Rohde & Schwarz
Power Meter
R&S NRP

Getting Started

ROHDE&SCHWARZ

Overview

This Getting Started contains step-by-step instructions for simple measurements and provides an introduction to the R&S NRP's basic modes of operation. Each step is listed in order. The operating steps that are to be performed are highlighted in grey, while the sections between contain screenshots and also comments and references to more information.

The five sections describe the following:

☞ Measuring average power	Step-by-step introduction to standard power measurements with the R&S NRP.
☞ Window handling (p. 12) and ☞ Setting measurement functions (p. 17)	Basic techniques for configuring measurement windows.
☞ Average burst power measurement using signal triggering (p. 19)	Steps for measuring average burst power without an external trigger.
☞ Measuring average power over defined time intervals (p. 21)	Simultaneous measurement of average power in one or more timeslots.

Some of the sections later on in this Getting Started assume familiarity with the basic operating techniques which are introduced in the first two sections. It is, therefore, advisable to go through the first two sections before considering other topics.

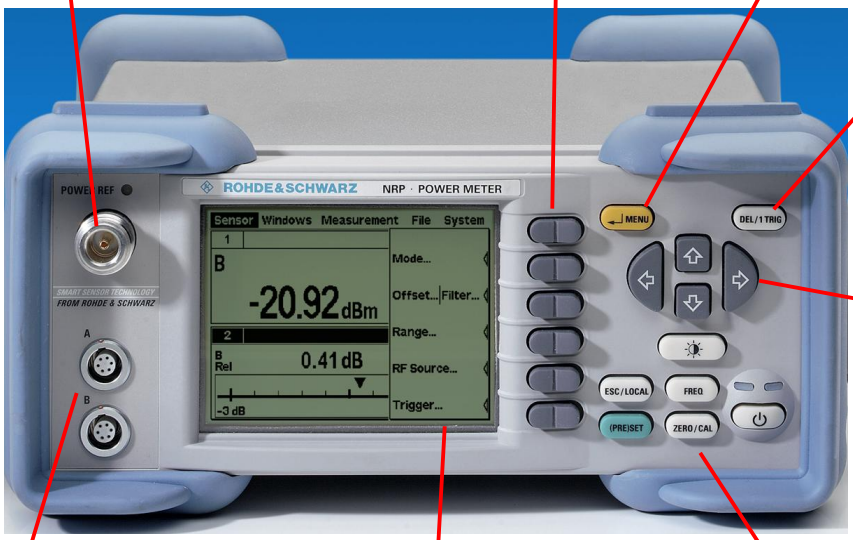
Front and rear views

Built-in **Test generator** (option R&S NRP-B1)

Softkeys for menu driven operation to simplify the test process

Enter / MENU key to confirm entries or open the menu

DEL / 1 TRIG key to delete entries in an editor or for single shot measurements



Cursor keypad for context sensitive functions

2 sensor connectors at the front panel, 2nd input optional (option R&S NRP-B2)

Graphic display for user defined indication of measurement values with up to 4 different windows

Hardkeys for fast access of important functions

Ethernet interface for remote control and read out of measurement results (option R&S NRP-B4 - coming soon)

USB interface for firmware update

IEEE bus for remote control and read out of measurement results

DC output provides voltage linear to measured power level

Trigger input for single or multi slot measurements or second DC output

Power supply

3rd and 4th sensor input (option R&S NRP-B5) or **rear panel sensor inputs** from front side (option R&S NRP-B6)

Measuring average power (Cont Av mode)

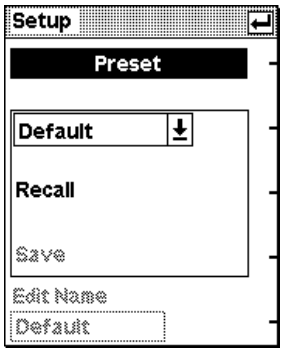
1 **Set the R&S NRP to the PRESET state.**

The instrument is set to a well-defined initial state to prevent any previous settings from causing incorrect results.

➢ Put the R&S NRP into operation as described in Chapter 1 and connect a sensor to connector **A**.

(PRE)SET

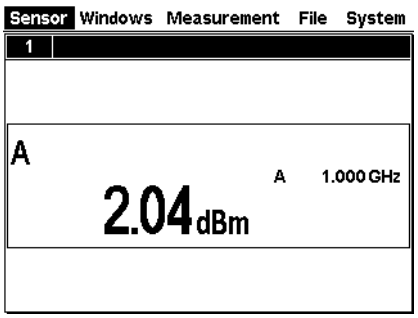
➢ Press the (PRE)SET key.



