R&S® ZVAX24
Pulse Profile Measurements
Application Sheet

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ROHDE&SCHWARZ

The following abbreviations are used throughout this guide: R&S® ZVAX24 is abbreviated as R&S ZVAX24. Options R&S® ZVAX-Bxxx are abbreviated as R&S ZVAX-Bxxx. The vector network analyzer R&S® ZVA24 is abbreviated as R&S ZVA24.

1 Pulse Profile Measurement

This application sheet describes the use of an R&S ZVA vector analyzer and an R&S ZVAX24 extension unit for creating a pulsed RF signal and performing pulse profile measurements.

1.1 Required Equipment

The pulse profile measurement can be carried out with the following equipment:

- Network analyzer (NWA) R&S ZVA24 with a firmware version V2.60 or higher and a motherboard part number 1305.6470.02 (see "Info > Hardware Info ...")
- Option R&S ZVA-K27, "Pulse Generator"
- Option R&S ZVA-K7, "Pulsed Measurements"
- Option R&S ZVA24-B16, "Direct Generator/Receiver Access" at source port 1
- One R&S ZVAX24 extension unit equipped with option R&S ZVAX24-B271, "Pulse Modulator Generator Port 1"

1.2 Measurement Principle

The pulse modulator option R&S ZVAX24-B271 provides a pulsed source signal at the NWA port 1. Pulse width and period are determined by the used pulse generator, which can e.g. be the internal pulse generator of the NWA provided by option R&S ZVA-B27. This option also provides a second "Sync" signal that can be used to synchronize the measurement to the rising edge of the generated pulses.

The DUT is connected between the test ports 1 and 2 of the analyzer; the transmitted pulsed signal is measured at port 2 using the analyzer's "Pulse Profile" mode.

The measurement involves the following steps:

1. Connecting the extension unit

2. Configuring the extension unit for the selected measurement and test setup ("ZVAX Path Configuration")

3. Defining the pulse generator and the trigger settings

4. Configuring the "Pulse Profile" mode

5. Calibration

6. Connecting the DUT and measuring

Power calibrations and system error corrections for test setups with an extension unit can be performed in the ordinary way.

1.3 Connecting the Extension Unit

The pulse profile measurement requires the following connections between the network analyzer and the extension unit.

- RF connection: Connect SOURCE IN (ZVAX) to SOURCE OUT (NWA) and SOURCE OUT (ZVAX) to SOURCE IN (NWA).
- Control connection: Connect USB FROM NWA (ZVAX) to any of the USB type A connectors at the front or rear panel of the NWA.
- Pulse generator connection: Connect CASCADE IN (ZVAX) to CASCADE (NWA) using the RJ-45 cable supplied with the extension unit.

