4530 SERIES RF POWER METER

4530 Series RF Power Meter

PEAK POWER

FREQUENCY RANGE: 50MHz TO 40GHz

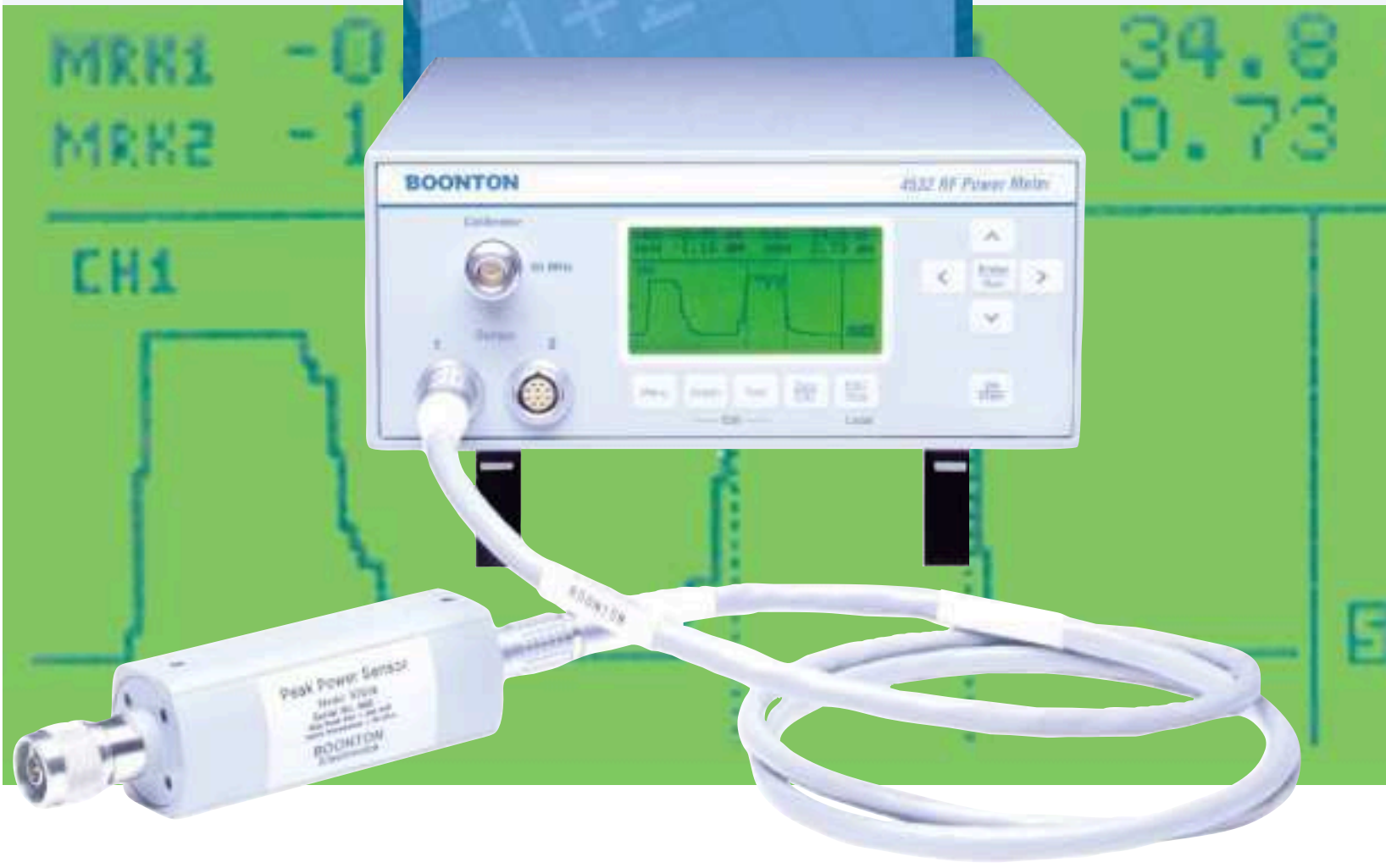
DYNAMIC RANGE: >60dB

BANDWIDTH: 20MHz

CW POWER

FREQUENCY RANGE: 10kHz TO 40GHz

DYNAMIC RANGE: 90dB



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The 4530 Series: Measure peak