The Setup dialog box is displayed.

Preset

➢ Press the **Preset** softkey.



The Setup dialog box disappears and the meter is in the preset state.

A display window indicates the result (in dBm) obtained with sensor A.

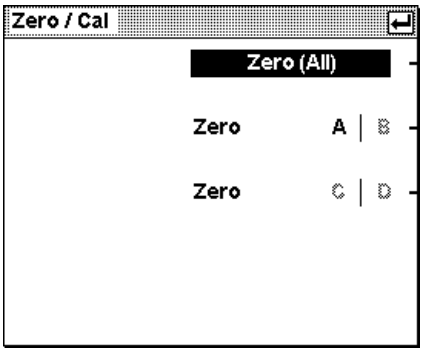
2 Zeroing the meter

A zero error correction is one of the meter's default settings. This procedure should be repeated as and when necessary, but primarily when the sensor reaches its operating temperature.

- If the sensor is already connected to a signal source, disconnect it or turn the source off.

ZERO/TEST

- Press the ZERO/TEST key



The **Zero/Cal** dialog box is displayed.

Zero all

- Press the **Zero all** softkey

The correction measurement takes several seconds. When completed a GO/NOGO message is output.

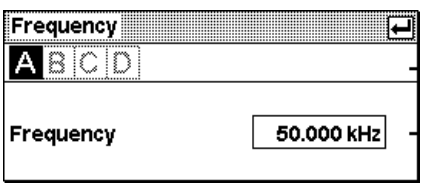
3 Setting the frequency

The R&S NRP must be set to the carrier frequency of the applied signal if the specified measurement accuracy is to be reached.

- Connect an unmodulated signal with a level between –10 dBm and +10 dBm to the sensor.

FREQ

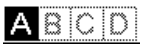
- Press the FREQ key



The Frequency dialog box is displayed.

A | B | C | D

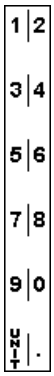
- Select channel A by pressing the appropriate rocker switch.



Note: *If only one sensor (A) is connected, the tabs B, C and D are grey, i.e. channel A is selected automatically.*

Frequency – 

➢ Press the **Frequency** softkey



A panel with all the characters you will need to enter the frequency is displayed next to the softkeys.

1 2 3 4 5 6 7 8 9 0 U . – 

➢ Clear the field with the (Del) key

➢ Enter the frequency of the applied signal by pressing the appropriate softkey.

➢ Using the **UNIT** softkey select the unit you want.

✓ **Try the following:**

To familiarize yourself with the editor, try the following steps:

➢ Using the left/right cursor keys, move the block cursor and overwrite the digits with new values.

➢ Use the up/down cursor keys to scroll the digits to the cursor position.

➢ Move the insertion mark to the right onto the units. Select the unit with the up/down cursor keys.

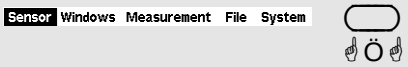
(↵ MENU)

➢ Confirm your entry.

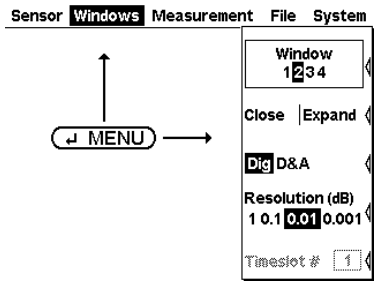
(↵ MENU)

➢ Close the dialog box.

4 Setting the unit in the display

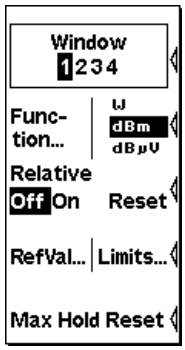


➢ Using the topmost rocker switch or the cursor keys (⇦⇨), select the **Measurement** menu.

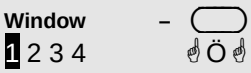


The menu opens out automatically for this procedure.

➢ Press the MENU key, if the menu is not displayed.



The results of post-processing are summarized in the **Measurement** menu.



➢ Use the **Window** softkey to select window 1.

