specs

4500B

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 greater than 35 MHz (sensor dependent), flexible triggering and greater than 60 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 bit map 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

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4500B RF PEAK POWER ANALYZER

Peak Power Analyzer

Large Display: View multiple channels and measurements on the 8.4 Inch Color TFT display

Wide Dynamic Range: Peak power sensors are available from 1 MHz to 40 GHz, some with greater than 60 dB dynamic range

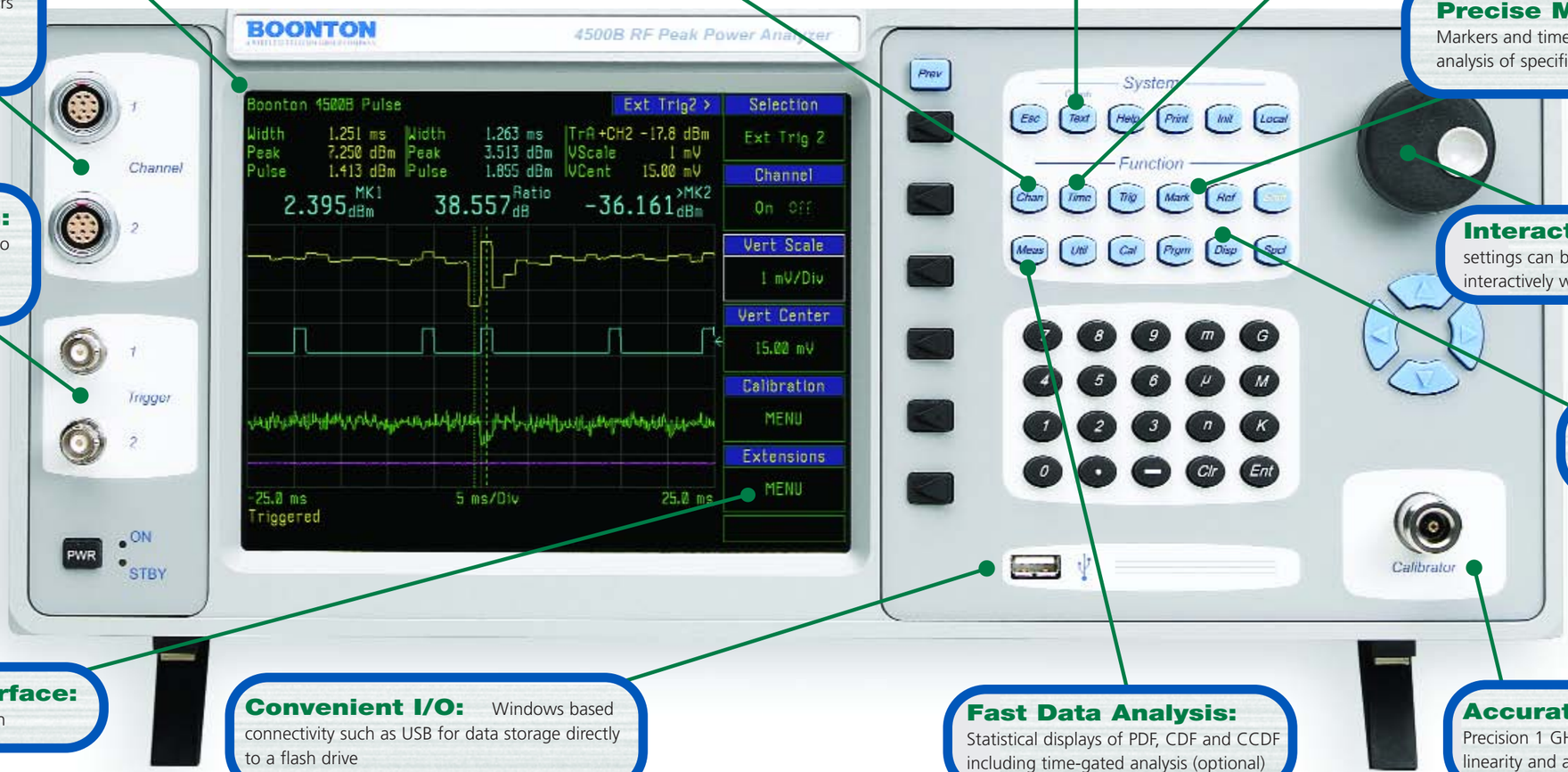
Powerful Automatic Measurements: One button text key automatically displays up to 15 power and time measurements per channel

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

High Bandwidth Sensors: Peak power sensors are available, some with video bandwidth greater than 35 MHz and risetimes less than 15 ns

