DARE!!

D.A.R.E!! Instruments
Measurement equipment

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl

RadiPower®

Operating Manual

RF power sensor

~ with USB interface ~

supports RMS power and peak power measurements,
envelope tracing and burst logging

Models:

RPR2006C/RPR2006P
RPR2018C/RPR2018P

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

Table of contents:

Supplier Information:

Dijkstra Advice, Research & EMC 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

D.A.R.E!! Instruments
Measurement equipment

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

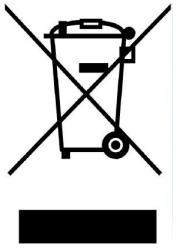
Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl

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.

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl

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 few microseconds. The C-version only supports RMS-measurements for CW signals.

Both Radi*P*ower® models (C- and P-version) are available in two ranges:

- RPR2006: 9kHz to 6GHz, -55dBm to +10dBm
- RPR2018: 10MHz to 18GHz, -45dBm to +10dBm

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

D.A.R.E!! Instruments
Measurement equipment

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl

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*
- *Installation CD with* RadiMation® Free software
- *This manual*

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl

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 powerful DSP, which processes all samples. The sophisticated software enables unique functions, such as envelope tracing and burst logging. The Pulse-version of the Radi*P*ower® supports all four different modes of operation:

mode 0:	RMS power:	to perform RMS power measurements of CW-signals
mode 1:	Peak power:	to perform peak measurements on RF-signals
mode 2:	Envelope tracing:	to capture the envelope of an RF-signal
mode 3:	Burst logging:	to log RF-bursts of e.g. frequency hopping devices

Mode 0: In RMS mode the Radi*P*ower® samples the demodulated signal at high speed up to a maximum of 10Msps[1]. 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.

Mode 1: In peak mode the Radi*P*ower® keeps track of the highest level which has been detected. This can be done for an infinite time. Once the power level has been read, the maximum value is automatically reset.

Mode 2: 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 buffers of the Radi*P*ower®.

Mode 3: For more complex transmitters, like frequency hopping devices, a special burst mode has been implemented. During the observation time, which can be up to 1 second at 1Msps measurement speed, 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 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.

[1] Only in RMS mode a sampling speed of 10Msps can be used.
The maximum sampling speed in all other modes is 1Msps.

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

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[2]. 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.

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

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

2. Remove the blind panel (marked WTBU) 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[3] 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[4].

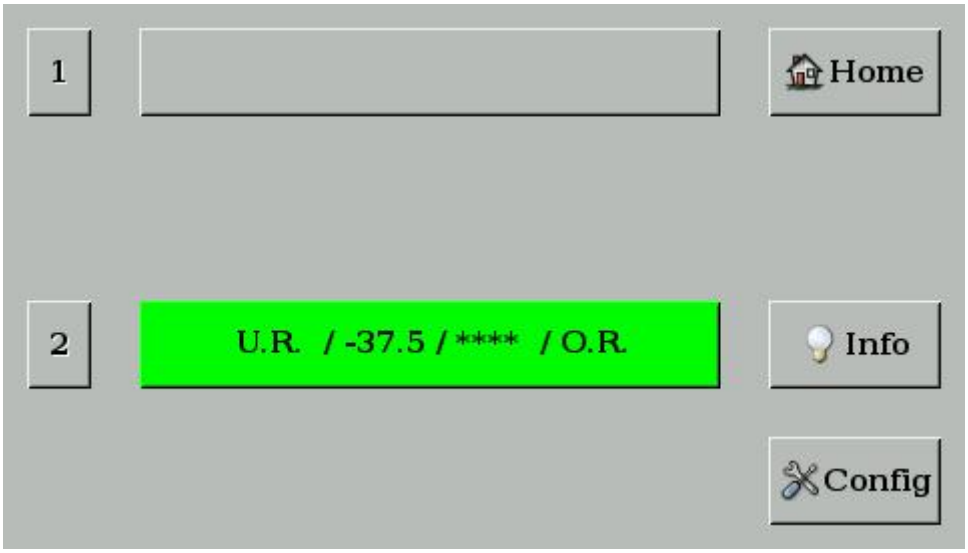
Readings from the sensor can now be taken directly from the TFT screen, with the Radi*M*ation® EMC software or any other (custom made) software package.