THE 4530 SERIES RF POWER METERS: ACCURACY AND SPEED FOR PRODUCTION TEST

Boonton's 4530 Series RF power meters combine the accuracy of a laboratory-grade instrument with the speed required for production test. They employ proprietary measurement techniques that accurately measure digitally-modulated signals, *faster*, than any other RF power meters on the market. So whether you're measuring CW power or the peak power of W-CDMA or HDTV signals, Boonton's single-channel Model 4531 and dual-channel Model 4532 are the logical choice for high-volume production test.

MORE THAN POWER ALONE

The 4530 is more than a simple RF power meter. It measures CW power, peak power, voltage, and performs statistical power analysis (CDF and PDF) as well. The 4530 is compatible with all Boonton RF power and voltage sensors too, from coaxial dual-diode types, to thermal sensors, for measurements up to 40 GHz. Sensor set-up is easy and accurate too, since calibration and set-up data are automatically downloaded from the sensor, as soon as it's plugged in.

The 4530 provides seamless CW power measurement over its broad dynamic range—without the interruptions and nonlinearities caused by range changes required by lesser power meters. Our thermal and peak-power sensors never need range switching, and even our CW diode sensors—with 90 dB dynamic range—use only two widely overlapping ranges.

FUTURE PERFECT

The 4530 measures the precise peak and average power of today's complex digitally-modulated carriers...and those of tomorrow as well. Modulation bandwidths up to 20 MHz are within the range of the 4530, which makes it the best choice for measuring CDMA, W-CDMA, CDMA2000, TDMA, GSM, GSM-EDGE, GPRS, OFDM, HDTV, and UMTS with the flexibility to accommodate new modulation schemes in the future. The 4530 displays periodic and pulse waveforms in graphical format, and a host of automatic measurements characterize the time and power profiles of the pulse. Powerful triggering, effective sampling rates up to 50 MSamples/sec. and programmable cursors give you instantaneous power

k and average power together.

measurements at precise time delays from the pulse edge. With an internal or external trigger you can perform time-gated or power-gated peak and average power measurements as well. Triggering can be synchronous or asynchronous. Display can be adjusted to pre-trigger or post-trigger to view any portion of the waveform.

For CDMA or other spread-spectrum signals, the 4530's powerful statistical analysis mode allows full profiling of power probability at all signal levels. The 4530 makes even these complex measurements fast, thanks to sustained acquisition rates above 1 MSample/sec. and smooth, range-free operation that allows a representative population to be acquired and analyzed rapidly.

RELIEF FOR AMPLIFIER DESIGNERS

The random and infrequent nature of power peaks makes them almost impossible to detect and measure with conventional power meters. That means you'll never know how an amplifier will perform in the field when driven into compression by these fleeting peaks–until it's too late. The 4530 gives you this critical information by analyzing the probability-of-occurrence near the point of absolute peak power, then detecting and analyzing the data with the high accuracy required to realistically evaluate an amplifier's performance. And with its extremely wide video bandwidth, the 4530 detects even the narrowest peaks.

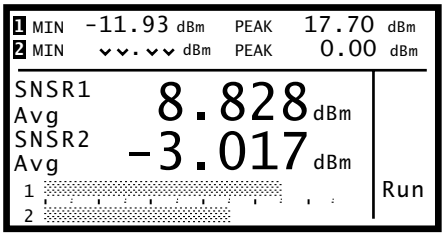
The 4530's powerful dual-processor architecture enables comprehensive measurements with unprecedented speed and performance. It eliminates the speed tradeoffs between data acquisition and output via GPIB that are a fact of life with other power meters. A high-speed, floating-point digital signal processor (DSP) performs the measurements, gathers and processes the power samples from the sensors, time-stamps the measurements, and provides linearity correction, gain adjustment and filtering—all in less than a microsecond.

