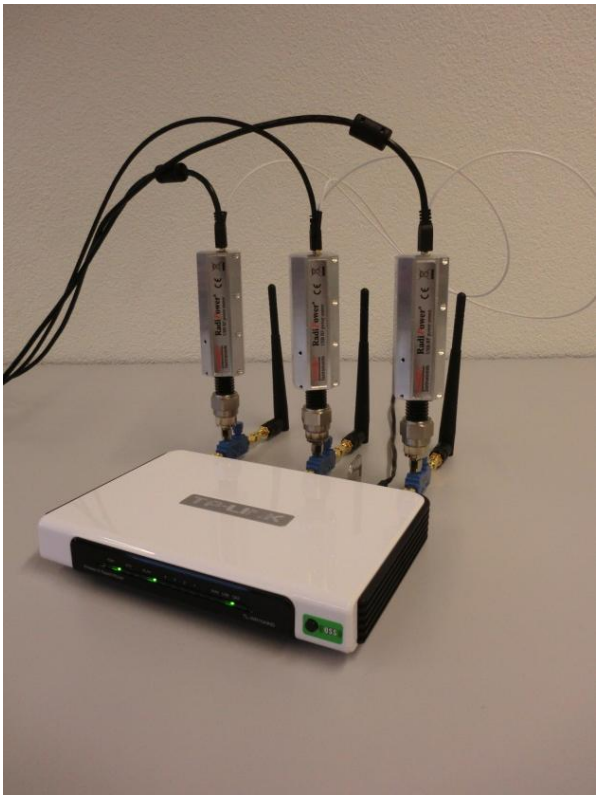
RadiPower®

Operating Manual



RF power sensor

~ with external triggering ~

Models:
RPR3006C/P/W

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Supplier Information:

D.A.R.E!! Instruments B.V.
Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel.: +31 (0)348 416592
Fax.: +31 (0)348 499732
Internet: www.dare.nl
Email: instruments@dare.nl

EUROPEAN DECLARATION OF CONFORMITY

We, D.A.R.E!! Instruments declare under our sole responsibility that the product;

RadiPower
model RPR3006C/P/W

to which this declaration relates is in conformity with the following standards or other normative documents;

Emission:	EN 61326-1:2006, Class B Electrical equipment for measurement, control and laboratory use.
Immunity:	EN 61326-1:2006, Industrial level, performance criteria A Electrical equipment for measurement, control and laboratory use.

following the provisions of;

EMC-Directive 2004/108/EC

The Technical Construction Files are maintained at;

D.A.R.E!! Instruments B.V.
Vijzelmolenlaan 7
NL-3447GX Woerden
The Netherlands

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Authorized by:

P.W.J. Dijkstra

Title of authority: Director

1 WARNINGS & PRECAUTIONS

Read the contents of this manual and become familiar with the safety markings, instructions, operation and handling of the system.

Only qualified service personnel are allowed to perform adjustment, maintenance or repair to the equipment.

Verify that the supply voltage is within the operating range of the equipment.

The Radi*P*ower® contains materials which can be recycled and reused. At the end of its life, specialised companies can dismantle the discarded system to concentrate the reusable materials and to minimize the amount of materials to be disposed of. Please return the system to your local reseller if it is discarded at the end of its life.

2 Introduction

An accurate power meter is indispensable to perform reliable EMC measurements. The Radi*P*ower® is a RF power meter especially designed for power measurements during EMC tests. The Radi*P*ower® is an affordable, accurate and extremely fast power meter. It provides accurate measurements over a wide frequency range, which enables effective measurements in accordance with the latest EMC standards.

EMC immunity measurements are time consuming. The total elapsed time is mainly depending on the number of frequency points, the dwell time and the speed of the power meter. As standards in general prescribe the first two parameters, the speed of the power meter is the only one that can be optimized. The unprecedented detector technology of D.A.R.E!! makes extremely fast accurate power measurements finally a reality, even at low power levels.

Next to speed, accuracy is the first concern when performing EMC measurements. The Radi*P*ower® allows high precision EMC measurements with a large dynamic range. With a high accuracy over the complete band it is suitable for measurements in accordance to automotive, military, telecom and EMC basic standards like IEC61000-4-3/6 standards.

Impedance mismatches contribute to the measurement uncertainty. The Radi*P*ower® has a very low Standing Wave Ratio (SWR) and as a result, measurement uncertainties are low compared to other contribution in EMC measurement setups.

Due to the USB interface the Radi*P*ower® can be easily used. Besides the Radi*M*ation® integral EMC measurement software the Radi*P*ower® can be controlled by all EMC measurement packages as all software codes to control the unit are available. For stand-alone use the Radi*M*ation® Free measurement software is delivered with the system. By using the USB1004A plug-in card, up to four Radi*P*ower® heads can be connected to a single plug-in card in a Radi*C*entre®.

To enable the possibility of measuring RF bursts, the Radi*P*ower® can also be delivered as a RF pulse power head. This P-version of the Radi*P*ower® is able to measure RF bursts as short as a fraction of a microsecond. The C-version only supports RMS-measurements for CW signals.

In combination with Radi*M*ation®, the RPR3006W can be used to perform simultaneous power measurements on multiple ports of MIMO devices according to EN 300 328 or EN 301 389. All necessary parameters are calculated by Radi*M*ation® Free.

3 The RadiPower®

The RadiPower® RF power sensor is optimised for EMC measurements, where high dynamic range, together with fast measurements is required, even at low power levels.
Where most power sensors require long measurement times at low RF levels, the RadiPower® RF power sensor is able to perform accurate power measurements with a high measurement speed at power levels close to the noise floor without the need for zero adjustment!

The RadiPower RF power sensor is mounted in a rugged metal housing in order to ensure long life and excellent RF shielding.

The power sensor is equipped with an N-type precision RF input connector and a standard USB-B connector for communication to a computer.

The RadiPower® sensor is supplied with the following items:

- *The* RadiPower® *RF power sensor*
- *Shielded USB cable*
- *USB stick with installation of RadiMation® Free software and drivers*
- *This manual in pdf format (use Acrobat reader)*

3.1 Functional description

The Radi*P*ower® uses a high performance demodulating logarithmic amplifier to detect the RF signal. The demodulated signal is sampled at high speed by a high speed ADC and samples are processed by a powerful DSP. The sophisticated software enables unique functions, such as envelope tracing and burst logging. The table below shows which models support the different measurement modes:

Mode		**RPR3006C**	**RPR3006P**	**RPR3006W**
RMS power	*performs RMS power measurements of CW-signals*	√	√	√
Peak power	*performs peak measurements (max hold) on RF-signals*	√	√	√
Envelope tracing	*captures the envelope of an RF-signal*		√	
Burst logging	*logs RF-bursts of e.g. frequency hopping devices*			√

RMS Mode: In RMS mode the Radi*P*ower® samples the signal at high speed. The RMS value of the power is calculated over the number of samples defined by the filter setting and can be read by a simple command. Due the high sampling speed the number of readings is high even at large filter settings.

Peak Mode: In peak mode the Radi*P*ower® keeps track of the highest level which has been measured. This can be done for an infinite time. Once the power level has been read, the maximum value is automatically reset.

Envelope tracing: is a unique feature which enables the possibility to visualize, for example, the inrush phenomena of transmitters or signal generators, without the need of an expensive RF analyser. Due to the extensive trigger possibilities, almost any RF-signal can be captured in the large buffers of the Radi*P*ower®.

Burst Mode: For more complex transmitters, like WLAN devices, a special burst mode has been implemented. During the observation time, the time and RMS power of each RF-burst is logged into memory. These measurements can be used to perform conducted measurements of RF output power according to new version of the ETSI EN 300 328 or EN 301 389 standard. Parameters like medium utilisation, Tx-gap and Tx- sequence are automatically calculated and displayed on the PC screen by Radi*M*ation® Free software. The Radi*P*ower® is equipped with a trigger in- and output to enable simultaneous measurements on multiple ports of MIMO devices. By daisy chaining the trigger signal of the RPR3006W, multiple power meters can be synchronized using Radi*M*ation® Free software.

4 Using the RadiPower® in a RadiCentre®

4.1 Hardware installation

For stand-alone use connect the RadiPower® sensor to a Windows computer with a USB 1.1 compatible port. Use the supplied USB cable to connect the RadiPower® sensor.

For use in combination with a RadiCentre® a USB1004A four channel plug-in card needs to be installed in the RadiCentre®. The USB1004A plug-in card can be fitted in any of the RadiCentre® models[1]. The hardware installation of the RadiPower® plug-in card is carried out according to the steps below:

1. Decide in which slot of the RadiCentre® system you want to install the new RadiPower® plug-in card.

[1] If the USB1004A is used in combination with a CTR1001S, serial RS232 is not supported. Only USB communication can be used.

2. Remove the blind panel from this slot by removing the two screws on top and the two screws at the bottom side of the panel.
3. Gently insert the Radi*P*ower® plug-in card into the slot of the Radi*C*entre®, and tighten the four screws.
4. Switch on the Radi*C*entre® system. The new Radi*P*ower® plug-in card will be automatically detected by the Radi*C*entre® system.
5. Connect the power sensor to the plug-in card using the supplied USB cable. The Radi*C*entre® will automatically detect the power sensor when it is plugged into one of the 4 USB slots on the back of the USB1004A plug-in card. Please note, for correct auto detection of power heads, one must wait at least 10 seconds between un-plugging and/or re-connecting any individual power sensor. Not taking the above measures into account may result in wrong power sensor detection. In this case please Re-start the Radi*C*entre® system in order to re-detect all connected sensors.
6. Place the interlock plug into the interlock connector of the Radi*C*entre® system.