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

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl

4.3 Sensor configuration

The "STATUS" box in the "main" window of the Radi*C*entre® will display the detected Radi*P*ower® plug-in card.



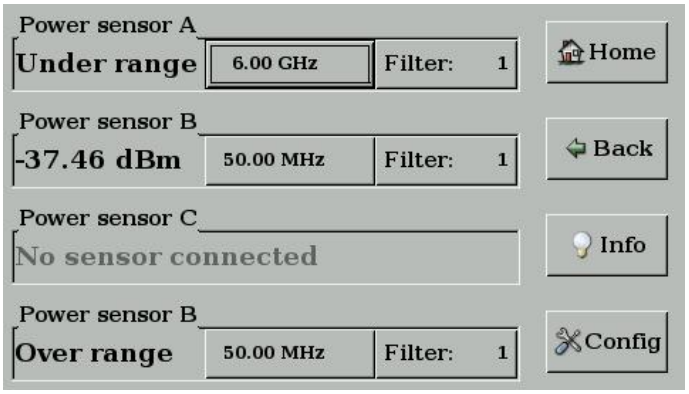
In the example, three power heads are connected to a USB1004A plug-in card:

A. the first Radi*P*ower® head is in 'under range'
B. the second Radi*P*ower® head measures -37,5 dBm
C. a third Radi*P*ower® head is not connected.
D. the fourth Radi*P*ower® head is in 'over range'

To monitor the measured power levels and set the measurement frequency, press the "STATUS" box of the required device.

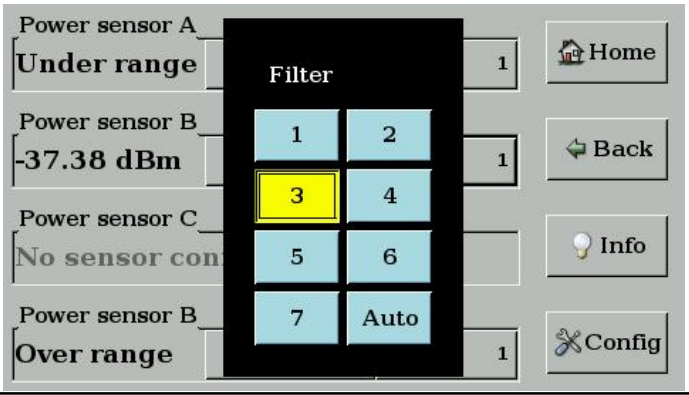
Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

A new window will display the measured power level for all connected power sensors (up to 4 sensors per plug-in card).



Behind the power level of each power sensor, the user can enter the measurement frequency in order to obtain the correct absolute power level.

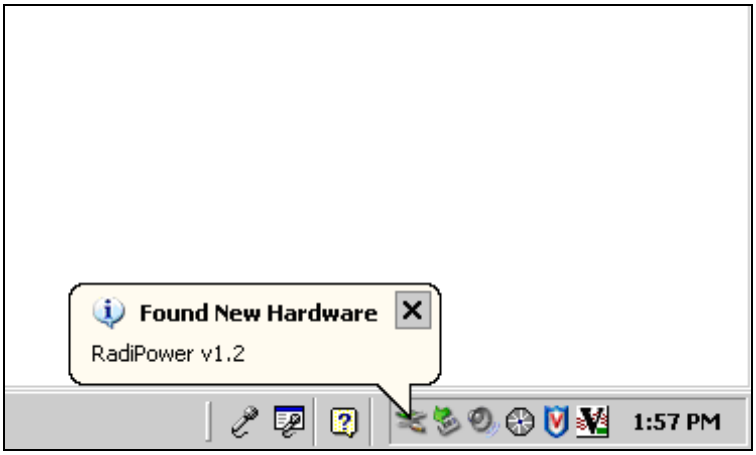
In addition the required number of averages can be set by selecting a filter setting.



5 Using the RadiPower® stand alone

5.1 Drivers installation

Plug in the RadiPower® 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 RadiPower® has been detected.