The processed measurements are then passed to a dedicated, 32-bit I/O processor that sends them to the LCD display and over RS-232 or GPIB interfaces when formatted measurements are required. Programming is easier as well, thanks to comprehensive use of the industry standard SCPI command syntax.

MODULATED AVERAGE POWER, PEAK POWER AND MORE

Using Boonton Peak Power sensors, the 4530 Series can measure the true average power of modulated waveforms, while providing important information about the instantaneous peak power missing in other power meters using "universal" power sensors.

The absolute peak power and crest factor are available, plus the held minimum and maximum average powers for viewing long-term trends.



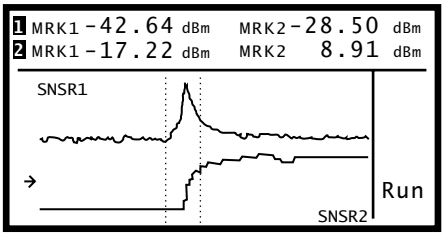
The MODULATED mode text display, showing the true average power for both channels, plus their tracking instantaneous peak and minimum values.

And Boonton's exclusive peak tracking mode allows short term crest factor measurements to be made on real signals without the need to manually reset the held peak every time the signal level changes.

A flexible text display shows the measurements for one or both channels, and a "chart recorder" display of average power may be displayed graphically.

CONTINUOUS OR PULSE MEASUREMENTS

In many of today's digital modulation formats, the data is transmitted in short bursts, and the RF carrier is then switched off to allow other users to occupy the same channel (often known as time division multiple access, or TDMA). In these signals, there are important restrictions not only on the power of the burst, but also on the edge positions within a data frame and the slopes of those transitions.



The PULSE mode graph display allows the measured waveforms to be shown in a real-time "oscilloscope" format, which can be zoomed or panned as desired.

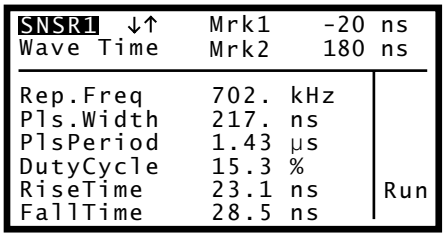
The 4530's Pulse Mode provides the solution today's engineers need for characterizing all types of communication signals where not only the RF power, but the timing of that power is important.

Pulse Mode is designed to feel familiar to most engineers and technicians - the instrument can be operated in much the same way as a digital oscilloscope. Flexible timebase and triggering capabilities allow you to quickly view and measure pulse or burst waveforms.

Common pulse power and timing measurements can be set up and performed automatically by the instrument, or can be defined manually for optimum flexibility.

Two programmable cursors can be used to measure instantaneous power at two time offsets relative to the trigger, or to define a time interval, also known as a "time gate," over which average and peak power measurements may be made.

The pulse average and peak power, width, frequency, and edge transition times are just a few of the many automatic measurements performed.



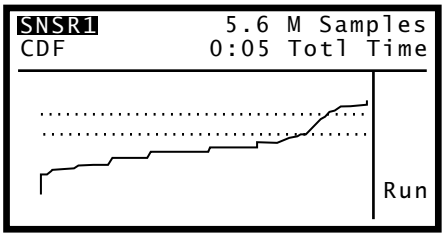
The PULSE mode text display can page through a series of automatic measurements of commonly needed pulse parameters.

HIGH-SPEED STATISTICAL MEASUREMENTS

In addition to its industry-leading performance with pulse and burst modulated signals, the 4530 Series offers the only true solution for characterizing nonperiodic signals such as CDMA and HDTV. These wideband signals are often noise-like, with many brief peaks that vary in magnitude and frequency of occurrence.

Measuring the average power of a spread spectrum signal does little to indicate how well an amplifier is coping with these peaks. Even adding a crest factor display only gives information about the highest peak (which by definition, only occurs once, and is of little value in predicting error rate).

The only way to accurately characterize these signals is to build a very large population of power samples in a short time, and analyze the statistical probability of occurrence of each power level.