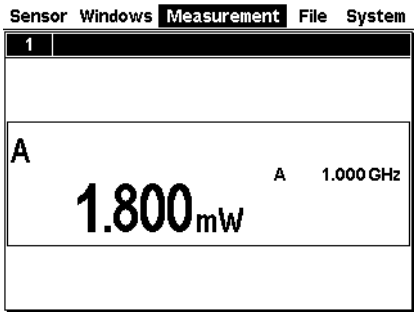
The functions in the **Windows** and **Measurement** menu are all defined for the selected window.

The dark title bar indicates the window that has been selected.

✓ **Tip:**

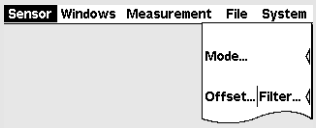
You can also select windows with the up/down cursor keys.

➢ Select **W** as the unit.



The result is displayed in W.

5 Setting a fixed offset correction



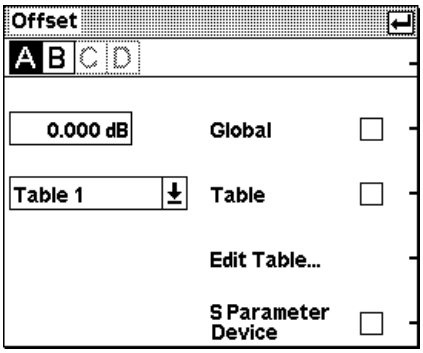
– ☝Ö☝

➢ Using the topmost rocker switch or the cursor keys (⇦⇨), select the **Sensor** menu.

All sensor-related settings can be made in the **Sensor** menu. This determines the type and details of data acquisition.

Offset... | Filter – ☝

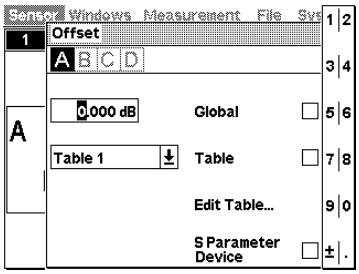
➢ Press the **Offset...** softkey (left-hand side of rocker-switch).



The Offset dialog box opens. Factors for correcting external signal losses or gains, due to an attenuator, for example, can be set in this box.

Global – ☝

➢ Activate the editor for the global offset by pressing the left-hand side of the rocker switch next to **Global**.



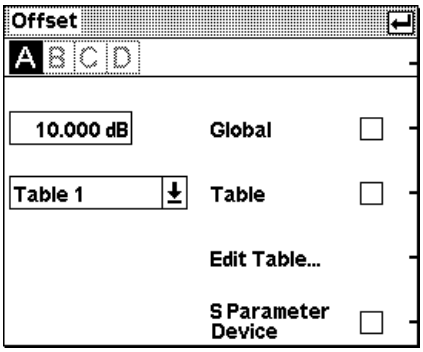
Positive values are for correcting losses and negative values for gains.

1 2 3 4 5 6 7 8 9 0 . – ☝☝

➢ If you have an attenuator at hand, enter its value and connect the attenuator between the sensor and the signal source, otherwise just enter 10 dB.

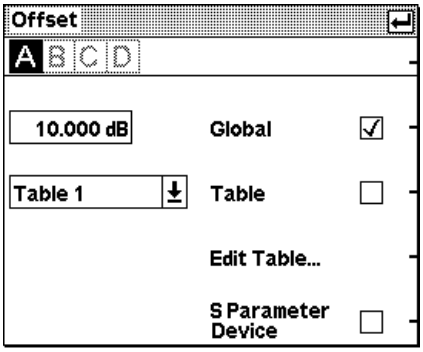
MENU

➢ Confirm the entry.



Global –

➢ Activate the global offset correction by pressing the right-hand side of the rocker switch next to **Global**.



Global offset correction is now on. The displayed value is increased or decreased depending on the sign of the offset.

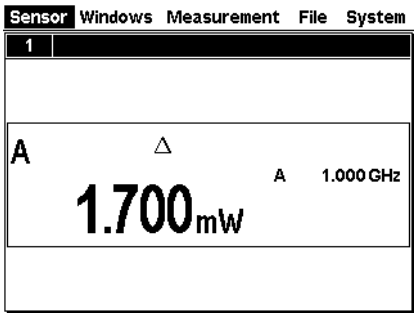
Factors which are not, or only minimally, dependent on frequency can be corrected in this way.