The DUT is connected between the analyzer ports 1 and 2. The schematic test setup is shown below.
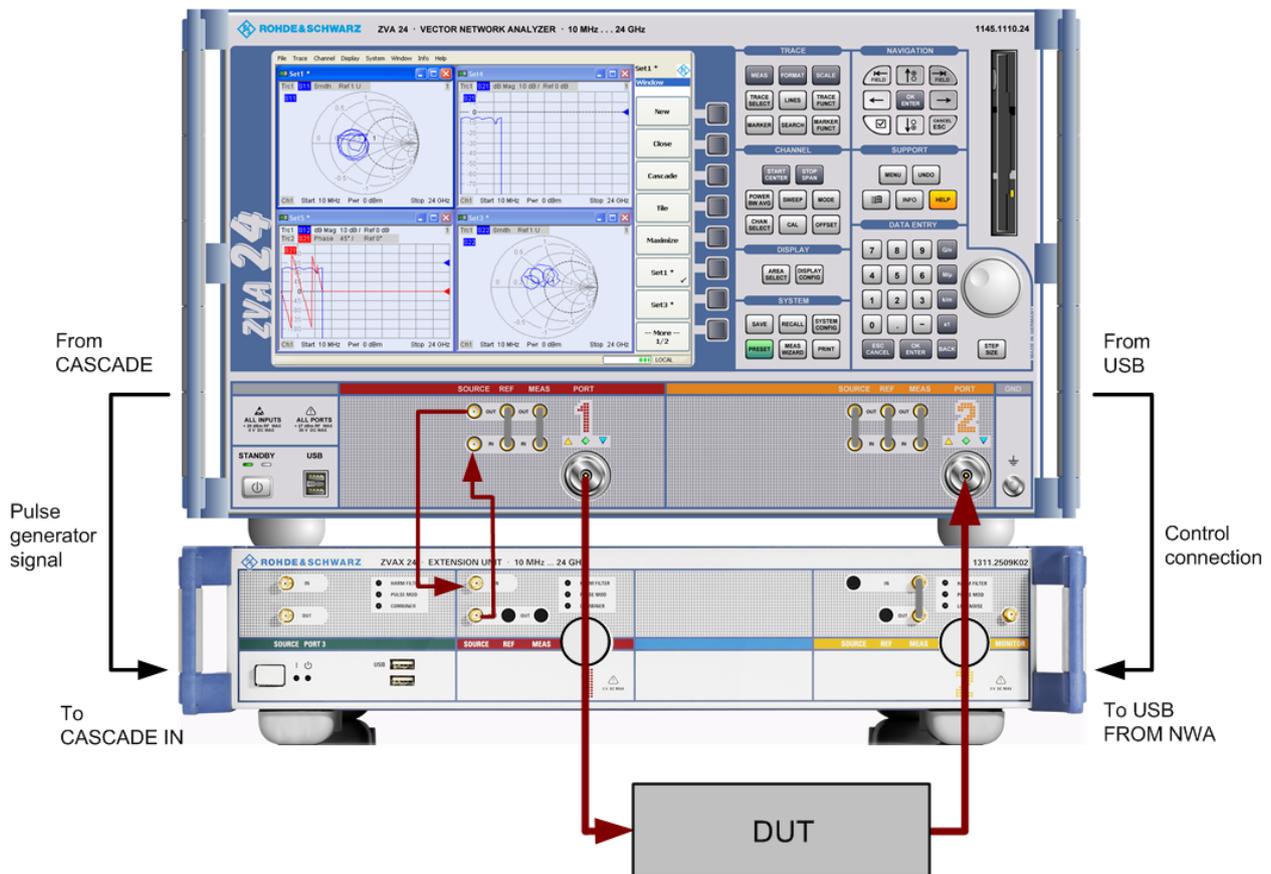
Fig. 1-1: Test setup for pulse profile measurement

1.4 ZVAX Path Configuration

When the extension unit is connected to the network analyzer as described before, it is possible to select the modules to be looped into the signal path(s) and the routing of

the pulse generator signals. This is done in the "ZVAX Path Configuration" dialog ("Channel > Mode > ZVAX Path Configuration"). The schematic in this dialog shows all RF modules installed in the extension unit.