The hardware installation for the module is now complete. The user can control the Radi*P*ower® sensor, either through the touch screen of the Radi*C*entre® system, or by external software like the Radi*M*ation® EMC test software or the standard supplied Radi*M*ation® Free software.

4.2 Switching on the Radi*C*entre® system

1. Make sure the Radi*P*ower® plug-in card is mounted correctly in to the Radi*C*entre®.
2. Make sure that the Radi*P*ower® sensor is set to the default[2] communication speed.
3. Connect the power head to the plug in card through the supplied USB cable.
4. Plug the mains cord into the mains inlet of the Radi*C*entre® system.
5. Switch the main power switch on the mains inlet to the “ON” position.
6. Switch the Radi*C*entre® system to operate, the “POWER ON” LED will now light.

The system is now ready to be used. The user can control the Radi*P*ower® sensor through the touch screen of the Radi*C*entre® system[3].

Readings from the sensor can now be taken directly from the TFT screen, with the Radi*M*ation® EMC software or any other (custom made) software package.

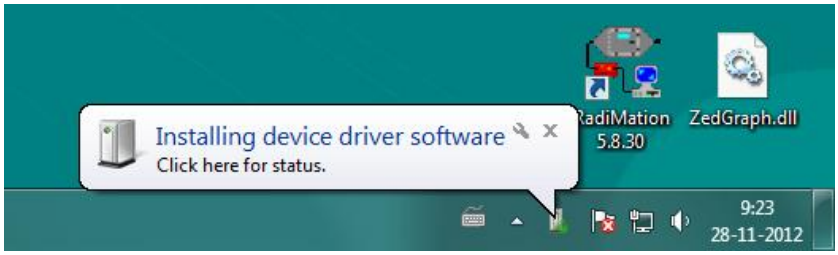
Please note that the Radi*C*entre® system only supports mode 0 of the Radi*P*ower® sensor.

[2] Default communication speed is 115200 bps, 8 bits, no parity, 1 stop bit. See page 16.
[3] Not possible with CTR1001S single slot Radi*C*entre®

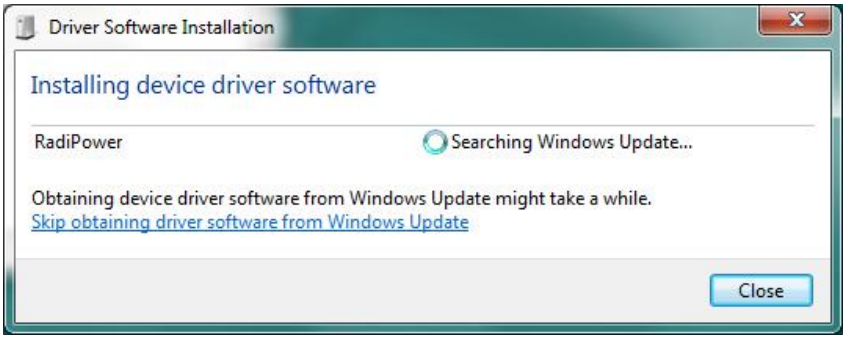
5 Using the Radi*P*ower® stand alone

5.1 Driver installation

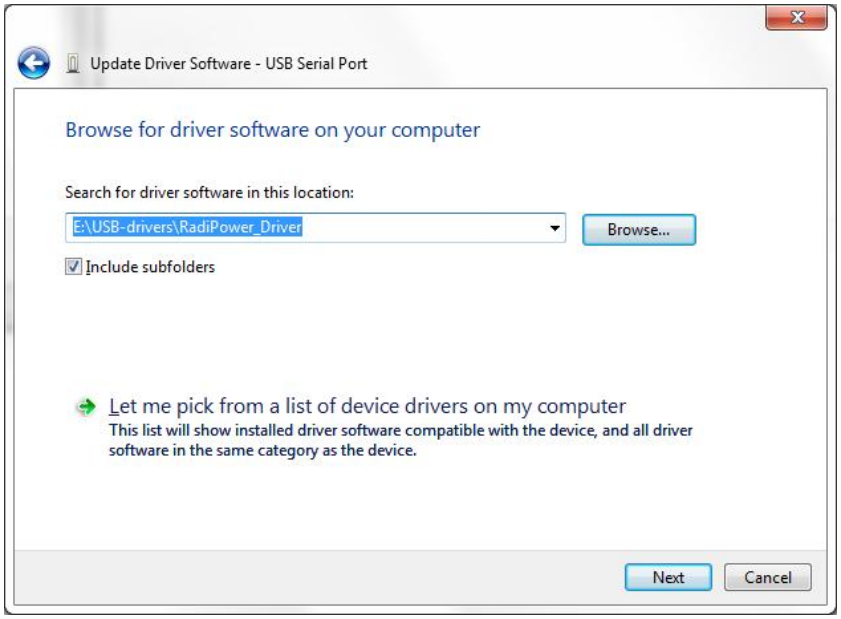
Plug in the Radi*P*ower® into a USB port of your PC. Windows will prompt that new hardware was found. Two drivers must be installed for normal usage on the computer. Windows will automatically start the installation of both drivers as soon as the Radi*P*ower® has been detected.



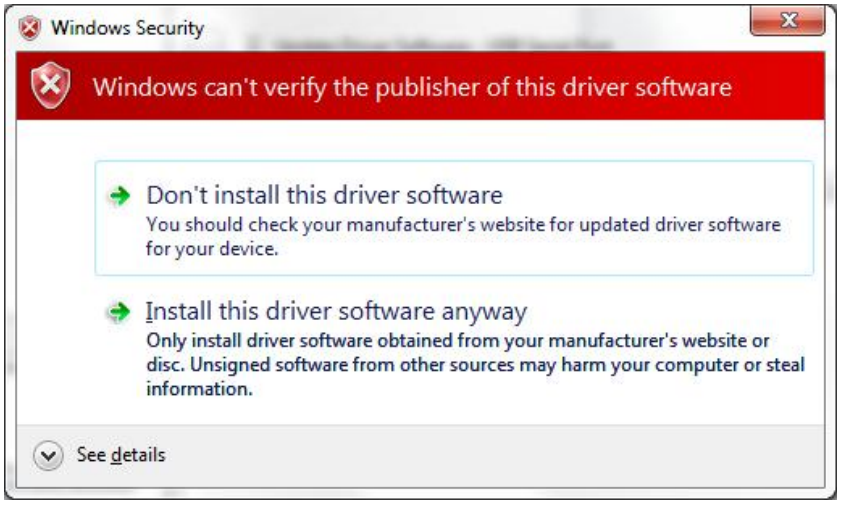
Windows will start searching for a driver. If the Radi*P*ower® has not been installed on your computer before, windows will not find a driver automatically.



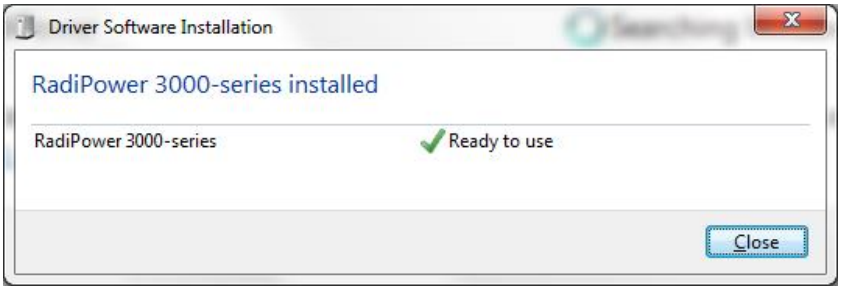
Windows will ask you to browse for a device driver. The driver of the Radi*P*ower® can be found on the USB stick. Browse for the USB-driver directory and RadiPower_Driver.