MENU

➢ Close the dialog box.

MENU

➢ Close the menu.

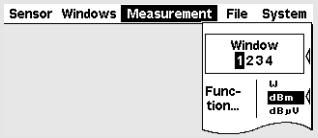


If you have connected an attenuator and entered its attenuation, the R&S NRP will display about the same value as before.

In the note line of the measurement window, the Δ symbol indicates that global offset correction has been activated.

6 Relative power measurements

The R&S NRP can calculate and display the relative difference between a measured value and a reference value. The reference value can be a measured value that has been saved or an arbitrary value that is entered.



– ☝Ö☝

➢ Using the topmost rocker switch or the cursor keys (⇦⇨), select the **Measurement** menu.

Relative – ☝

➢ To activate the relative mode, press the right-hand side of the rocker switch next to **Relative**.

Relative
Off On Reset

As the default setup was loaded in step 1, the value relative to 0 dBm is displayed.

Relative – ☝

➢ Press the rocker switch next to **Relative** again on the right-hand side.

Relative
Off On Reset

In the second line,

Off On Reset

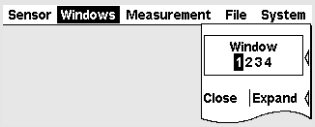
is displayed briefly and then the original display returns.

The last power result obtained has now been made the new reference value. If the power has not changed in the meantime, the reference value and the power are equal and the indicated value is 0 dB.

➢ If an attenuator is still connected, remove it now and connect the sensor directly to the signal source.

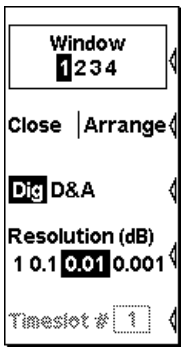
The displayed value should now equal the attenuation that has been entered.

7 Checking settings (window zoom).



– ☝Ö☝

➢ Using the topmost rocker switch, or the cursor keys (⇦⇨), select the **Windows** menu



The **Windows** menu contains all the functions required for opening, closing and configuring windows.

Select
1 2 3 4
– ☝Ö☝

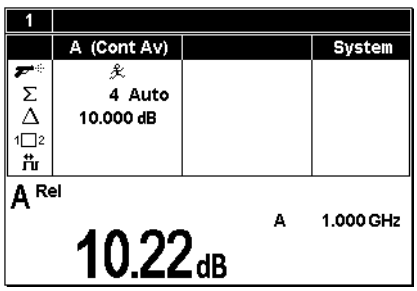
➢ Check if window 1 has been selected.

Close | **Expand** – ☝

➢ Press the **Expand** softkey.

↵ MENU
☝

➢ Close the menu.



Window 1 now expands to occupy the full space below the menu bar and displays all the key measurement parameters: The frequency from 3, the offset correction from 5 and the relative display from 6.

➢ To return the window to its normal size, open the **Windows** menu with the ↵ MENU key and press the **Arrange** softkey.

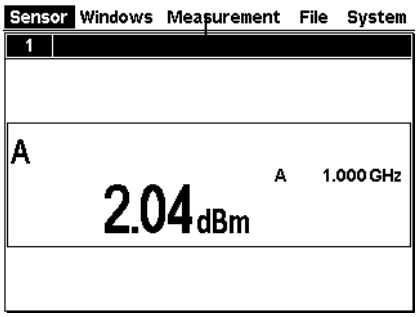
Window handling

Up to four windows can be shown simultaneously on the R&S NRP's display. Each window can be configured for a separate measurement. The following examples show how to handle windows.

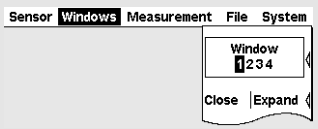
1 **Opening, creating, zooming and closing windows.**

(PRE)SET

➢ Press the (PRE)SET key and then the **Preset** softkey.

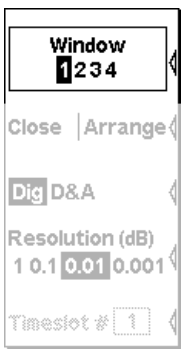


A display window indicating the result from sensor A (in dBm) appears.



– Ö

➢ Using the topmost rocker switch or the cursor keys (⇦⇨), select the **Windows** menu.



The **Windows** softkey can be used to select which window the functions in the **Windows** menu and in the **Measurement** menu will act on.