The Cumulative Distribution Function (CDF) plots the probability of occurence of all power levels in a group of power samples.

The Cumulative Distribution Function, or CDF, displayed by the 4530 plots the probability that the power will be at or below a specified level. By examining the areas close to 100% probability, it is possible to see how often the highest peaks occur. It is easy to see amplifier compression under actual operating conditions, and to predict the effect on error rate that this may have.

The 4530's Statistical Mode allows you to place one or two vertical or horizontal cursors on the plot, and read the percent

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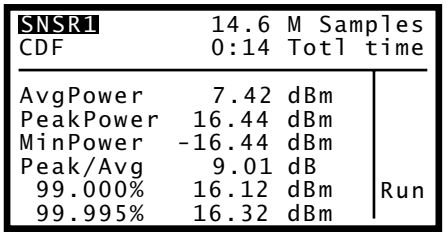
probability for a particular power level, or the power at a probability. And of course the accumulated average, peak and minimum powers for the entire population may be displayed.

As with all measurement modes, the graph display includes complete pan and zoom ability, and can present the data in CDF, CCDF or distribution (histogram bar) formats.

WIDEBAND CDMA POWER

The 4530's wide bandwidth, high speed sampling and digital signal processing speed allows fast and accurate characterization of current and future CDMA2000 and WCDMA formats.

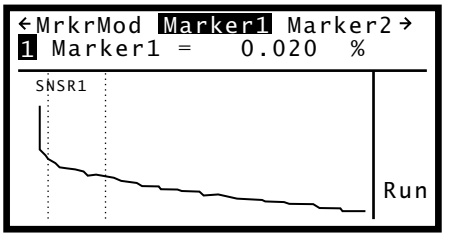


The 4530 Series' Statistical Mode displays the full set of statistical calculations for the entire population.

No other power meter offers the wide bandwidth of the 4530 series–up to 20 MHz. And only Boonton's innovative sensor architecture allows measurement of the ENTIRE dynamic range of a signal without range switching and its associated bandwidth limiting as the signal level changes.

This allows modulated and peak measurements of wide dynamic range signals, but is doubly important for statistical measurements, since changing the range and bandwidth for a portion of samples would invalidate the statistical properties of the entire sample population, and render the measurements meaningless.

In addition to bandwidth, the 4530's high sustained sampling and processing speed ensures that few of the narrow peaks of wideband signals will fall between samples, and a representative population can be acquired in seconds.

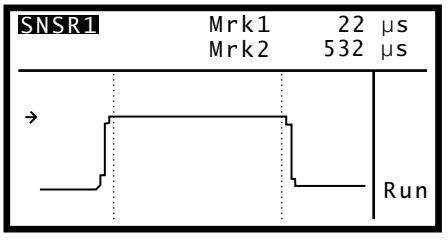


Viewing statistical data in the CCDF presentation allows close examination of the probability of very infrequent peaks that approach the absolute peak power.

GSM AND BEYOND

The standard GSM signal uses a digitally modulated burst to transmit data. Each user is allocated one of eight "timeslots," and must only transmit within its assigned timeslot. In addition to controlling power when on, an on/off ramp profile must be carefully followed to avoid interference with other users.

The 4530's pulse mode is ideal for measuring all power and timing parameters of current and future GSM formats. With trigger delay and holdoff, it is possible to synchronize on difficult bursts, and measure power at any instant or over any interval, whether pre- or post-trigger.



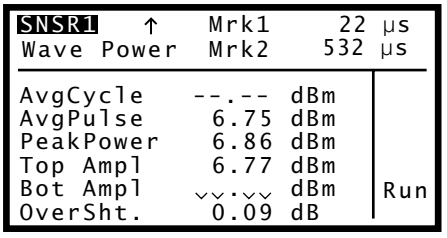
Screen cursors can be easily positioned over the active portion of a single GSM timeslot, allowing measurement of average power and crest factor during this interval.