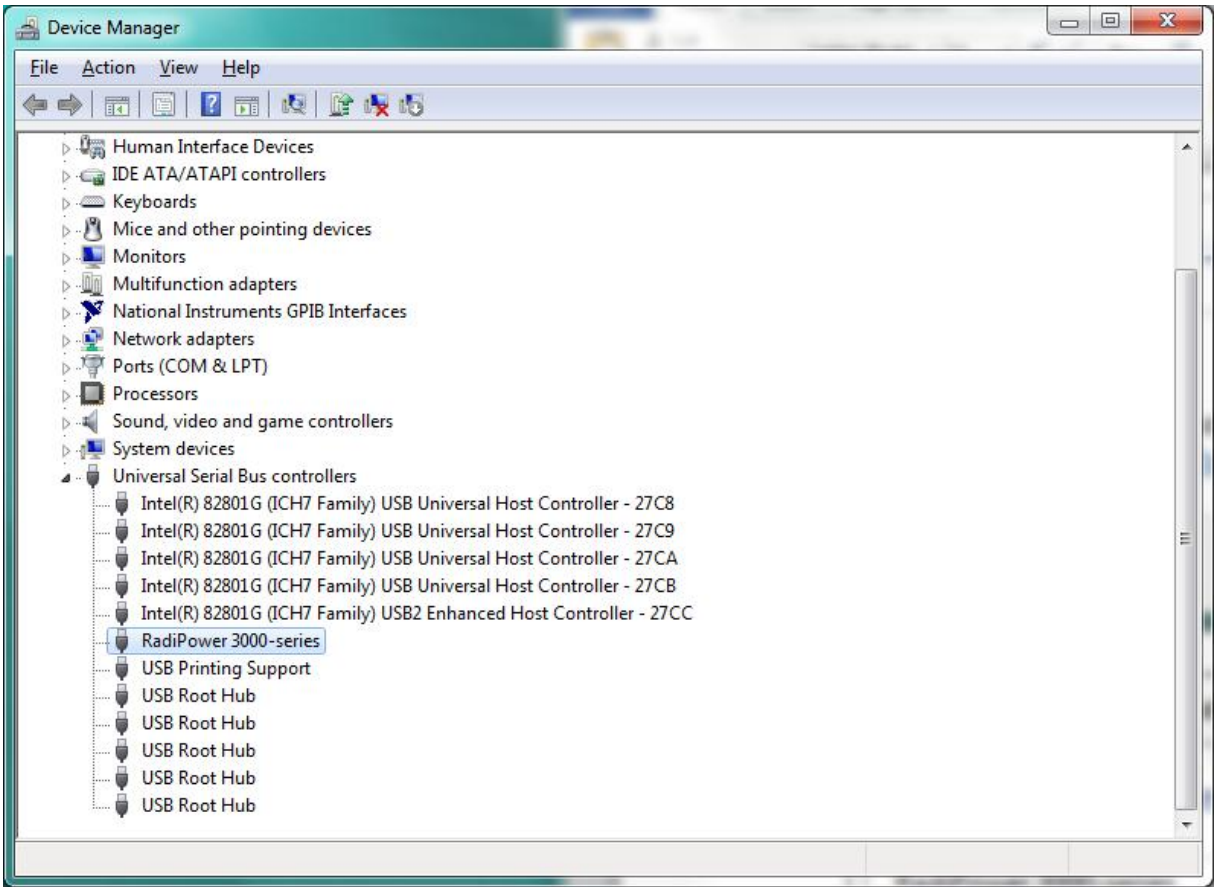
Press the Next button. Windows will now probably show a warning:



Select: “Install this driver anyway” and wait for the installation to complete.



The Radi*P*ower® is now installed. Press the Close button to proceed. In the device manager of Windows you will find the Radi*P*ower® in the USB section:



5.2 Software installation

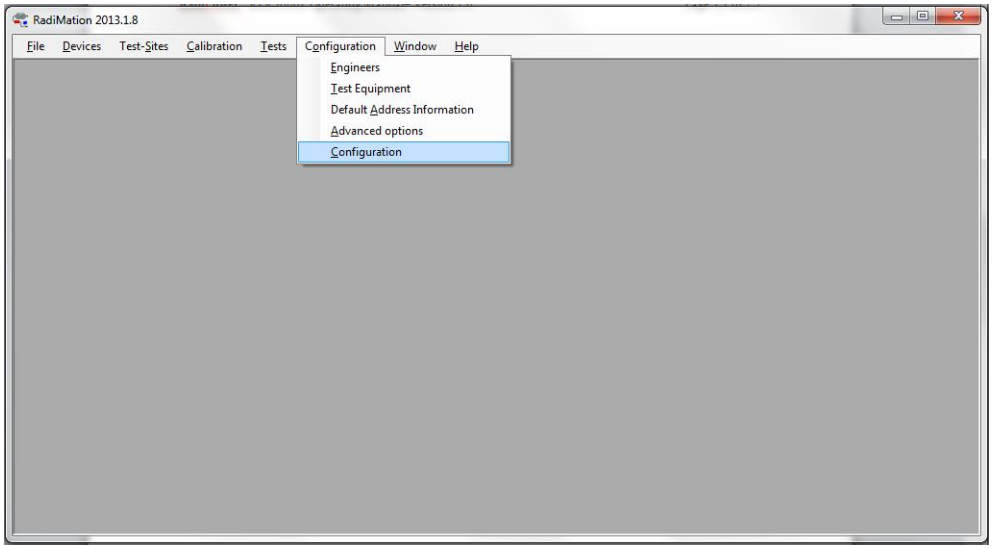
5.2.1 RadiMation® Free software

- Install the RadiMation® Free software using the setup file from the supplied USB stick.
- Follow the instructions during the installation and finally start RadiMation® Free.
- Configure a device driver and select the correct communication port and device number.
- From the device menu, select the power sensor device driver.

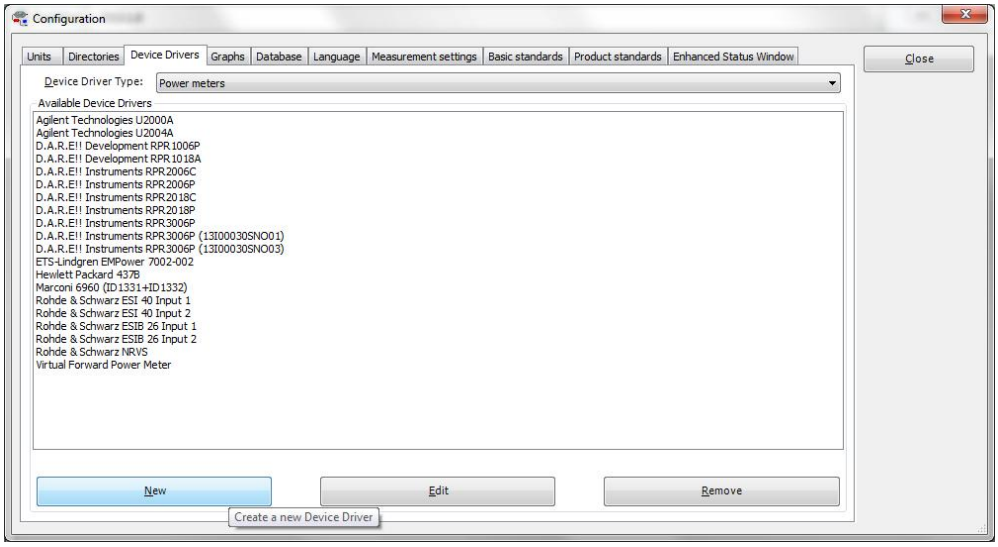
RadiMation® is now ready for use with the RadiPower® power sensor.
For extensive documentation, visit: http://wiki.radimation.com

5.3 Setting up a MIMO measurement using RadiMation® Free

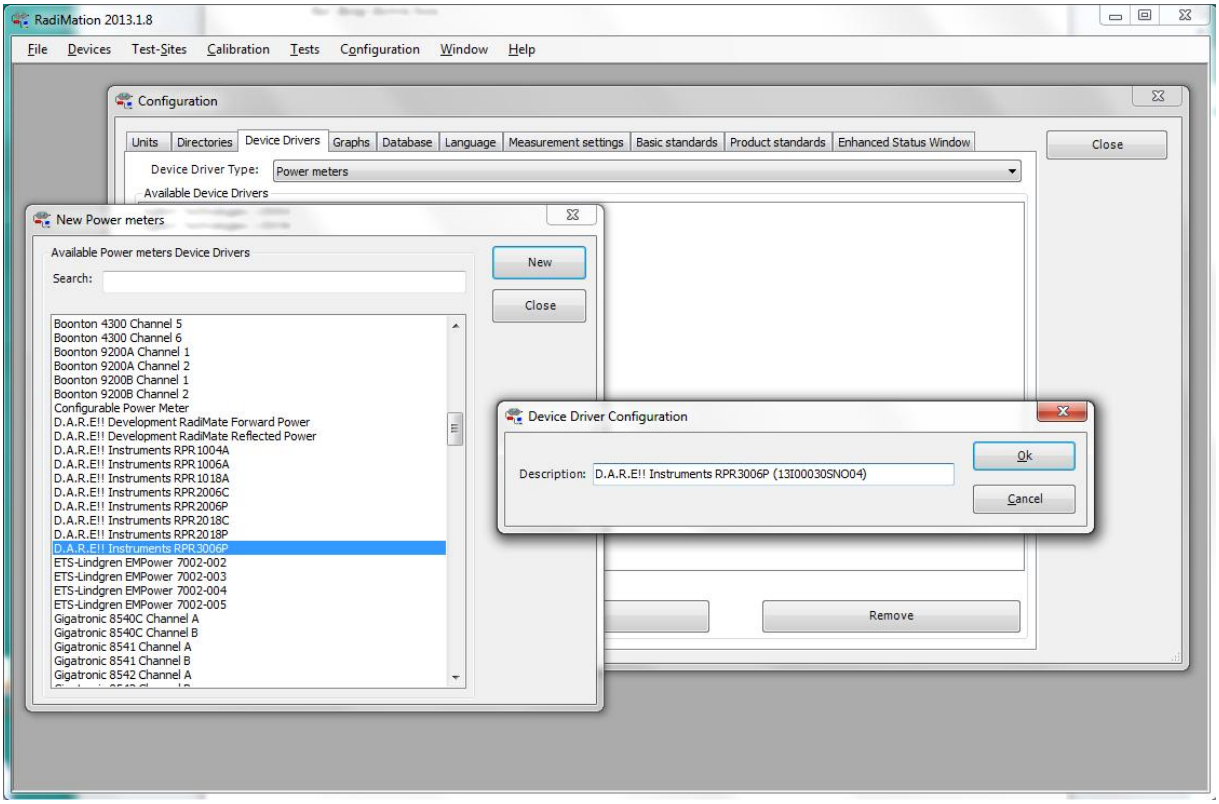
Start Radi*M*ation® Free. First of all, the power meters which will be used for the measurements must be added in the configuration. From the menu bar select “Configuration” and select “Configuration” again.