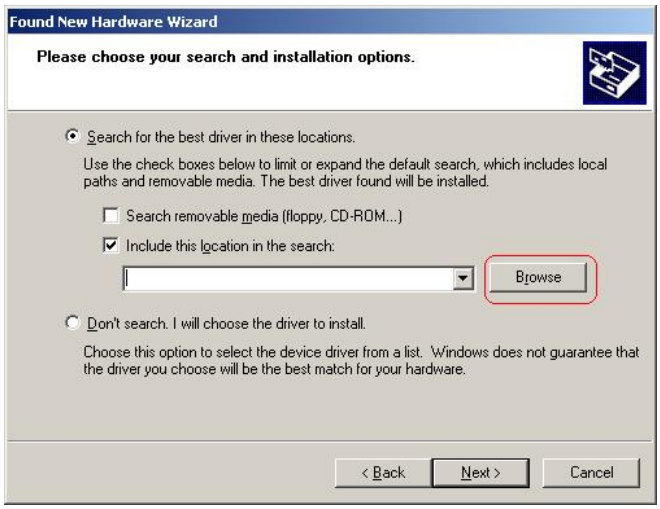


Windows will ask you to install device drivers:

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl

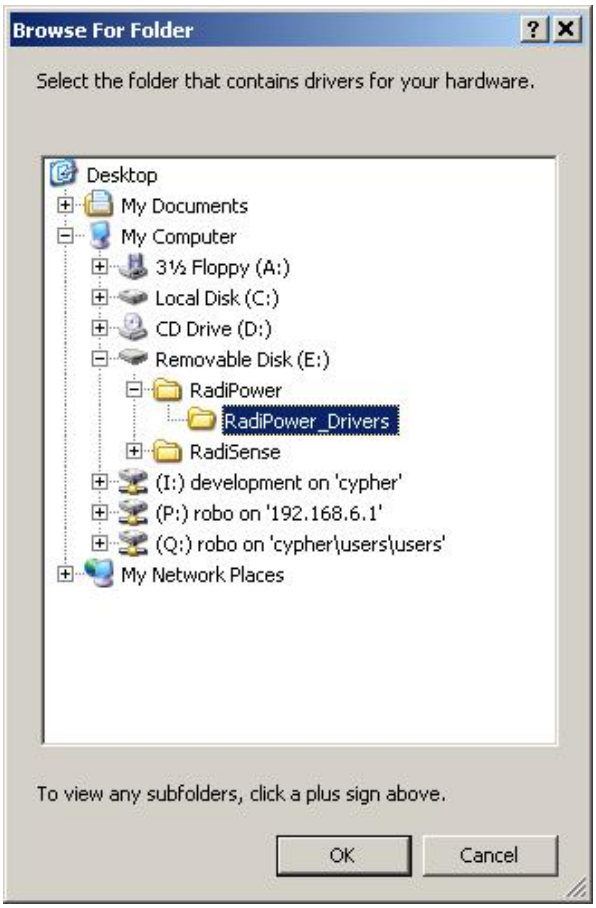
Select “Install from a list or specific location (Advanced). Press the “NEXT>” Button



Press the “Browse” Button

Select the Folder of the RadiPower _Drivers.

Press the “OK” Button.



Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

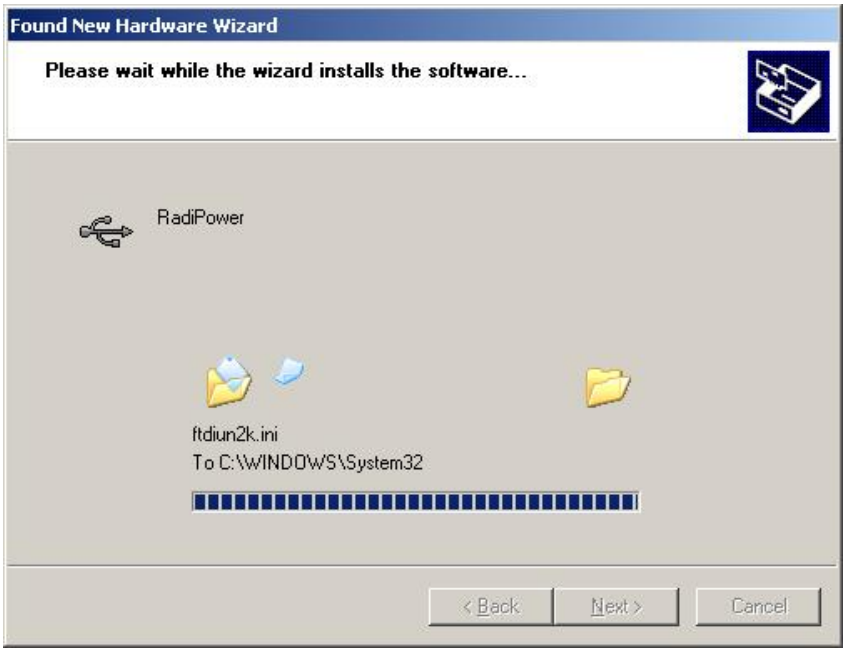
Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl

Press the “NEXT>” Button

Press the “Continue Anyway” Button

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl



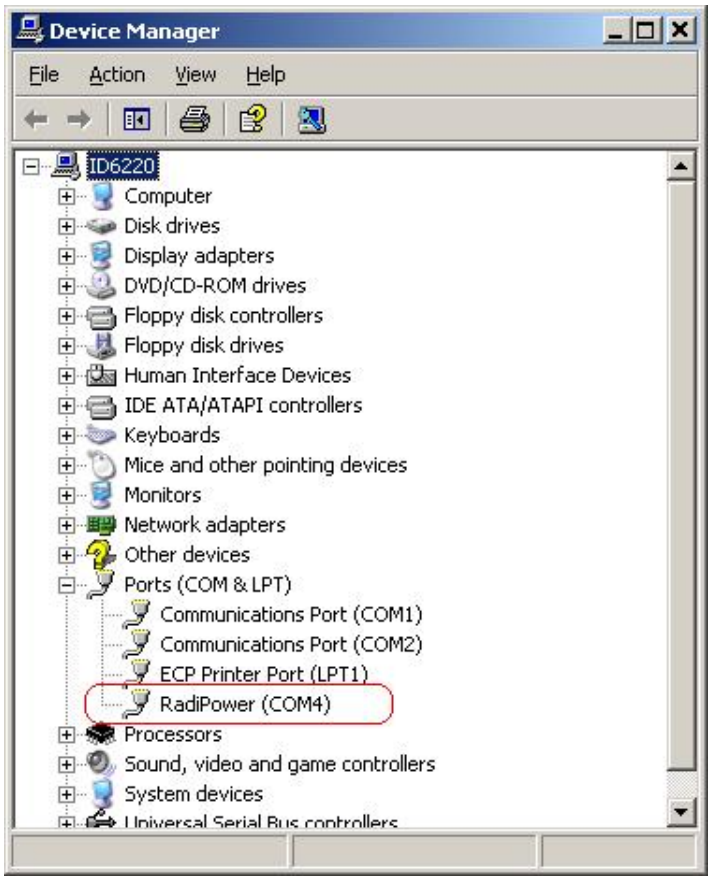
Press the “Finish” Button

- Please note that this process will repeat for the second driver.

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

5.2 Comport settings

The Radi*P*ower® sensor uses a virtual comport. The settings can be viewed and changed in the Windows Device Manager. In Windows press:
[Start] -> [Settings] -> [Control Panel] -> [System] -> Tab [Hardware] - > [Device Manager]



