USB power sensors on the PC: easy to use – even without a base unit

The new PC-based R&S®NRPV virtual power meter makes it easy for users to unlock the potential offered by the USB power sensors of the R&S®NRP-Z family. With its wide range of measurement and analysis functions, it is a powerful software package that offers distinct advantages over conventional sensors requiring a base unit for operation.

Easy to use – even without a base unit

The USB power sensors of the R&S®NRP-Z family offer a wide range of functions for measuring the power of multiple signal waveforms in large frequency ranges. They are among the world´s fastest and most accurate power sensors, with characteristics unmatched by competitors. These extremely accurate power sensors are standalone measuring instruments with remote control interface. They are frequently used in automated test systems, but can also be operated manually.

Most of the R&S®NRP-Z power sensors recognize over 150 commands for the various measurement modes. To ensure that the full spectrum of measurement options offered by these instruments is used interactively, Rohde&Schwarz has developed a powerful PC software package, the R&S®NRPV virtual power meter. It provides access to almost all functions of the USB power sensors from Rohde&Schwarz in a single, easy-to-use application.

The R&S®NRPV software runs under the Windows XP, Windows Vista and Windows 7 operating systems. When installed on a PC, the software provides a wide variety of options and convenient measurement and analysis functions which go far beyond those conventionally available via base units. For example, the large monitors of today's workstations make it possible to provide detailed displays. The mouse can be used to move around and zoom in on signal traces on the graphical display. With the press of a single button, users can store the results from scalar measurements in CSV files, which can later be processed by common spreadsheet applications.

The virtual power meter offers six main measurement modes, each of which is displayed in a separate window:

Trace	Power versus time in a graphical display
Continuous	Continuous power as a scalar value
Burst Average	Average power of pulsed signals with automatic pulse recognition
Gated Average	Average power in defined time gates
Timeslot	Power in up to 16 consecutive timeslots
Statistics	Probability density function (PDF), cumulative distribution function (CDF) and complementary cumulative distribution function (CCDF)

Up to four windows that either display the same mode or different measurement modes can be open at the same time (FIG 1). Up to four measurands or results can be configured within each window, e.g. the measurement results from one or more sensors or mathematical results derived from those measurement results. It is even possible to display up to eight graphs in trace mode, four physical and four mathematical ones.

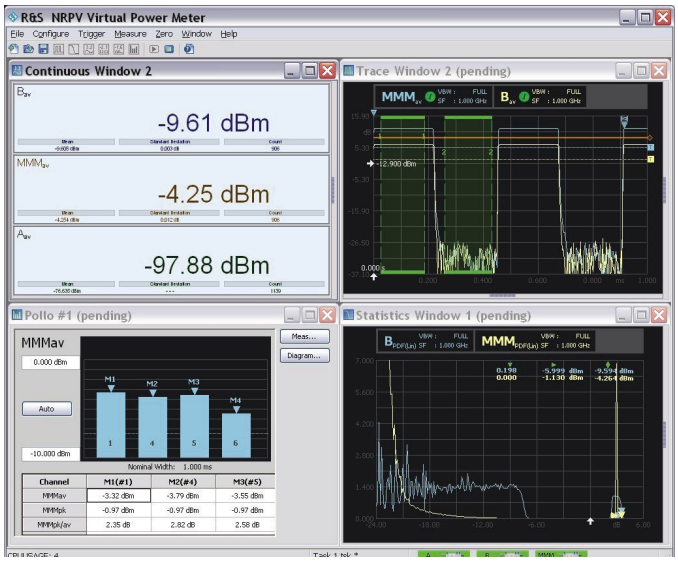


FIG 1 The R&S®NRPV virtual power meter with four open windows.

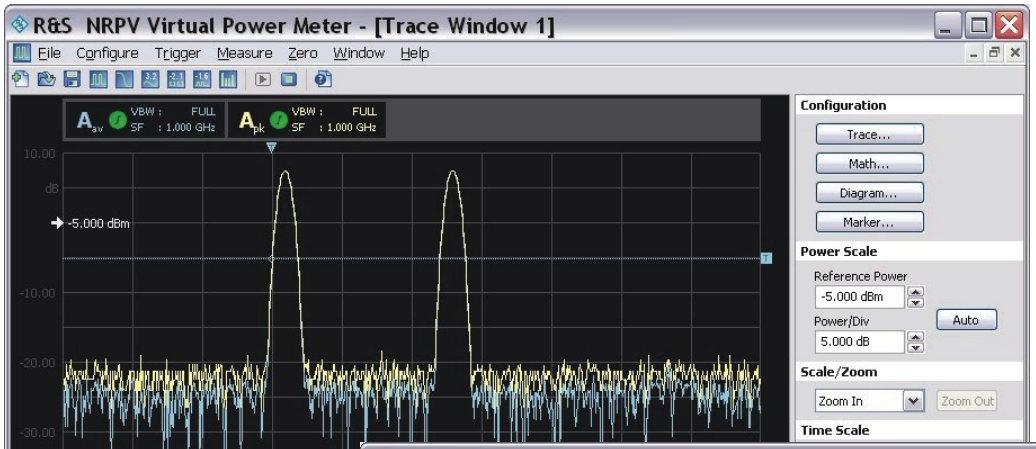


FIG 2 Trace window (shown here with a DME double pulse). Typical applications: radar, A&D, avionics.