Two programmable cursors allow power measurements on the active portions of each timeslot, while excluding the transition intervals between, or can be used to examine the ramp profile during timeslot transition intervals. Interval (or "time gated") measurements include average as well as peak and minimum power, so the 4530 Series is ready for even the wideband next-generation GSM formats.

AUTOMATIC TIME GATING

For measurement of single bursts such as the GSM reverse link, the 4530's automatic time gated pulse measurements can be used to quickly measure the "on" power during the active portion of the burst while excluding the edge transitions.

For example, the time gating may be set to measure the burst between the 3% and 97% time points. For a GSM burst (on time about 564µS) this means that the leading and trailing 17µS will be excluded, and the reading will be the average power of the burst during the middle 530µS.



As an alternative to manual cursors, the automatic time gating feature locates the burst start and stop times from the edge transitions, and performs the measurement over a user-defined portion of this time interval.

SPECIFICATION	4530 POWER METER	
Sensor Inputs (Performance depends upon sensor model selected)		
Channels:	Single (4531) and dual (4532) channel versions available	
RF Frequency Range:	Determined by sensor, 10Hz to 40 GHz	
Peak Power Measurement Range:	-40 to +20 dBm	
CW Measurement Range:	-70 to +20 dBm	
Relative Offset Range:	±99.99 dB	
Video Bandwidth:	20 MHz	
Pulse Repetition Rate:	1.8 MHz max.	
Calibration Sources		
Internal Calibrator		
Output Frequency:	50 MHz ±0.005%	
Level:	-60 to +20 dBm	
Resolution:	0.1 dB steps	
Source SWR (Refl. Coeff.):	1.05(0.024)	
Accuracy: 0° to 20°C, (NIST traceable):	+20 to –39.9 dBm	±0.06 dB (1.4%)
	-40 to -60 dBm	±0.09 dB (2.1%)
RF Connector:	Type N	
Trigger (Pulse mode only, signal inputs.)		
Modes:	Pre-trigger and post-trigger	
Internal Trigger Level Range:	Equivalent to -30 to +20 dBm pulse amplitude range.	
External Trigger Level Range:	±5 volts, ±50 volts with 10:1 divider probe.	
External Trigger Input:	1 megohm in parallel with approximately 15pF, dc coupled.	
Connector type:	BNC	
Trigger time resolution:	20 ns	
Trigger Delay Range:	±900 microseconds for timespans 5µs and faster ±4 milliseconds for timespans 10µs to 50µs ±(80*timespan) for timespans 50µs to 2ms ±(30*timespan) for timespans 5ms and slower	
Trigger Holdoff Range:	10 microseconds to 1 second	
Trigger Holdoff Resolution:	1 microsecond	
Sampling Characteristics		
Effective sampling rate:	50 Megasamples per second (each channel, pulse mode)	
Sustained sampling rate:	2.5 Megasamples per second (each channel, pulse mode)	
Measurement Technique:	Continuous and triggered (burst) sampling	
Measurement Characteristics		
Measurements:	Average Power* Maximum Average Power* Minimum Average Power* Maximum Instantaneous (“Peak”) Power* Minimum Instantaneous Power* Peak to Average Power Ratio* Cumulative Distribution Functions: CDF, 1-CDF Probability Distribution (histogram) Power at a percent statistical probability Statistical probability at a power level CW Power RF Voltage	
Channel Math:	Displays the sum or difference between channels or between a channel and a reference measurement (Modulated and CW modes only).	
Trace Averaging:	1 to 4096 samples per data point.	
Panel setup storage:	4 complete setups.	
Measurement rate (via GPIB):	Greater than 200 two-channel measurements per second, neglecting bus master overhead, or 500 single-channel measurements per second.	
Interface		
Video Output:	Detected logarithmic RF envelope for external oscilloscope monitor.	
GPIB Interface:	Complies with IEEE-488.1. Implements AH1, SH1,T6, LE0, SR1, RL1, PP0, DC1, DT1, C0, and E1.	
RS-232 Interface:	Accepts GPIB commands (except bus dependent commands). Provide for user software updates.	
Remote Programming:	SCPI-like and Native Mode commands via GPIB or RS-232 interfaces.	
Software Drivers:	LABVIEW drivers available.	
Environmental Specifications		
General:	Manufactured to the intent of MIL-T28800E, Type III, Class 5, Style E	
CE Mark:	Conforms to European Community (EU) specifications: EN 61010-1(90)(+A1/92)(+A2/95) EN 61010-2-031 EN 61326-1(97) EN 55022(94)(A2/97)ClassB	
Display:	Graphic type LCD, LED backlighted. Text and trace displays.	
Operating Temperature:	0 to 50°C	
Ventilation:	Fan cooled.	
Altitude:	Operation up to 15,000 feet.	
Storage Temperature:	-40 to 75°C	
Humidity:	95% ±5% maximum (non-condensing)	
Power Requirements:	90 to 260 VAC, 47 to 63 Hz, <50 VA, <30 Watts. No voltage switching required.	
Physical Specifications		
Dimensions:	3.5 inches (8.9 cm) high, 8.4 inches (21.3 cm) wide, approx 13.5 inches (34.3 cm) deep, not including feet and connector clearances.	
Weight:	7lbs. (3.2kg)	
Connector location option:	Sensor input(s)and calibrator connector: Front or rear panel.	
Construction:	Surface mount, multi-layer printed circuit boards mounted to rigid aluminum frame and front extrusion/casting with aluminum sheet metal enclosure.	

