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Boonton

Data Sheet

4500B RF Peak Power Analyzer



Taking performance to a new peak

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4500B RF Peak Power Analyzer

The Boonton Model 4500B is the instrument of choice for capturing, displaying, analyzing and characterizing RF power in both the time and statistical domains. Applications include pulsed RF such as RADAR, TDMA and GSM, pseudorandom or noise-like signals such as CDMA and WLAN and modulated time slotted signals such as GSM-EDGE and TD-SCDMA.



The 4500B features 100 psec timebase resolution, video bandwidth up to 65 MHz (sensor dependent), flexible triggering and greater than 70 dB dynamic range (sensor dependent) without any range switching to cover the most demanding peak power measurement applications. The 4500B also features continuous statistical analysis of power (optional) at acquisition rates up to 25 MSa/s, a text display of up to 15 automatic measurements per channel as well as envelope and persistence views to provide fast in-depth signal analysis. Convenient I/O including USB ports for storing data such as instrument setups, trace waveforms and bitmap image files.

Features

- 8.4" TFT color LCD display
- Displays up to 4 measurement channels, 2 memory channels and 1 math channel simultaneously
- Automatic peak-to-peak, delay-by-time and delay-by-events triggering
- Statistical analysis including gated CCDF and PDF with linear or log presentation (optional)
- Text view of up to 15 time and power measurements per channel
- Envelope, persistence and roll mode displays
- GPIB, USB and LAN
- Peak Power Sensors available with high video bandwidth, fast risetime, and wide dynamic range
- Video bandwidth up to 65 MHz

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High Bandwidth
Peak power meter with video bandwith up to 65 MHz and rise time less than 7 nsec (sensor dependent)

Large Display
View multiple channels and measurements on the 8.4" color TFT display

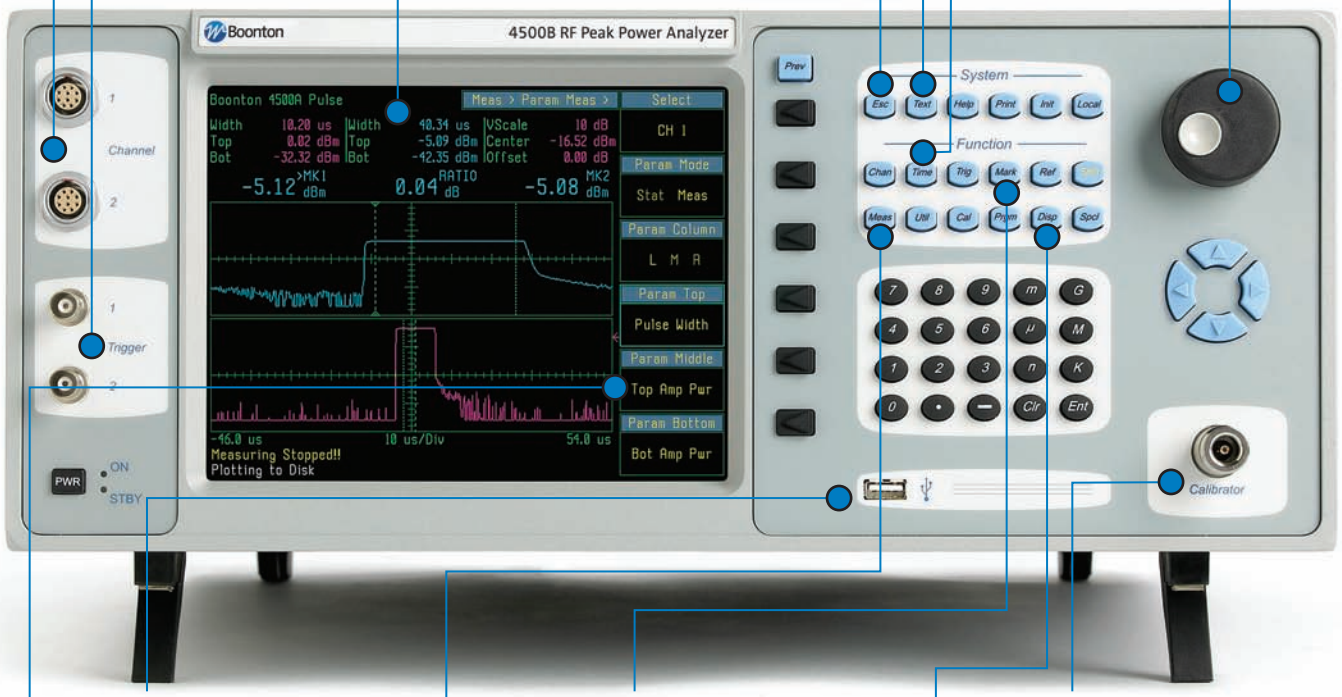
Powerful Automatic Measurements
One button text key automatically displays up to 15 power and time measurements per channel