In the configuration window, select the tab “device drivers” and select “power meters” from the drop down box.



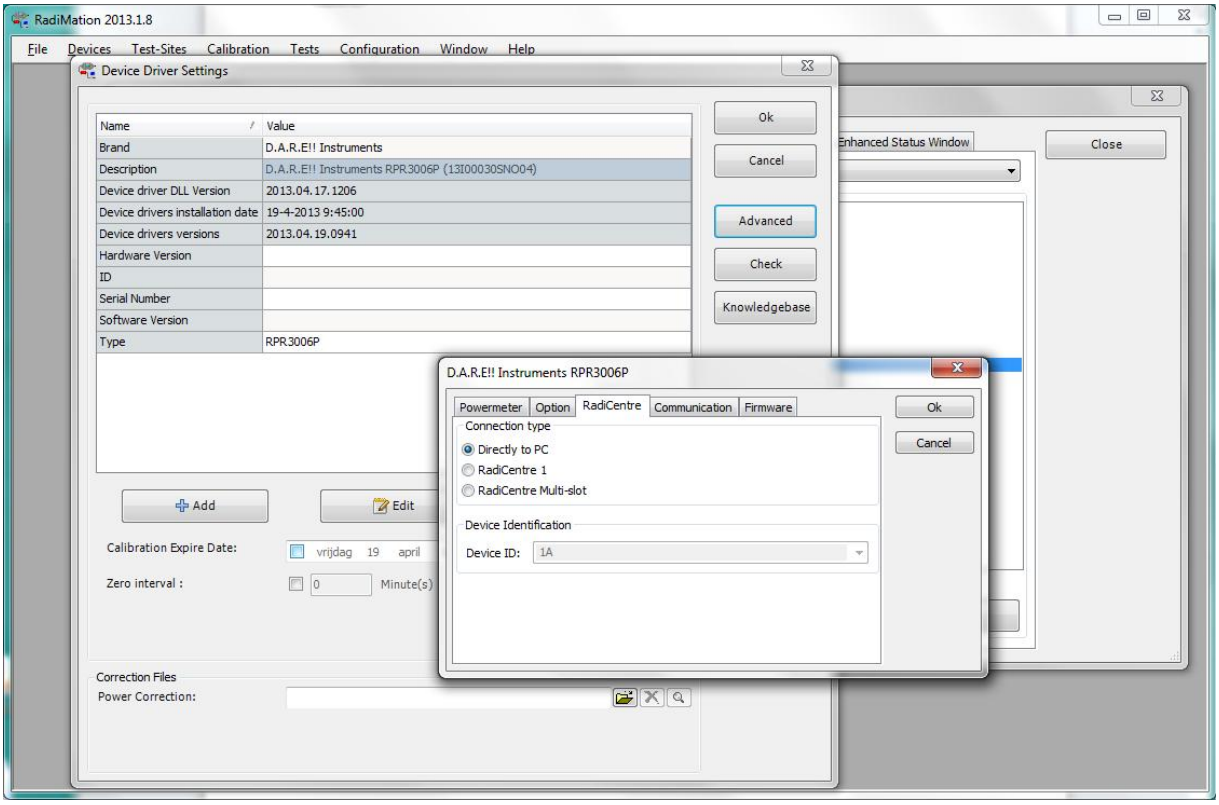
Press the “New” button. From the list, search for “D.A.R.E!! Instruments RPR3006P” and select this power meter. Enter a unique name for the power meter and press “OK”. The power meter is now in the configuration list.



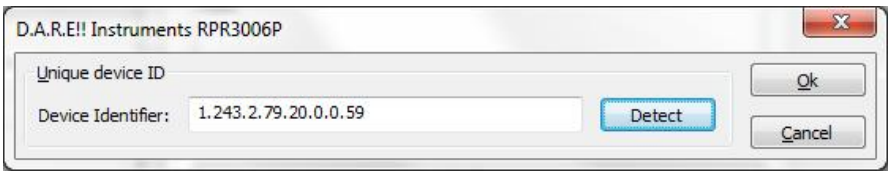
Make sure that the power meter is connected to your PC with the USB port and the drivers are installed. Check the Windows Device Manager to determine if the Radi*P*ower® USB is loaded correctly.

From the configuration list, select the Radi*P*ower® and press “Edit”. A Device Driver Settings window will now appear.

- Press the “Advanced” button.
- Select the “Option” tab and set the desired filter for CW measurements, for example Filter 3.
- Select the “RadiCentre” tab and select “Directly to PC”.
- Select the “Communication” tab and select “USB”. Press Configure.

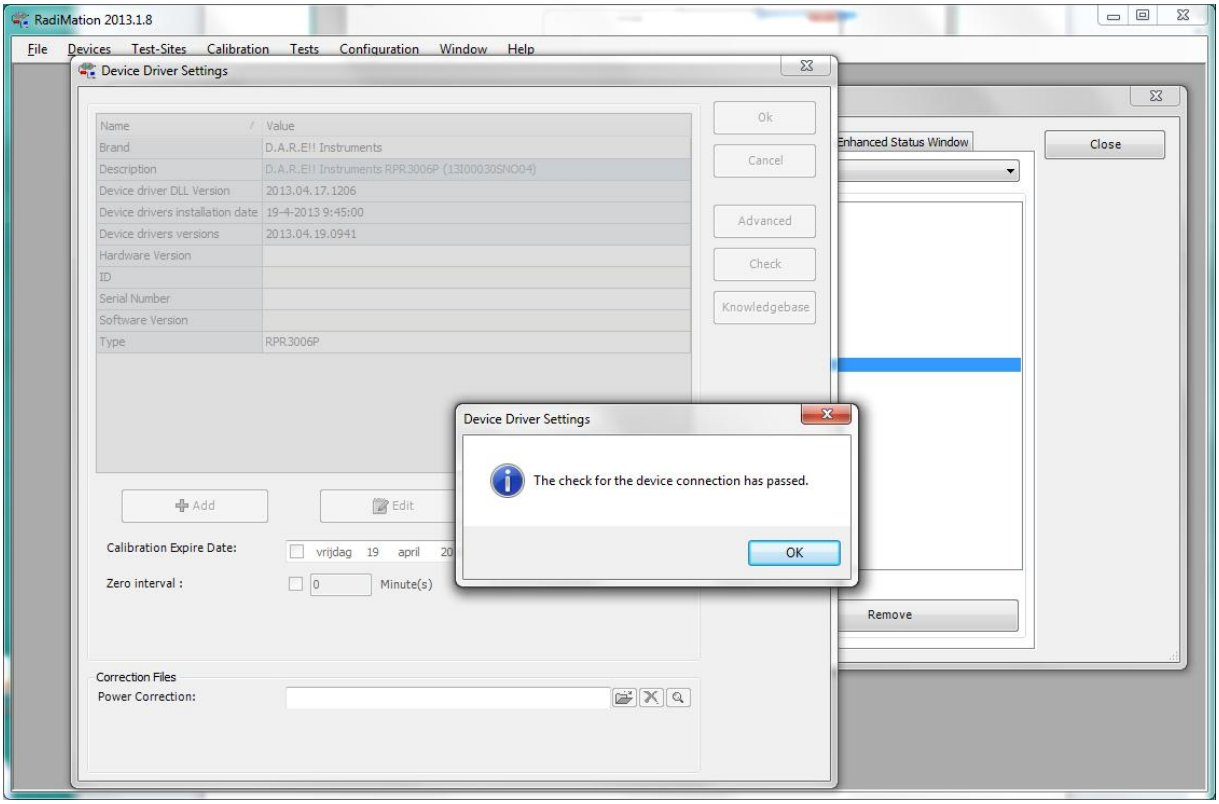


A new window will appear to detect the USB identifier of the Radi*P*ower®. Make sure that only one Radi*P*ower® is connected and press “Detect”.



If the Device Identifier is detected, press “OK”.
Press “OK” again to return to the Configuration window.

Finally a check can be performed to determine if the Radi*P*ower® is ready to be used. From the configuration windows press the “Check” button.



Repeat the procedure to add more Radi*P*ower® heads. Please note that each Radi*P*ower® has to have a unique name.

If all necessary power meters are added in the configuration, the measurement can be setup and all Radi*P*ower® can be connected to the USB ports of the PC.

