TV Test Transmitter SFQ

High-precision internal noise source enhances measurement functions

TV Test Transmitter SFQ can now be fitted with an optional noise generator (SFQ-B5) with internal self-calibration ensuring high carrier/noise ratio (C/N) for all modulation modes (FIG 1). In addition, any number of TV test transmitters featuring this option can be interconnected to produce RF signals of the same and coupled frequency with different interference. Diversity reception of mobile DVB-T receivers can be tested in this way.

Exact settings of carrier and noise power are essential

Signal degradation due to interference on the transmission link is inevitable in the broadcasting of TV programs. To simulate this and test a receiver's subsequent behaviour, impairments are added to the test signal, noise being among the most important ones. The associated setting parameter is the C/N ratio, the spacing measured in dB between carrier power (C) and noise power (N).

Both carrier and noise power require exact settings in the TV test transmitter. The carrier power does not only consist of the power of a single carrier but that of the entire spectrum. The spectrum width in turn varies within large limits, depending on modulation mode and symbol rate for example. As a consequence, the RF level has to be set anew with each modification of these parameters to provide the required output power. The noise power has to be adapted to the particular setting. The setting accuracy of carrier power and noise power, however, is subject to tolerances because TV test transmitters for DVB / DTV with vector modulation operate with an automatic level control (ALC) due to the high crest factor. And although internal potentiometers are temperature-compensated, level changes of the carrier of several tenths of a dB are inevitable due to temperature variations and aging of components. Despite all these unavoidable tolerances, TV Test Transmitter SFQ has so far always been reliable for high accuracy when setting C/N ratio.

When do you need a highly precise C/N?

Is higher accuracy necessary in the first place? Certainly not for analog TV transmission (AM). The lower the C/N ratio, the more distorted the picture. The human eye can barely perceive a difference of 1 dB in C/N, so a failure limit cannot be precisely defined.

At first glance the digital transmission chain – this applies to antenna, cable and also satellite reception – does not

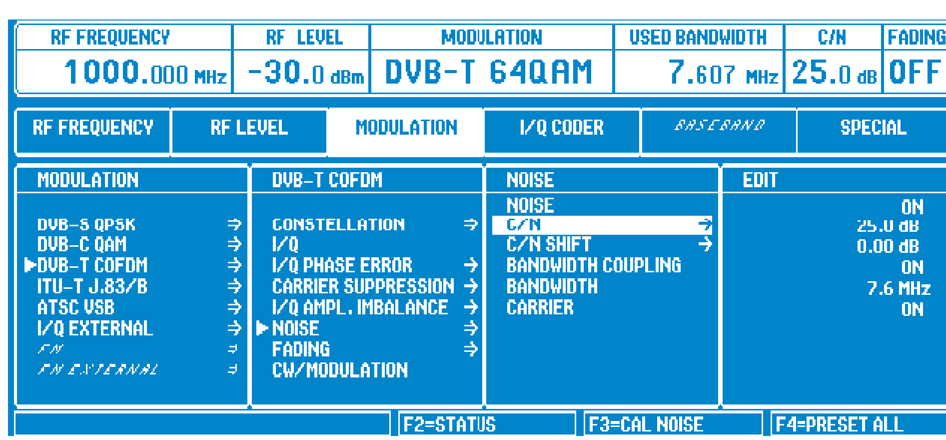

FIG 1
The new noise generator option presents itself on the display of TV Test Transmitter SFQ

Retrofitting SFQ

SFQ can be retrofitted with the new noise generator. And by using new software*, the previous noise generator (model 02) can be calibrated in the same way as the new noise generator. A PC and a spectrum analyzer are all the equipment required. The power ratio is not measured internally but externally; the calibration values are transferred to SFQ and ensure precise C/N setting.