Interactive Control
Most settings can be selected and updated interactively with instant visual feedback

Dual Trigger System
Internal and external trigger with auto peak-to-peak and B trigger delay by time or events qualifier

Wide Dynamic Range
Peak power sensors are available up to 40 GHz, some with 70 dB dynamic range

Superior Time Capture
View signals from 5 nsec/div to 1 hr/div with 100 psec resolution



Convenient I/O
Windows based connectivity such as USB for data storage directly to a flash drive

Precise Measurements
Markers and time gates allow for the analysis of specific portions of a waveform

Accurate Auto-Calibration Precision
1 GHz RF step calibrator for superior linearity and absolute level accuracy

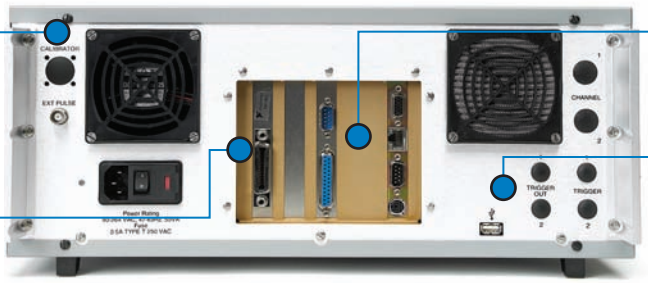
Intuitive User Interface
Easy to navigate, soft menu driven

Fast Data Analysis
Statistical displays of PDF, CDF and CCDF including time-gated analysis (optional)

Clear Views
Persistence, envelope and roll mode displays aid visual analysis

Efficient Design
Power factor corrected power supply and thermostatically controlled, dual-fan cooling system

Remote Control
GPIB with SCPI compliant command set anvd legacy Support



Convenient I/O
Printer ports, external monitor, LAN and USB

Optional Inputs
Replace front panel inputs, optional trigger output

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Superior Time Capture

The Boonton 4500B features a large 8.4″ diagonal TFT color LCD, 640 x 480 pixels, with CCFL backlight for a clear view of up to two live RF channels, two live trigger channels, two stored memory channels and one live math channel simultaneously.

The need to clearly view multiple channels can be invaluable in many applications. The large color display in the 4500B is especially well suited for multiple channel applications. User selectable colors are used to distinguish overlapping traces and to color correlate graphical channel data with its measurements. For example, if the color of the channel 1 is yellow, then the measurements calculated on channel 1 are also yellow. The traces and measurements are clearly marked and color correlated.

The 4500B gives the user the flexibility to customize the display by allowing them to select the measurements or specific parametric settings and measurement indicators they wish to display. These measurements can be grouped to avoid clutter.