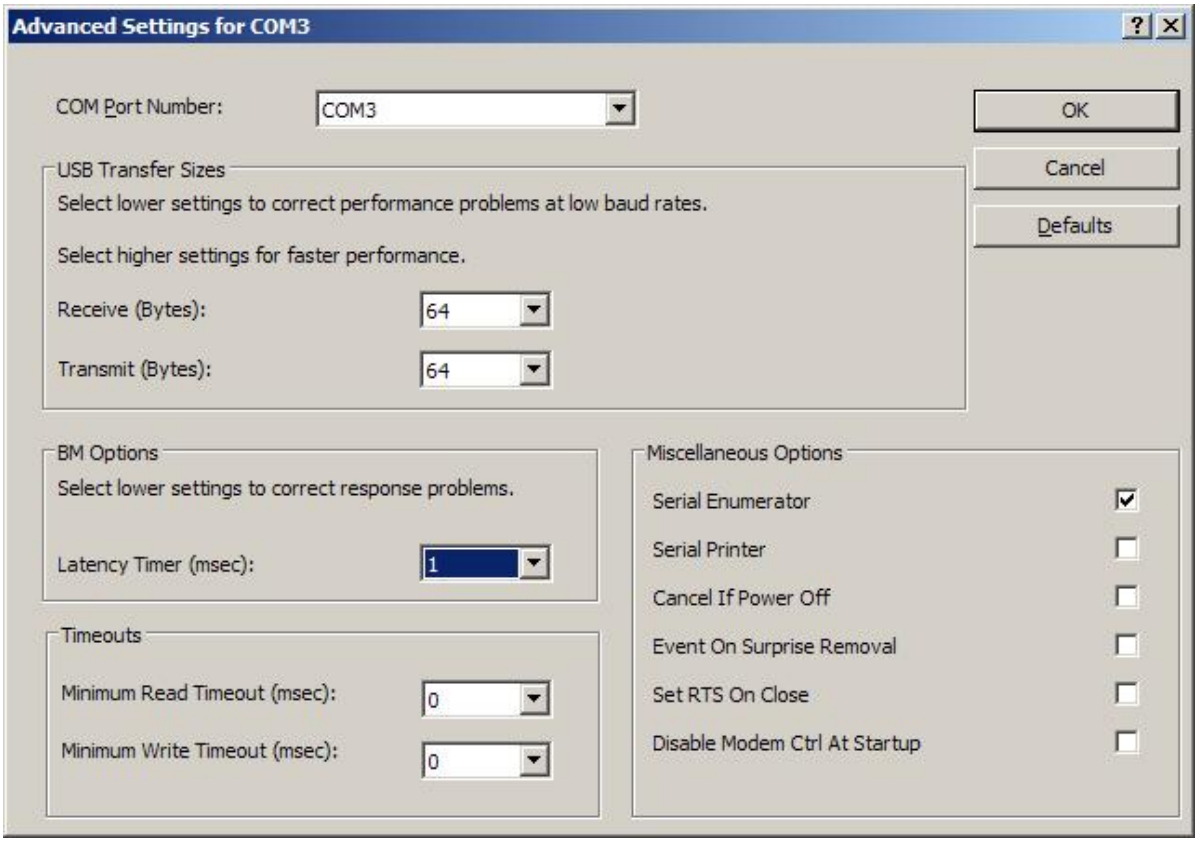
The default setting for the serial port[5] is:

Baud rate:	115k2
Data bits:	8
Parity:	None
Stop Bits:	1
Flow control:	None

[5] Make sure that the serial port which is being used is COM8 or lower.

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

To improve the communication speed to the Radi*P*ower® the Buffer Transfer size can be reduced and Latency Timer set to 1msec. These settings must be applied for the COM-port which is being used for the Radi*P*ower®.



5.3 Software installation

5.3.1 RadiMation® Free software

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

Radi*M*ation® is now ready for use with the Radi*P*ower® power sensor.
For extensive documentation, visit: http://wiki.radimation.com