✓ **Tip**

The cursor keys (↓) (↑) can, in most cases, be used instead of the rocker switch to select windows. This also applies to opened dialog boxes.

Windows
1 2 3 4

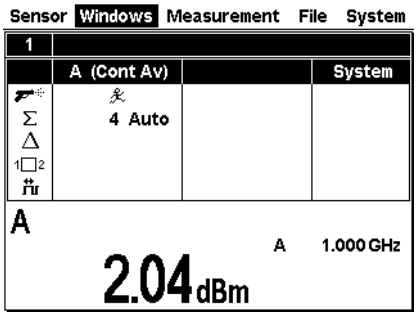
– Ö

➢ Select window 1.

The third softkey is now labelled **Close | Expand**.

Close | Expand – ⬭

➢ Press the Expand key



The window expands to occupy the full display height and indicates all parameters relevant to the measurement. The currently displayed values are the default values obtained after a preset.

Instead of **Expand,** the **Arrange** function is now available to arrange all opened windows.

Close | Arrange – ⬭

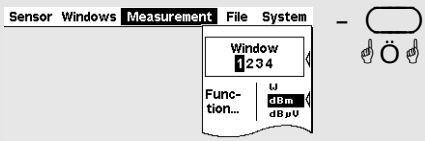
➢ Press the **Arrange** key.

Window 1 returns to its previous size.

The following steps show the difference between the **Open** and **Init** functions. You first have to change two settings of window 1.

Dig D/A – ⬭

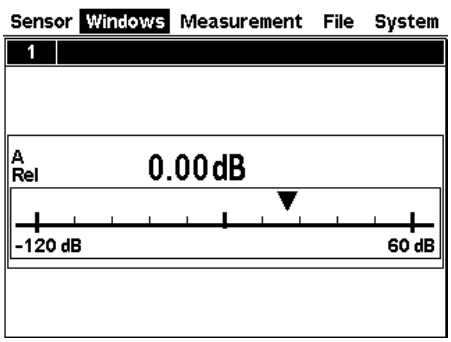
➢ Using the **Dig D/A** softkey, activate the analog display of results.



– ⬭ Ö ⬭

➢ Go to the **Measurement** menu and select **Relative On**.

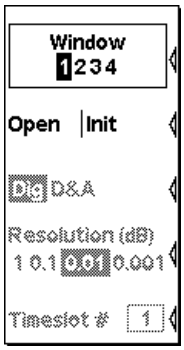
➢ Return to the **Windows** menu.



Window 1 now displays the **A Rel** function on an analog scale.

Close | Arrange – ⬭

➢ Now, close window 1 with the **Close** softkey.



"Select" in **Window** shows that window 1 is still selected.

The labelling next to the third softkey is now **Open | Init**.

Open | Init – ⬭

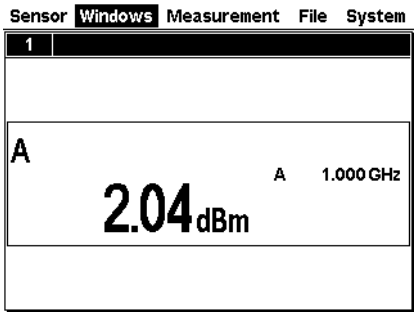
➢ Now, press the **Open** softkey (**not Init**).

The appearance of the window has not changed, and all window-specific settings have been maintained.

Close | Arrange – ⬭

Open | **Init** – ⬭

➢ Again close window 1 with **Close,** but open it this time with **Init**.



The window again displays the measurement function **A** in digital format.

The difference between **Open** and **Init** is that **Open** keeps the values of all the parameters that have been previously set in this window while **Init** sets all the parameters to their default values.

Caution: This function only resets the window settings made in the **Windows** *and* **Measurement** *menus, but it does not affect the sensor settings!*

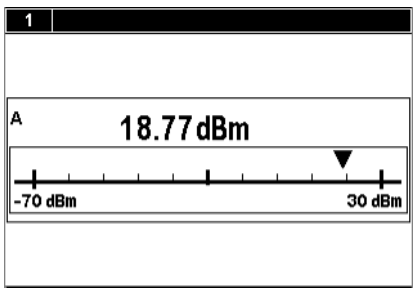
2 Display options

The **Type** softkey is used to select various display modes.

The standard display mode is **Dig**ital measured value.