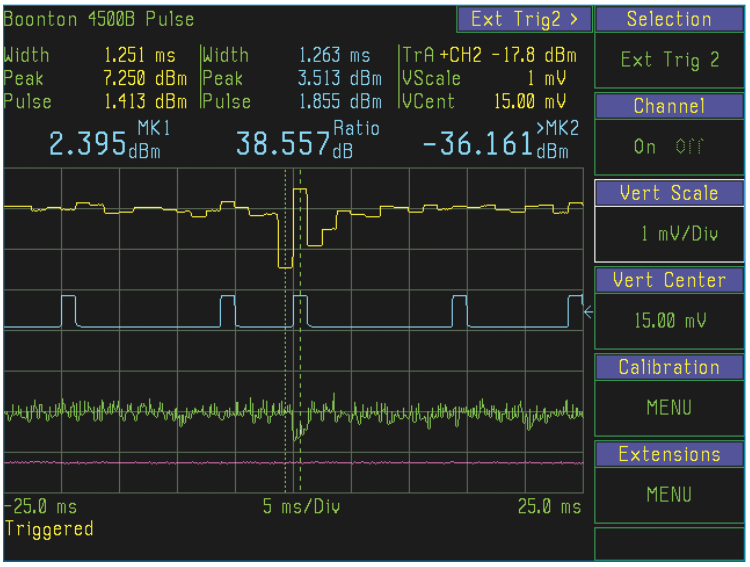


Figure 1: Analysis of CDMA Pulse Train with RF and Trigger Channels Updating Simultaneously

Unique Trigger System

The 4500B features a unique trigger qualifier that allows a user to qualify the trigger on a specific event or a specific delay time allowing a user-selected pulse to be captured, even when its timing is variable. Modern communications signals typically have long frames of data and it is often important to lock a peak power acquisition to a specific time slot or to a specific event within a group. The B trigger qualifier eliminates problematic synchronization issues associated with time jitter within pulse bursts that are often found in UWB and RADAR applications. This qualifier may be set up to 999,999 events or up to 1 second.

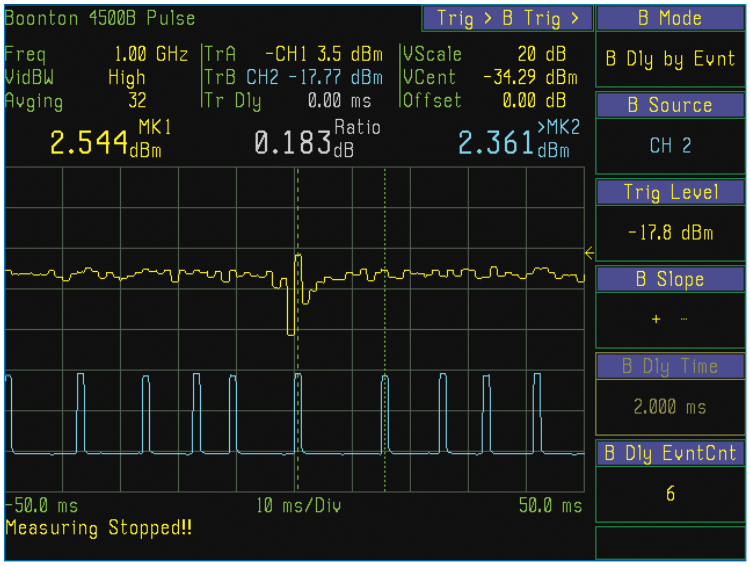


Figure 2: Qualify the Trigger on a Specific Event in CDMA pulse train

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Automatic Analysis

The 4500B provides power-versus-time waveform analysis of repetitive RF signals. Applications include TDMA and GSM, as well as RF amplifier linearity testing, RADAR, satcom, and avionics. The timebase extends to 5 nsec/div and the logarithmic power display will show more than 70 dB dynamic ranges at the same time.

Peak power sensors are available that feature <7 nsec risetime (video bandwidth up to 65 MHz) and dynamic range of 70 dB (pulse mode) or 80 dB (modulated mode). These sensors have been optimized for use with the 4500B and are ideal for measuring RADAR or signals in 3G and future 4G wireless systems that use complex modulation such as OFDM.

Two adjustable markers can read the power at any point across the waveform. In addition, the markers can be used to define the portion of the waveform in which the maximum power, minimum power, long term average power and peak to average ratios are measured. This is especially useful for characterizing the power level over a portion of the top of a pulse. An auto measure function measures and calculates 15 common power and timing parameters. All parameters for up to four active channels are summarized in a Text display and are also available as user defined display parameters above the Graph display.