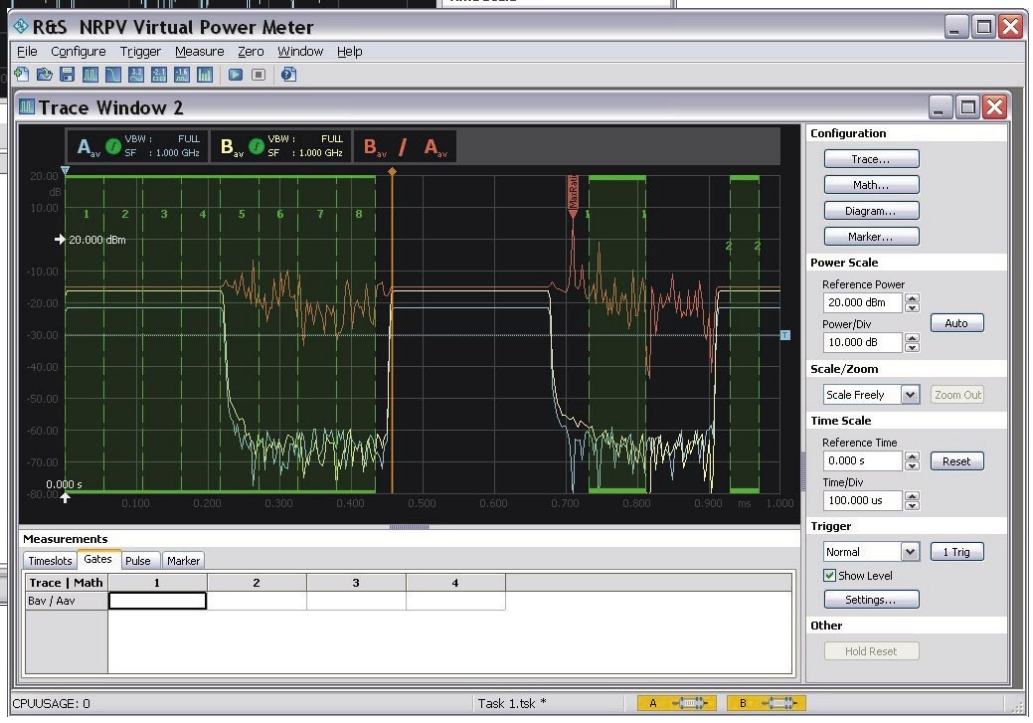


FIG 3 Traces with defined time gates and timeslots. Typical applications: telecommunications systems, GSM / EDGE, pulsed amplifier measurement.

Trace mode

One of the most important measurement modes is the trace mode. It measures and displays power versus time. This mode is supported by the R&S®NRP-Z11 / -Z21 / -Z22 / -Z28 / -Z31 three-path sensors and by the R&S®NRP-Z81 / -Z85 / -Z86 fast wideband sensors. For the sensors of the R&S®NRP-Z8x family, a pulse analysis can also be activated that automatically determines up to 20 characteristic values for pulsed signals, such as rise/fall times, overshoot, pulse-top power, pulse length, pulse period, etc. The measurement results are conveniently displayed in graphics and tables (FIG 2).

The trace mode can supply additional results from the captured data. Up to four independent time gates can be user-defined in any position and in any length (FIG 3). Timeslot measurements can also be enabled in the trace mode. In contrast to time gates, timeslots are all of the same duration and they are adjacent. In addition to physical measurements, the

FIG 4 Trace window with enlarged results.

