



USB / ETHERNET | PEAK & AVERAGE

Smart Power Sensor

PWR-8PW-RC

50Ω 0.01 to 8 GHz, -60 dBm to +20 dBm

THE BIG DEAL

- Peak, average, crest factor & duty cycle measurements
- Modulated, pulsed & CW signal types
- Wide dynamic range, -60 to +20 dBm
- 10 MHz video bandwidth
- 20 million samples / sec
- USB and Ethernet control

APPLICATIONS

- Pulse profiling & statistical signal analysis
- ASK, FSK, OFDM, QAM, LTE modulations
- VHF / UHF / L / S / C band radar
- Signal level calibration
- Remote power monitoring



Generic photo used for illustration purposes only.

Model No.	PWR-8PW-RC
Case Style	JL2441
Connectors	N-type (male)

DOWNLOAD

SOFTWARE PACKAGE

Refer to user guide for compliance information



PRODUCT OVERVIEW

Mini-Circuits' PWR-8PW-RC is a high performance sensor for any power measurement application from 10 MHz to 8 GHz. The 10 MHz internal modulation bandwidth, coupled with a data processing rate of 20 million samples-per-second, enables measurement of a wide range of analog & digital modulation types. The video output port additionally provides 30 MHz video bandwidth for additional analysis or automatic level control circuits.

The power sensor has USB and Ethernet interfaces, allowing control directly from a PC, or remote power measurement over a network. The software provides peak & average power measurements, statistical analysis (crest factor, duty cycle, rise / fall time) and time domain plots for any signal type, including pulsed waveforms down to 100 ns pulse width and 0.1% duty cycle.

Full software support is provided, including our user-friendly GUI application for Windows and a full API with programming instructions for Windows and Linux environments (both 32-bit and 64-bit systems).

KEY FEATURES

Feature	Advantages
Peak, average and pulse profiling	Measure peak & average power of CW and modulated signals. Analyze and graphically plot the peak & average power, duty cycle, pulse width, crest factor, rise & fall times of pulsed signals.
External trigger controls	Trigger in and out ports support precise synchronization with external test equipment, allowing capture of irregular signal patterns & pulses.
Selectable video BW	Switch between CW, 1.5 MHz, 5 MHz & 10 MHz video bandwidths on demand to minimize measurement noise.
Video output port	Direct access to the modulated signal trace with 30 MHz video bandwidth for external processing or observation with an oscilloscope.
Full software support	User friendly Windows GUI (graphical user interface) allows manual control straight out of the box, while the comprehensive API (application programming interface) with examples and instructions allows easy automation in most programming environments.

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ELECTRICAL SPECIFICATIONS¹

Parameter	Conditions	Frequency (GHz)	Min.	Typ.	Max.	Unit
Frequency range	-	-	0.01	-	8	
Input power range	-	0.01 - 8	-60	-	+20	dBm
Uncertainty of power measurement @ 25°C ^{2,3}	-60 to -55 dBm	0.01 - 8	-	±0.40	±0.80	dB
	-55 to +20 dBm	0.01 - 8	-	±0.15	±0.40	dB
Uncertainty of power measurement @ 0°C to 50°C ^{2,3}	-60 to -55 dBm	0.01 - 8	-	±0.50	-	dB
	-55 to +20 dBm	0.01 - 8	-	±0.50	-	
Return Loss	-	0.01 - 8	18	23	-	dB
Linearity @ 25°C	-	0.01 - 8	-	2	-	%
Measurement resolution (power)	-	0.01 - 8	0.01	-	-	dB
Measurement resolution (time) ⁶	Sample period ≤ 80 μs	0.01 - 8	-	50	-	ns
	Sample period > 80 μs		-	(sample period)/1800	-	
Averaging range	-	0.01 - 8	1	-	999	-
Sample period	Note 4	0.01 - 8	4	-	1,000,000	μs
Time base accuracy	-	-	-	-	50	ppm
Sample rate ⁵	Sample period ≤ 80 μs	0.01 - 8	-	20,000,000	-	sps
	Sample period > 80 μs		-	1800/(sample period)	-	
Measurement rate ⁷ (including typical USB delays)	Sample period = 4 μs	0.01 - 8	-	500	-	per sec
Video bandwidth	Internal pulse profiling ⁸	0.01 - 8	-	-	10	MHz
	Video out port	0.01 - 8	-	-	30	
Minimum pulse width	All modulated signals	0.01 - 8	-	-	0.1	μs
Rise/Fall time ⁹	Sample period ≤ 80 μs	0.01 - 8	-	50	-	ns
Pulse duty cycle for pulse profiling ⁵	-	0.01 - 8	0.1	-	99.9	%
DC current (via USB) ¹⁰	Ethernet disabled	0.01 - 8	-	650	700	mA
	Ethernet enabled		-	800	880	

1. Maximum continuous safe operational power limit: +23 dBm. All specifications after 30 minutes warmup time

2. Tested with CW signal, at CW mode

3. Power uncertainty is specified for default sample period of 80 μs.

4. Sample rate (resolution) reduces automatically for sample periods longer than 80 μs, producing "dead time" within the sample period when long sample periods are set.