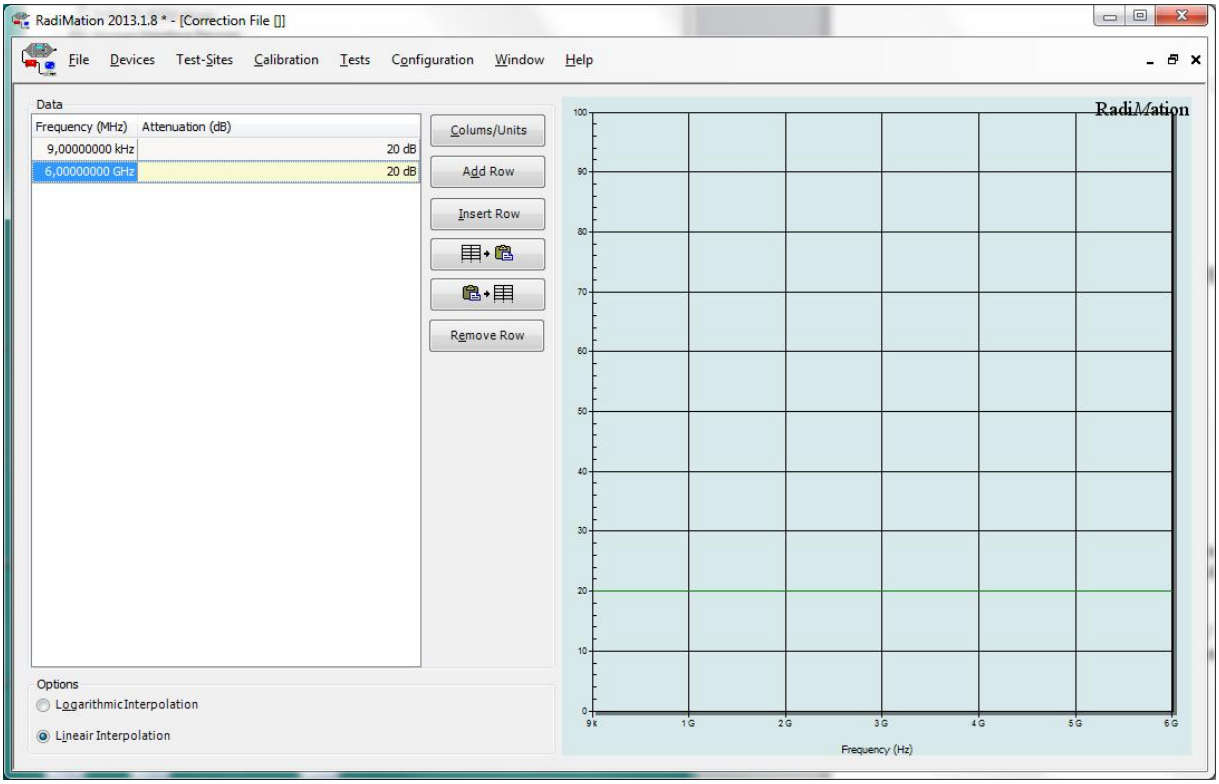
5.4 Adding coupler values in RadiMation®

In a MIMO test setup, power measurements are often performed using a coupler on the antenna port. Coupling factors can easily be added in RadiMation® using a correction file.

To create a correction file, select “File” – “New” – “Correction” from the menu bar.
Press “Colums/units” to create to columns for Frequency and Attenuation.

To create a constant correction versus frequency:

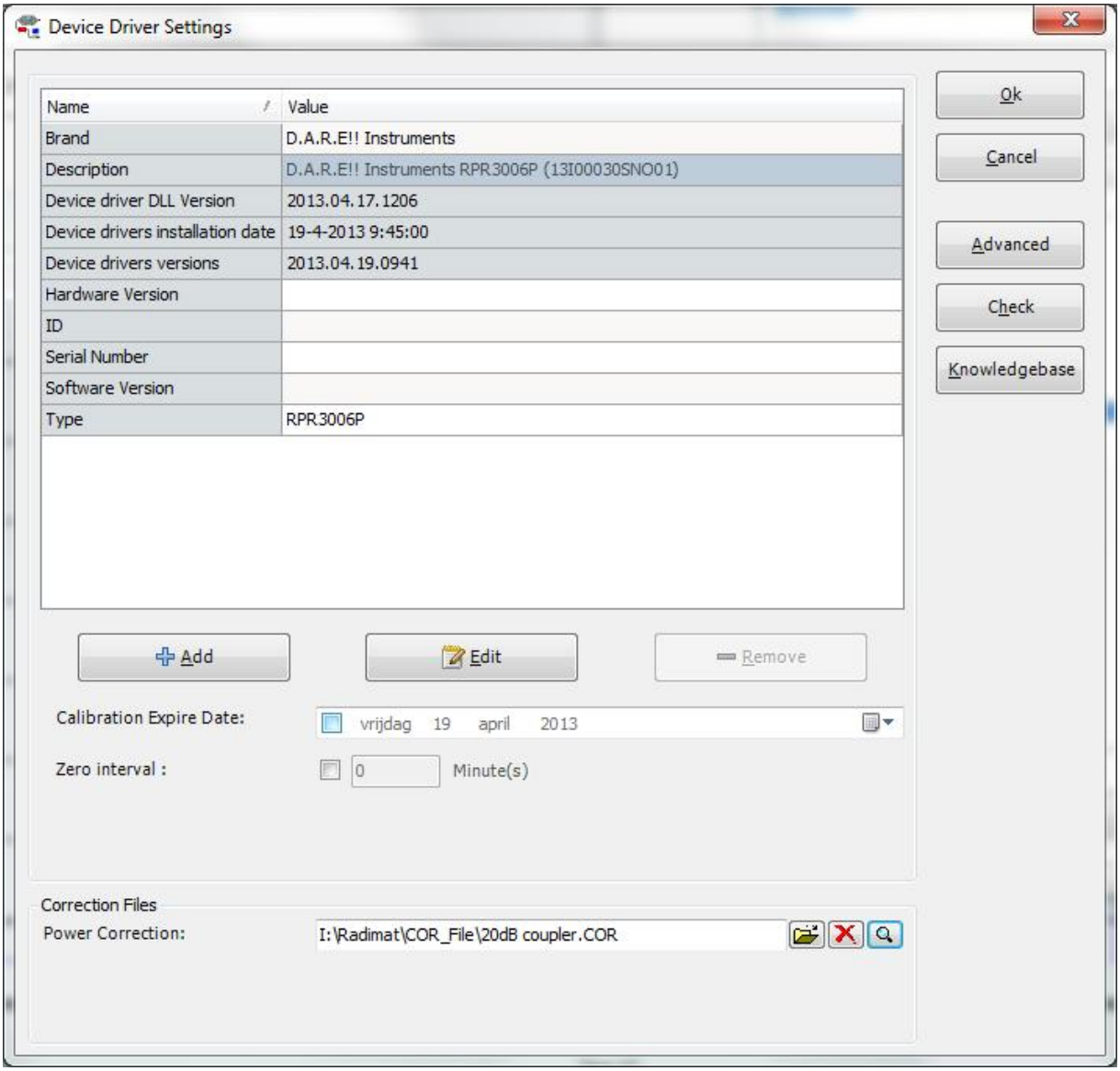
- Press “Add Row” and enter the lowest frequency with the corresponding attenuation.
- Press “Add Row” again and enter the highest frequency with the corresponding attenuation.



If calibration data of the coupler is available, this data can be used to create an accurate correction for the coupler.

After all data has been entered, select “File” – “Save Correction As” to save the data.

Next the correction data of the coupler has to be added to the correct power meter. Select “Configuration” and “Configuration” again. In the Configuration window select the “Device drivers” tab and select the power meter for which the correction has to be added. Press “Edit”.

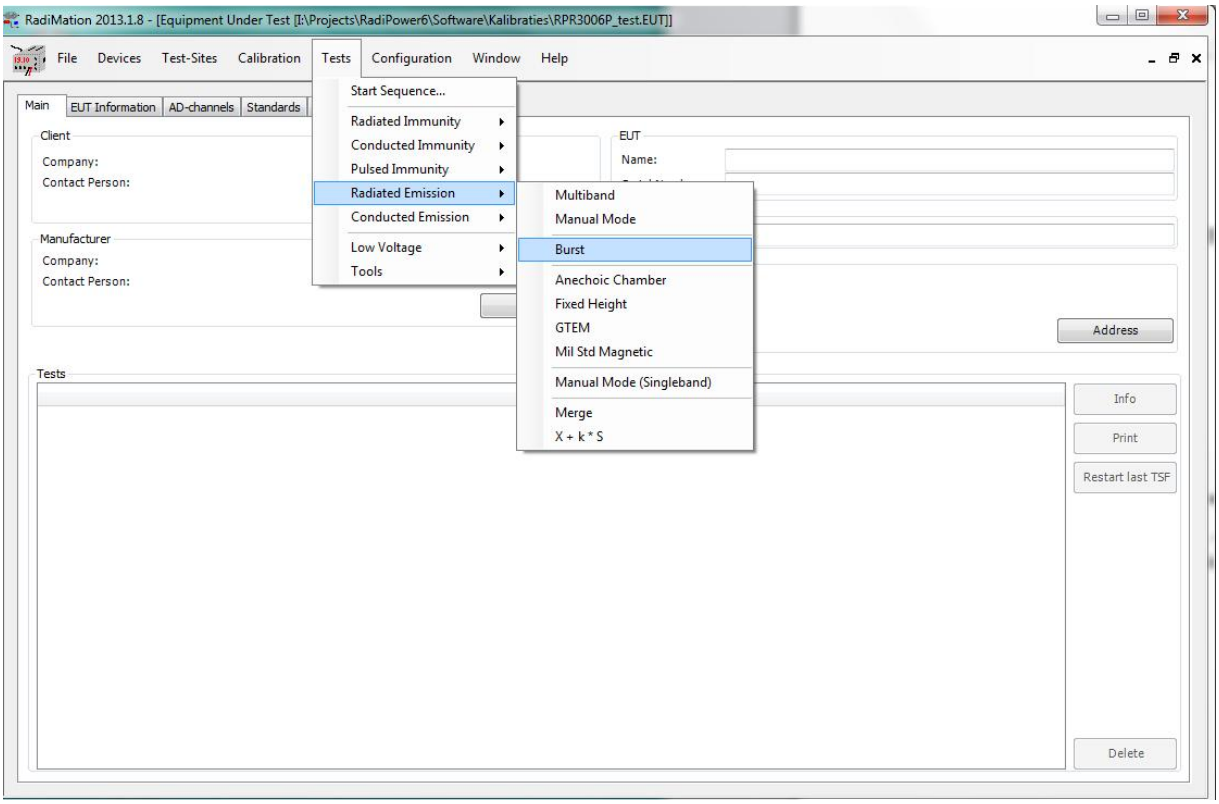


Press the “file open”- button in de Correction Files area to select the correction file.
Perform this procedure for each power meter for which a coupler correction has to be added.
Radi*M*ation® will now automatically calculate the power values including the coupler values.