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

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



Intuitive User Interface: Easy to navigate, soft menu driven

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

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

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

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

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

Capture Multiple Channels, Marker Measurements, Automatic Measurements and Status in One Display

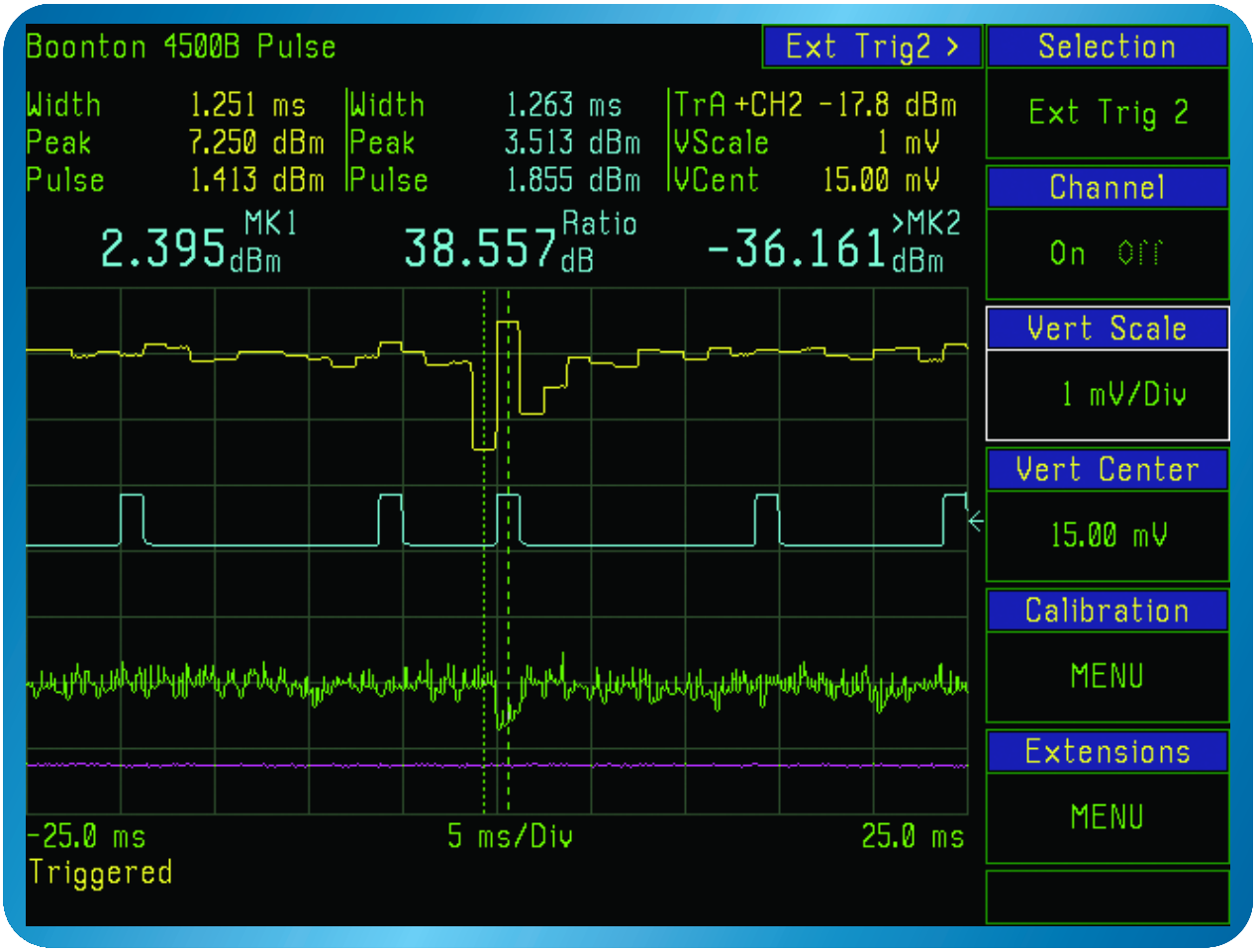


Figure 1: Analysis of CDMA Pulse Train with RF and Trigger Channels Updating Simultaneously

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.