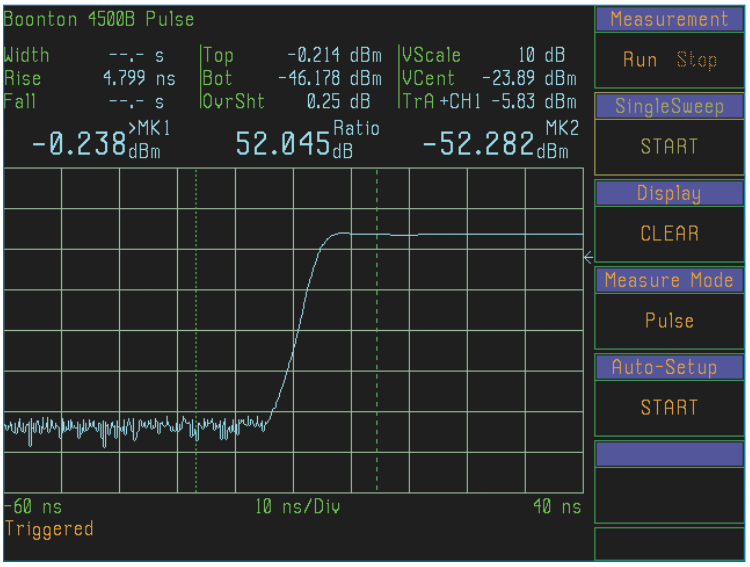


Figure 3: Pulsed RF including width, rise time & fall time measurements

Powerful Statistical Analysis

The 4500B features optional probability density functions (PDF) and cumulative distribution functions (CDF, CCDF) to accurately characterize noise-like RF such as CDMA, HDTV and WLAN. These statistical functions build and analyze a very large population of power samples continuously at a rate of up to 25 MHz or triggered up to 50 MHz on two channels simultaneously. These functions are fast, accurate and allow the measurement of very infrequent power peaks for a user-defined population size or acquisition interval. Although the programmable acquisition time can be very long or continuous, even short runs can resolve very low probabilities, due to the extremely high sample throughput.

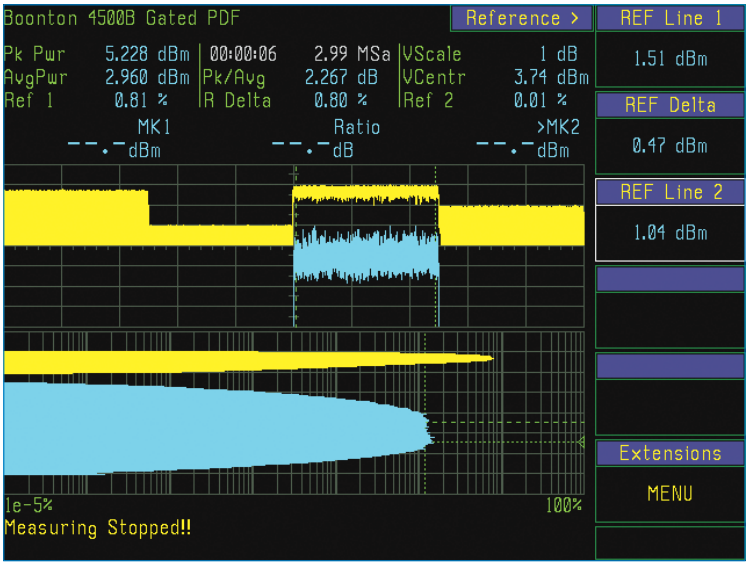


Figure 4: Analyze CDMA timeslots with time gated probability density function (PDF)

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Specifications

Sensor Inputs*

RF Frequency Range	1 MHz to 40 GHz
Pulse Measurement Range	-50 to +20 dBm
Modulated Measurement Range	-60 to +20 dBm
Relative Offset Range	±100.00 dB
Logarithmic Vertical Scale	
0.1 to 50 dBm/div	in 1-2-5 sequence
0.1 to 50 dBV/div	in 1-2-5 sequence
0.1 to 50 dBmV/div	in 1-2-5 sequence
0.1 to 50 dBuV/div	in 1-2-5 sequence
Linear Vertical Scale	
1 nW/div to 50 MW/div	in 1-2-5 sequence
1 mV/div to 50 kV/div	in 1-2-5 sequence
Video Bandwidth	65 MHz
Rise Time	<7 nsec
Single-Shot Bandwidth	5 MHz (based on 10 samples per pulse)
Pulse Repetition Rate	50 MHz max
Minimum Pulse Width	6 nsec

