Products: R&S NRP-Zxx

R&S NRPView
PC Software for R&S NRP-Zxx Sensors

Application Note 1MA77

The software R&S NRPView extends the functions of the Power Viewer provided with R&S NRP Toolkit. Besides the basic continuous average measurement function, it includes a timeslot, burst and scope measurement mode with a graphical user interface.

ROHDE & SCHWARZ

Contents

1 Overview

The R&S NRP-Z power sensors are highly accurate standalone instruments that can be operated directly from a PC via a USB connection. With up to 90 dB dynamic range and automatic error correction (temperature compensation, S-parameter correction, etc.), the sensors are suitable for almost every measurement task.

The software R&S NRPView extends the functionality of the R&S NRP Power Viewer provided with R&S NRP Toolkit. Besides the continuous average power measurement function that is available with the R&S NRP Power Viewer, R&S NRPView includes a timeslot, burst and scope mode with a graphical user interface.

For a detailed description of sensor characteristics, please refer to the R&S NRP operating manual [1].

2 Software Features

- All sensor features can be shown, all sensor settings are available

- Four different sensor modes (ContAv, Timeslot, Scope, Burst)

- Easy to use

- Supports all kinds of sensors of the R&S NRP-Z series

- Predefined settings for all major communication standards such as GSM, W-CDMA etc.

- Simulation mode to familiarize yourself with the software without having any sensor connected

3 Hardware and Software Requirements

Hardware requirements

	Minimum	Recommended
CPU	Pentium 133 MHz	Pentium II 450 MHz or higher
RAM	32 Mbyte	128 Mbyte
Hard disk	10 Mbyte free space	---
Monitor	VGA monitor (640 x 480)	XGA monitor (1024 x 768)

Software requirements

|	Minimum	Recommended
OS	Windows 98 / 2000 / ME / XP	---
OS add-ons	---	Microsoft Internet Explorer 5.0 or higher
IEC/IEEE bus driver	---	---
VISA	---	---
Add-ons	R&S NRP Toolkit	---

4   Installing the Software

Installing the R&S NRPView software

The setup file NRPView_<Version Number>.EXE" is necessary for installing the R&S NRPView software on the controller.

Execute the installation program and select the installation directory. During installation, program files are copied to a directory of your choice. A new menu item "NRPView" is created in the START menu of your Windows system.

R&S NRP Toolkit is necessary to run R&S NRPView on your PC. If R&S NRP Toolkit is not already installed, you can install it optionally during the R&S NRPView installation. The same applies to the R&S NRP-Z VXI Plug&Play Drivers if you intend to use the power sensors via external software.
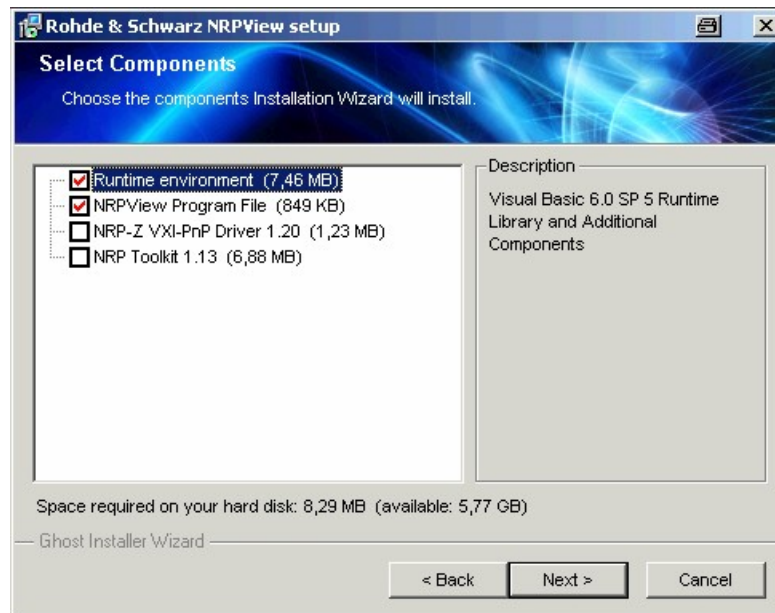
5   Connecting the Computer and the Instrument

- Connect the sensors to the USB ports of your computer using the R&S NRP-Z3 or R&S NRP-Z4 adapter cables. If the sensors are being connected to your computer the first time, an automatic installation routine will install the necessary R&S NRP-Zxx drivers.

- If no sensor is connected, R&S NRPView will start in a demo mode, where you can explore the features of the program.

- Hotplugging the NRP-Z sensors is possible. However it may cause problems on certain computers. So it is not advisable to connect/disconnect sensors while the software is running and a measurement has been started. Please make sure that all sensors are attached correctly to the PC when starting R&S NRPView.