5. Sample rate is measured in samples per second (sps).

6. Measurement resolution is the inverse of sample rate. For best accuracy, select a power sensor with sufficient resolution for the anticipated rate of variation in the RF signal

7. The number of complete measurements taken per second (including typical USB communication time) with the specified sample period.

8. Internal video BW is selectable between CW, 1.5, 5 & 10 MHz.

9. While the sensor's internal rise time is 50 ns, this does not mean a signal with a rise time of 50 ns can be accurately measured. See page 5 for details.

10. It is recommended to use USB 3.0/3.1 port or a powered hub capable of providing at least 860 mA.

TRIGGER PARAMETERS, 25°C ^{1,2}

Parameter	Conditions	Min.	Typ.	Max.	Unit
Trigger Input Options ¹¹	Internal (on 3dB change), external (on rise or fall), free running				
Trigger Timeout ¹²	Internal & External Triggers	1	-	5000	ms
Min Internal Trigger Level ¹³	Internal Trigger (on rise)	-	-	-48	dBm
Trigger In Delay (set by user)	Trigger to Start of Sample Period	0	-	10	ms
Trigger Out Delay (from RF)	In Internal Trigger modes	-	50	-	ns
Trigger In	Logic Low	0	-	0.6	V
	Logic High	2.7	-	5.0	
Trigger Out ¹⁴ (into high impedance load)	Logic Low (Active)	0	-	0.6	
	Logic High (Inactive)	2.7	-	3.3	
Video Out @ 50 Ω load	Output Voltage	0.5	-	2.2	

11. Internal trigger only available in peak mode, in response to pulse signals. Free running or external triggers should be used for average mode.

12. Trigger Timeout is set by default to 500 ms, but can be changed using SCPI commands. Please refer to programming guide for details.

13. Internal trigger functions may not correctly identify a pulse lower than -48 dBm. If a trigger is needed for such signals it is recommended to use external trigger.

14. Follows RF pulse sequence; active (low) for "on" time, inactive (high) for "off" time; rests at 0V when not sampling.



ABSOLUTE MAXIMUM RATINGS ^{15,16}

Parameter	Ratings
Operating Temperature	0°C to 50°C
Storage Temperature	-30°C to 70°C
DC voltage at RF Ports	25 V
Trigger In	-0.3 to 5.5 V
CW Power	+26 dBm

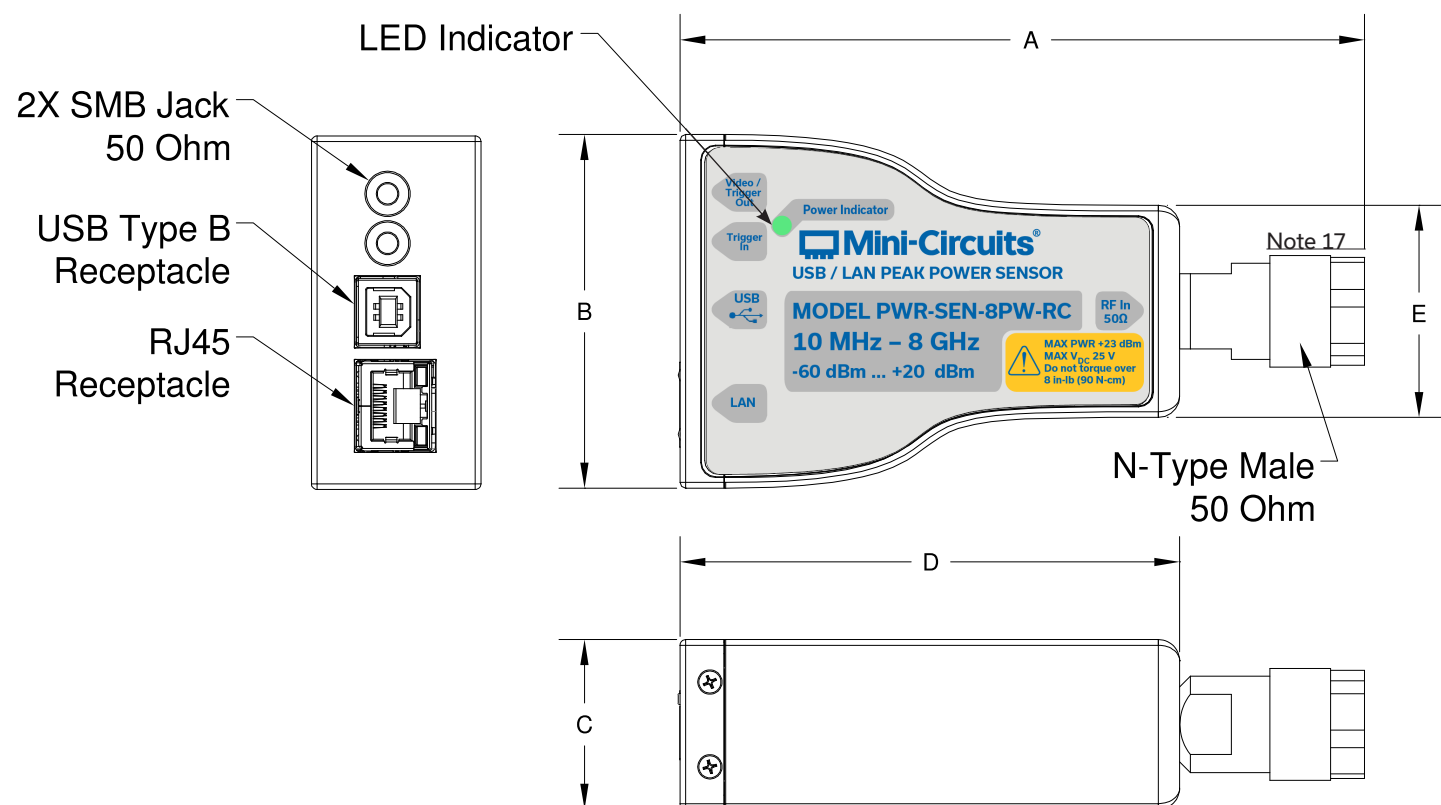
15. Permanent damage may occur if any of these limits are exceeded.