Capture a Signal Based on a User-Selected Pulse or Time Delay

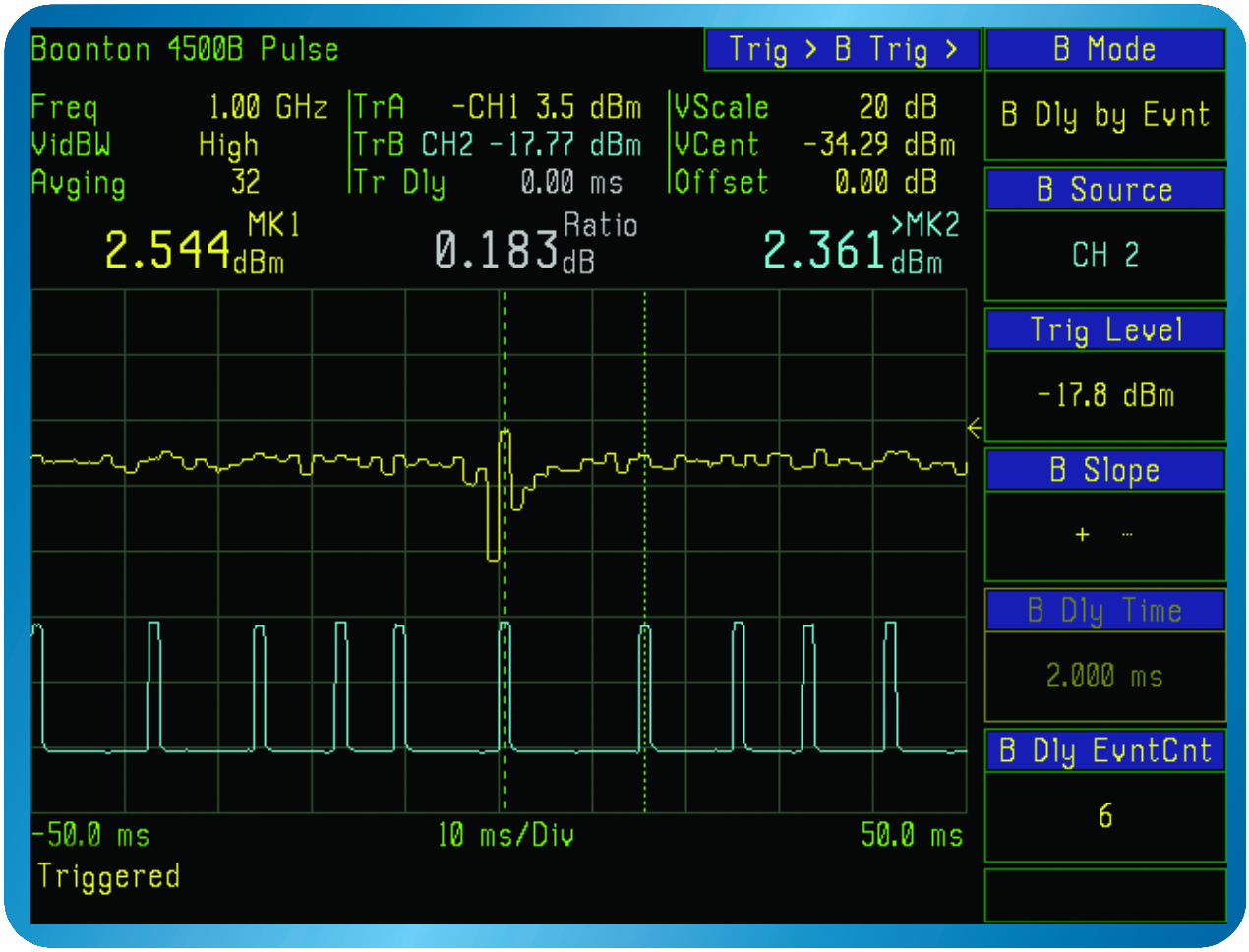


Figure 2: Qualify the Trigger on a Specific Event in CDMA pulse train

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.