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

6 RadiPower® command set

6.1 General

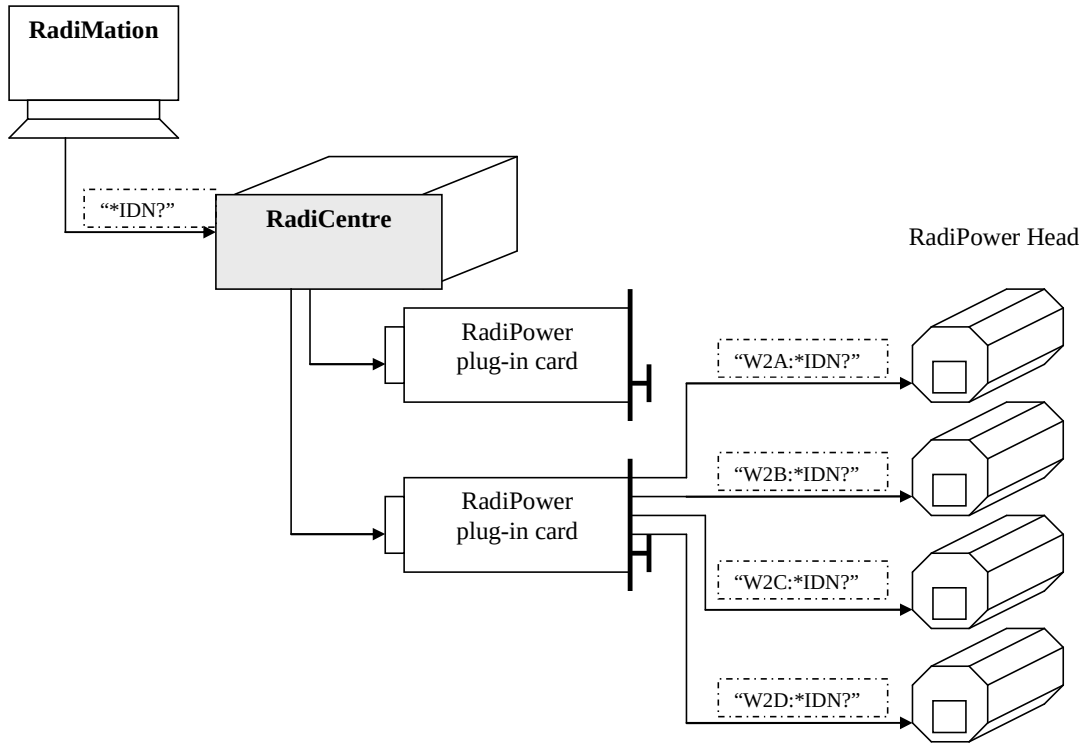
The table in paragraph 7.2 shows all available commands which also can be used in conjunction with the plug-in card of the RadiPower® sensor.
Please note that all commands must have the prefix of the "Device number" in front of the specific command if the RadiPower® is used in the RadiCentre®. When the RadiPower® is directly plugged in a USB connector of a PC, no prefix is necessary.

Refer to the RadiCentre® manual for more information on the "Device number" of a module.

RadiPower® exists of two parts:

- A Plug-in card (USB1004A) for the RadiCentre®
- And a RadiPower® Head (which must be connected to the plug-in card)

See figure below



Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl

Examples:

The message:
"W2A:POWER?"
Gets the power level of the Radi*P*ower® Head which is connected to port A of the Radi*P*ower® plug-in card in slot 2 of the Radi*C*entre®.
"W2B:FILTER?"
Gets the filter setting of the Radi*P*ower® Head which is connected to port B of the Radi*P*ower® plug-in card in slot 2.
"W3B:FILTER?"
Gets the filter setting of the Radi*P*ower® Head which is connected to port B of the Radi*P*ower® plug-in card in slot 3.

"W"	= '*device-character*' of the Radi*P*ower® plug-in card
"2"	= '*board-number*' of the Radi*P*ower® plug-in card
"A"	= port of the Radi*P*ower® Head
"FILTER?"	= command to the Radi*P*ower® Head

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 dB	Sets power offset to 0 dB
POWER_UNIT	0	Sets measurement unit to dBm
VBW (mode 0) VBW (mode 1, 2 and 3)	3 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_TRIGGER	0;1;2	Rising edge triggering, 2 samples 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

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

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!!, RPR20XXY, 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?"	"2.27"	Returns SW version
"VERSION_HW?"	"2.0"	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

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

RadiPower general commands – continued		
Command	**Reply**	**Description**
"FILTER AUTO"	"OK"	Sets the filter to automatic See specification for setting
"FILTER <n>"	"OK"	Sets the number of samples used to calculate the RMS power value, with n=1 1 = 10 samples 2 = 30 samples 3 = 100 samples 4 = 300 samples 5 = 1000 samples 6 = 3000 samples 7 = 5000 samples
"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>" [6]	"OK"	Sets the power unit, with u= 0 for dBm and 1 for Watts
"POWER_UNIT?"	"0" or "1"	Returns the power unit.
"VBW <n>" [7]	"OK"	Sets Video bandwidth (VBW), with n= 0 for 10MHz 1 for 1MHz 2 for 200kHz 3 for 1kHz 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 = 10MHz at 1MSps VBW = 1MHz at 100kSps VBW = 200kHz at 20kSps
"VBW?" [5]	"0", "1", "2", "3" or "AUTO"	Returns the VBW setting
"ACQ_SPEED <s>"	"OK"	Sets ADC sample speed in kSps <s> can be 20, 100 or 1000.
"ACQ_SPEED?"	"20", "100" or "1000"	Returns ADC speed in kSps

[6] Applies only for the POWER? command in mode 0 and mode 1
[7] Only for the RPR2006C and RPR2006P, does not apply for the RPR2018 models

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl

Remarks to general commands:

In mode 0 (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 RMS value.