5.5 Performing a MIMO measurement with RPR3006W and RadiMation® Free

Create a new EUT-file by selecting “File” – “New” – “EUT” from the menu bar. Choose a filename and select “OK”. A new EUT-window will now be opened.

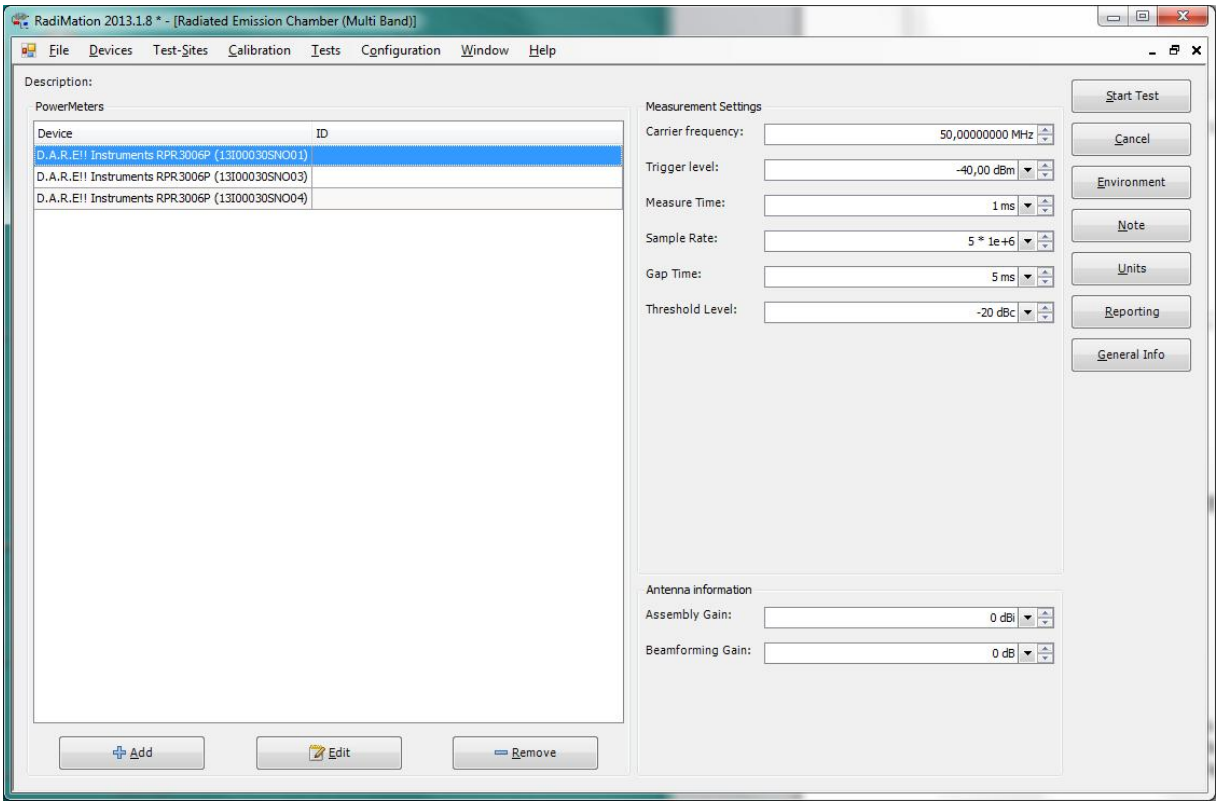
From the menu bar select “Test” – “Radiated Emission” – “Burst”.



Press “New” to create a new TSF-file (Test Setup).

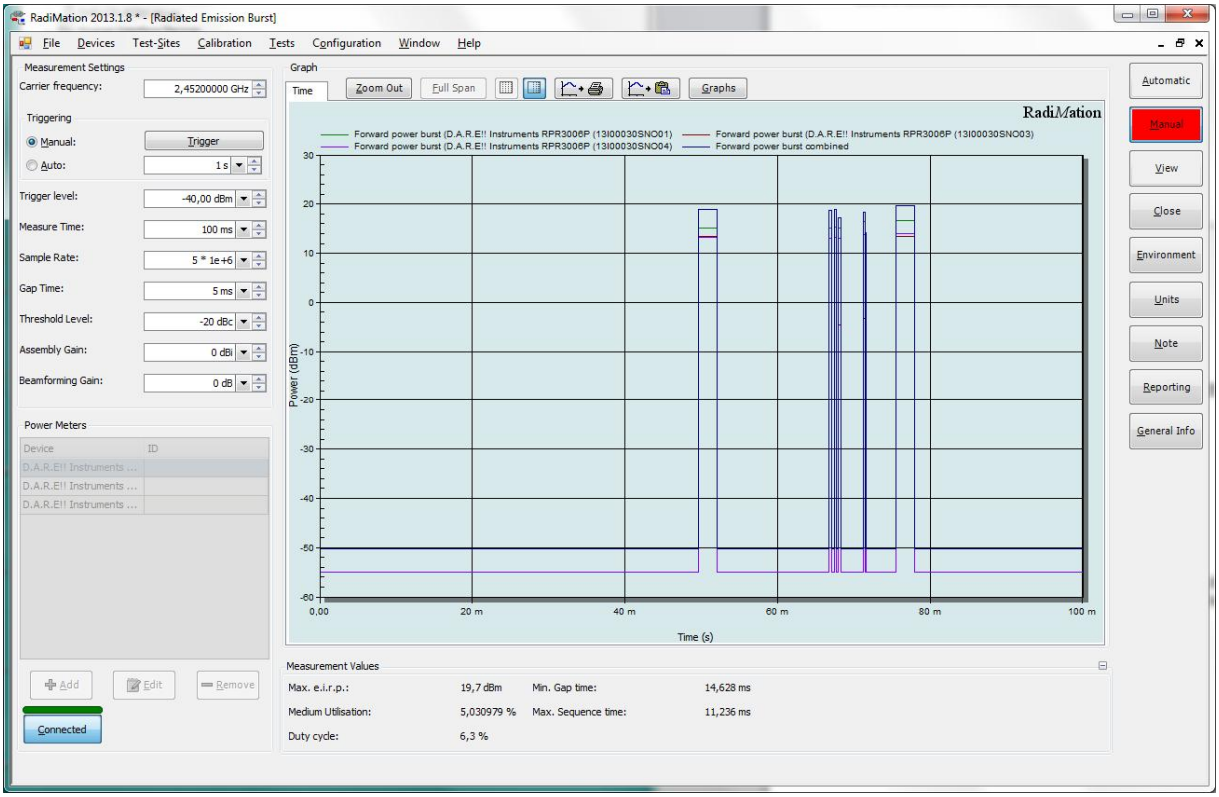
A new window will now be opened in which the test can be configured.

- Press the "+ Add" button to add all the power meters to your test.
- Enter the correct parameters on the right hand side (frequency, trigger level, etc)



Press "Start Test" to start the conducted power measurement test with multiple power meters. Enter a filename to save the test.

After a measurement has been performed, all parameter such as Max e.i.r.p, medium utilisation, Duty cycle, Min Gap time and Max. Sequence time are calculated by Radi*M*ation®.



6 RadiPower® command set

6.1 General

The Radi*P*ower® uses a high speed communication protocol which is supported by Radi*M*ation®. This results in short transfer times of the data, even at long observation times or large numbers of samples.
As a result, a simple terminal program cannot be used to communicate with the Radi*P*ower® directly. The Radi*P*ower® uses a USB2.0 FTDI transceiver with a D2XX driver for Windows. Programmers can use the functions which are supported by the D2XX driver to read from and write data to the Radi*P*ower® for designing their own driver for other automation software. More information can be found on: http://www.ftdichip.com/Support/FTSwExamples.htm

When the Radi*P*ower® sensor is connected to a Radi*C*entre® with a USB1004A plug-in card, all commands must be preceded by the "Device number" and "Port number" of the card in the Radi*C*entre®. The "Device number" is the number of the slot in which the USB1004A is placed. The "Port number" is the port identifier the USB1004A plug-in card to which the Radi*P*ower® sensor has been connected.

For example:
Using a Radi*C*entre® with USB1004A plug-in card in slot 2, with the Radi*P*ower® sensor connected to port A, must be used with prefix 2A for all commands:

To obtain the identifier from this power sensor send: "2A*IDN?"

Or to get a power reading from this sensor send: "2APOWER?"

"2" = "Device number" of the Radi*P*ower® plug-in card
"A" = "Port number" of the Radi*P*ower® plug-in card used
"POWER?" = command to the Radi*P*ower® Head

Refer to the Radi*C*entre® manual for more information on the "Device number" of a module.