Display the Envelope of Your Signal and Quickly Analyze the Peaks

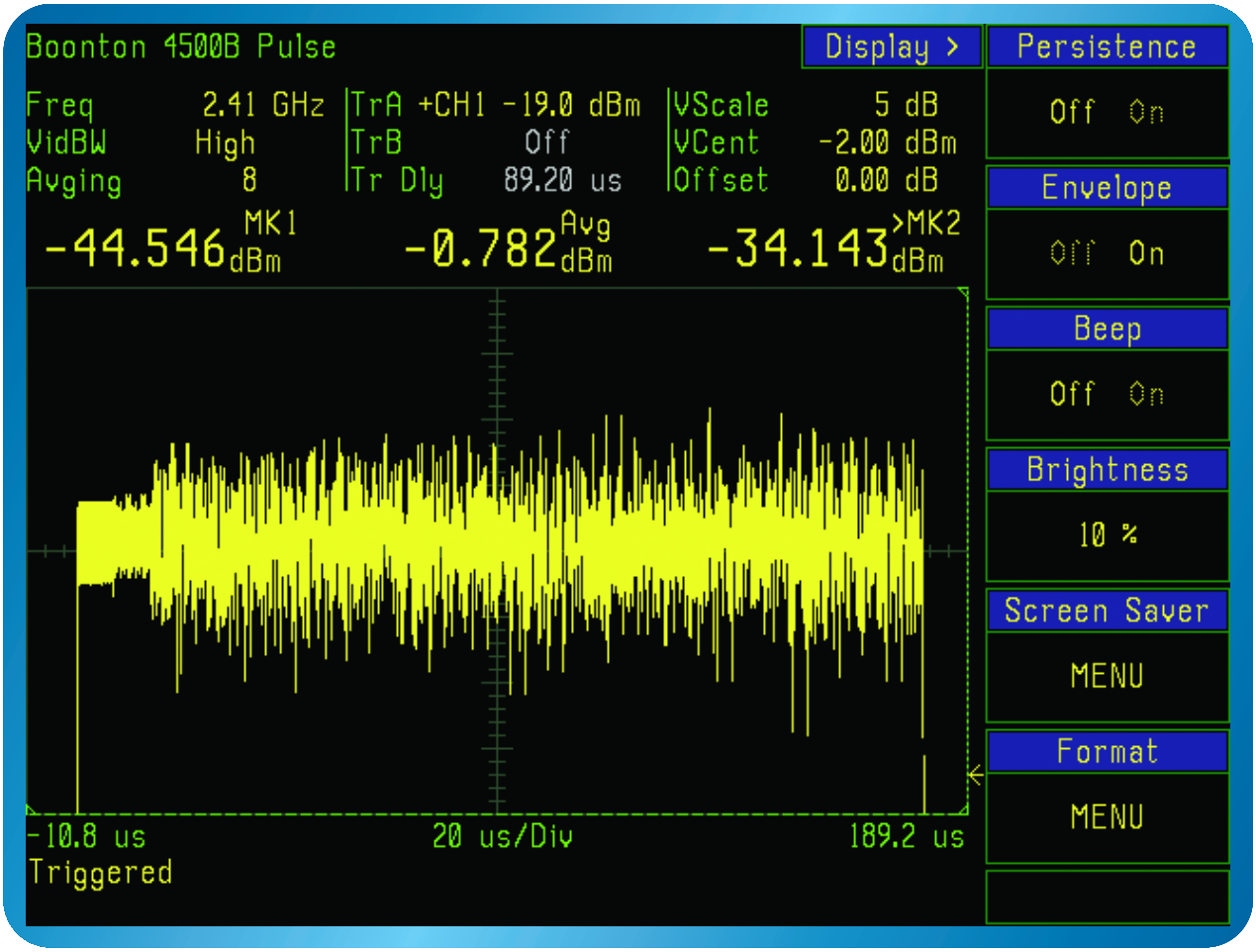


Figure 3: Envelope of 802.11 WLAN Signal

The 4500B features persistence and envelope displays to aid in the analysis of noise-like signals with complex modulation schemes such as WLAN and CDMA. Persistence and envelope displays provide a fast view of the maximum and minimum excursions of the signal under test. These display modes provide a clear, large screen representation of changing signals. The combination of a large 8.4" diagonal color display with persistence and envelope displays make viewing signals far easier than with traditional bench-top power meters.

