Power sensors for production: fast, reliable and cost-effective

For measuring instruments used in production, a compromise between technical characteristics and purchasing costs must often be made. For this reason, Rohde&Schwarz has developed two power sensors that are optimized for production applications. They cover the frequency ranges to 8 GHz and to 18 GHz, offer a wide dynamic range and are suitable for both continuous wave (CW) and modulated signals.

Multipath diode power sensors – tailored for use in production

Diode power sensors from Rohde&Schwarz deliver very accurate results even at extremely low power levels. They have been successful on the market for more than 10 years, due to their outstanding characteristics and their patented multipath technology featuring three measurement paths (see box).

For use in production, not all these outstanding characteristics are necessarily required. Rather, costs play a crucial role in this special environment. To provide attractive measuring equipment for such use as well, Rohde&Schwarz offers a good compromise with its new R&S®NRP-Z211 and R&S®NRP-Z221 power sensors (Fig. 1): Equipped with only two measurement paths, these sensors have a favorable purchasing price yet still ensure a good dynamic range that fully suffices for most production applications. Although other two-path sensors are available on the market, the new Rohde&Schwarz power sensors and their patented multipath technology offer significant advantages.

Fig. 1 R&S®NRP-Z211 power sensor.

Patented multipath technology ensures high measurement speed

The R&S®NRP-Z211 and R&S®NRP-Z221 power sensors use two measurement paths having six series-connected diodes each. The two paths together cover a dynamic range of 80 dB. The more sensitive path extends from –60 dBm to –4 dBm, the second path from –33 dBm to +20 dBm. Unlike conventional two-path sensors, where changing the measurement path requires a hard switchover, the new Rohde&Schwarz power sensors do not perform any switchover. Instead, measurements are always made in parallel in both measurement paths, and the result is determined using a patented weighting algorithm. Consequently, the path transition is smooth and hysteresis-free, avoiding the "hard" switchover point and the associated delay of about 25 ms as with competitive products. In addition, the noise contribution of the less sensitive path in the transition region is reduced by a factor of four (6 dB). As a result, assuming the same uncertainty contribution, a measurement speed 16 times faster is possible. The