How to check that an R&S NRP-Zxx is working properly:

Select START/SETTINGS/CONTROL PANEL/SYSTEM/DEVICE MANAGER. If the R&S NRP-Zxx is working properly, it must be identified by the computer as indicated below:
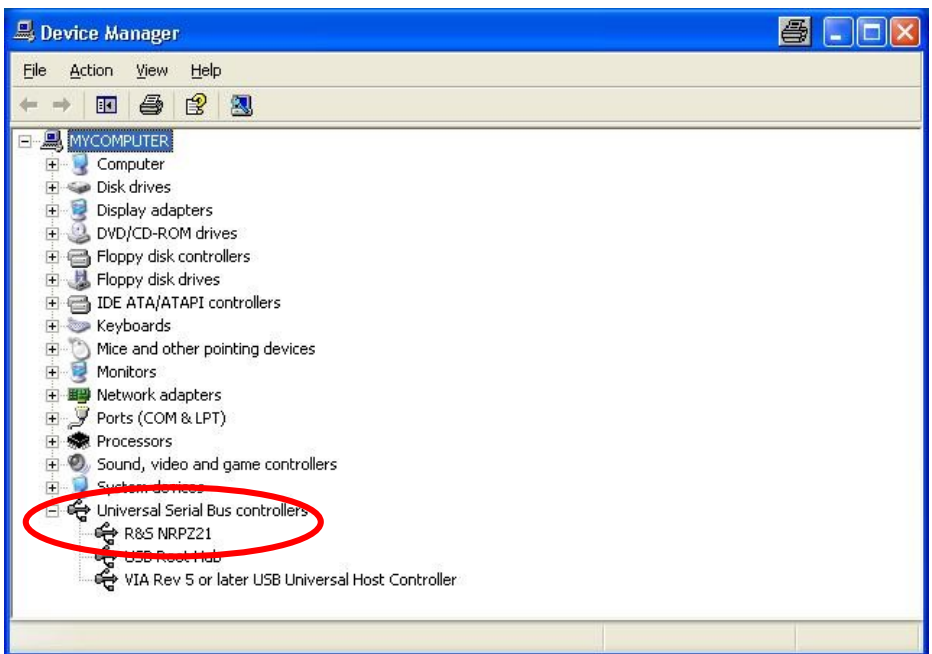
If instead of an R&S NRP-Zxx an unknown device is shown, please carefully check all the points of the following checklist.
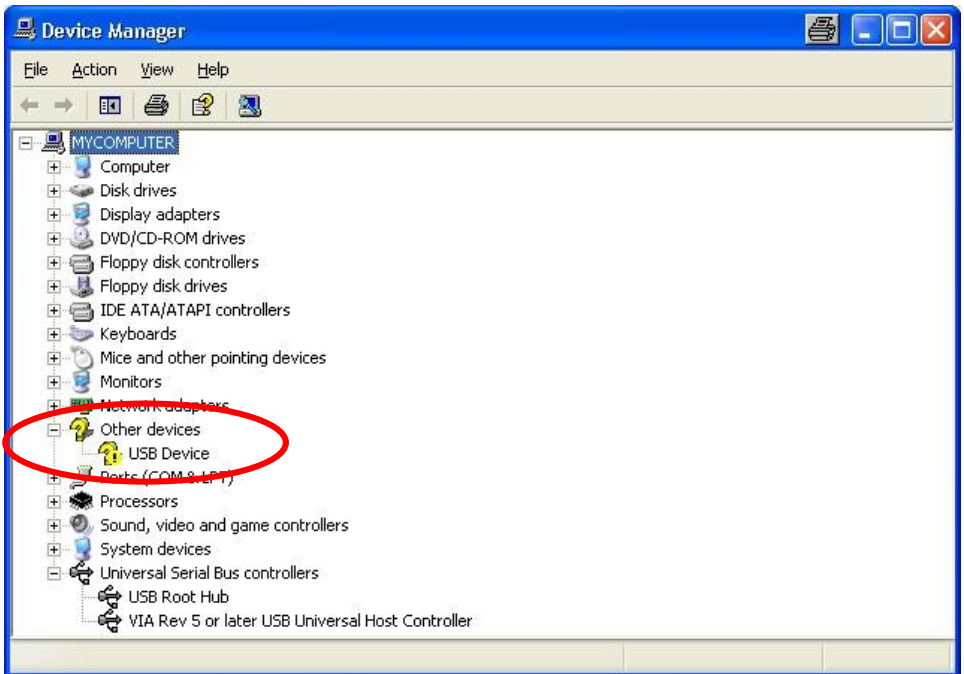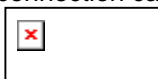
Troubleshooting checklist for USB-related problems

Software

- Use Windows XP or Windows 2000 operating system with latest available service pack (SP 2 or higher for Windows XP, SP 4 or higher for Windows 2000)

- Use latest version of R&S NRP Toolkit software (version 1.13 or higher available at http://www.rohde-schwarz.com/product/nrp-z under Downloads->Firmware/Software).

