Power Meter R&S®NRP

Gated measurements made easy

Due to signal-synchronized gates and graphical display of the power envelope, power measurements on pulsed RF signals have become simpler than ever with the Power Meter R&S®NRP (FIG 1). This article describes the operation of the Gates function in the Scope mode using a TDMA signal as an example and shows that this mode is indispensable for power measurements when developing modern communications standards.

FIG 1 The Power Meter R&S®NRP can handle development and production problems with great ease. It has the right sensor for every task.

Representation of a signal in the time domain

Modern mobile radio system designs increasingly use time division multiple access (TDMA) standards, since they are much better at exploiting the capacity of transmission channels. Using this method, the information for the individual voice and data channels is output in compressed form in timeslots. Several consecutive timeslots in such a TDMA system form an entire frame. After the frame is transmitted, the process generally resumes with the first timeslot.

The power within one or more timeslots is of interest when developing such mobile radio systems or when troubleshooting. With respect to these requirements, the most appropriate sensor needs to be selected. Conventional thermal power sensors cannot adequately measure complex signal characteristics of this type, since they cannot delimit specific areas of power contribution in a timeslot, e.g. the data section of a GSM burst [1]. It is also not possible to separately measure the burst power of the individual timeslots in a frame, as thermal sensors average

the RF power occurring over the entire frame. This is because thermal sensor operation involves converting power into heat. Sampling the power envelope over time – which is feasible with diode sensors – is also not possible with thermal sensors. In contrast to diode sensors, thermal sensors have an inherently lower dynamic range. However, diode sensors always include signal details such as overshoots, interference pulses and glitches as well as signal edges of a pulsed RF signal in the measurement in proportion to their power.

The Power Meter R&S®NRP makes it easy to avoid these effects, since its intelligent diode sensors (R&S®NRP-Z11 or -Z2x) enable the R&S®NRP to display power versus time like an oscilloscope. This means that you do not miss a single detail of the signal you want to investigate. Furthermore, you can add timeslot and gate structures to your pulsed RF signals and configure them. To do this, you merely have to change to the Gates or Timeslot mode of the Scope mode. By graphically editing the gates added to the Scope window, you can selectively suppress unwanted components at the beginning and end, which occur, for example, in the transition between two timeslots. You can thus systematically delimit and measure signal components of interest. Extensive trigger functions, derived from an external source or from the test signal, ensure stable conditions. When the R&S®NRP is set to internal triggering, it can perform stable triggering of the pulsed RF signal down to a threshold value of –40 dBm without any problem. The R&S®NRP with its R&S®NRP-Z11 or -Z2x power sensors truly excels due to its wide dynamic range and due to the fact that it can perform time domain measurements down to –50 dBm at a video bandwidth of 100 kHz [2].

Up to four gates in the Scope mode

Just how easy the Gates function is to use in the R&S®NRP's Scope mode can be seen by looking at a GSM/EDGE signal, whose eight 577 µs timeslots form a 4.615 ms frame. In the Scope mode, you can define up to four different gates. For each gate, the R&S®NRP can display the average power (Avg), the peak value in the display (Peak) and the Peak/Avg ratio as numeric values [3].

The power meter's capability to create and display the ratio of the gated measurement results of two different sensors is unprecedented in the field of modern power measurements (FIG 3). This capability makes it quite simple, for example, to measure the gain or gain compression of a power amplifier in specific sections of a test signal and display the result together with the envelope. This feature is also very useful when determining the return loss of an amplifier.

Unbeatable dynamic range: Timegate and Timeslot modes

If the Scope mode's excellent dynamic range* is not sufficient, the dedicated Timegate and Timeslot modes provide an even more impressive dynamic range of 85 dB [4]. To use the modes, you merely have to change to one of them after you set all necessary parameters in the Scope mode in the R&S®NRP's Sensor menu. You do not even need to transfer the marker positions manually, since the power meter automatically sets them in the appropriate entry field in the Timegate mode. The Timeslot mode is actually a special case of the Timegate mode in which a repeating gate is configured that can be shifted timeslot by timeslot in the frame structure. You can define the frame length by entering the number of timeslots and thus easily measure the power of the individual timeslots in a GSM/EDGE frame by switching the timeslot counter.

Gates in the Scope mode provide you with the required overview of your designs

The R&S®NRP's Scope mode is an excellent tool in many areas of development. The integrated Gates measurement function helps you to develop future communications standards faster and better. The R&S®NRP is an indispensable tool because it enables you to visualize burst and pulsed signals, exactly delimit specific areas of power contribution, and measure their power with great precision.

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* 70 dB, power vs time, 256 points (external trigger).