16. Operating in the range between operating power limits and absolute maximum ratings for extended periods of time may result in reduced life and reliability.

CONNECTIONS

Port Name	Connector Type
RF Input	N-type male
Trigger In	SMB male
Trigger Out	SMB male
USB	USB type-B female
Ethernet	RJ45 socket

OUTLINE DRAWING (JL2441)



OUTLINE DIMENSIONS (INCH)

A	B	C	D	E	weight (grams)
4.85	2.50	1.20	3.54	1.50	260
123.10	63.50	30.50	89.90	38.10	

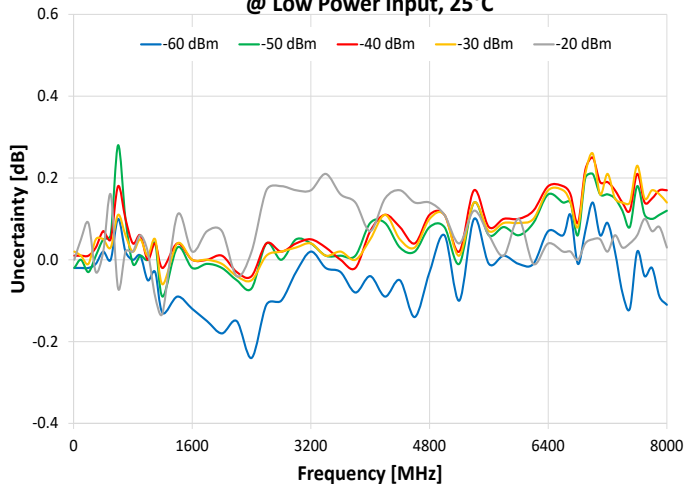
17. Maximum torque 8 in-lb (90 N-cm).