- Use latest remote control driver (version 1.20 or higher available at http://www.rohde-schwarz.com/product/nrp-z under Downloads->Drivers).

Hardware

- Use only high-speed hubs for USB 2.0 with own power supply.

- Disconnect the power supply of the hub when switching off the computer. Connect the hub's power supply before starting Windows.

- Do not extend USB cables (R&S NRP-Z cable + trigger cable + USB extension cable) beyond a total length of five meters.

- Do not cascade hubs unnecessarily.

- Use only connection cables of highspeed USB 2.0 hubs or those with logo: .

- Check firmware version of R&S NRP sensors:
  Use version $\geq$3.20 for R&S NRP-Z11, R&S NRP-Z21, R&S NRP-Z22, R&S NRP-Z23, R&S NRP-Z24, R&S NRP-Z91, version $\geq$1.40 for R&S NRP-Z51, R&S NRP-Z55.
  (to be found at: http://www.rohde-schwarz.com/product/nrp-z under Downloads ->Firmware/Software).

- Exchange hub if all points above are fulfilled and you are still unsuccessful.

6 Starting and Operating the Software

When you start R&S NRPView for the first time, you are requested to register the program.

We kindly ask you to register R&S NRPView. Registration is free of charge and does not obligate you or your company. The unregistered version has full functionality and no expiration date, but will prompt for registration every time you start it.

Please follow the instructions on the screen to register R&S NRPView. After clicking "Continue" or entering Name and Key, the user interface will be available.

The software starts with the following display:
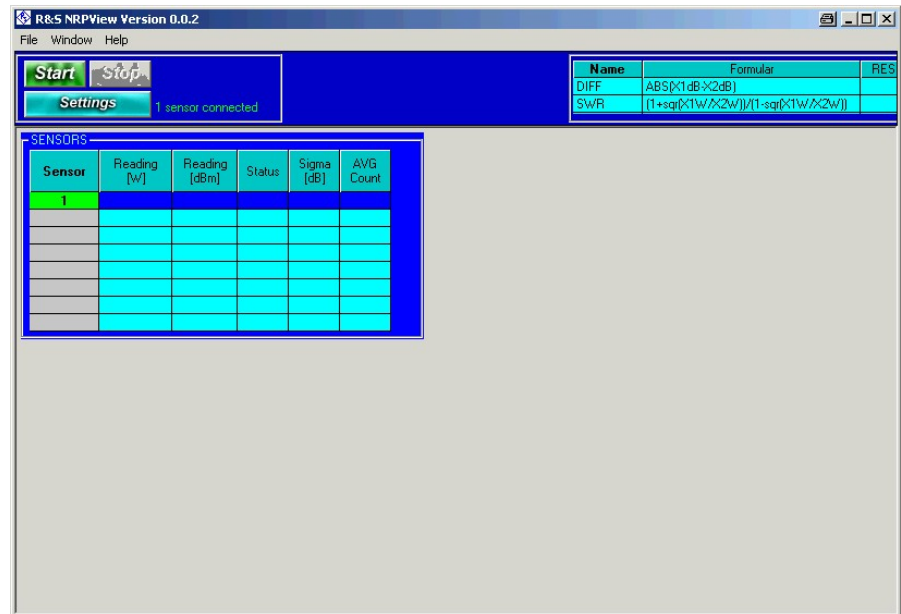
Quickstart

If the program is used the first time, use the settings menu to configure your sensor and measurement. Check that the *Window - Settings always on top* menu item is active so that the settings menu will always be available. Select the sensor for configuration from the *SENSOR* dropdown list. Select the operating mode of this sensor from the *Mode* dropdown list. Depending on the selected mode, various settings are available after pressing the *General*, *Mode*, *Trigger*, *Correction* and *Advanced* buttons. The *General* tab provides access to *Sensor Zeroing*, *Sensor Info* and *Sensor Self Test*. Averaging functions for all operating modes other than scope mode can be set in this menu.

Menu structure

File

Load Sensor Settings
Loads a predefined or user-defined sensor setting for the currently selected sensor.

Save Sensor settings
Saves the settings of the currently selected sensor to a file.

Record Data…
Saves the measured power values for each sensor into a file. This option is only active after a measurement has been started and is not valid for sensors in scope or time slot modes.