* All measurements marked with an asterisk (*) may be performed continuously, or in a synchronous, triggered mode. When triggered, these measurements may be made at a single time offset relative to the trigger, or over a defined time interval. The time offset or interval may be before or after, or may span the trigger interval.

Note: Specifications subject to change without notice.

PEAK POWER SENSORS

Model Impedance RF Connector	Frequency Range (Low Bandwidth setting)	Dynamic Range Peak Power Range Internal Trigger Range	Overload Rating Pulse Continuous	Risetime / Bandwidth Sensor Response on 4530 Fast Risetime (Bandwidth)	 Slow Risetime (Bandwidth)	Maximum SWR Frequency	 SWR
DUAL DIODE SENSORS							
57318 50Ω N(M)	0.5 to 18 GHz (0.05 to 18 GHz)	-24 to +20 dBm -10 to +20 dBm	1 W for 1µs 200 mW	<20 ns[1] (20 MHz)	<10 µs (350 KHz)	0.05 to 2 GHz 2 to 6 GHz 6 to 16 GHz 16 to 18 GHz	1.15 1.20 1.28 1.34
57340 50Ω K(M)	0.5 to 40 GHz (0.05 to 40 GHz)	-24 to +20 dBm -10 to +20 dBm	1 W for 1µs 200 mW	<20 ns[1] (20 MHz)	<10 µs (350 KHz)	0.05 to 4 GHz 4 to 38 GHz 38 to 40 GHz	1.25 1.65 2.00
57518 50Ω N(M)	0.1 to 18 GHz (0.05 to 18 GHz)	-40 to +20 dBm -27 to +20 dBm	1 W for 1µs 200 mW	<100 ns (6 MHz)	<10 µs (350 KHz)	0.05 to 2 GHz 2 to 6 GHz 6 to 16 GHz 16 to 18 GHz	1.15 1.20 1.28 1.34
57540 50Ω K(M)	0.1 to 40 GHz (0.05 to 40 GHz)	-40 to +20 dBm -27 to +20 dBm	1 W for 1µs 200 mW	<100 ns (6 MHz)	<10 µs (350 KHz)	0.05 to 4 GHz 4 to 38 GHz 38 to 40 GHz	1.15 1.65 2.00

[1] Models 4400A and 4500A: <15ns, (35 MHz).

