Automatic pulse analysis with the R&S®SMA100A RF signal generator

With the R&S®SMA-K28 power analysis option, the R&S®SMA100A RF signal generator not only helps to measure frequency responses and compression curves, it also becomes a full-fledged pulse analyzer.

Signal generators and power sensors – an intelligent combination

It has already been possible for some time now to operate the R&S®NRP-Zxx power sensors on all Rohde&Schwarz signal generators. This is useful, for example, for correcting the test setup's frequency response. The R&S®SMA100A and R&S®SMF100A generators, together with the R&S®SMA-K28 power analysis option, can also be employed to accomplish demanding tasks, such as measuring the frequency response or compression behavior of a DUT.

On the other hand, with pulsed signals, such as the ones used in radar technology or in avionics for distance measurement equipment (DME), it is primarily the pulse parameters (FIG 1) that have to be measured. Such measurements are preferably performed completely automatically. This measurement function is included in the current firmware, which can also be used to quickly and easily retrofit existing equipment. The R&S®NRP-Z81 wideband power sensor is the prerequisite for performing such measurements.

The basics of pulse analysis

Pulses are measured in line with the international IEC 469 standard. The algorithm in the R&S®NRP-Z81 first determines the pulse amplitude of the measured trace by establishing the distance between top power and base power. This pulse amplitude then serves as the basis for the percentage values of three reference levels that can be preset – distal, mesial, and proximal. These three levels are used to measure the pulse (FIG 1). Typical values are 90 %, 50 %, and 10 % (for example, for measuring DME double pulses, see article beginning on page 50). While the distal and proximal reference levels are only employed to determine the pulse's rise and fall times, the mesial reference level is used to determine all other timing parameters.

The analog R&S®SMA100A signal generator creates signals of the utmost spectral purity up to 6 GHz. With the new R&S®SMA-K26 firmware option, it can also generate DME signals and, together with the R&S®NRP-Z81 wideband power sensor, it can analyze the most important parameters for a DME ground station (see article beginning on page 50).

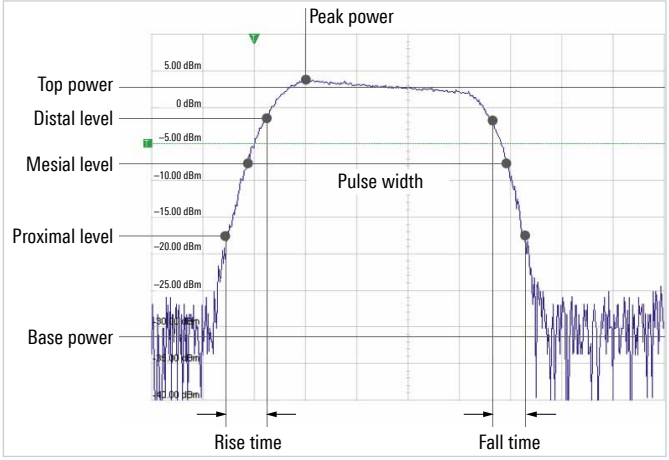

FIG 1 Definition of the pulse parameters in line with the IEC 469 standard.

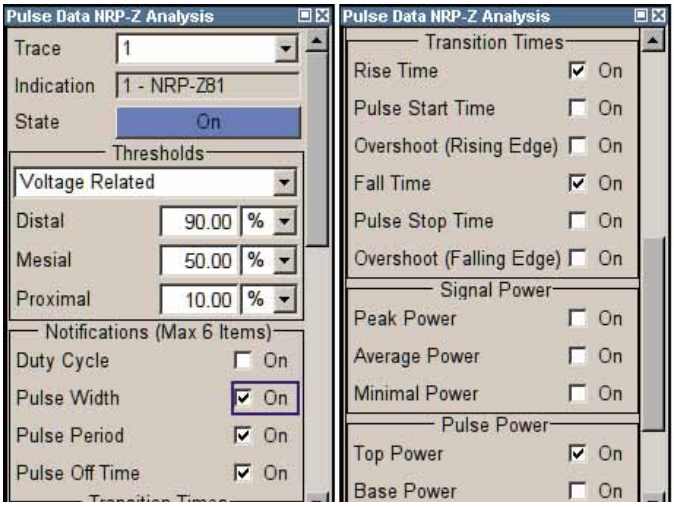

FIG 2 Setting the parameters for pulse analysis.