TYPICAL PERFORMANCE CURVES

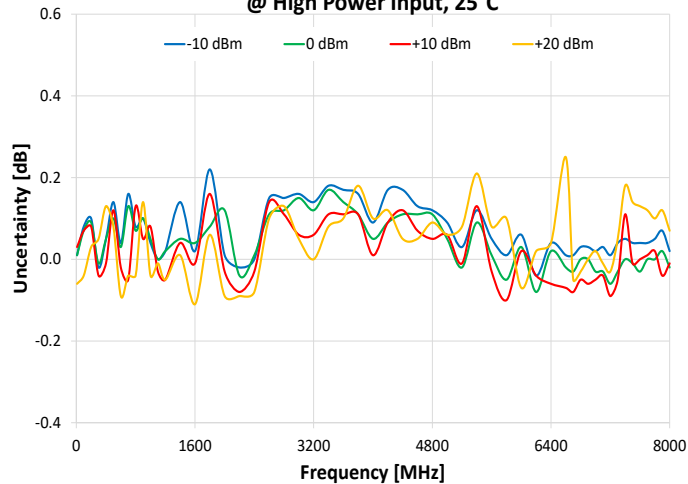
Uncertainty in Power Measurement

@ Low Power Input, 25°C

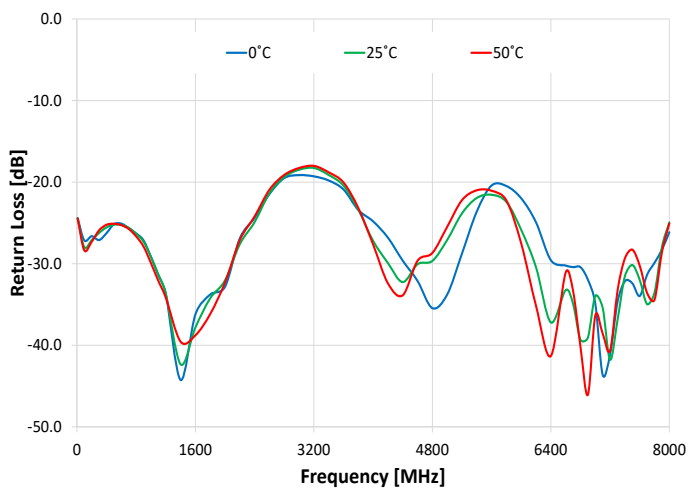


Uncertainty in Power Measurement

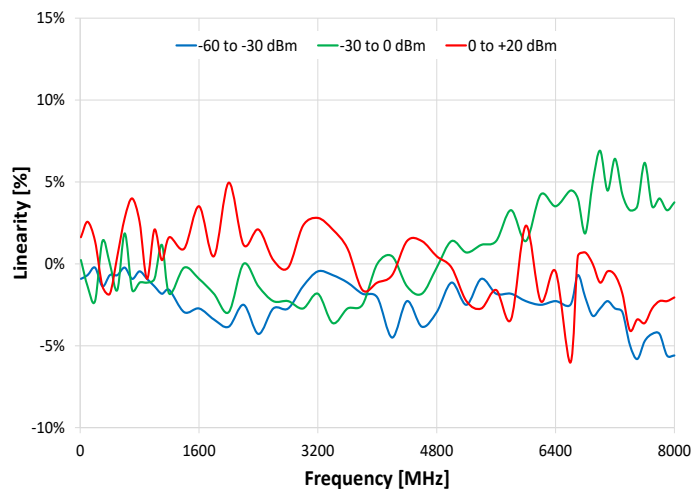
@ High Power Input, 25°C



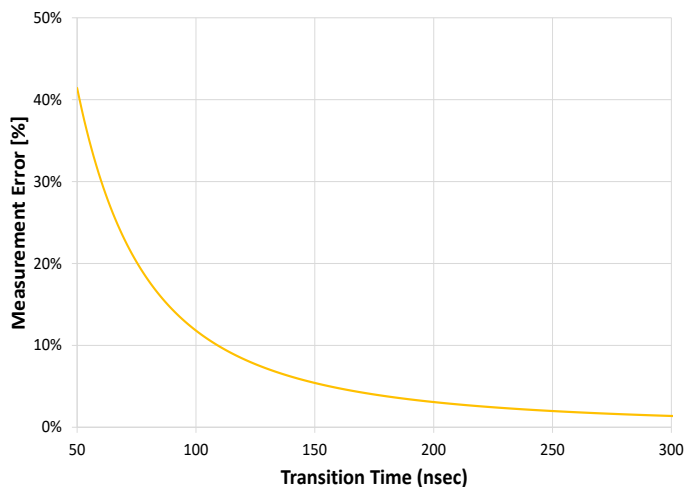
R. Loss vs. Frequency



Linearity vs. Frequency @ 25°C



Rise/Fall Time Measurement Error



**SOFTWARE SPECIFICATIONS****SOFTWARE & DOCUMENTATION DOWNLOAD:**

- Mini-Circuits' full software and support package including user guide, Windows GUI, DLL files, programming manual and examples can be downloaded free of charge from: <https://www.minicircuits.com/softwaredownload/pm.html>
- Please contact testsolutions@minicircuits.com for support

MINIMUM SYSTEM REQUIREMENTS:

Parameter	Requirements	
Interface	USB HID or Ethernet (HTTP & Telnet)	
System Requirements	GUI	Windows 7 or later
	USB API DLL	Windows 7 or later and programming environment with ActiveX or .NET support
	USB Direct Programming	Linux, Windows 7 or later
	Ethernet	Windows, Linux or Mac computer with a network port and Ethernet TCP/IP support
Hardware	Pentium II or later with 256 MB RAM	
Control cable	Power sensor to be used with the supplied USB cable only	

APPLICATION PROGRAMMING INTERFACE (API)**ETHERNET SUPPORT:**

- Simple ASCII / SCPI command set for attenuator control
- Communication via HTTP or Telnet
- Supported by most common programming environments

USB SUPPORT (WINDOWS):

- ActiveX COM DLL file for creation of 32-bit programs
- .NET library DLL file for creation of 32 / 64-bit programs
- Supported by most common programming environments (refer to application note [AN-49-001](#) for summary of supported environments)

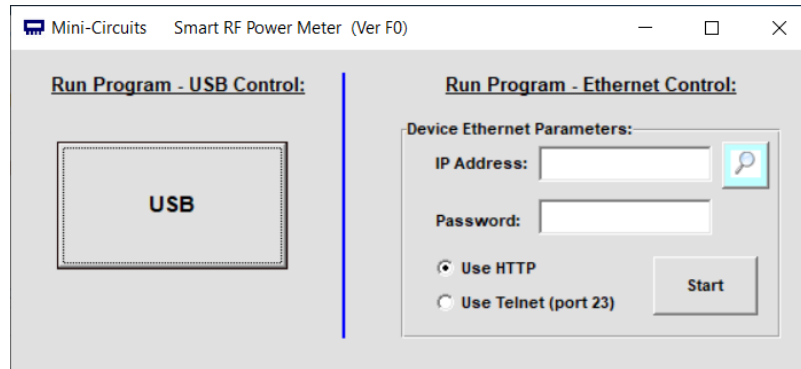
USB SUPPORT (LINUX):

- Direct USB programming using a series of USB interrupt codes
- Full programming instructions and examples available for a wide range of programming environments / languages.