Analyze Your Signal with Automatic Measurements and Markers

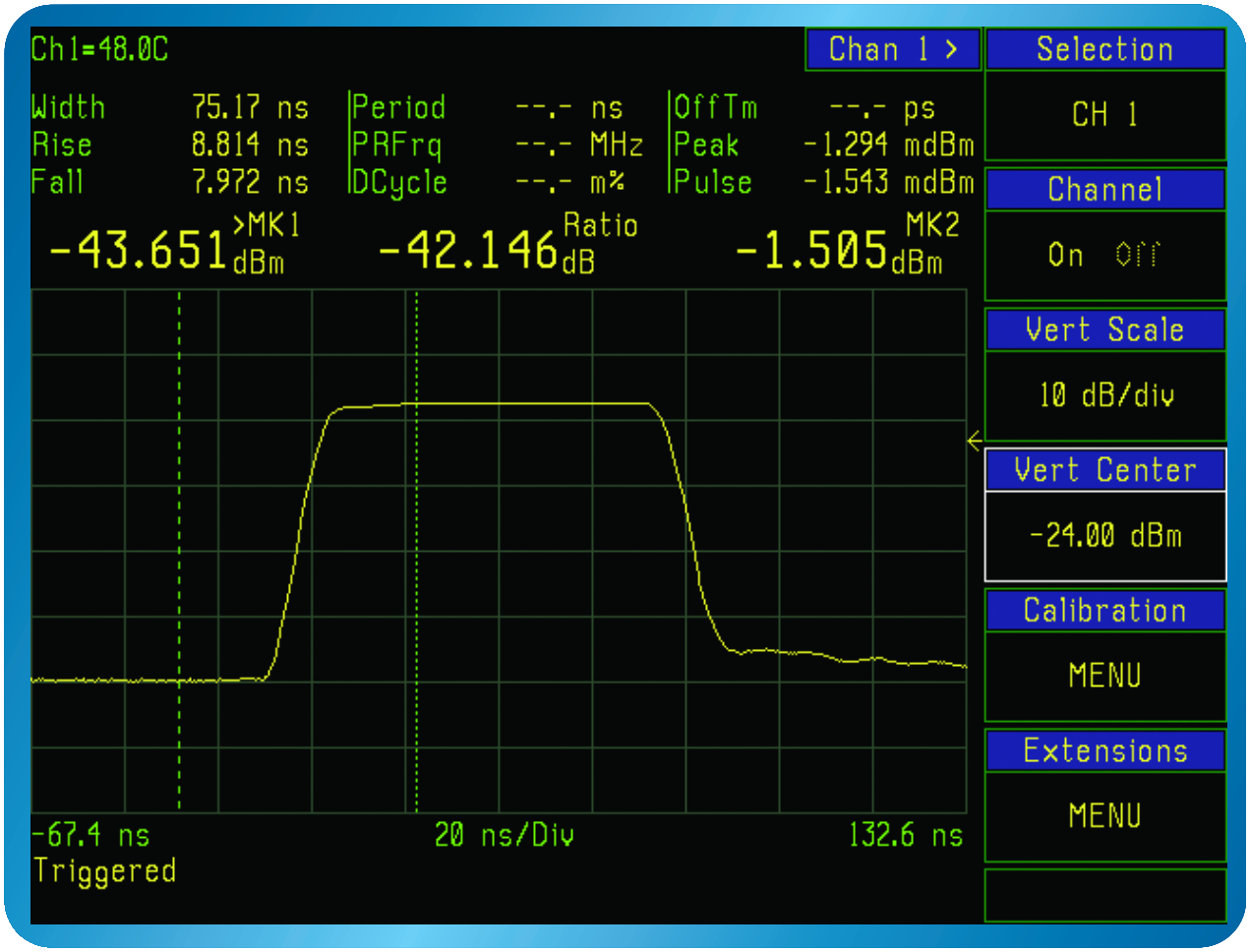


Figure 4: Pulsed RF including width, rise time and fall time measurements

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 60 dB dynamic range.

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.