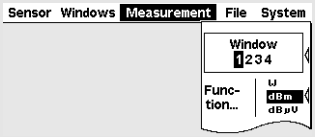
Dig D/A Graph – 

➢ Select the **D/A** display mode.



Window 1 now shows an analog scale and a digital reading.

3 Auxiliary values (Maximum, Minimum, Max, Min, …).

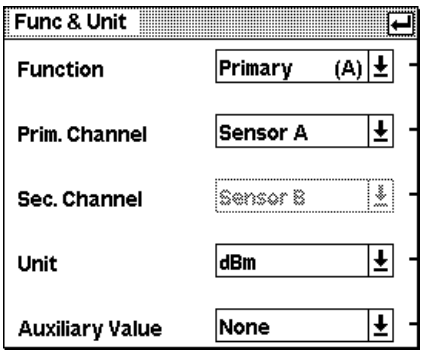


– Ö

➢ Select the **Measurement** menu.

Function… – Ö

➢ Select **Function...**in this menu.



The measurement function, unit, sensors used and the auxiliary value can be selected in the Function & Unit dialog box.

Auxiliary Value – Ö

➢ Open the **Auxiliary Value** drop-down list.

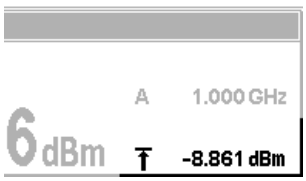
Auxiliary Value – Ö

➢ Select **Max**.

MENU

➢ Close the dialog box.

➢ Press the **Max Hold Reset** softkey and close the menu with MENU.



The updated maximum is now displayed on the right next to the measured value.

If you reduce the signal power, the maximum should remain the same. However, if the signal power is increased, the maximum changes accordingly.

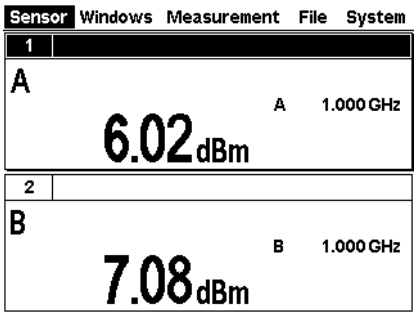
Setting measurement functions

A multichannel meter with two sensors connected is required for this section. If only one sensor is available, you can only select the measurement functions "Primary" and "Secondary".

1 **Measuring one power relative to another.**

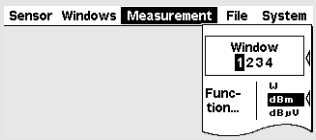
(PRE)SET

- Connect the two sensors to connectors A and B on the R&S NRP and apply an unmodulated signal with a level between –10 dBm and +10 dBm to each of the sensors.
- Press the (PRE)SET key and then the **Preset** softkey.



Now, two display windows with the results (in dBm) from sensors A and B appear.

A window for each sensor is opened with Preset.



– Ö

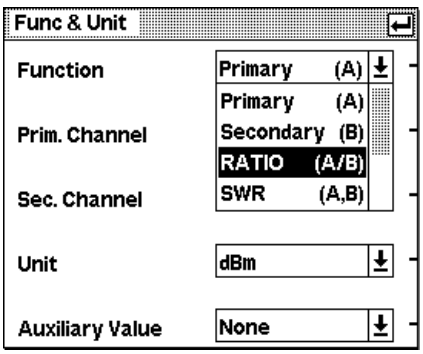
- Select the **Measurement** menu and then select **Function...** from this menu.

Function… –

Function –

Ö

- Open the **Function** drop-down list in the Function & Unit dialog box.



In this window, you can select the function which is used to calculate the result in the active window. **Ratio (A/B)**, for example, outputs the ratio of the power measured in channel **A** to the power measured in channel **B**.

➢ Check whether **Sensor A** is selected in the drop-down list for the primary channel and **Sensor B** in the drop-down list for the secondary channel.

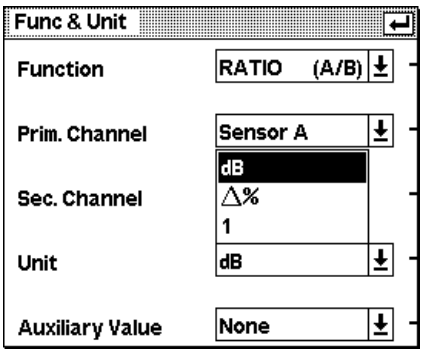
✓ **Tip**
You can also operate the drop-down lists by means of the cursor keys (↓) (↑) instead of the rocker switch.