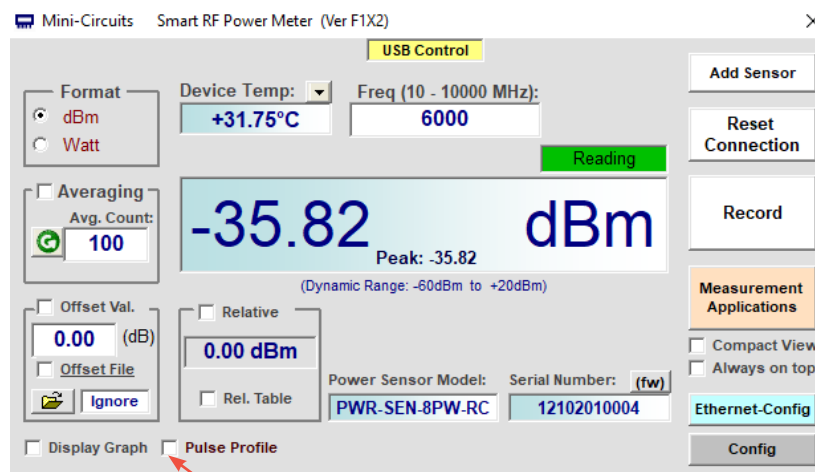


GRAPHICAL USER INTERFACE (GUI) FOR WINDOWS - KEY FEATURES

- Connect via USB or Ethernet (HTTP, Telnet) to control the module.
- Control multiple power sensors at once.



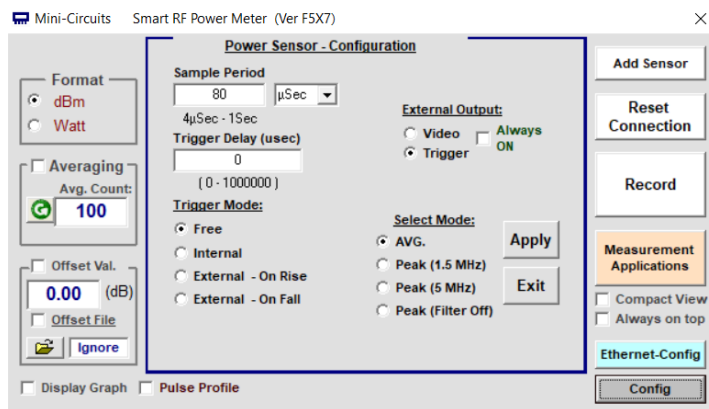
- Set compensation frequency and monitor power measurement.
- Configure measurement (offsets, relative power readings, averaging, set video BW, etc.).
- Peak and average power measurement.
- Pulse profiling (see [user-guide](#) and page 8 for details).
- Internal and external trigger and video outputs.
- Graphical pulse display with "zoom on pulse" feature (see [user-guide](#) and page 9 for details).
- Schedule data recording.



Enable pulse profiling and graphical pulse display, see page 8 for details.

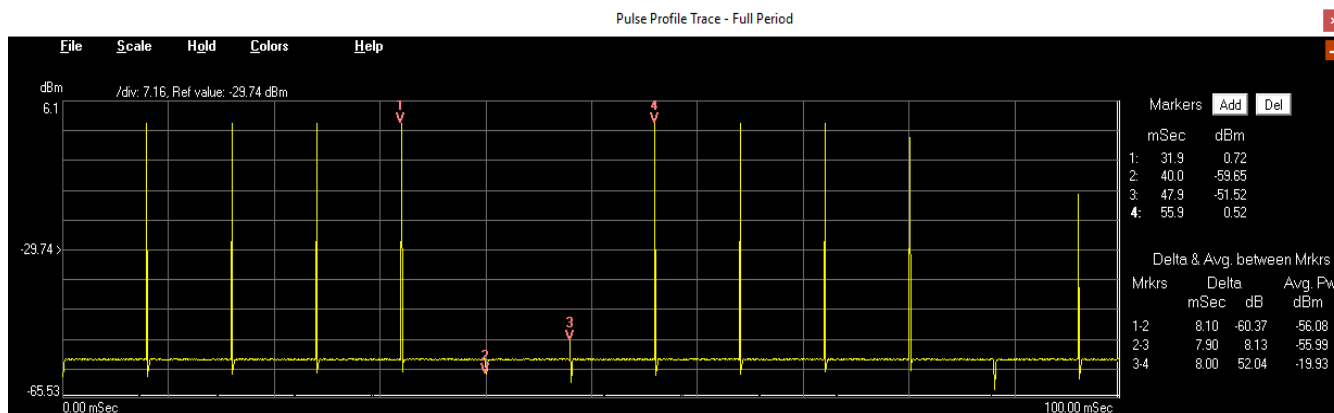


PULSE PROFILING FEATURES CONFIGURATION SCREEN



- Set the sample period between 4 μ s and 1s to capture the pulse profile.
- Select from 4 trigger options:
 1. Free – No trigger / free running measurements.
 2. Internal – Detect and stabilize the measurements on 3dB change.
 3. External On Rise – Measurements are triggered on the rising edge of an external trigger signal.
 4. External On Fall – Measurements are triggered on the falling edge of an external trigger signal.
- Select an external output type:
 1. Video – Output allows wider bandwidth pulses to be recorded by external measurement equipment.
 2. Trigger – Provides a TTL output on the rising edge of a pulse for synchronization with external measurement equipment.

