Vector Signal Generator R&S®SMU 200 A

# Noise – an annoyance? Not with the new noise option!

**With its outstanding signal quality, the Vector Signal Generator R&S®SMU 200 A meets all expectations even in the most demanding applications [*]. Users frequently need to intentionally apply noise to – or otherwise affect – the "ideal" signal from this generator. The secret is additive white Gaussian noise (AWGN). Yet, even this noise signal needs to be "ideal". A contradiction in terms? Not with the new option Additive White Gaussian Noise R&S®SMU-K62 for generating noise.**

## Intentional noise

The predefined AWGN signal of the option Additive White Gaussian Noise R&S®SMU-K62 is typically superimposed on the ideal signal generated in the baseband by the Vector Signal Generator R&S®SMU 200 A. Many telecommunications standards require precisely this combination of ideal and noise signals. This makes AWGN signals extremely important in telecommunications.

Superimposing white Gaussian noise on transmitter signals is an important standard method used in tasks such as determining receiver sensitivity. "White" indicates a constant spectral power density, i.e. successive noise values are statistically independent of each other. The noise power density is Gaussian and equally distributed across the frequency (FIG 1). Typical applications for R&S®SMU-K62 are bit error or block error measurements as a function of the defined C/N ratio, such as required when testing 3GPP FDD base stations in accordance with TS25.141.

The R&S®SMU-K62 software option offers two modes. In the first, you can add the noise signal to the baseband signal (Additive Noise mode). In the second, you can modulate the noise signal as a noise-only signal on the carrier (Noise Only mode). In the two-path configuration, R&S®SMU-K62 provides two independent noise generators, thus making many new applications possible.

You can easily perform a visual inspection of the cumulative signal obtained from the ideal signal and noise signal without additional measurement devices. One alternative is to display the cumulative signal as a small graphic in the block diagram, providing you with a simple overview (FIG 2). Another is to display the cumulative signal in a separate window as a large diagram containing detailed information (FIG 3). With its state-of-the-art FPGAs, R&S®SMU-K62 can also handle future requirements.

Gerhard Miller; Frank-Werner Thümmler

### "Ideal" properties due to signals that are generated completely digitally

- **Wide, scalable noise bandwidth** 1 kHz to 60 MHz
- **Barely detectable ripple in the noise power density spectrum** 0.01 dB within the selected bandwidth
- **Variable over broad range** C/N or $E_b/N_0$ ratio between –30 dB and +30 dB
- **Crest factor of 18 dB** Significantly exceeds the requirements of current mobile radio standards, which require min. 12 dB
- **Minimum deviations** Close adherence to the defined ideal/noise power (< 0.1 B)
- **Independent** Since no A/D and D/A converters are required, independent with respect to temperature drift, frequency response and nonlinearities
- **Important** Uncorrelated I and Q paths
- **Decisive** Reproducible tests due to internal digital signal generation with pseudo-noise generators and simultaneous large period length of the AWGN signal
- **Virtually unbelievable** Internal period between 317 years at minimum bandwidth and approx. two days at maximum bandwidth (for 3GPP FDD with a bandwidth of 3.84 Mchip/s, the period is approx. one month; for GSM with 270.833 ksymbol/s, the period is 427 days)