Function – ☝Ö☝

➢ Select **Ratio (A/B)** from the drop-down list for the measurement function and close the drop-down list with (↵ MENU).

Unit – ☝Ö☝

➢ Now, press the **Unit** softkey.



The ratio of two powers is dimensionless – this is why only **dB**, **Δ%** and **1** are available in the unit list. The symbol **Δ%** represents the relative uncertainty in % (0% means the powers in both channels are equal), the symbol **1** represents a straight ratio, i.e. not the log of a ratio.

Measuring av. burst power with signal trig. (Burst Av mode)

An R&S NRP-Z1x or R&S NRP-Z2x diode sensor is required for this section. A pulsed RF signal is also needed to perform the measurements.

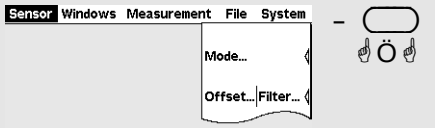
The R&S NRP-Z1x and R&S NRP-Z2x sensors have two measurement modes for RF burst power: Burst Av and Timeslot.

An external trigger is not required in the *Burst Av* mode – the sensor automatically determines the trigger point from the measured signal. It is also not necessary to specify the width of the burst as the sensor determines the end of the burst automatically.

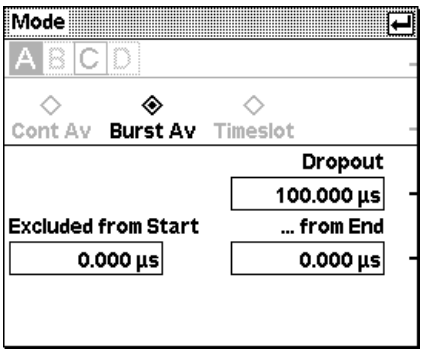
1 Setting the burst mode.

- Connect an R&S NRP-Z1x or R&S NRP-Z2x sensor to connector A on the R&S NRP and apply a pulsed signal with a level between –10 dBm and +10 dBm.
- Press the (PRE)SET key and then the **Preset** softkey.

A measurement window is now available.



- Select the **Sensor** menu and then select the **Mode** item in this menu.
- Select the **Burst Av** mode.



The burst mode parameters are displayed at the bottom of the dialog box.

As there is usually no point in measuring the initial and final pulse transients, they can be excluded with the parameters **Excluded from Start** and **Excluded from End**.

The parameter **Dropout** helps to ensure the reliable detection of the end of modulated-signal bursts (e.g. NADC).

See Chapter 4 in the User Manual, Measuring the average burst power, for a detailed description.

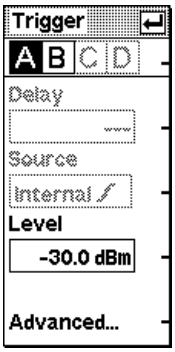
2 Settings to ensure reliable triggering

MENU

➢ Close the **Mode** dialog box.

Trigger ... –

➢ Now, open the **Trigger** dialog box.

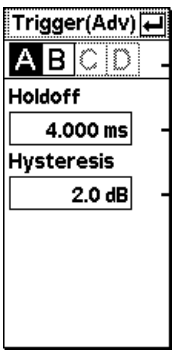


➢ Level

Set the trigger threshold in this box.

Advanced ... –

➢ Now, open the **Advanced** dialog box from the **Trigger** dialog box.



In the **Advanced Trigger** dialog box, the parameters **Holdoff** and **Hysteresis** can be used to ensure reliable triggering – even when difficult signals are involved.

➢ **Holdoff**

For specifying a time interval (measured from the start of the detected burst) in which no further burst starts are to be detected.

➢ **Hysteresis**

The effect of setting a trigger hysteresis which is not equal to 0 dB is that the measurement level must be under the trigger threshold by at least this amount, if triggering is to occur again. In the case of burst signals, trigger hysteresis is not critical and this is why any value between 0 and 3 dB can be selected.

See Chapter 4 in the User Manual, Trigger Settings, for a detailed description of these parameters.