Pressing this option activates the Record Data dialog box:

Here you can specify the time interval to trigger a measurement on all active sensors and record the measured data. After clicking on "Submit" you are prompted to specify a file to save the data into. The file is in the CSV format and can be read with a simple text editor or with Microsoft Excel.

|	A	B	C	D	E	F	G
1	Date	Time	a (W)	a (dBm)	b (W)	b (dBm)	c (W)
2	12.07.2005	11:27:11	-4,06E-10	-63,9200359	5,21E-11	-72,8287896	3,64E-1
3	12.07.2005	11:27:12	9,78E-13	-90,0978995	4,06E-11	-73,9139378	1,78E-1
4	12.07.2005	11:27:16	-1,39E-10	-68,575016	4,61E-11	-73,3662956	1,39E-1
5	12.07.2005	11:27:17	-1,57E-10	-68,0408946	4,20E-11	-73,7640923	3,52E-1
6	12.07.2005	11:27:18	-7,77E-11	-71,0942279	4,54E-11	-73,4320373	2,14E-1
7	12.07.2005	11:27:19	-1,64E-10	-67,8415763	3,36E-11	-74,7363497	2,58E-1
8	12.07.2005	11:27:20	1,06E-10	-69,7603121	2,31E-11	-76,3650911	1,86E-1
9	12.07.2005	11:27:21	-3,58E-10	-64,4571602	-1,09E-11	-79,635809	4,56E-1
10	12.07.2005	11:27:22	-1,31E-10	-68,8363148	-1,75E-11	-77,5763488	5,68E-1
11	12.07.2005	11:27:23	-3,33E-11	-74,772479	-1,64E-11	-77,8586612	5,73E-1
12	12.07.2005	11:27:24	8,80E-12	-80,5554743	-1,10E-11	-79,5712287	7,66E-1
13	12.07.2005	11:27:25	9,02E-11	-70,4482356	-2,91E-11	-75,3639396	4,98E-1
14	12.07.2005	11:27:26	2,08E-10	-66,8260141	-4,72E-11	-73,256342	5,79E-1
15	12.07.2005	11:27:27	3,22E-11	-74,918247	-3,08E-11	-75,109963	5,96E-1
16	12.07.2005	11:27:28	-2,00E-12	-86,9980508	-5,42E-11	-72,6624054	9,56E-1
17	12.07.2005	11:27:29	9,58E-11	-70,187519	-5,82E-11	-72,3475615	6,65E-1
18	12.07.2005	11:27:30	-3,26E-11	-74,8691453	-5,63E-11	-72,4958414	7,18E-1

The file has the following format: the first line is a header where all the sensor names are displayed (two times each – e.g. "a (W), a (dBm)"), each next line represents a measurement of all active sensors. The results are saved both in Watt and in dBm, together with the date and time when they were recorded. No power values for sensors in scope or time slot modes are saved (e.g. sensor "i" on the picture).

Note: *Sensors in time slot or scope modes are always displayed first in the table of active sensors and in the log file.*

After recording has been started the sensors trigger a measurement only in periods specified in the Record Data dialog box. To return to normal triggering mode and stop recording of the data you can either click on File -> Stop Recording or on the "Stop" button. Clicking on the "Stop" button will stop all measurements, while clicking on File->Stop deactivates only the recording of the data.
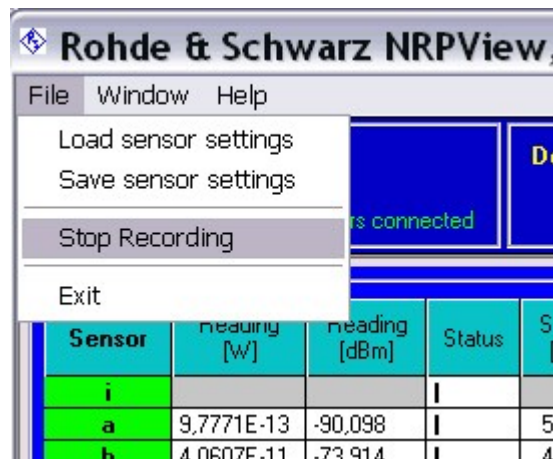
Exit
Terminates the program and saves the current session to HD. If the program is started later again, the sensors will automatically load their last configuration.

Window

Settings always on top
If this option is selected, the Settings dialog will always be on top of the
other windows.

Help

About
Information about the software and all installed components.

Main controls

Main control

	Start button Starts the measurement for all selected sensors.
	Stop button Stops the measurement for all sensors.
	Settings button Opens the settings window.

Sensor status display

In this display you can see the status of all sensors currently connected to the computer.

- In the first column under "Sensor" the names of the sensors will be displayed if the user has defined them. Otherwise the sensor number will be displayed. Furthermore, you can see if the sensor is selected for measurement. In this case, the field is green. If the sensor is disabled, the field is gray. To toggle the status, double-click in the field and the sensor will be deactivated or activated.

- In the second and third column you see the measurement results in W or dBm if the sensor is running in ContAv or Burst mode. In Timeslot or Scope mode, the fields will stay empty.

- In the Status column you can see the status of the sensor. The column can display the following items:
  - **"Conf."**: The sensor is currently configured
  - **A progress bar:** Every time a measurement value is received, the bar will move one step forward.