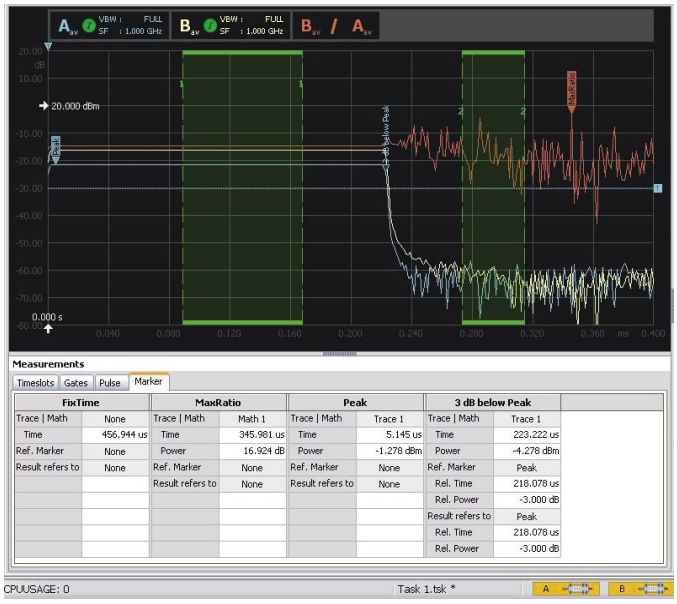
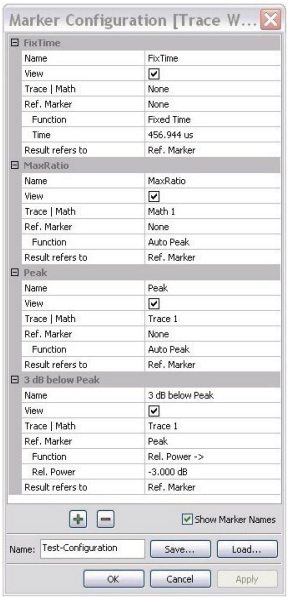


FIG 5 Marker functions with a variety of configuration options support the analysis of power traces.



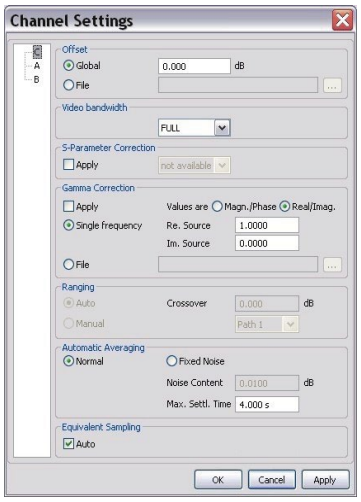


FIG 6 Configuration dialogs help to use the many options offered by the R&S®NRP-Z power sensors for interactive measurements.

trace window can also display mathematical traces. Mathematical traces show the ratio and the difference between two signal traces as well as the standing wave ratio (SWR).

The R&S®NRPV software also proves useful in test setups where the PC is located several meters from the DUT. To ensure optimum readability, all windows are fully scalable so that individual results can be enlarged and pinned to any spot on the monitor. One double-click on a table value is sufficient to permanently display the measurement results in any desired size on a transparent background, making it easy to read even from a large distance (FIG 4).

Marker functions with a variety of configuration options support the analysis of power traces (FIG 5). Markers can be added or deleted and named as needed. In addition to basic time or level rulers, automatic peak search markers are available, along with markers that reference other markers. This makes it easy to measure time and level differences.

A variety of configuration dialogs help users to set or modify the many options offered by the R&S®NRP-Z power sensors during interactive measurements. For example, it might be necessary to use only one specific path of the three-path diode sensors and to disable the automatic switchover between paths on the sensors. The software package offers these types of features, along with the option to select the video bandwidth or to set the gamma and S-parameter correction and offsets (FIG 6). Offsets are globally applied to a sensor (i.e. for all frequencies), or they can be preset as a list of frequency reference points in the form of S1P files.

Scalar modes

Scalar measurements comprise the continuous, burst average and gated average modes, which determine the average power versus time for the input signal. This is done either continuously, synchronously with the signal (triggered) or in defined time gates. All scalar measurement modes allow the display of additional parameters, such as minimum or maximum values, standard deviations, the number of measurements or measurement frequency. For every measurement channel and for every measurement result, the user can choose between absolute and relative value displays. The units (W, dBm, dBµV, dB, %, etc.) can be defined individually for every value. This also applies to the upper and lower limit values, which can be used for limit monitoring (FIG 7). The software provides a visual or acoustic signal when limit values are overranged or underranged.

Timeslot mode

In principle, the timeslot mode is also one of the scalar modes. In this mode, the test signal is triggered and the average power is determined in up to 16 consecutive timeslots of equal duration. The software displays the results in a bargraph (FIG 8). Depending on the type of sensor, average or peak values can be displayed, and the peak/average ratio can also be calculated.

Statistics mode

Statistics mode rounds out the measurement modes offered by the R&S®NRPV software. It determines how frequently a signal level is reached or exceeded. Nonlinearities of transmitter output stages, amplifiers and other active components or networks can be assessed, for example. CCDF, PDF and CDF are available for measuring the envelope power. The statistical analysis is either triggered by a signal or runs continuously. When triggered by a signal, the analysis is synchronized with the signal trace to evaluate any segment of a periodic signal by defining an appropriate time gate. The continuous mode, however, strings one analysis timeslot after the other. For the statistical analysis, a predefined number of samples (points) are captured and the selected PDF, CDF or CCDF is then displayed (FIG 9).