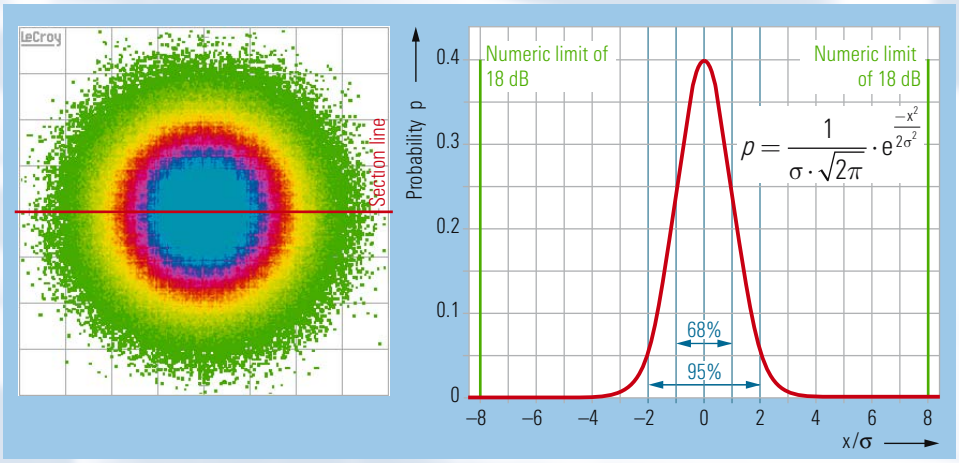
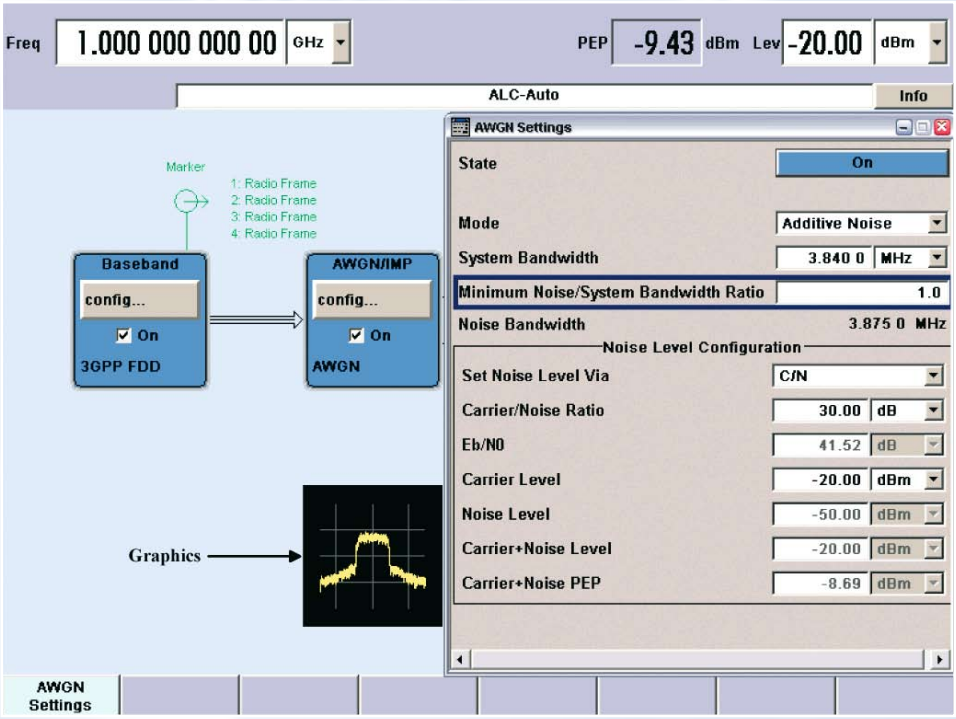



**FIG 1**
**Left: I/Q plot of a noise signal from R&S®SMU-K62. The colours indicate the frequency distribution, with decreasing frequency from inside to outside. Right: Section through the I/Q plot, with a numeric limit of 18 dB.**

**FIG 2 Additive White Gaussian Noise R&S®SMU-K62 is easy to operate. You can display the output signal from the baseband as a graphic on the block diagram, or you can display it in large format in a separate window (FIG 3).**




**More information and data sheets plus an electronic configurator at www.rohde-schwarz.com (search term: SMU200A)**


REFERENCES

[*] Vector Signal Generator R&S®SMU200A: The art of signal generation. News from Rohde & Schwarz (2003) No. 180, pp 21–27


**FIG 3 Left: 3GPP ideal signal (bandwidth 3.84 MHz); center: noise signal (bandwidth 12.4 MHz); right: cumulative signal.**