For power measurements of AM modulated signals, acquisition speed, filter and VBW settings are important to obtain accurate measurements. For example if an AM modulated signal is to be measured with a modulation frequency of 1 kHz, the VBW should be set to 0, 1, 2 or AUTO. In general the VBW should be 10 times smaller than the RF carrier frequency, but higher than the modulation frequency.
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 1Msps, the filter should be set to 5 or higher, which results in 1000 or more samples. At lower sampling speeds, for example 100ksps, the filter should be set to 3 or higher to measure at least one full period of the envelope signal.

In mode 1 (max hold) 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 mode 1, 2 or 3.

The VBW setting can be different for mode 0 and the other three modes 1, 2 and 3. If a VBW has been set for mode 0, this will not affect the VBW setting for mode 1, 2 or 3 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.

In mode 2 (envelope tracing) temperature readings are not updated as long as the triggering is armed. During the armed mode, 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.

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

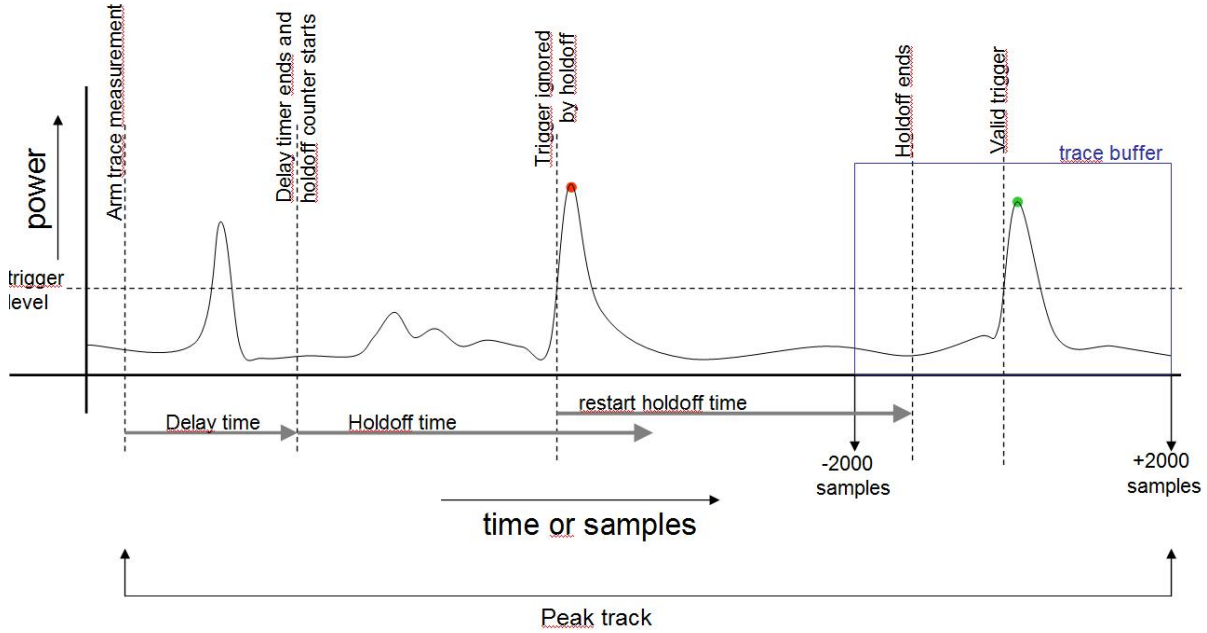
Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands
Tel. +31 (0)348 416 592
Fax +31 (0)348 499 732
www.dare.nl
instruments@dare.nl