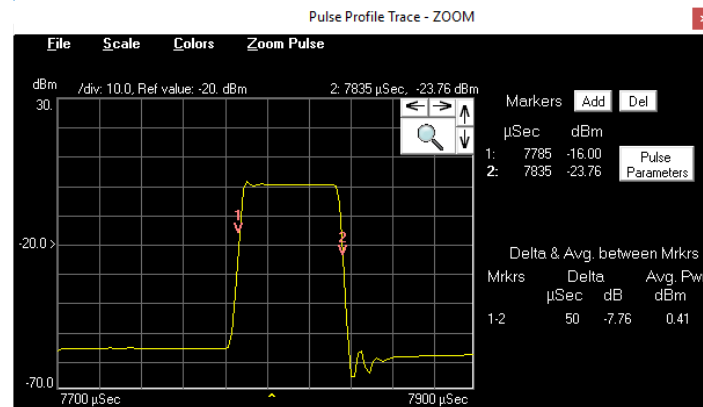
FULL SAMPLE PERIOD



The main pulse profile display shows the full sample period of the sensor in the time domain. Up to four markers can be set as required to measure power levels and calculate time / power deltas.



ZOOM ON PULSE



"Zoom on pulse" feature will automatically zoom on the first identified pulse and allows any portion of the pulse profile to be focused on / expanded in a second graphical display. Simply 'right-click' and drag the mouse cursor over relevant section of the profile.

For signals with duty cycle greater than 99.9% or under 0.1% the automatic "zoom on pulse" may not work. In such cases, you can adjust the zoom window by clicking on the arrow icons to increment/decrement the trigger delay and span, or the magnifying glass to type in precise values.

CALCULATED PULSE PARAMETERS

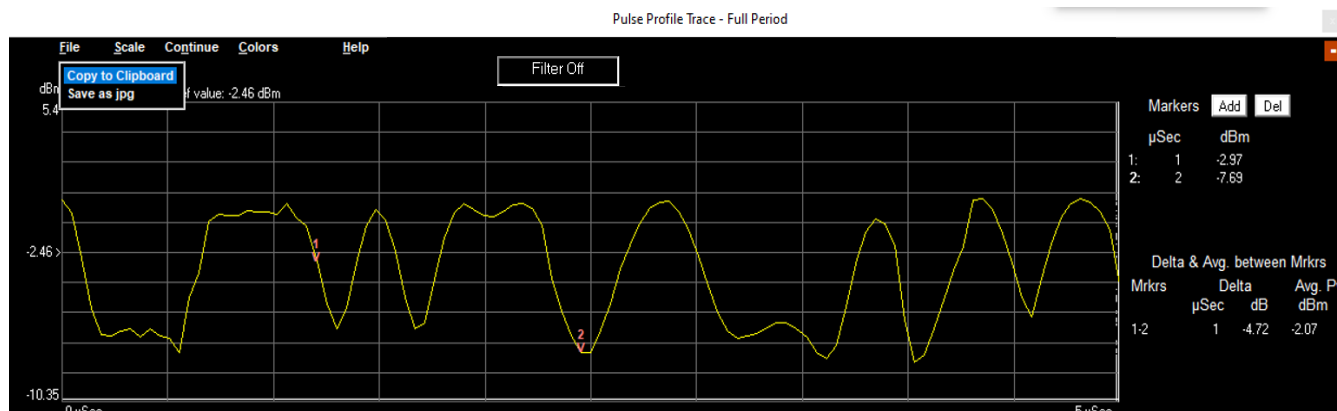
Calculated Parameters	
Parameter	Value
Pulse Width (mSec)	0.044
Pulse Period (mSec)	8.020
Duty Cycle (%)	0.55
Rise Time (μs)	3.54
Fall Time (μs)	3.54
Pulse Pwr (dBm)	0.75
Cycle Avg. (dBm)	-19.70
Crest Factor (dB)	20.45
Over Shoot (dB)	0.98

Full pulse parameters are calculated and displayed in tabular form, including peak / average power, pulse width / period, duty cycle, rise / fall time, crest factor and overshoot.

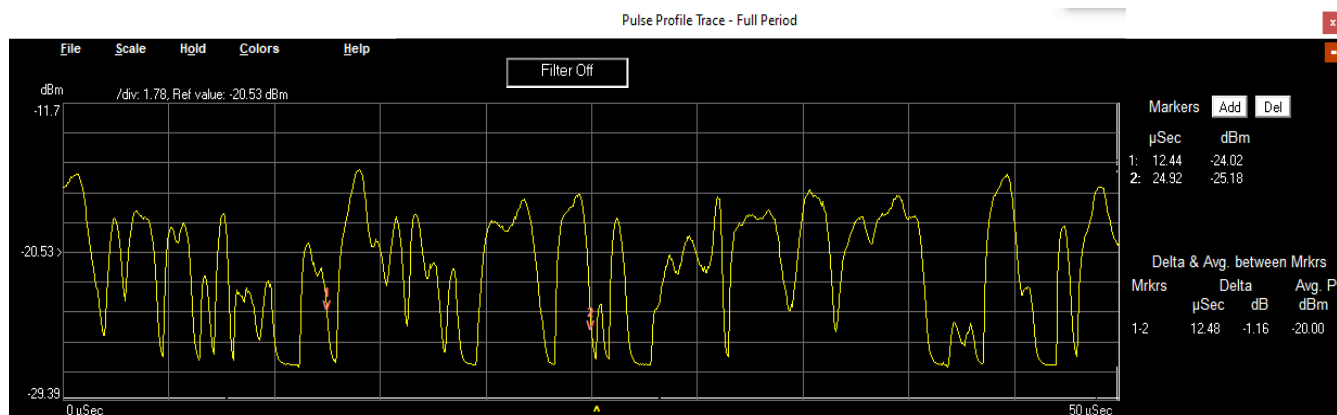
The calculated pulse parameters are based on the waveform shown in the "zoom on pulse" window so the user should make sure that the pulse area of interest is properly displayed in that window.