  If the progress bar is not moving, the measurement is either not running or one of the sensors is not able to trigger or -- if averaging is enabled -- one of the sensors is currently measuring.

- In the **Sigma [dB]** column the area is displayed in which 95% of all measured values lie, calculated over the last 30 measured values.

- The **AVG Count** column shows over how many values the sensor is averaging.

Formula editor

Name	Formular	RESULT
DIFF	ABS(X1dB-X2dB)	
SWR	(1+sqr(X1W/X2W))/(1-sqr(X1W/X2W))	

The formula editor is combined with a realtime parser. You can define two formulas. By double-clicking *Name* you can change the name of the formula, and by double-clicking *Formula* you can change the formula. The result of the calculation will be displayed in the *RESULT* field. Please note that only ContAv or Burst measurement results can be calculated. Use X<Sensor-Number>dB for dBm and X<Sensor-Number>W for Watt values.

The following expressions can be evaluated by the parser:

Func	Description	Note
+	addition	
-	subtraction	
*	multiplication	
/	division	35/4 = 8.75
%	division quotient	35%4 = 3 (the same as mod)
\	integer division	35\4 = 8
^	raise to power	3^1.8 = 7.22467405584208
!	factorial	5!=120 (the same as fact)
abs(x)	absolute value	abs(-5)= 5
atn(x)	inverse tangent	
cos(x)	cosine	argument in radiant
sin(x)	sin	argument in radiant
exp(x)	exponential	exp(1) = 2.71828182845905
fix(x)	integer part	fix(-3.8) = 3
int(x)	integer part	int(-3.8) = 4
dec(x)	decimal part	dec(-3.8) = -0.8
ln(x)	logarithm natural	argumnet x>0
log(x)	logarithm decimal	argument x>0
rnd(x)	random	returns a random number between x and 0
sgn(x)	sign	returns 1 if x >0 ; 0 if x=0; -1 if x < 0
sqr(x)	square root	sqr(2) =1.4142135623731; also 2^(1/2)
cbr(x)	cube root	cbr(2) =1.25992104989487; also 2^(1/3)
tan(x)	tangent	argument (in radiant) x^1 k*p/2 with k = ± 1, ± 2…
acos(x)	inverse cosine	$-1 \leq x \leq 1$
asin(x)	inverse sine	$-1 \leq x \leq 1$
cosh(x)	hyperbolic cosine	
sinh(x)	hyperbolic sine	
tanh(x)	hyperbolic tangent	
acosh(x)	inverse hyperbolic cosine	$x \geq 1$
asinh(x)	inverse hyperbolic sine	
atanh(x)	inverse hyperbolic tangent	$-1 < x < 1$
root(x,n)	n-th root	$x \geq 0$ (the same as x^(1/n))
mod(a;b)	division quotient	
fact(n)	factorial	argument $0 \leq n \leq 170$
comb(n;k)	combinations	comb(6;3) = 20
min(a;b)	min between two numbers	
max(a;b)	max between two numbers	

mcd(a;b)	maximun common divisor	mcm(4346;174) = 2
mcm(a;b)	minimun common multiple	mcm(4346;174) = 378102
gcd(a;b)	greatest common divisor	The same as mcd
lcm(a;b)	lowest common multiple	The same as mcm
erf(x)	error Gauss's function	x ≥ 0
gamma(x)	gamma	0 < x ≤ 171
gammaln(x)	logarithm gamma	x > 0
digamma(x)	digamma	x > 0
beta(x;y)	beta	x > 0 y > 0
zeta(x)	zeta Riemman's function	x < -1 or x > 1
ei(x)	exponential integral function	x > 0
csc(x)	cosecant	argument (in radiant) x ≠ k*p with k = 0, ± 1, ± 2…
sec(x)	secant	argument (in radiant) x ≠ k*p/2 with k = ± 1, ± 2…
cot(x)	cotangent	argument (in radiant) x ≠ k*p with k = 0, ± 1, ± 2…
acsc(x)	inverse cosecant	
asec(x)	inverse secant	
acot(x)	inverse cotangent	
csch(x)	hyperbolic cosecant	x > 0
sech(x)	hyperbolic secant	x > 1
coth(x)	hyperbolic cotangent	x > 2
acsch(x)	inverse hyperbolic cosecant	
asech(x)	inverse hyperbolic secant	0 ≤ x ≤ 1
acoth(x)	inverse hyperbolic cotangent	x < -1 or x > 1
rad(x)	radiant conversion	rad(90) = 1.5707963267949
deg(x)	degree conversion	deg(pi/4) = 45
round(x;d)	round number with d decimal	round(1.35712; 2) = 1.36
>	greater than	return 1 (true) 0 (false)
>=	equal or greater than	return 1 (true) 0 (false)
<	less than	return 1 (true) 0 (false)
<=	equal or less than	return 1 (true) 0 (false)
=	equal	return 1 (true) 0 (false)
<>	not equal	return 1 (true) 0 (false)
and	logic and	and(a;b) = return 0 (false) if a = 0 or b = 0
or	logic or	or(a;b) = return 0 (false) only if a = 0 and b = 0
not	logic not	not(a) = return 0 (false) if a ≠ 0 ; else 1
xor	logic exclusive-or	xor(a;b) = return 1 (true) only if a = b
nand	logic nand	nand(a;b) = return 1 (true) if a = 1 or b = 1
nor	logic nor	nor(a;b) = return 1 (true) only if a = 0 and b = 0
nxor	logic exclusive-nor	nxor(a;b) = return 1 (true) only if a = b