The dialog below corresponds to a fully equipped extension unit. The source signal path for port 1 corresponds to the highlighted section in the center.
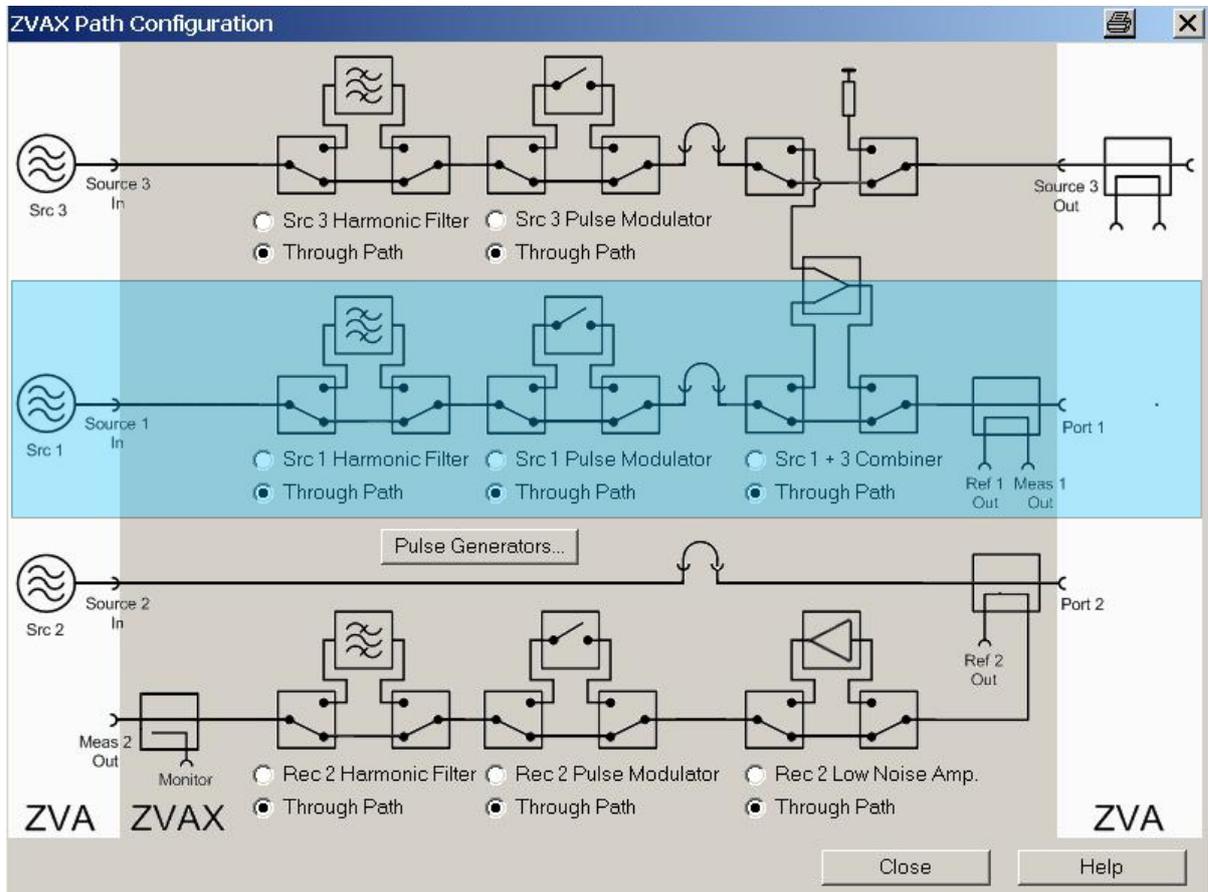
Fig. 1-2: ZVAX Path Configuration

1. Use the radio buttons in the "ZVAX Path Configuration" dialog to activate the "Src 1 Pulse Modulator". If your extension unit contains a harmonic filter or combiner, select the corresponding through paths.

2. Click "Pulse Generators" and make sure the "Modulator Source" and "Modulator Assignment" settings are as shown below.
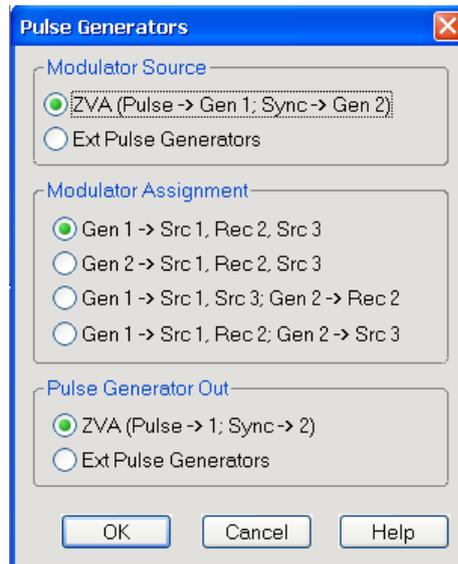
Fig. 1-3: Pulse Generator settings

