Fig. 1: The R&S®NRP-Z41 and R&S®NRP-Z61 multipath power sensors.

The world's first multipath power sensors up to 40 GHz and 50 GHz

The new R&S®NRP-Z41 and R&S®NRP-Z61 power sensors are unique in the field of RF power measurement. They are the world's first multipath power sensors that offer upper frequency limits of 40 GHz and 50 GHz. These values are almost twice that of comparable sensors from the competition, which currently reach 26.5 GHz.

Comprehensive portfolio of multipath power sensors

Multipath power sensors from Rohde&Schwarz feature a dynamic range of up to 90 dB, short measurement times and low measurement uncertainty [*]. They can perform precise average value measurements on CW or any wideband modulated signals. Even modulated signals' envelope versus time can be displayed, either directly or by means of average power measurements in defined gates.

As part of the R&S®NRP product family, the R&S®NRP-Z41 and R&S®NRP-Z61 sensors (Fig. 1) share all of the characteristics of this portfolio. They are complete measuring instruments that include a USB port, making it possible to operate them in conjunction with the R&S®NRP base unit, a PC, spectrum and network analyzers or signal generators. Even a smartphone with an appropriate app can be used as a display device. Like all sensors in the R&S®NRP family, the new sensors permit auto-averaging, embedding of upstream components and gamma correction for compensating measurements errors caused by mismatch.

State-of-the-art technology makes it possible

At the heart of the new sensors lies the detector chip (Fig. 2). The integration of the entire detector on a single chip made it possible to increase the upper frequency limit from 33 GHz to

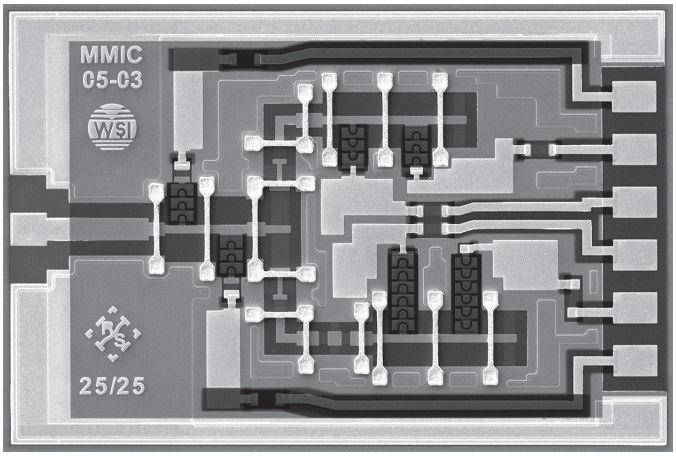

Fig. 2: Scanning electron microscope image of the integrated detector chip (dimensions: 1.5 mm × 1.0 mm).

50 GHz. The detector consists of three measurement paths. The RF or microwave signal from the input end is applied directly to the most sensitive path. The other two measurement paths receive the input signal with varying degrees of attenuation. Each path includes a full-wave rectifier, consisting of a diode stack with a load capacitor. The path attenuations are adjusted so that over the entire level range of –67 dBm to +20 dBm, at least one path is always available for detection of the signal within the square law region of the detector. This ensures that measurement errors resulting from nonlinearities or modulated signals are so small that their effect on the overall measurement uncertainty is negligible.

The detector chip connection with its coplanar structure at the input end is made via a patented, extremely low-reflection microwave transition. A metalized film is used to continuously convert the coaxial field pattern into a coplanar field. A highly advanced coaxial system – also used in other Rohde&Schwarz products up to 110 GHz – is located at the detector input.

In keeping with the thermal power sensors of the R&S®NRP family, the coupling nut on the connector for both new sensors is fitted with ball bearings. This special feature provides several advantages over conventional solutions. For example, it allows very sensitive handling and provides excellent reproducibility of both reflection and power measurements. It establishes a reliable connection without unnecessarily rotating the sensor, thereby reducing wear and tear on the coaxial connector. In addition, a securely tightened connection will not loosen if the sensor is rotated.

Applications

The R&S®NRP-Z41 and -Z61 sensors have characteristics comparable to the R&S®NRP-Z11 / -Z21 and -Z31 sensors, except that they extend the frequency range to 50 GHz. They are ideal for all research, development and production applications that depend on fast measurement speeds, high measurement accuracy and a wide dynamic range. For example, they are ideal for level measurements in microwave systems (carrier frequencies of e.g. 38 GHz or 42 GHz), for radar pulse power measurements or for characterizing broadband amplifiers.

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A comparison of sensor technologies

Rohde&Schwarz is the only manufacturer offering three state-of-the-art sensor technologies for the frequency range above 26.5 GHz:

- Thermal power sensors
- Multipath power sensors and
- Wideband power sensors

Average sensors with only one path and the associated limited level range, as well as CW diode sensors, are old technologies and therefore not part of the R&S®NRP family.

Thermal power sensors

- Measurement of average power for any signal
- Reference measurements with very low measurement uncertainty
- Linearity standard for RF and microwave signals
- No errors for any wideband modulated signal
- Harmonics measured according to their power
- No measurement of envelope power (rise time approx. 1 ms)

Multipath power sensors

- Measurement of average power for any wideband modulated signal
- Measurement of envelope power with video bandwidths of less than 100 kHz (rise time approx. 4 µs)
- Fast measurement for even the widest possible dynamic range

Wideband power sensors

- Time-based or statistical analysis, including pulse analysis of wideband signals with video bandwidths of up to 30 MHz (rise time approx. 13 ns)
- Average power measurement for
  - Any wideband signals at levels less than –15 dBm
  - Signals with bandwidths smaller than the video bandwidth for any level

References

* The following article provides a detailed description of the advantages and characteristics of multipath power sensors:
The better choice: USB power sensors from Rohde&Schwarz.
NEWS (2013) No. 208, pp. 26 – 29.