Additional commands for envelope tracing mode (mode 2)		
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_DATA?"	Power values from buffer samples 0 to 1000	Returns log power values from buffer in dBm (ASCII text dump, values are separated by a ";")
"ACQ_LOG_DATA_ENH? <i>,<j>"	Power values from buffer <i> samples before trigger to <j> samples after trigger.	Returns logdata from pre and or post trigger buffer (text dump). Buffer sizes <i> and <j> can be 0 to 2000
"ACQ_LOG_DATA_ENH_BIN? <i>,<j>"	Power values from buffer <i> samples before trigger to <j> samples after trigger.	Returns logdata from pre and/or post trigger buffer (binary dump, 2 byte integer *100) special code 0x7777 represents data start, 0xAAAA represents data end.
"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_TRIGGER <a>,<b>,<c>"	"OK"	Sets trigger mode: a=0 for Edge triggering a=1 for Level triggering b=0 for Falling edge b=1 for Rising edge c=2 to 10 for number of samples used to evaluate edge or level trigger. During edge trigger the distance between two samples is 10, during level trigger the distance between to samples is 1
"ACQ_LOG_TRIGGER?"	Retruns trigger settings <a>;<b>;<c>	a= mode b= rising/falling edge c= trigger filter
"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_TRIG_DIST <d>"	"OK"	Sets the distance between two consecutive samples for detecting rising or falling edge (d=1 to10) NOTE: This command is only used for debugging. Default distance is 10 samples.
"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

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.

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

Additional commands for envelope tracing mode (mode 2) – continued		
Command	**Reply**	**Description**
"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
"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



During 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.

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

Additional commands for burst mode (mode 3)		
Requests	**Reply**	**Description**
BM_MEASURE_PERIOD <T>	"OK"	Sets the measurement period T (ms), with T can be from 1-1000ms
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 -70 and +12 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 800.
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.

6.4 Response times for data readout

In mode 2 several commands can be used to read the data from the buffers of the RadiPower®. The following table shows the approximate time for the data transfer at 115200 bps.

Times for data transfer in envelope tracing mode (mode 2)		
Command	**Description**	**Time**
"ACQ_LOG_DATA?"	Read power values from buffer samples 0 to 1000 in ASCII text	720ms
"ACQ_LOG_DATA_ENH? <i>,<j>"	Read power values from buffer <i> samples before trigger to <j> samples after trigger in ASCII text	720ms for i=j=500 1425ms for i=j=1000 2850ms for i=j=2000
"ACQ_LOG_DATA_ENH_BIN? <i>,<j>"	Read power values from buffer <i> samples before trigger to <j> samples after trigger in binary format	180ms for i=j=500 360ms for i=j=1000 720ms for i=j=2000

6.5 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	RPR2006	RPR2018
Detector type	Log detector	
Measuring function[1]	RMS CW power, Peak power (max hold) Envelope tracing and Burst mode	
Frequency range	9 kHz[2] to 6 GHz	80 MHz to 18 GHz
Power measuring range	-55 dBm to + 10 dBm (Usable to -60 dBm)	-45 dBm to + 10 dBm (Usable to -50 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	1,20
100 MHz to 2 GHz	1,15	
2 GHz to 6 GHz	1,35	
6 GHz to 18 GHz	n/a	1,35
Frequency response accuracy (at 23º C ± 2º C)	+/- 0,25 dB	+/- 0,25 dB (≤ 10 GHz) +/- 0,50 dB (> 10 GHz)
Linearity error	0,05 dB + 0,005 dB/dB	0 , 5 dB / 10 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	20 kSps, 100kSps or 1 MSps	
Minimum RF burst width	2µs	

Filter setting for RMS (Mode 0)	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] C-model only supports CW-mode, P-model supports all modes
[2] Depends on VBW setting

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01

Electrical specifications	RPR2006	RPR2018

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	152 * 32 * 32 mm
RF input connector	N type precision	
Data connector (power head side)	USB type B	

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)	120 mA	160 mA

Interfaces	
Communication	USB 1.1 (drivers supplied for Windows XP and Windows 7)
RadiCentre	USB1004A plug-in card

Dijkstra Advice, Research & EMC Instruments B.V.
KvK Utrecht 30138673
Rabobank Montfoort 15.83.13.585
IBAN: NL31RABO0158313585 - SWIFT code RABONL2U
VAT number: NL 8057.53.709.B01