7 Configuring Measurements

Start the measurement with the green Start button, and the program will run with its standard configurations:
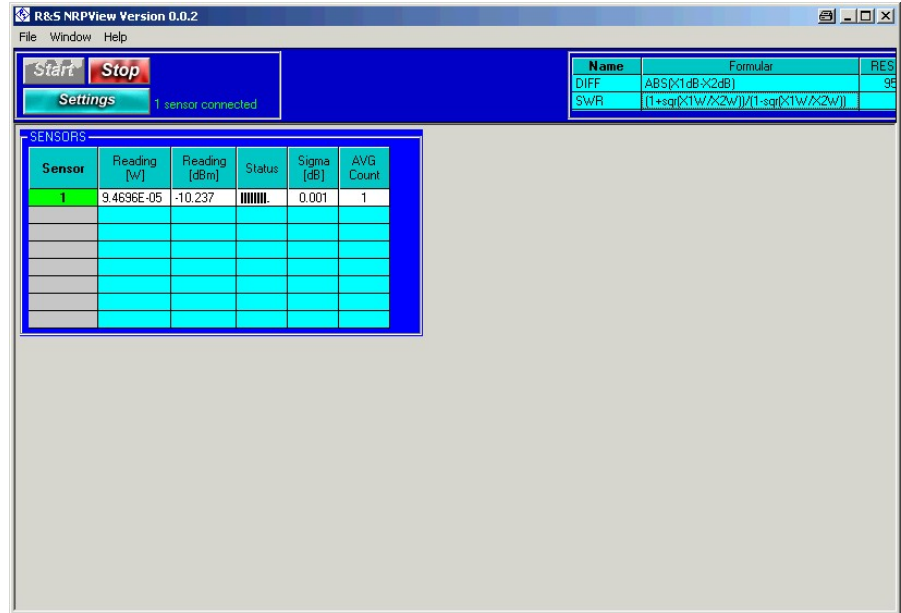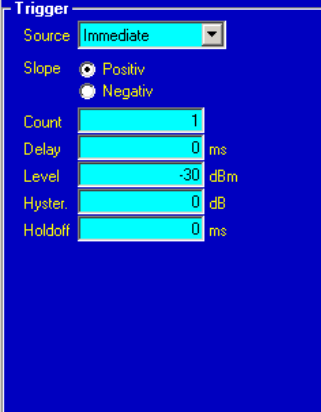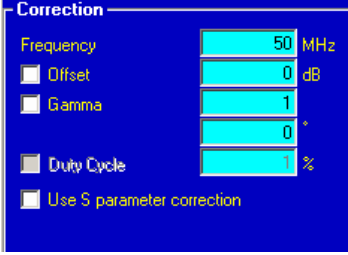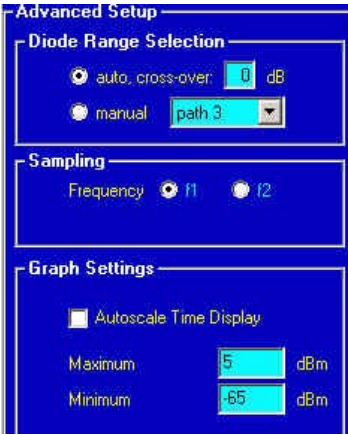

Now all connected sensors will run in their standard configuration in ContAv mode and display their results in the Sensors display.

Settings dialog

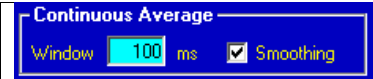| Basic setup	
	SENSOR Selects the sensors you want to configure.
	Mode Selects the measurement mode for the selected sensor.
	General, Mode, Trigger, Correction, Advanced Selects the setting display frame: general settings, mode-specific settings, trigger settings, correction settings and advanced settings.