* More details available from your nearest Rohde & Schwarz representative

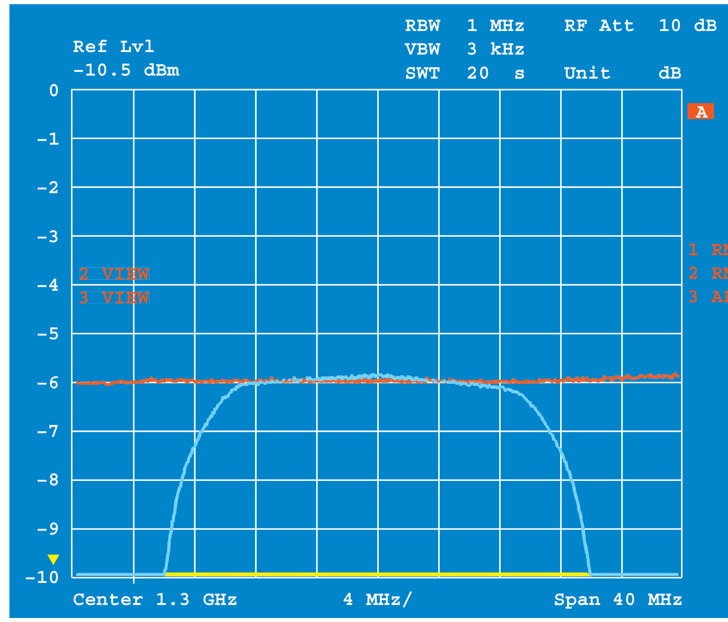

FIG 2 Modulation DVB-S, symbol rate 27.5 Msymbol/s, C/N = 0 dB; blue: DVB-S spectrum, red: noise

seem susceptible to noise. As long as digital information can be clearly identified, problems do not occur; error correction eliminates the odd errors. Socalled blocking in the picture indicates the limit of possible error correction, inevitably leading very fast to total picture loss. The better the receiver, the later such total loss will occur.

The failure limit is defined by equivalent noise degradation (END), an important parameter arrived at through the bit error ratio (BER). END is determined at the quasi errorfree (QEF) point. With a BER of 2×10^{-4} (measured before the Reed-Solomon decoder) the following Reed-Solomon error correction can eliminate almost all transport stream errors up to a BER of $<1 \times 10^{-11}$ (quasi errorfree). To find the C/N ratio at which the QEF point is reached, white Gaussian noise is superimposed on the DVB/DTV signal to be transmitted and its level varied up to a BER of 2×10^{-4}. The deviation of the found C/N from the theoretical limit line – BER as a function of C/N – corresponds to equivalent noise degradation.

Defining END by this method places very high demands on absolute C/N accuracy. To ensure this, the new noise generator for SFQ comes with an internal calibration feature that allows measurement of carrier and noise power under exactly the same conditions and storage of the calibration factors. FIG 2 shows a DVB-S and a noise signal for C/N = 0 dB.

Testing diversity reception

The hardware for a new application is also implemented on the board of the noise generator to test receivers with several antenna inputs for diversity reception according to DVB-T standard. Development and testshop require test sets to provide several RF signals with the same and coupled frequency, but with different interference simulation. An active power splitter on the board applies the I/Q baseband signals to the rear of SFQ, from where they can be fed into the IQ-EXT input of a second SFQ. The DVB-T transfer level of the I/Q baseband signal is predefined in SFQ. The IQ correction value can be edited for other DVB/DTV standards or different applications. Using the fading simulators and noise generators of both test transmitters, simulation of two independent transmission paths of a transmitter is possible for two receiving antennas. A third SFQ can use the IQ baseband signals of the second SFQ for a third receiving antenna. This configuration can be cascaded as required.

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More information and data sheet at www.rohde-schwarz.com or enter 170/11 on reader service card

More SFQ news in the article starting on page 34

Condensed data of Noise Generator Option SFQ-B5

Bandwidth	1 MHz to 60 MHz (settable)
C/N variation range	50 dB
Resolution	0.1 dB
C/N error	<0.3 dB (after calibration), typ. <0.2 dB