* Specifications sensor model dependent

Time Base

Time Base Range	5 nsec/div to 1 hr/div
Time Base Accuracy	0.01%
Time Base Resolution	100 psec
Time Base Display	Sweeping or roll mode

Statistical X-Axis (optional)

Scale	Linear or logarithmic, 1 to 7 cycles
Linear Ranges	0.1%/div to 10%/div
Linear Offset	0 to 99.9%, 0.1% resolution
Log Range	1e-9% to 100%

Calibration Source

Operating Modes	CW, internal or external pulse
Frequency	1.024 GHz ± 0.01%
Level Range	-50 to +20 dBm
Resolution	0.1 dB
Output VSWR	1.20 maximum
Absolute Accuracy	±0.065 dB (±1.5%) at 0 dBm
Accuracy vs Level	add ±0.03 dB per 5 dB increment from 0 dBm
Preset Internal Pulse Period	0.1 or 1 or 10 msec
Preset Internal Pulse Duty Cycle	10% to 90% in 10% increments
Variable Pulse On Time	7 usec to 65.535 msec in 1 usec steps
Variable Pulse Period	28 usec to 131.072 msec in 2 usec steps Off-time limits - within 7 usec to 65.535 msec
Pulse Polarity	+ or –
RF Connector	Precision type N
External Pulse Input	Rear panel BNC, TTL level compatible

Auto-Calibration

The calibrator is used to automatically generate linearity calibration data for peak power sensors.

Measurement System

Sensor Inputs	One or two sensor measurement channels.

Measurement Technique

Random repetitive sampling system that provides pre and post trigger data as well as statistical histogram accumulation.

Maximum Sampling Rate

50 Mega-samples/second on up to four channels simultaneously. (Equivalent effective sampling rate of 10 Giga-samples/second)

Memory Depth	256K samples per channel at max sampling rate
Vertical Resolution	14-bit A/D Converter
Waveform Averaging	1 to 16,384 samples per data point (time domain measurement)
Number of Histogram Bins	16,384
Size of Sample Bins	32-bits (4,000 mega-samples)
Bin Power Resolution	<0.02 dB

Statistical Acquisition (optional)

Modes	Continuous or gated by pulse mode time markers
Sampling Rate	25 Mega-samples/second on 2 channels simultaneously.
Limit Count	Adjustable, 2–4096 Megasamples
Limit Time	`3600 seconds (appr. 2.5 min. at full sample rate)
Terminal Action	Stop, flush and restart or decimate performance

System Displays

Display Type

Power versus time (pulse mode), Power versus time (modulated mode), External trigger versus time (pulse mode), Auto-measure text (all modes), Help text (all modes), Reports (sensors, configuration, calibrator, files, stored waveforms, GPIB commands, GPIB buffers)

Statistical Display Type (optional)

Cumulative Distribution Function (CDF), Complementary Cumulative Distribution Function (CCDF), Split screen, gated CCDF and power versus time (pulse mode,CCDF), Distribution function (histogram), External trigger statistical (statistical mode), Auto-measure text (statistical mode)