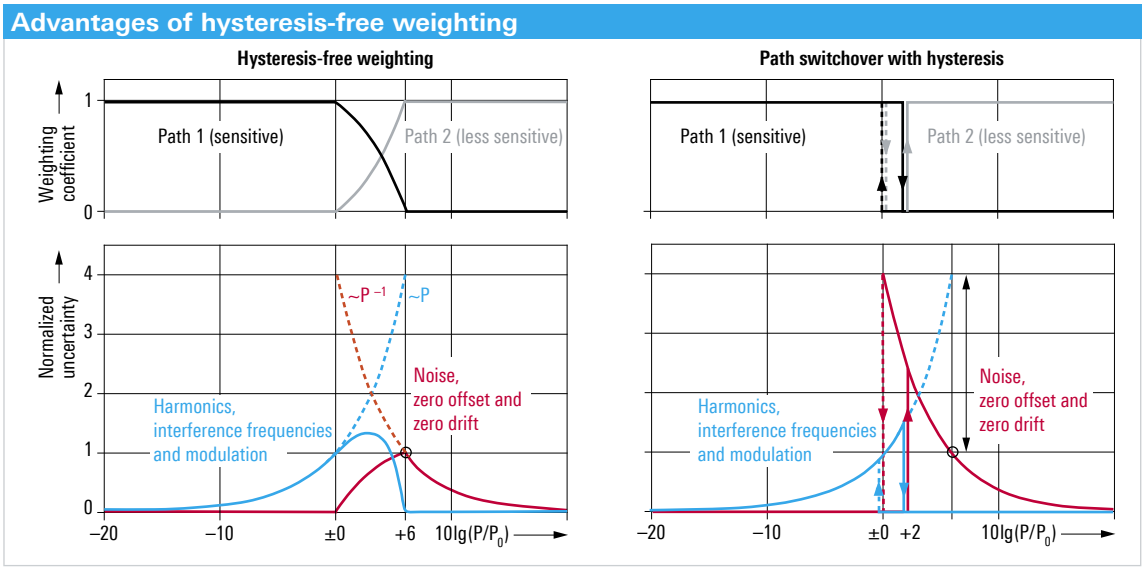
Diode power sensors: fast and accurate

Diode power sensors are state of the art: They offer high measurement speed and precise power measurements over a wide dynamic range. With measurements on modulated signals, however, they may reach their limits, because the dynamic range of a single measurement path usually does not suffice. For these measurements, the entire signal level range – from the minimum to the maximum – must fit into the square-law region of the diode characteristic, because this is the only region in which the power detector behaves linearly and allows exact determination of the power average without additional measurement errors.

Remedy: more paths and more diodes per path

Diode power sensors with multipath architecture get around this problem. Due to their staggered measurement paths, they offer an expanded dynamic range. Each path covers a different level range and operates exclusively in the square-law region of the detectors. To further increase the dynamic range, each measurement path includes a number of series-connected diodes, distributing the measurement voltage over multiple diodes. The square-law region of each measurement path becomes larger and, as a result, so does the power sensor's overall dynamic range.

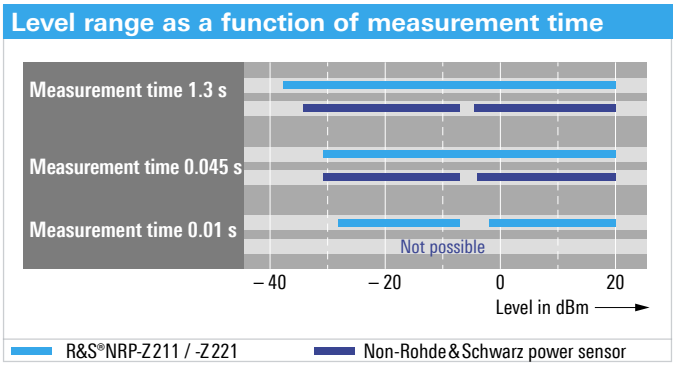
Fig. 2 Left: Simultaneous measurement of both paths and the patented weighting algorithm from Rohde&Schwarz decrease noise by a factor of four (6 dB). Right: Result with hard path switchover with sequential measurement.



power sensors from Rohde&Schwarz therefore provide a distinct overall advantage. Of particular interest in production applications with stringent requirements in terms of measurement speed and accuracy is the considerably larger continuous level range of Rohde&Schwarz power sensors (Fig. 3).

If especially high measurement speeds are required, the new power sensors can be operated in a measurement mode in which they store up to 1024 measurement results internally in a buffer memory and, to save time, subsequently transfer these results in one block to the control computer.

Fig. 3 Comparison of the R&S®NRP-Z211 / -Z221 power sensors and a non-Rohde&Schwarz power sensor. The diagram shows the usable level range as a function of the measurement time, based on 0.5 % uncertainty due to zero offset, zero drift and noise.



Minimal space requirement in automatic test systems

Since the space available in automatic test system racks is limited, a major advantage is that the sensors can be operated without a base unit. The compact R&S®NRP-Z211 / -Z221 two-path diode power sensors can be connected to a control host via the R&S®NRP-Z4 USB adapter and controlled via a measurement program.

Optimum conditions for interruption-free production

The R&S®NRP-Z211 / -Z221 power sensors feature an extremely low failure rate: The computed mean time between failures (MTBF) is approximately 100 years (assuming operation eight hours a day, five days a week) – a definite advantage in everyday production. The recommended calibration interval of two years also contributes to production that is as interruption-free as possible.

Summary

The R&S®NRP-Z211 and R&S®NRP-Z221 two-path diode power sensors offer the market´s best price/performance ratio of their class. Their high measurement speed, their level measurement range optimized for production purposes and their excellent reliability as well as low initial and lifetime cost make them the power sensors of choice when it comes to applications in production.

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