General Settings	
	Name Here you can see/change the "symbolic" name of the sensor.
	Type Type and S/N of the selected sensor are displayed to identify the sensor.
	Zero, Sensor Info, Run Self Test Zeros the sensor, runs the self test or displays the sensor information.
	Averaging Enables/disables Averaging (for all modes excluding Scope mode).
	Moving Averaging Enables/disables Moving Averaging.
	Auto: Resolution Auto resolution in decimal notation.
	Fixed Noise: Content Fixed noise in dB.
	Max. Settl. Time Max. settling time in seconds.
	Normal: Length Manual averaging count.
	Ref. Timeslot # Timeslot for getting the average parameters for Timeslot mode.

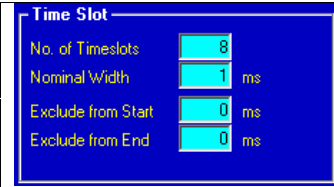| Trigger	
	Source Selects trigger mode from the dropdown list (Single, External, Hold, Immediate and Internal).
	Slope Defines whether the trigger looks for rising (Positiv) or falling (Negativ) edges.
	Delay Enters the delay time in ms between recognizing a trigger event and measurement start.
	Level Sets the level in dBm the signal has to cross to trigger.
	Hyster. (Hysteresis) Sets the value in dB the signal has to exceed after a trigger to make it a valid one.
	Holdoff Sets the time in ms after a trigger during which all further trigger events will be ignored.

| Correction	
	Frequency Sets the frequency for frequency correction.
	Offset Enables/disables and sets the value for offset correction.
	Gamma Enables/disables and sets the value for gamma correction.
	Duty Cycle Enables/disables and sets the value for duty cycle in %.
	Use S parameter correction Enables/disables S parameter correction.
Advanced Setup	
	Diode Range Selection Specifies which diode range is used. Manual allows manual selection. By using auto cross-over, you can specify a cross-over range in dB.
	Sampling Specifies the sampling frequency for the sensor.
	Graph Settings Specifies the graph settings to either auto scaling or manual scaling.

Measurement mode setup

ContAv

	Window Sets measurement time for one single measurement.
	Smoothing Enables/ disables smoothing.

Time Slot

	No. of Timeslots Sets how many slots are measured.
	Nominal Width Sets the width in ms of each slot.
	Exclude from Start Specifies the time in ms that is not measured after the slot start.
	Exclude from End Specifies the time in ms that is not measured before the slot end.

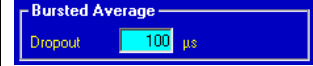When running timeslot measurements, the following display is shown:
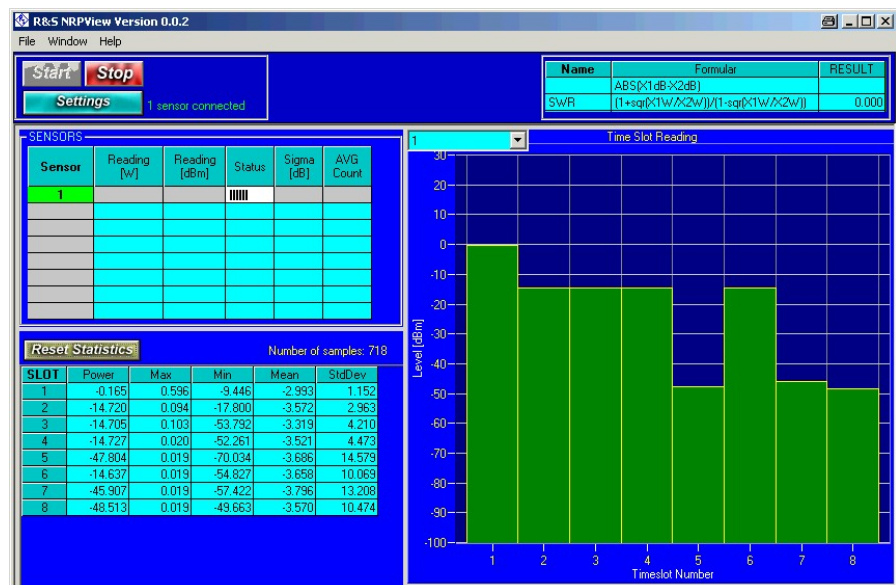
The drop down list at the top left of the timeslot display shows all sensors that are currently running in timeslot mode. You can select the one you want to see in the display and in the table.

All values are displayed in dBm, Sigma is – as in ContAv mode – the area in which 95% of all measured values are located, calculated over the last 30 measured values.

With "Reset Statistics" you can reset the statistics in the table.

Burst

	Dropout Prevents brief power drops due to modulation from being misinterpreted as the end of a burst.

Scope

	Points Sets number of points to be measured in Scope mode.
	Meas Time Sets measurement time for Scope mode in milliseconds.
	Time Offset Sets display offset in milliseconds. Negative values will shift the display to the right.
	Realtime Selects Realtime mode.
	Averaging See General Setting Dialog.
	Show exclude lines in Timeslot Specifies in which timeslot the exclude times are displayed.

