averaging:** User selectable, auto-averaging or manual from 1-512 readings.

**dB Rel and Offset:** Power display can be offset by -99.999 to +99.999 dB to account for external loss/gain.

**Configuration Storage Registers:** Allows up to 20 front panel setups.

**Power Measurements and Display Configurations:** Any two of the following channel configurations, simultaneously: A, B, A/B, B/A, A-B, B-A, DLYA, DLYB

## ACCURACY

**Calibrator:**Power Sweep calibration signal to dynamically linearize the sensors (Type N connector).

**Frequency:** 50 MHz, nominal

**0.0 dBm Accuracy:** ±1.2% worst case for one year, over temperature range of 5° to 35°C.

**VSWR:** <1.05 (Return Loss >33 dB)

**Instrumentation, Relative to 0 dBm:**
±0.02 dB over any 20 dB range from -70 to +16 dBm.
±0.02 dB + (±0.05 dB/dB) from +16 to +20 dBm.
±0.04 dB from -70 to +16 dBm.

**Temperature Coefficient of Linearity:** <0.3%/°C temperature change following Power Sweep calibration. 24 hour warm-up required.

**Zeroing Accuracy:** (CW)

**Zero Set:** 12 <±50 pW, <±100 pW with 80400A and 80600A Series Modulation Power Sensors.

**Zero Drift:** 12 <±100 pW during 1 hour

**Noise:** <±50 pW, <±100 pW with 80400A and 80600A Series Modulation Power Sensors. <±200 pW with 80700A Series Sensors, measureable over any 1 minute interval 3 standard deviations.

## REMOTE INPUTS/OUTPUTS

**V Prop F Input (BNC):** Used to correct power readings for sensor frequency response using source VpropF output. [13]

**Analog Output (BNC):** Provides an output voltage of 0 to 10V for Channels 1 and 2 in either Lin or Log units. [13] Does not operate in Swift or Buffered modes.

**Blanking Output (BNC):** TTL High during power meter zero. Can be used to shut off signal generator RF output during sensor zero.

**Trigger Input (BNC):** TTL trigger input signal for Swift and Fast Buffered modes.

**GPIB Interface:** IEEE-488 and IEC-625 remote programming.

## GENERAL SPECIFICATIONS

**Temperature Range:**
**Operating:** 0° to 50°C (+32° to +122°F)
**Storage:** -40°C to 70°C (-40° to +158°F)

**Power Requirements:**
100/120/220/240V ±10%,
48 to 440 Hz, 25VA typical

**Physical Characteristics:**

**Dimensions:** 215 mm (8.4 in) wide, 89 mm (3.5 in) high, 368 mm (14.5 in) deep

**Weight:** 4.55 kg (10lbs)

## ORDERING INFORMATION

### POWER METERS

| | |
|---|---|
| 8541C | Single Input Universal Power Meter (includes 1 sensor cable) |
| 8542C | Dual Input Universal Power Meter (includes 2 sensor cables) |

### ACCESSORIES

One manual, one power cord, detachable sensor cables.

### POWER METER OPTIONS

01 Rack mount kit
02 Add 256K buffer for Fast Buffered Mode Power Readings Stores up to 128,000 readings
03 8541C Rear Panel Sensor and Calibrator Connections
04 8542C Rear Panel Sensor and Calibrator Connections
05 Soft Carry Case
06 Second Analog Output, -10V to +10 V
07 Side Mounted Carrying Handle
08 Transit Case, (Includes Soft Carry Case)
09 Dual Rack Mount Kit (with assembly instructions)
10 Dual Rack Mount Kit (factory assembled)
11 Time Gating
13 8541C Rear Panel Sensor Connector Only
14 8542C Rear Panel Sensor Connector Only

SPANAWAVE

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[10] Depending on sensor used. [11] MAP (Modulated Average Power), PAP (Pulse Average Power), BAP (Burst Average Power). [12] Specified performance applies with maximum averaging and 24 hour warm-up at constant temperature. [13] Operates in Normal Mode only.

Specifications subject to change without notice.

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