Please note that the Radi*C*entre® system only supports mode 0 of the Radi*P*ower® sensor.
The RPR3006P will be set to mode 0 and behave like the "C" –version.
Special functionality, like envelope tracing and burst mode, cannot be used in combination with a Radi*C*entre®.

6.2 Default values

To return to factory defaults, the “RESET” command can be used and the following parameters will be set to their default values:

Command	Default value	Description
MODE	0	RMS power measurement
AUTO_STORE	0	Parameter changes will not be stored automatically
FREQUENCY	1300000 kHz	1300 MHz
FILTER	AUTO	Automatic filter setting (related to power level)
POWER_OFFSET	0.00	Sets power offset to 0,00 dB
POWER_UNIT	0	Sets measurement unit to dBm
VBW (mode 0) VBW (mode 1, 2 and 3)	1k AUTO	1kHz VBW in RMS mode for CW signals Automatic VBW setting for all other modes
ACQ_SPEED	1000	1 MSps
ACQ_LOG_THRESHOLD	-40.0	-40 dBm
ACQ_LOG_TRIG_TYPE	0,1	Internal triggering, rising edge
ACQ_LOG_TRIG_SET	2,2	2 samples with 2 samples distance for evaluation
ACQ_AUTO_TRIGGER	0	Single trigger
ACQ_LOG_DELAY	0	No delay time before trigger
ACQ_LOG_TRIG_HOLDOFF	0	No holdoff before trigger
BM_MEASURE_PERIOD	1000	1000 ms
BM_NOISE_TIMER	10	10 samples
BM_TRIG_LEVEL	-40	-40 dBm

6.3 Commands

Please note that every command has to be terminated with a carriage return. The default communication setting of the serial USB port is 115200,8,N,1.

RadiPower general commands (all modes)		
Command	**Reply**	**Description**
"*IDN?"	"D.A.R.E!!, RPR30XXY, version"	Returns the ID of the RadiPower sensor
"ID_NUMBER?"	"x.x.x.x.x.x.x.x"	Returns the unique id number. For example: 114.80.79.87.20.0.0.225
"VERSION_SW?"	"3.10"	Returns SW version
"VERSION_HW?"	"3.0"	Returns HW version
"REBOOT SYSTEM"	"OK"	Reboots the system / Restarts embedded software
"RESET"	"OK"	Resets the RadiPower to default values
"TEMPERATURE?"	"272"	Returns board temperature in 0.1 degrees In this example: 27,2°C
"BAUD <n>"	"OK"	Sets the baudrate, with n= 0 for 57600 bps 1 for 115200 bps (default) 2 for 230400 bps 3 for 460800 bps
"BAUD?"	"0", "1", "2" or "3"	Returns the current baudrate
"MODE <m>"	"OK"	Sets mode, with m= 0 for RMS mode 1 for max hold (peak) 2 for envelope tracing mode 3 for burst mode
"MODE?"	"0", "1", "2" or "3"	Returns current mode
"STORE"	"OK"	Stores the current settings in flash memory
"AUTO_STORE <s>"	"OK"	Sets the auto store mode, with s= 0 settings will not be automatically stored 1 settings will be stored in flash after each change of the settings.
"AUTO_STORE?"	"0" or "1"	Returns the current store setting
"FREQUENCY <f>"	"OK"	Set the frequency <f> in kHz.
"FREQUENCY?"	"1300000 kHz"	Returns the frequency in kHz In this example: 1.300.000 kHz
"FREQUENCY? MIN"	"9 kHz"	Lowest measurable frequency In this example: 9kHz
"FREQUENCY? MAX"	"6000000 kHz"	Highest measurable frequency In this example: 6GHz

RadiPower general commands – continued		
Command	**Reply**	**Description**
"FILTER <n>"	"OK"	Sets the number of samples used to calculate the RMS power value, with n= 1 = 10 samples 2 = 30 samples 3 = 100 samples 4 = 300 samples 5 = 1000 samples 6 = 3000 samples 7 = 5000 samples or AUTO
"FILTER?"	"1" to "7" or "AUTO"	Returns the filter setting
"POWER?"	"-38,81 dBm"	Returns the measured power in dBm In this example: -38.81 dBm
"POWER_OFFSET <p>"	"OK"	Sets the power offset, with p= From -100,00 dBm to +100,00 dBm
"POWER_OFFSET?"	"30,00 dB"	Returns the power offset in dB In this example: 30 dB
"POWER_UNIT <u>" [4]	"OK"	Sets the power unit, with u= 0 for dBm and 1 for Watts
"POWER_UNIT?"	"0" or "1"	Returns the power unit.
"VBW <b>"	"OK"	Sets Video bandwidth (VBW), <b> can be 1k, 10k, 100k, 1M or 10M (Hz) The VBW should be 10 times smaller than the lowest frequency to be measured.
"VBW AUTO" [5]	"OK"	Set the VBW to automatic. The VBW is coupled to the sample speed of the power meter: VBW = 10 MHz at 20 MSps and 40 MSps VBW = 1 MHz at 5 MSps VBW = 100 kHz at 1 MSps and 500 kSps VBW = 10 kHz at 100 kSps and 50 kSps VBW = 1 kHz at 10 kSps
"VBW?" [5]	"1k", "10k", "100k", "1M", "10M" or "AUTO"	Returns the VBW setting
"ACQ_SPEED <s>"	"OK"	Sets ADC sample speed in kSps. <s> can be 10, 50, 100, 500, 1000, 5000, 10000, 20000 or 40000
"ACQ_SPEED?"	"5000"	Returns ADC speed in kSps
"FILTER_BW?	"BW"	Returns the filter bandwidth <BW> in Hz. Sample speed divided by number of averages defined by the filter setting.

[4] Applies only for the POWER? command in RMS mode and Peak mode

Remarks to general commands:

- In RMS mode, a new power measurement is started after the “power?”-command has been given. Depending on the filter setting, the RadiPower performs the required number of measurements and returns the average value of all linear power samples.

- For power measurements of AM modulated signals, acquisition speed, filter and VBW settings are important to obtain correct results. In general the VBW should be 10 times smaller than the RF carrier frequency, but higher than the modulation frequency. For example if an AM modulated signal is measured with a modulation frequency of 1 kHz, the VBW should be set to 10k or higher.
  The acquisition speed and filter should be set in such a way that at least one full period of the modulation signal is measured. At 1 Msps, the filter should be set to 5 or higher, which results in 1000 or more samples being averaged. At lower sampling speeds, for example 100ksps, the filter should be set to 3 or higher to cover at least one full period of the envelope signal.
  In formula:

$$\text{[illegible]} = \frac{\text{[illegible]}}{\text{[illegible]}} < \text{[illegible]}$$

  While:

$$\text{[illegible]} \ll \text{[illegible]} \ll \text{[illegible]}$$

- In PEAK mode the “power?”-command will return the highest value measured, since the previous “power?”-command. After reading the power, the stored value will be cleared.

- The filter setting does not apply in Peak mode, Envelope tracing or Burst mode.

- The VBW setting can be different for RMS mode and the other modes. If a VBW has been set for RMS mode, this will not affect the VBW setting for the other modes and vice versa.

- Power measurements will be interrupted if a temperature reading is requested.

- The STORE command stores all settings in flash memory. All parameters mentioned in the table on page 19 (default values) are stored, including the BAUD setting.

- During Envelope tracing temperature readings are not updated as long as the trigger is armed. While armed, temperature readings are still possible, but the actual values are taken before the measurement was armed. As soon as a trigger occurs, the temperatures are updated in the sensor

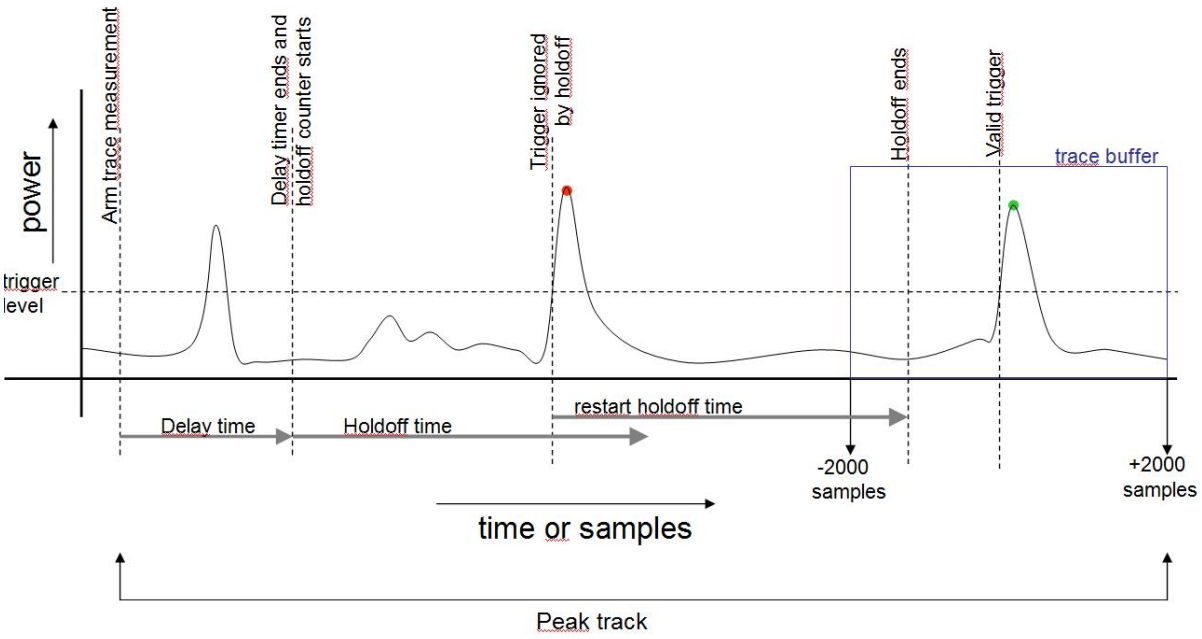
- VBW command does not apply for the burst mode (RPR3006W), since this model has no video filter.