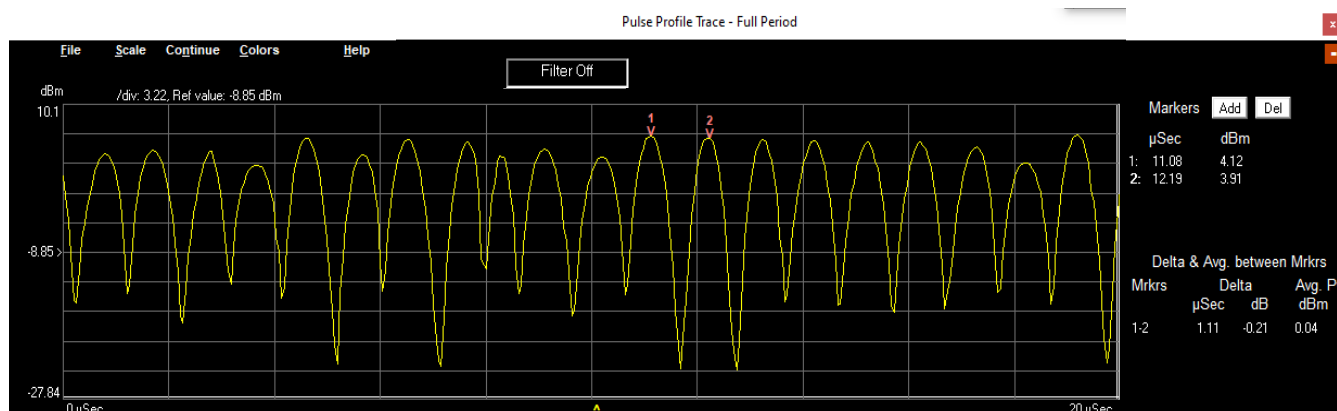
PULSE PROFILING EXAMPLES FOR STANDARD MODULATION TYPES



ASK @ 5 Msps



QAM256 in DECT setup, Gaussian filter @ 1.152 Msps

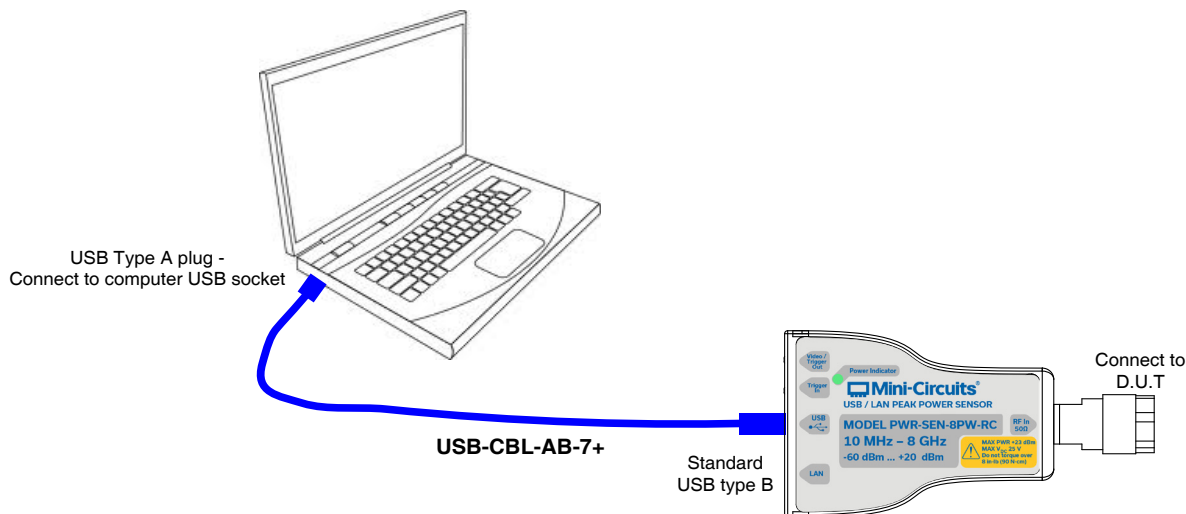


QPSK, QAM16 & QAM64 in LTE uplink setup (1.4 MHz channels, 3.7 MHz offsets) 8 MHz clock