Analyze Your Signal with Channel Math

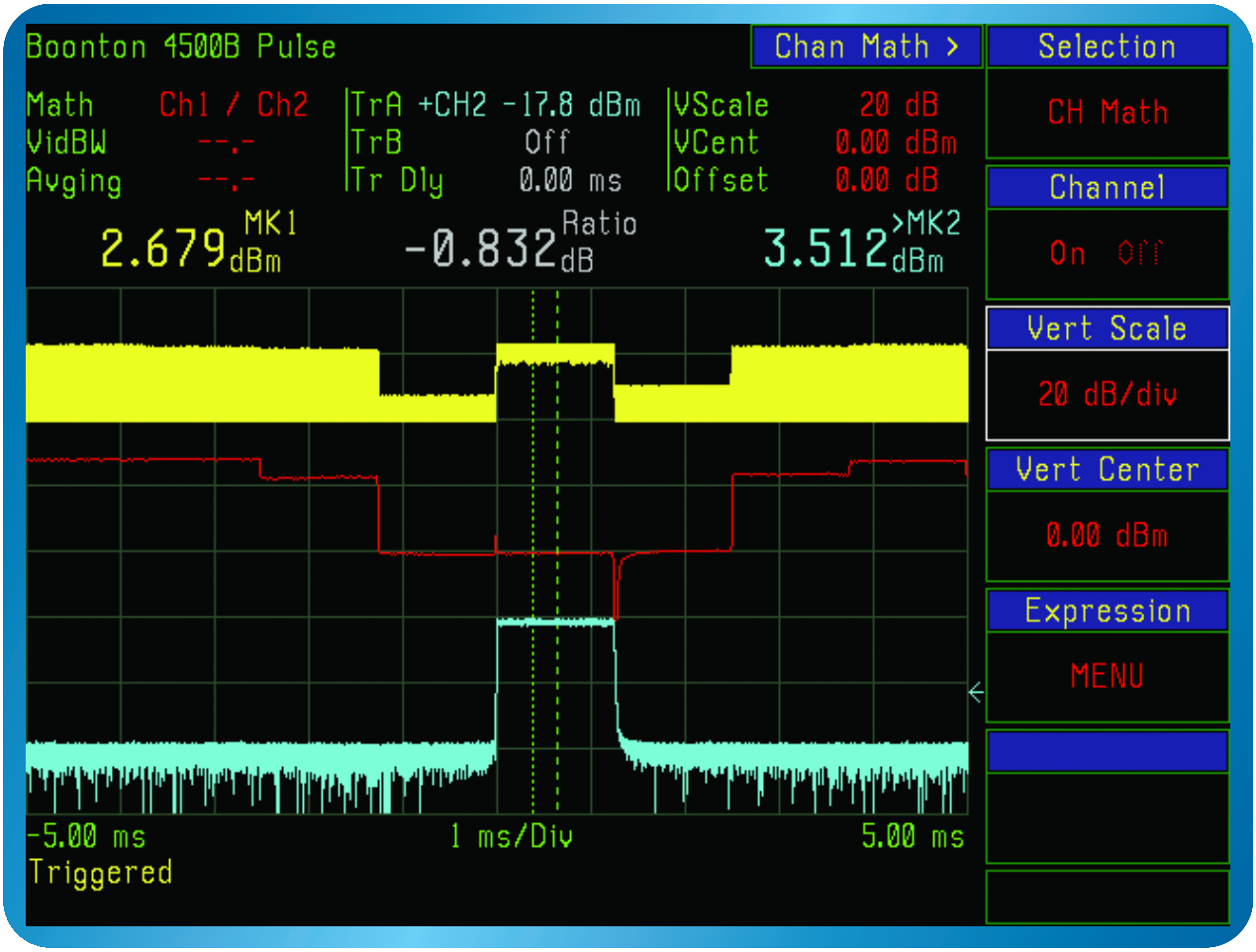


Figure 5: Math functions showing the ratio between channels of two signals

Channel math can be performed on active and saved memory traces. These powerful math functions can be used to analyze the differences between channels, making difficult measurements like output stage compression and inter-modulation distortion easy to identify and correct. The large color display provides a clear view of the active channels and continuously updated math function. Status and measurement data is color correlated with the associated channel or math function allowing for quick setup and clear views of multiple channel measurements at the same time.