.Additional commands for envelope tracing mode (RPR3006P)		
Command	**Reply**	**Description**
"ACQ_LOG_RESET"	"OK"	Resets (clears) sample buffers
"ACQ_LOG_STATUS?"	"0" or "1"	0= waiting for trigger 1= buffers filled
"ACQ_LOG_BUF_SIZE <m,n>"	"OK"	Sets the buffer size in samples, with: <m> pre trigger buffer size <n> post trigger buffer size The sum of <m> and <n> cannot exceed 100.000 samples
"ACQ_LOG_BUF_SIZE?"	<m>,<n>	Returns the buffer size of the buffer <m> are the number of samples pre trigger <n> are the number of samples post trigger
"ACQ_LOG_DATA_ENH? <i>,<j>"	Power values from buffer <i> samples before trigger to <j> samples after trigger.	Returns samples from pre and post buffer (ASCII text dump). The sum of <i> and <j> cannot exceed 100.000 samples. Furthermore <i> cannot be greater than <m> and <j> cannot be greater than <n>.
"ACQ_LOG_DATA_ENH_BIN? <i>,<j>"	Power values from buffer <i> samples before trigger to <j> samples after trigger.	Returns samples from pre and post buffer (binary dump, 2 byte integer *100) special code 0x7777 represents data start, 0xAAAA represents data end. The sum of <i> and <j> cannot exceed 100.000 samples. Furthermore <i> cannot be greater than <m> and <j> cannot be greater than <n>.
"ACQ_LOG_THRESHOLD <l>"	"OK"	Sets the trigger level to power level <l> in dBm
"ACQ_LOG_THRESHOLD?"	"-40"	Returns trigger level, second value is an internal level for debug purposes
"ACQ_LOG_MAX?"	"-9.97 dBm"	Returns the highest power value in dBm which has been recorded in the buffers. In this example: -9,97 dBm
"ACQ_LOG_DELAY <d>"	"OK"	Sets number of samples that a trigger will be delayed after the measurement is armed. The number of samples <d> can be from 0 to 2.000.000
"ACQ_LOG_DELAY?"	"0" to "2000000"	Returns number of samples that trigger will be held off after first occurring trigger

Additional commands for Envelope tracing mode (RPR3006P) – Triggering		
Command	**Reply**	**Description**
"ACQ_LOG_TRIG_TYPE <a>,<b>"	"OK"	Sets trigger type: a=0 for Internal triggering a=1 for External triggering b=0 for Falling edge b=1 for Rising edge
"ACQ_LOG_TRIG_TYPE?"	Retrurns trigger type <a>,<b>	See command above
"ACQ_ AUTO_TRIGGER <t>"	"OK"	t="1" for automatic (normal) triggering t="0" for single triggering
"ACQ_ AUTO_TRIGGER?"	"0" of "1"	Returns trigger mode
"ACQ_LOG_TRIG_HOLDOFF <d>"	"OK"	Sets number of samples that a trigger will be held off after first occurring trigger. If a trigger occurs during the hold off period, the counter will be reset. The number of samples <d> can be from 0 to 1.000.000
"ACQ_LOG_TRIG_HOLDOFF?"	"0" to "1000000"	Returns number of samples that trigger will be held off after first occurring trigger

If auto trigger mode is set to 1, the power sensor will be automatically armed each time the data has been read from the device.

Graphical explanation of trigger mechanism:



During envelope tracing mode, the peak value will be tracked and stored in memory from the moment the measurement is armed. The peak value can be read by using the "ACQ_LOG_MAX?" command, which will also reset the peak value once it has been read. Peak track will stop as soon as a valid trigger has been found and the buffers are ready to be read from the device (ACQ_LOG_STATUS=1).
Please note that a high number of samples for the DELAY or HOLDOFF command at low sampling rates results in long measurement times up to 100 seconds.

Additional commands for Burst mode (RPR3006W)		
Requests	**Reply**	**Description**
BM_MEASURE_PERIOD <T>	"OK"	Sets the measurement period T (ms), with T can be from 1 to 60.000 ms
BM_MEASURE_PERIOD?	"500"	Returns the measurement period. In this example 500 ms
BM_NOISE_TIMER <n>	"OK"	Sets the number n of samples, which are allowed below the threshold, before a new burst is counted. N can be set between 0 and 5000 samples
BM_NOISE_TIMER?	"10"	Returns the number of samples which are set. In this example 10.
BM_TRIG_LEVEL <l>	"OK"	Sets the trigger level for burst detection. The level l can be set between -50 and +10 dBm.
BM_TRIG_LEVEL?	"-40"	Returns the trigger level in dBm. In this example the level is set to -40 dBm.
BM_GO	"OK"	Starts a single burst measurement
BM_STAT?	"0" or "1"	Returns the status of the burst measurement. 0 if the measurement is not started or in progress. 1 if the measurement is completed and the data is ready to be read.
BM_BURST_COUNT?	"252"	Returns the number of bursts found within the set measurement period. The maximum number is 100.000
BM_BURST_DATA?<i>	"x;y;z" or "NO DATA"	Returns for burst with number i the start time (x); end time (y); RMS power (z). Final character is a newline.
BM_BURST_DATA_DUMP	"x;y;z" or "NO DATA"	Returns for each burst within the measurement period the start time (x); end time (y); RMS power (z). Final character is a newline.

In burst mode, the Radi*P*ower® can store the information of 100.000 bursts independent of the observation time. For each burst the RMS power and start/stop-times are stored in the buffers. The sample speed can be set to 1 MS/s or 5 MS/s to ensure correct measurements according to the ETSI standard for wideband devices.

In MIMO measurements, using multiple synchronised Radi*P*ower® meters, Radi*M*ation® captures samples simultaneously and calculates the total power according to the EN 300 328 or EN 301 389 standard.

6.4 Error codes

Error codes	
Error code	**Description**
“ERROR 1”	Wrong command
“ERROR 50”	Wrong argument
“ERROR 51”	Argument too low
“ERROR 52”	Argument too high
“ERROR_601”	Frequency not set
“ERROR_602”	Overrange
“ERROR_603”	Underrange
“ERROR_604”	No Cal data

7 RadiPower® specifications

Electrical specifications	RPR3006C	RPR3006P	RPR3006W
Detector type	Log detector		RMS detector
Measuring function	RMS CW power, Peak power	RMS CW power, Peak power Envelope tracing	RMS CW power, Peak power Burst mode
Frequency range	9 kHz[1] to 6 GHz		10 MHz tot 6 GHz
Power measuring range	-60 to + 10 dBm		-50 to + 10 dBm
Input damage level	> +20 dBm		
Resolution	0,01 dB		
RF input connector	Precision N-type		
RF input impedance	50 Ohm		
Max. SWR: < 100 MHz	1,05		1,05
100 MHz to 1 GHz	1,10		
1 GHz to 6 GHz	1,20		1,15
Frequency response accuracy (at 23° C ± 2° C)	+/- 0,2 dB		
Deviation from CW for wideband modulated signals	n/a		< 0,2 dB
Linearity error	0,05 dB + 0,005 dB/dB		
Temperature effect	0,15 dB max over full temperature range		
Measuring units	dBm or Watts		
Zero adjustment	Not required		
Frequency response correction	Stored frequency response data is taken into account by numerical entry of the measurement frequency		
Measurement speed	10, 50, 100 kS/s, 1, 5, 10, 20, 40 MS/s		1 or 5 MS/s
Storage capacity	100.000 samples		100.000 bursts
Filters for RMS Mode	**Number of samples used for RMS calculation**		
Filter 1	10		
Filter 2	30		
Filter 3	100		
Filter 4	300		
Filter 5	1000		
Filter 6	3000		
Filter 7	5000		

[1] Depends on VBW setting

Electrical specifications	RPR3006C/P/W

Auto filter mode	Number of samples used for RMS calculation
+10 to 0 dBm	100 (filter 3)
0 to -10 dBm	100 (filter 3)
-10 to -20 dBm	100 (filter 3)
-20 to -30 dBm	300 (filter 4)
-30 to -40 dBm	1000 (filter 5)
-40 to -50 dBm	3000 (filter 6)
below -50 dBm	5000 (filter 7)

Mechanical	
Dimensions of measuring device	124 * 32 * 32 mm
RF input connector	N type precision
Data connector (power head side)	USB mini type B
Trigger input and output	MMCX

Environmental	
Temperature range (operating)	0° to 40° Celsius
Temperature range (storage)	-20 to 85° C
Relative humidity	10 – 90% (non-condensing)

Compliance	
EMC	EN 61326
Low Voltage	n/a

Supply	
Supply voltage	+5Vdc from USB port (4,75 V to 5,25 V)
Current consumption (USB)	Max. 200 mA

Interfaces	
Communication	USB 2.0 (drivers supplied for Windows XP and Windows 7)
RadiCentre	USB1004A plug-in card