When running the scope mode, the following display is shown:
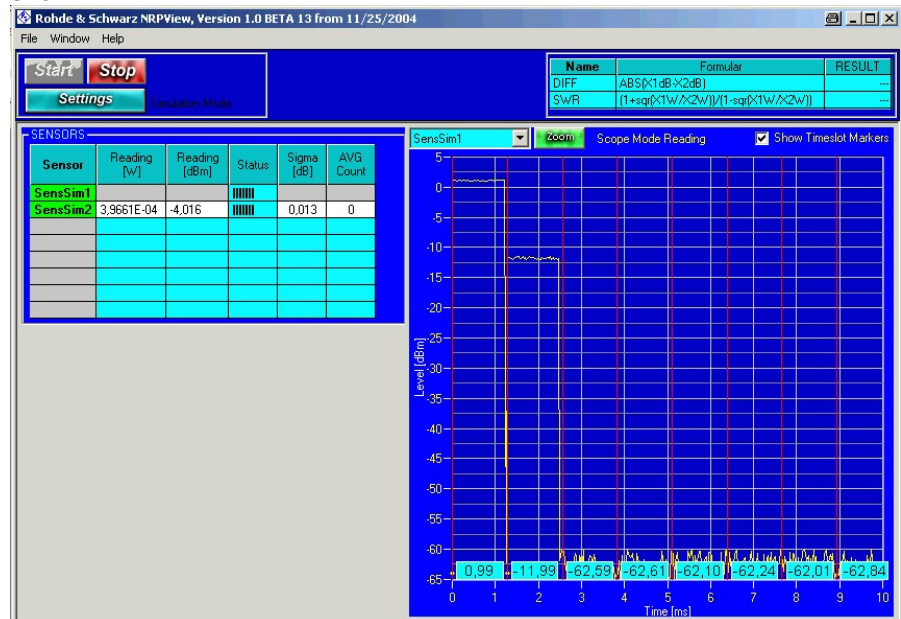
As in the timeslot mode, you can select the sensor you want to see via the dropdown list at the top left of the display.

If you activate *Show Timeslot Markers*, you can see and change the Trigger Delay, Timeslot Count, Timeslot Width and the Exclude start and stop times directly in the Scope diagram and adjust them to your signal. The corresponding average power in dBm is displayed beneath the slots.

You can adjust the trigger delay by dragging the first red line to the starting position.

The timeslot width is adjusted by dragging one of the other red lines to its position. All other red lines will adjust automatically

You can move the two yellow lines for the exclude times. To show them in another timeslot, you have to go to *Settings*, *Mode* and adjust *Show Exclude lines in Timeslot*.

Demo mode

If you start the program without a sensor connected, the program will start in demo mode. It will simulate two sensors, showing different power and noise floors and also different readings in timeslot and scope mode. This is only to demonstrate the capabilities of the program. Please note that changing any settings has no effect on the measured values.

8   Literature

[1] Power Meter R&S NRP - Operating Manual
        PD 1144.1400.12

[2] Power Sensor R&S NRP-Zxx - Operating Manuals
        PD 1137.7406.32, etc.

[3] R&S NRP homepage: http//www.nrp.rohde-schwarz.com

[4] R&S NRPView homepage:
   http://www.rohde-schwarz.com/appnote/1MA73

9   Additional Information

Please contact TM-Applications@rsd.rohde-schwarz.com for comments and further suggestions.

10 Ordering information

Power Sensors

R&S NRP-Z11 Diode Power Sensor	200 pW to 200 mW 10 MHz to 8 GHz	1138.3004.02
R&S NRP-Z21 Diode Power Sensor	200 pW to 200 mW 100 MHz to 18 GHz	1137.6000.02
R&S NRP-Z22 Average Power Sensor	2 nW to 1.5 W 10 MHz to 18 GHz	1137.7506.02
R&S NRP-Z23Average Power Sensor	20 nW to 15 W 10 MHz to 18 GHz	1137.8002.02
R&S NRP-Z24 Average Power Sensor	60 nW to 30 W 10 MHz to 18 GHz	1137.8502.02
R&S NRP-Z51 Thermal Power Sensor	1 µW to 100mW DC to 18 GHz	1138.0005.02
R&S NRP-Z55 Thermal Power Sensor	1 µW to 100 mW DC to 40 GHz	1138.2008.02
R&S NRP-Z91 Average Power Sensor	200 pW to 200 mW 9 kHz to 6 GHz	1168.8004.02

Options

R&S NRP-Z2	Sensor Extension Cable	1146.6750.05 (5m) 1146.6750.10 (10m)
R&S NRP-Z3	USB Adapter (active) with trigger port	1146.7005.02
R&S NRP-Z4	USB Adapter (passive)	1146.8001.02

ROHDE & SCHWARZ