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Trigger

Trigger Source	
Channel 1 (internal), Channel 2 (internal, with optional channel 2)	
External trigger 1, External trigger 2 (with optional channel 2)	
Trigger Slope	+ or –
Trigger Delay Range	
Time base setting Delay range;	pre trig(-), post trig(+)
5 nsec to 500 nsec	-4 msec to +100 msec
1 usec to 10 msec	±4000 divisions
20 msec to 3600 sec	-40 to +100 sec
Trigger Delay Resolution	0.02 divisions
Trigger Hold-off Range	0.0 – 1.0 sec
Trigger Hold-off Resolution	10 nsec
Trigger Mode	Normal, auto, auto peak-to-peak, free Run
B Trigger Mode	A only, B delay-by-time, B delay-by-events specs
B Trigger Source	Chan 1, chan 2, ext trig 1, ext trig 2
B Trigger Slope	+ or –
B Trigger Events Counter Range	1 to 999,999 events
B Trigger Time Delay Range	0.0 – 1.0 sec
B Trigger Time Delay Resolution	10 nsec
Internal Trigger Level Range	-40 to +20 dBm (sensor-dependent)
External Trigger Level Range	±5 volts, ±50 volts
External Trigger Input	1M or 50 ohm, DC Coupled

Pulse and Modulated Mode Marker Measurements

Markers (Vertical Cursors)	Settable in time relative to the trigger position
Marker Independently	Power at specified time
Pair of Marker:	
Power at two specified times with ratio or average power between them. The minimum and maximum power between the markers and the ratio or average power between them. The average power, peak power (hold) and peak-to average power ratio between the markers.	
Lines (Horizontal Cursors)	Settable in power
Automatic Tracking	
Intersection of either marker and the waveform. Either marker and pulse distal, mesial or proximal levels.	

Statistical Mode Marker Measurements (optional)

Markers (Vertical Cursors)	Settable in percent (distribution functions)
Each Marker Independently	Power at specified percent
Pair of Markers	
Power ratio at two specified percents. Statistical analysis between markers (using triggered statistical mode)	
Ref Lines (Horizontal Cursors)	Settable in power
Automatic Tracking	
Set to track the intersection of either marker and the distribution function measure percent probability at a defined power level.	

Pulse Mode Automatic Measurements

Pulse width	Pulse rise-time
Pulse fall-time	Pulse period
Pulse repetition frequency	Pulse duty cycle
Pulse off-time	Peak power
Pulse power	Percent overshoot
Average power	Top level power
Bottom level power	Edge delay
Pulse edge skew between channels	

Statistical Mode Automatic Measurements (optional)

Peak power	Average power
Minimum power	Peak to average ratio
Dynamic range	Percent at reference lines
Power at markers (absolute or normalized)	
Total time (indicated)	
Total number of samples (indicated)	

Waveform Storage

Storage Locations	
Waveforms & distribution functions can be saved to and recalled from internal storage locations and removable file-based memory devices.	

External Interfaces

GPIB	Programmable interface; complies with SCPI ver. 1990
RS-232C Interface 1	Serial printer/plotter interface
RS-232C Interface 2	Diagnostic interface
USB	General purpose i/o interface
LPT1	Parallel printer/plotter (Centronics type)
LAN (optional)	Ethernet port.

Other Characteristics

Display	8.4″ Diagonal TFT color LCD, 640 x 480 pixels, With CCFL Backlight.
Main Computer	Pentium based architecture
Hard Disk	Internal EIDE 40 Gbytes
Acquisition Engine	
32-bit Floating Point DSP in each installed channel CE Mark Compliance for use in the European Union	
Operating Temperature:	0 to 50º C
Power Requirements	90 to 260 VAC, 47 to 63 Hz, 120W
Dimensions (HWD)	19″ rack-mountable; 7.0″ x 17.5″ x 19.5″ (17.8 cm x 44.5 cm x 49.5 cm)
Weight	25 lbs (11.4 kg)

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Ordering information

4500B	RF Peak Power Analyzer, single channel, front panel inputs.
-01	Dual channel, front panel inputs
-02	Single channel, rear panel inputs
-03	Dual channel, rear panel inputs
-06	Trigger outputs (rear panel only)
-07	Calibrator, rear panel output
-10	Statistical package (includes gated CCDF and PDF)
-11	LAN remote control
-15	Removeable flash drive (replacing HD)
-30	Warranty extended to 3 years
97103101A	Spare Removable Solid State Hard Drive with image (requires option -15)
57006	Peak power sensor*
59318	Peak power sensor*
59340	Peak power sensor*

* More sensors available

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