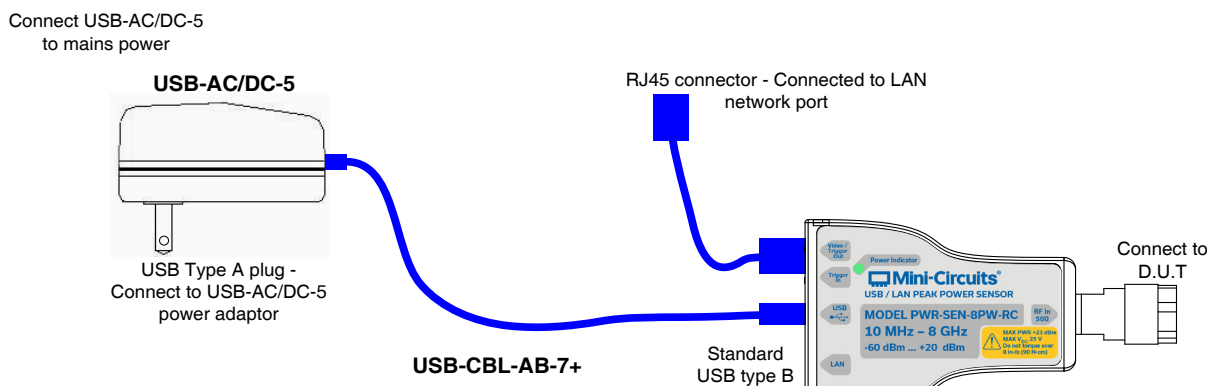


CONNECTION DIAGRAMS

USB CONTROL

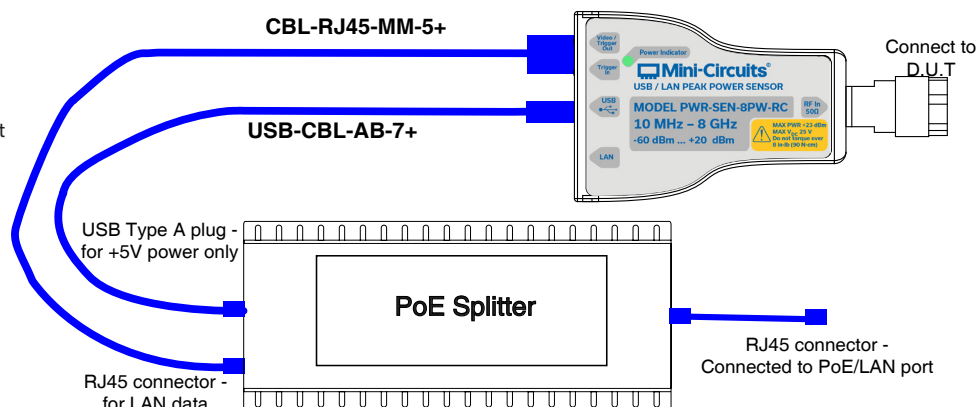


ETHERNET CONTROL (USING POWER ADAPTER)



ETHERNET CONTROL (USING POE SYSTEM)

Note:
Commercially available PoE splitter not supplied by Mini-Circuits.





Mini-Circuits

USB / ETHERNET | PEAK & AVERAGE

Smart Power Sensor

PWR-8PW-RC

ORDERING INFORMATION

Please contact Mini-Circuits' Test Solutions department for price and availability: testsolutions@minicircuits.com

Model	Description
PWR-8PW-RC	USB / Ethernet, Peak & Average Smart Power Sensor

Included Accessories	Part No.	Description
	PWR-SEN-8PW-RC	Power sensor head
	USB-CBL-AB-7+	6.8 ft (2.1 m) USB Cable: USB type A (Male) to USB type B (Male) ¹⁸
	CBL-5FT-BMSMB+	5.0 ft (1.5 m) Trigger cable: BNC (Male) to SMB (Female)

18. Power sensor to be used with the supplied control cable only.

OPTIONAL ACCESSORIES

USB-AC/DC-5	AC/DC +5V power adaptor with USB connector ^{19, 20}
USB-CBL-AB-3+	2.7 ft (0.8 m) USB Cable: USB type A (Male) to USB type B (Male)
USB-CBL-AB-7+	6.8 ft (2.1 m) USB Cable: USB type A (Male) to USB type B (Male)
CBL-5FT-BMSMB+	5.0 ft (1.5 m) Trigger cable: BNC (Male) to SMB (Female)
CBL-RJ45-MM-5+	5.0 ft (1.5 m) Ethernet cable: RJ45 (Male) to RJ45 (Male) Cat 5E cable
NF-SM50+	N-Type Female to SMA Male Adapter
NF-SF50+	N-Type Female to SMA Female Adapter
NF-BM50+	N-Type Female to BNC Male Adapter

19. Includes power plugs for US, UK, EU, IL, AU & China. Plugs for other countries are also available. If you need a power cord for a country not listed please contact testsolutions@minicircuits.com

20. Power adaptor, powered hub or USB 3.0/3.1 port may be used to provide power when in Ethernet control, not needed in USB control.

CALIBRATION

CALSEN-8PW-RC	Calibration Service	Click Here
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NOTES:

- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at <https://www.minicircuits.com/terms/viewterm.html>