1.5   Pulse Generator Signals

The pulse generator provides single pulses with defined width and period or sequences of pulses (pulse trains). In the example below, a single pulse with a width of 1.4 µs is generated. The pulse is repeated after a pulse period of 5 µs. The second pulse generator signal ("Sync" signal) can be used to synchronize data acquisition to the pulse.
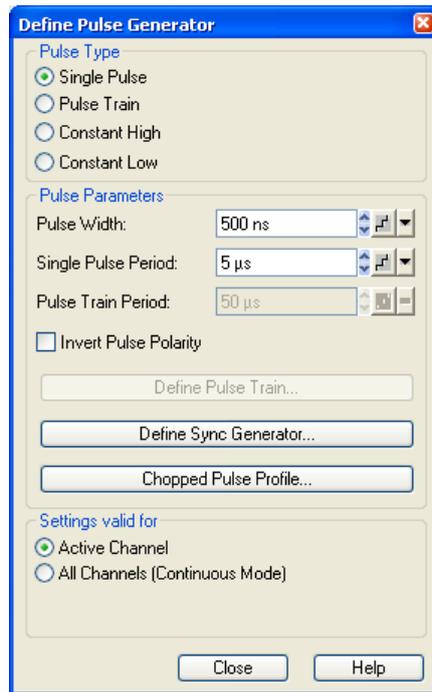
Fig. 1-4: Define Pulse Generator

1. Click "Channel > Sweep > Sweep Type > Pulse Generator" to activate the pulse generator signal.

2. Click "Def Pulse Generator..." and configure the "Pulse Parameters" as shown above.

3. In the "Define Pulse Generator" dialog, click "Define Sync Generator..." and ensure that the "Sync" signal is configured as shown below.
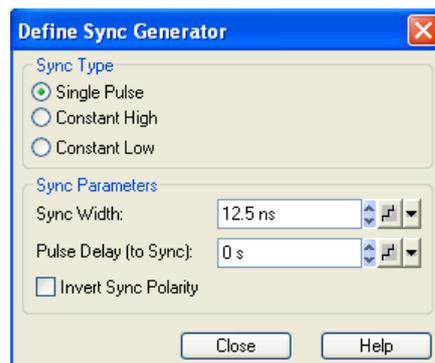
Fig. 1-5: Define Sync Generator

4. Click "Channel > Sweep > Trigger > Pulse Gen..." to select the pulse generator as trigger source.
    The dialog "Pulse Gen Trigger" opens. Close it without modifying the default setting ("Rising Edge Sync").

1.6 Pulse Profile Mode

The pulse profile mode of the network analyzer is particularly suited for measurements on pulsed signals. The parameters must be adjusted to the pulse generator settings. In the example below, the start and stop time have been adjusted to view the 1.4 µs pulse width defined previously.
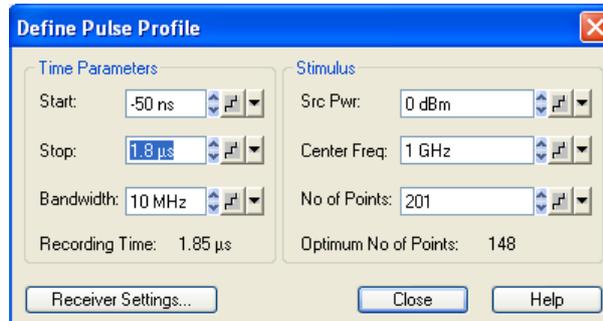
Fig. 1-6: Define Pulse Profile

1. Click "Channel > Sweep > Sweep Type > Pulse Profile" to activate the pulse profile mode.

2. Click "Define Pulse Profile..." and configure the "Time Parameters" as shown above.

The R&S ZVA help system provides detailed information about the pulse profile mode including measurement examples.

1.7 Calibration

The source signal from port 1 is attenuated on its way through the R&S ZVAX24 extension unit. The unit stores a number of power correction data sets to account for the effects of the different modules and signal paths in the extension unit. Whenever a new R&S ZVAX24 configuration is defined the analyzer modifies its own factory power correction data using the appropriate data set from the unit (see chapter 1.4, "ZVAX Path Configuration", on page 4).