Analyze Your Signal With Time Gated Measurements

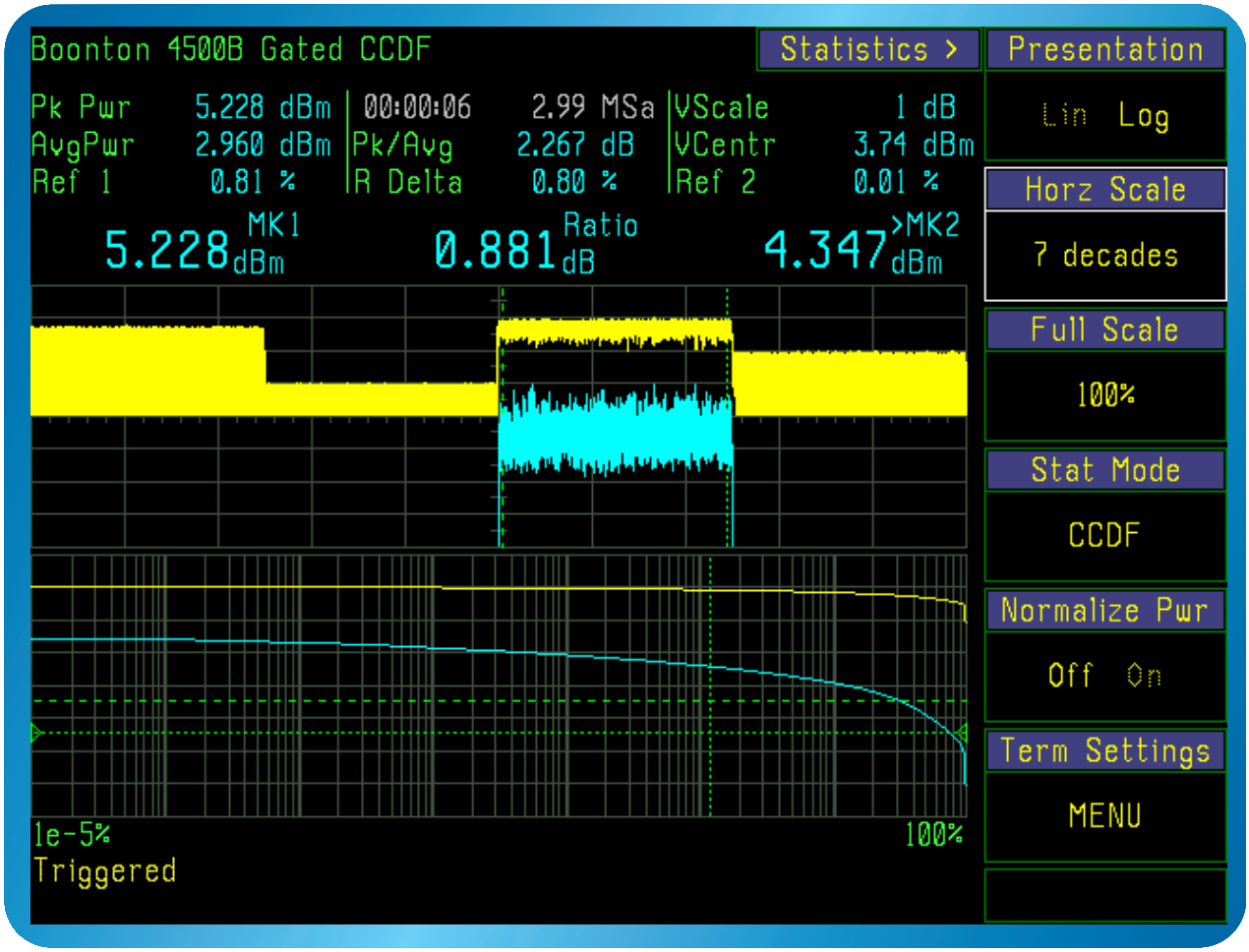


Figure 6: CDMA timeslots with time gated complementary cumulative distribution function (CCDF)

Optional statistical power measurement techniques are powerful tools in measuring noise-like signals such as CDMA, QAM, or OFDM. Complementary cumulative distribution function (CCDF) shows the peak power, average power and the peak-to-average ratio as well as the probability of occurrence of different power levels with respect to time. The instantaneous power values are sorted by amplitude and counted, and the values are displayed as a power level vs. percent probability of occurrence. A powerful analysis technique in the 4500B allows user defined intervals of signals to be gated and the statistical distribution calculated. Time gated measurements provide analysis of specific areas of interest on a signal.