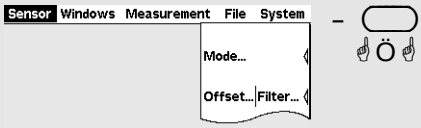
Measuring average power in a specific timeslot (Timeslot mode)

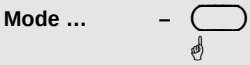
The *Timeslot* mode is used to measure the average power in a specific time of any complex signal. Usually, an external trigger is used. This ensures that triggering is always reliable and it is possible to measure very low powers. For example, it is possible to simultaneously perform measurements in one or more TDMA timeslots.

1 Setting the timeslot mode.

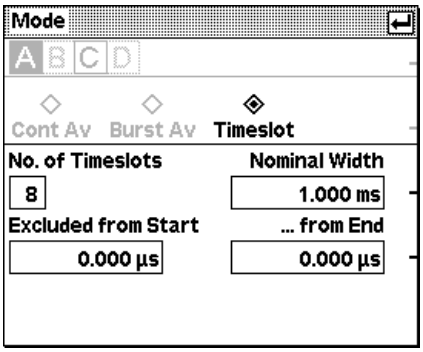
- Connect an R&S NRP-Z1x or R&S NRP-Z2x sensor to connector A on the R&S NRP and apply a pulsed signal with a level between –10 dBm and +10 dBm.
- Press the (PRE)SET key and then the **Preset** softkey.

A measurement window is now available.





- Select the **Sensor** menu and then select the **Mode** item in this menu
- Then select the **Timeslot** mode.



The associated parameters are displayed at the bottom of the dialog box.

- Set the length of the time interval of interest or the nominal timeslot width as the **Nominal Width**.
- Using **Excluded from Start** and **Excluded from End** define the sections of the timeslot that are to be excluded from the measurement.
- The parameter **No. of Timeslots** specifies the number of consecutive timeslots on which simultaneous measurements are to be made. In this example, the number is 1.

See Chapter 4 in the User Manual, Triggered measurements in timeslots, for a detailed description.

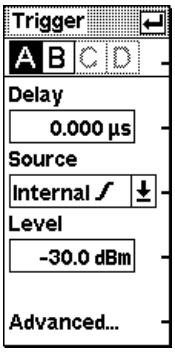
2 Setting timeslot trigger parameters.

MENU

➢ Close the **Mode** dialog box.

Trigger ... –

➢ Now, open the **Trigger** dialog box.



The following trigger parameters are provided in the Timeslot mode:

➢ **Source** (trigger source)

You can either select external triggering (via connector I/O2 on the rear panel) or internal triggering (derived from the signal) on the positive or negative slope.

Note: Because of the double assignment of I/O2 as the trigger input or the analog output, ensure that the setting in Dialog System→IO is correct!

➢ **Delay**

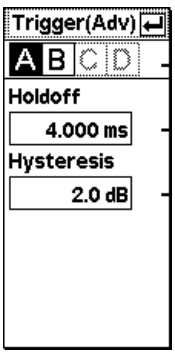
For defining the start of Timeslot 1 with respect to the trigger edge. The value can be positive or negative.

➢ **Level**

For setting the trigger threshold for the **Internal** trigger source.

Advanced ... –

➢ Now, open the **Advanced** dialog box.



The setting in this dialog box ensures reliable triggering on a number of possible trigger events.

See page 20 and further on Chapter 4 in the User Manual, Trigger Settings, for a detailed description of these parameters.

3 Simultaneous measurements in several timeslots.

To perform simultaneous average power measurements in several timeslots in a frame of a TDMA signal, you need an external trigger signal that is synchronized with the start of the frame.

- Apply an RF signal with a TDMA structure and a level between –10 dBm and +10 dBm to the sensor.
- Set the timeslot and trigger parameters as described in sections 1 and 2 as appropriate for the signal.

Mode ... –

- Open the **Mode** dialog box.

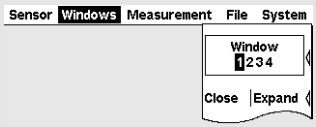
No. of Timeslots –

- Enter the number of timeslots in a frame – e.g. 8 for GSM.

Nominal Width –

- Set the appropriate **Nominal Width** of the timeslots – e.g. 577 µs for GSM – and close the **Mode** dialog box.

MENU



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- Select the **Windows** menu.
- Use the rocker switch next to **Timeslot #** to display the measured values associated with the various timeslots in the measurement window.

✓ **Tip**

You can also open a separate window for each timeslot. Up to four timeslot results can be displayed simultaneously in this way.