The active modified factory power correction data set is replaced when the user performs his own power calibration. Power calibrations and system error corrections for test setups with an extension unit can be made in the ordinary way.

1.8 Measurement

After power calibration and system error correction, the pulsed measurement can be performed as outlined in chapter 1.6, "Pulse Profile Mode", on page 8. All measured

quantities (S-parameters, wave quantities, ratios etc.) and other trace settings are available.

The following example shows the reflected wave a_1, the transmitted wave b_2, and the forward transmission coefficient S_{21} of a DUT with the settings of the previous sections.
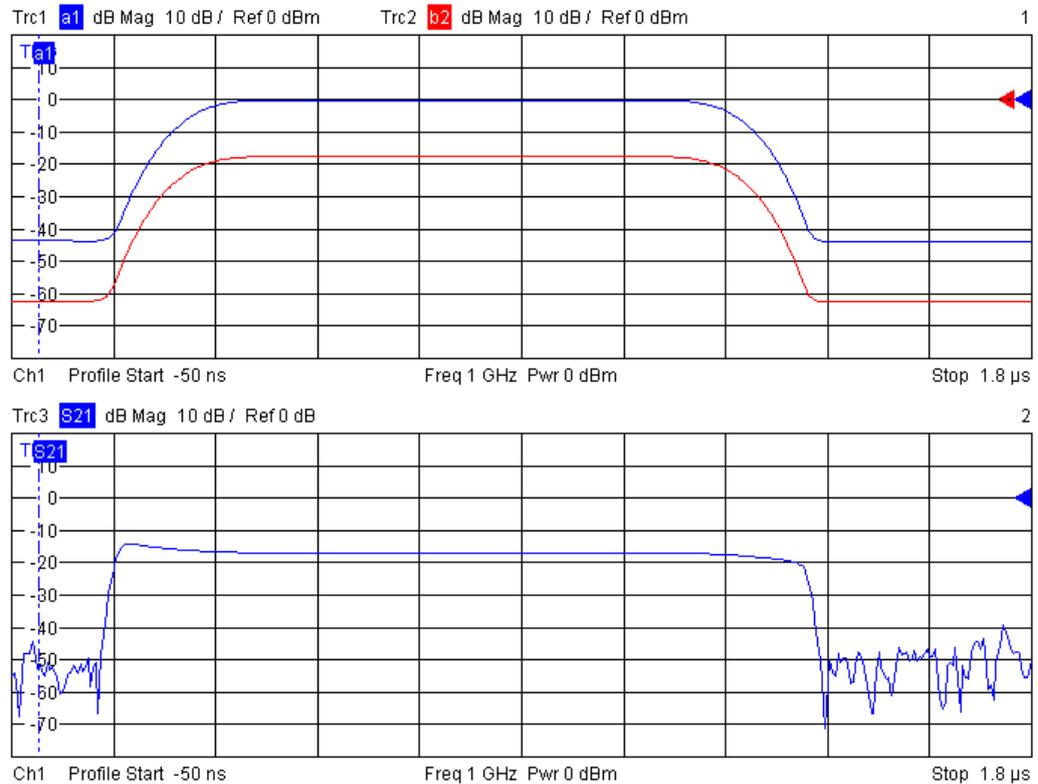
Fig. 1-7: Example for pulse profile measurement

It can be seen that the steepness of the edges of the S_{21} pulse arises from ratioing (b/a) and does not provide a measure for the rise and fall times of the pulse itself.

1.9 Possible Extensions

The extension unit R&S ZVAX24 can accommodate up to three pulse modulators (for two source paths and a receiver path) plus a variety of other hardware options. Options installed internally are shown in the "ZVAX Path Configuration" dialog (figure 1-3). An arbitrary combination of options may be used simultaneously.

1.10 Additional Information

For a comprehensive description of the measurement dialogs related to the R&S ZVAX24 including remote control refer to the R&S ZVA online help system or to

the printable operating manual, which is available for download at http://www.rohde-schwarz.com/product/zva.

For an description of the R&S ZVAX24 connectors and safety instructions refer to the R&S ZVAX24 Quick Start Guide.