Characterize Your Signal With Fast Statistical Analysis

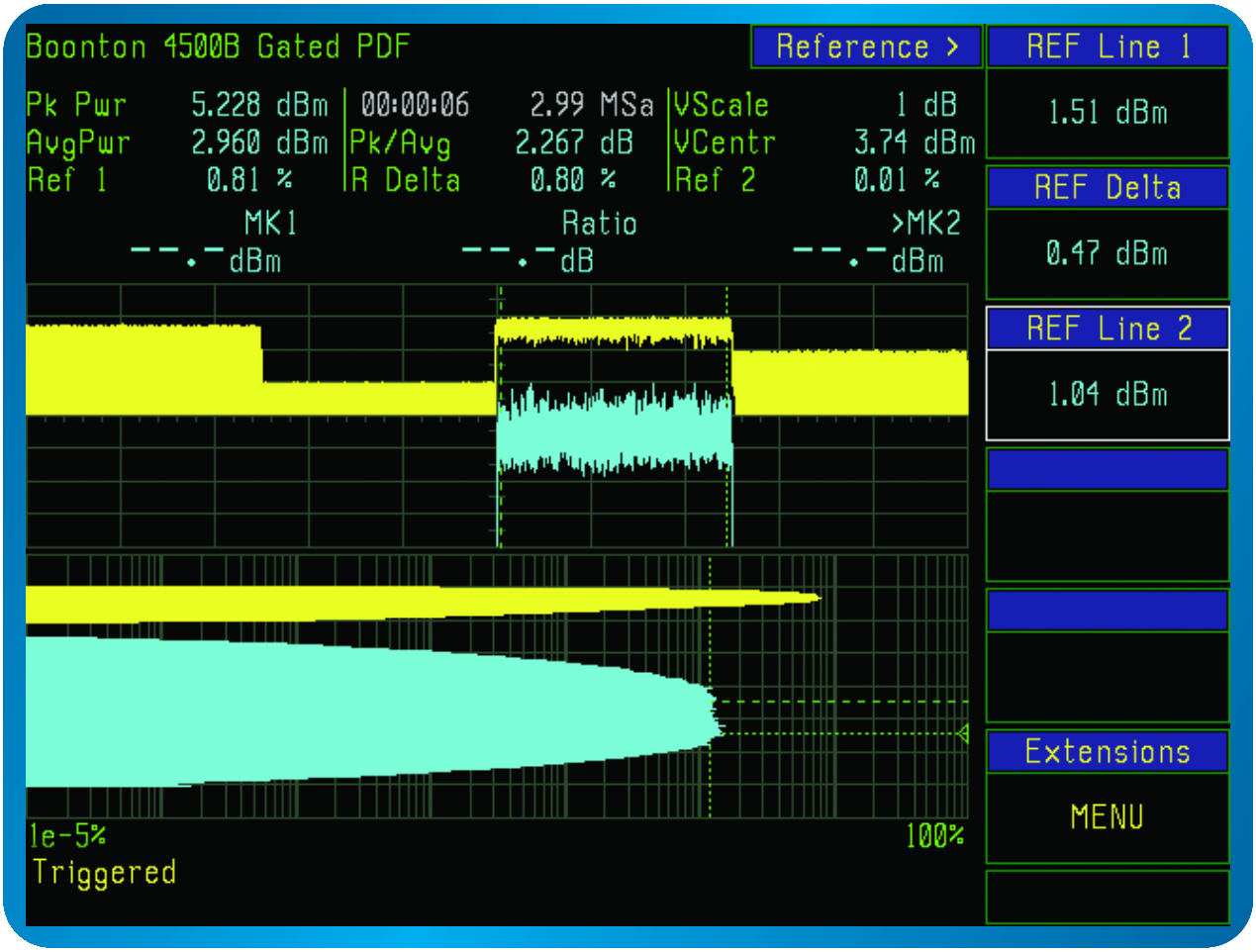


Figure 7: Analyze CDMA timeslots with time gated probability density function (PDF)

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.

specs

Sensor Inputs (performance specifications are sensor model dependent)

RF Frequency Range:	1 MHz to 40 GHz
Pulse Measurement Range:	-40 to +20 dBm
Modulated Measurement Range:	-50 to +20 dBm
Relative Offset Range:	±100.00dB
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
Rise Time:	<3 nsec
Single-Shot Bandwidth:	5 MHz (based on 10 samples per pulse)
Pulse Repetition Rate:	50 MHz max
Minimum Pulse Width:	6 nsec

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%

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
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

Calibration Source

Operating Modes:	CW, internal pulse 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:	100 usec, 1 msec 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:	0.008%, 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 Mega-samples
Limit Time:	3600 seconds (approximately 2.5 min. at full sample rate)
Terminal Action:	Stop, flush and restart or decimate

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)

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 Markers:	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

Power Versus Time (Pulse) Mode:	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 Pulse edge skew between channels Edge delay

Statistical Mode Automatic Measurements (optional)

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

Waveform Storage

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

External Interfaces

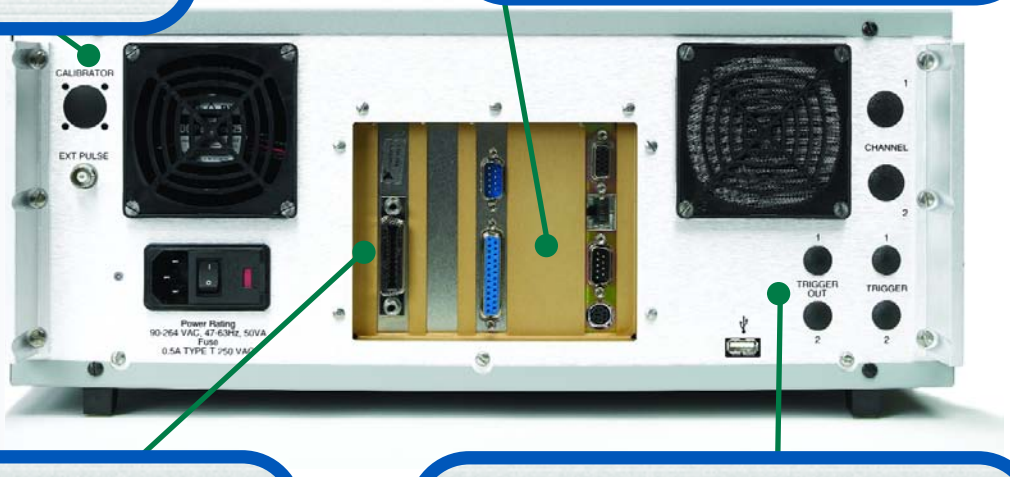
GPIB:	Programmable interface; complies with SCPI ver. 1990
RS-232C Interface 1:	Serial printer/plotter interface
RS-232C Interface 2:	Diagnostic interface
USB:	General purpose i/o interface
LPT1:	Parallel printer/plotter (Centronics type)
LAN:	Ethernet port. Optional software required.

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 50 degrees 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)

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

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



Remote Control: GPIB with SCPI compliant command set and legacy support.

Optional Inputs: Replace front panel inputs, optional trigger output

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)
-30	Warranty extended to 3 years

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