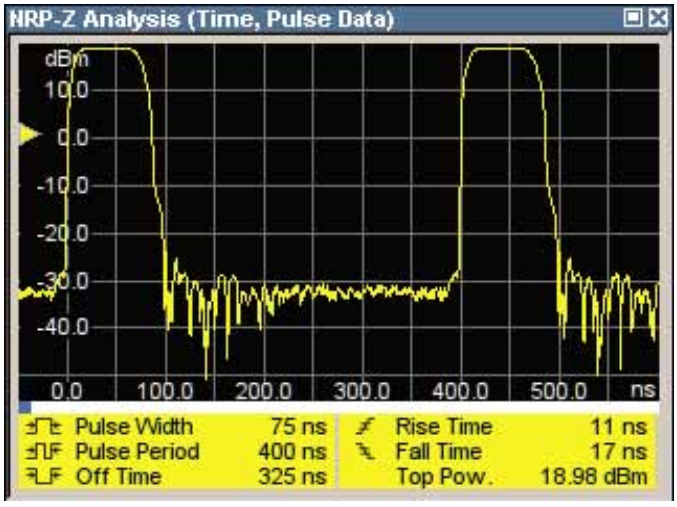

FIG 3 Representation of the measured pulse parameters on the R&S®SMA100A signal generator's display.

Fast operation

FIG 2 shows all of the setting options for automatic pulse analysis. The system continuously measures 18 parameters (FIG 4), six of which can be selected for the display of the measurement values (FIG 3). In order to ensure ideal use of the screen space and simultaneously be able to operate the instrument quickly, the established R&S®SMA100A operating philosophy has been expanded. When the analysis results are displayed in full-screen mode (as in FIG 3), it is possible, for instance, to use the BACKSPACE key to very quickly trigger automatic scaling of the level axis. All settings and measurement results are, of course, also available via the remote-control interfaces (GPIB/LAN/USB). The results can be stored as diagrams or as Excel® data records.

Summary

This expansion of the R&S®SMA-K28 power analysis option combined with the R&S®NRP-Z81 wideband power sensor turns the R&S®SMA100A RF signal generator into a versatile single-box solution for numerous applications that simultaneously require ultra-pure test signals and the ability to quickly characterize pulsed signals with great precision. This option is also available for the R&S®SMF100A microwave signal generator.

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Parameter	Meaning
Duty cycle	Ratio of the pulse width to the pulse period, expressed as a percentage $\frac{pulse\ width}{pulse\ period} \times 100\%$
Pulse width	See FIG 1
Pulse period	Distance between a rising edge and the next rising edge
Pulse off time	Distance between two pulses; distance between a falling edge and the next rising edge
Rise time	Pulse rise time, see FIG 1
Pulse start time	Beginning of the pulse, relative to the time at which the pulse was triggered
Overshoot (rising edge)	Overshoot on the rising edge, expressed as a percentage $\frac{peak\ power - top\ power}{top\ power - base\ power} \times 100\%$
Fall time	Pulse fall time, see FIG 1
Pulse stop time	End of the pulse, relative to the time at which the pulse was triggered
Overshoot (falling edge)	Overshoot on the falling edge, expressed as a percentage $\frac{base\ power - minimal\ power}{top\ power - base\ power} \times 100\%$
Minimal power	Minimum power measured anywhere in the measured trace
Peak power	Maximum power measured anywhere in the measured trace, see FIG 1
Average power	Average power for the pulse
Top power	Maximum power, adjusted to remove consideration of possible transient processes; this is often determined using an amplitude histogram, see FIG 1
Base power	Average power during the interpulse period
Mesial / proximal / distal power	Absolute power at the time at which the envelope trace reaches the defined reference level

FIG 4 These 18 different parameters are measured continuously with the automatic pulse analysis.