CW POWER SENSORS

Model Impedance RF Connector	Frequency Range	Dynamic Range	Overload Rating Pulse Continuous	Maximum SWR Frequency	 SWR
WIDE DYNAMIC RANGE DUAL DIODE POWER SENSORS					
51075 50Ω N(M)	500 kHz to 18 GHz	-70 to +20 dBm	1 W for 1 µs 300 mW	500 kHz to 2 GHz 2 GHz to 6 GHz 6 GHz to 8 GHz	1.15 1.20 1.40
51077 50Ω N(M)	500 kHz to 18 GHz	-60 to +30 dBm	10 W for 1 µs 3 W	500 kHz to 2 GHz 2 GHz to 6 GHz 6 GHz to 18 GHz	1.15 1.20 1.40
51079 50Ω N(M)	500 kHz to 18 GHz	-50 to +40 dBm	100 W for 1 µs 25 W	500 kHz to 2 GHz 2 GHz to 6 GHz 6 GHz to 18 GHz	1.15 1.20 1.40
51071 50Ω K(M)	10 MHz to 26.5 GHz	-70 to +20 dBm	1 W for 1 µs 300 mW	10 MHz to 2 GHz 2 GHz to 4 GHz 4 GHz to 18 GHz 18 GHz to 26.5 GHz	1.15 1.20 1.45 1.50
51072 50Ω K(M)	30 MHz to 40 GHz	-70 to +20 dBm	1 W for 1 µs 300 mW	30 MHz to 4 GHz 4 GHz to 38 GHz 38 GHz to 40 GHz	1.25 1.65 2.00

Frequency calibration factors (NIST-traceable) and other data are stored within all the Peak Power Sensors. Linearity calibration is performed by the built-in calibrator of the peak power meter.

One five-foot long peak sensor cable is included per channel except when one or more CW sensors are ordered with the instrument. In this case a cable with data adapter will be substituted for a peak sensor cable in each instance.

A five-foot long sensor cable is standard. Longer cables are available at a higher cost. Effective bandwidth is reduced with longer cables.

RF VOLTAGE PROBE KITS

Model	Frequency Range	Dynamic Range	Overload Rating	Maximum SWR
952063	10 kHz to 1.2 GHz	200 µV to 10 V	63 VDC or Peak AC 10 VRMS AC continuous	N/A
952064	10 Hz to 100 MHz	200 µV to 10 V	63 VDC or Peak AC 10 VRMS AC continuous	N/A

ADDITIONAL PRODUCTS* AND SERVICES AVAILABLE FROM BOONTON ELECTRONICS CORPORATION

- **Model 4400A/4500A series RF Peak Power Meter/Analyzer** 10 kHz to 40 GHz
- **Model 4230A series RF Power Meter** 10 kHz to 40 GHz
- **Model 4730/5730 series VXI Power Meter** 10 kHz to 40 GHz
- **Model 9230 series RF Voltmeter** 200 µV to 300 V, 10 Hz to 1.26 Hz
- **Model 5230 series Universal RF Power Meter/Voltmeter** 200 µV to 300 V, 10 Hz to 40 GHz
- **Model 92EA RF Millivoltmeter** 200 µV to 300 V, 10 Hz to 1.2 GHz
- **Model 7200 Capacitance Meter** 0 to 2000 pF, 1 MHz, Digital display
- **Model 72B Capacitance Meter** 1 pF to 3000 pF, 1 MHz, Analog display
- **Model 8201 Modulation Analyzer** 100 kHz to 2.5 GHz
- **Model 8701 VXI Modulation Analyzer** 100 kHz to 2.5 GHz
- **Model 1121 Audio Analyzer** 10 Hz to 140 kHz

**Check with factory for availability.*

SERVICE AND SUPPORT YOU CAN COUNT ON

Boonton Electronics backs all of its products with a full range of test, repair, upgrade, and calibration services, assuring that all your instrumentation remains accurate, reliable, and conforms to original factory specifications.

Services include:

- Certified Repairs (NIST Traceable)
- Repair Warranty (6 Months, Materials and Labor)
- Automatic Instrument/Software Upgrades*
- 10-day Turnaround
- Priority Service
- Flexible Service, Repair, and Calibration Contracts

Contact our Customer Service Department at (973) 386-9696 for details and pricing information.

*Available on most models

Your Local Representative:

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