Summary

Its wide range of measurement and analysis functions make the R&S®NRPV virtual power meter a powerful software package that is a welcome addition to any toolset. It easily and conveniently unlocks the full potential offered by the USB power sensors of the R&S®NRP-Z family. The licensing model offered by Rohde&Schwarz makes the R&S®NRPV software also very cost-effective. The software can be downloaded from the Internet and tried out immediately using any USB power sensor from Rohde&Schwarz. Long-term use requires the purchase of a license key for the respective power sensor (R&S®NRPZ-K1 option). As a result, users are not tied down to a specific PC, nor is a dongle required. And because R&S®NRPV fully supports sensor hot-plugging, it's easy to swap power sensors between PCs.

With the ongoing development of power sensors at Rohde&Schwarz, the R&S®NRPV software will remain the application platform for all future sensors.

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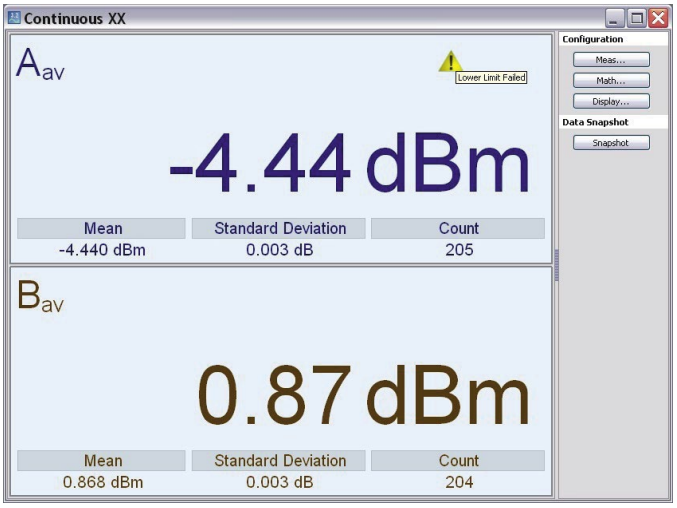

FIG 7 Scalar measurement with limit overrange.

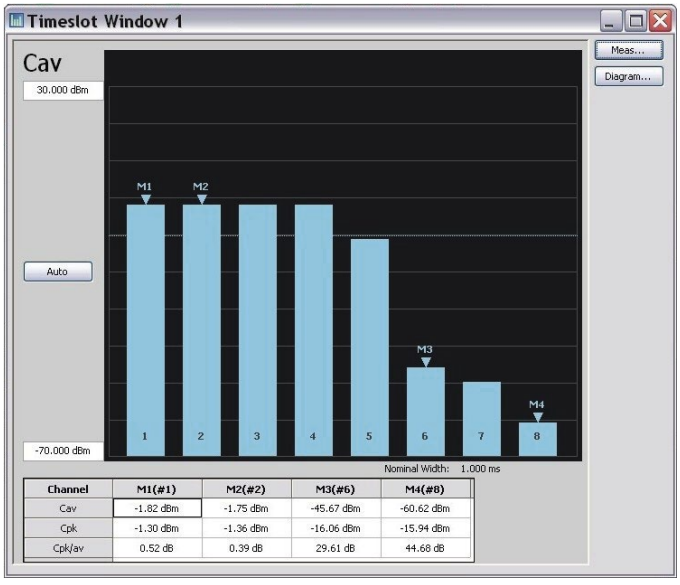

FIG 8 Timeslot mode.

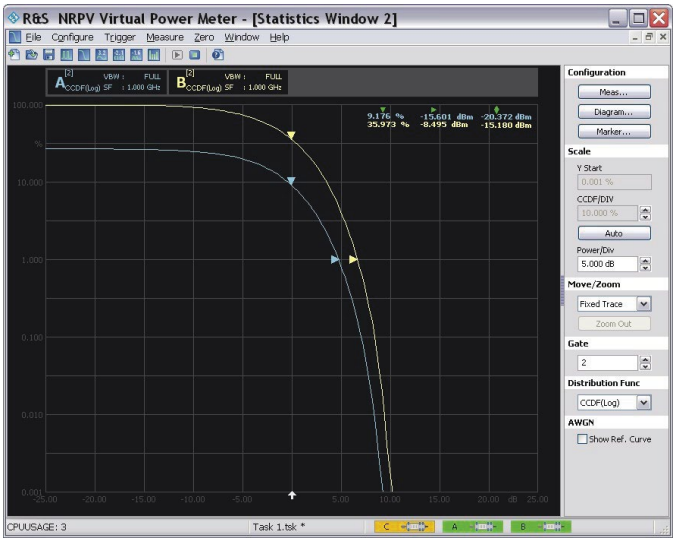

FIG 9 Statistics mode. Typical applications: measurements on amplifiers for various radiocommunications systems.