Powerful, PC-based signal analysis

The R&S®GX430 software is a single-channel solution from Rohde & Schwarz for the analysis and processing of analog and digital HF / VHF / UHF signals. Together with a modern Rohde & Schwarz receiver such as the R&S®EM510 or the R&S®EM550, it allows the received signals to be detected, classified, demodulated and decoded on a (Windows®) PC. The results obtained can be passed to a radiomonitoring system solution for further evaluation.
and signal processing

Compact, single-channel solution

The functional-oriented options for the R&S®GX430 software allow the user to choose the optimum functions for each workplace (e.g. classification, production, manual or automatic procedures). The software is installed on a PC (Windows® XP/Vista) (FIG 1). Several options are available for connecting it to the signal source. Modern receivers from Rohde & Schwarz that support the transmission of digital IF over a LAN, such as the R&S®EM510, are connected to the R&S®GX430 computer via an Ethernet LAN. It is possible to transmit an IF with a bandwidth of up to 1 MHz. For instruments without LAN interfaces, it is possible to connect the audio output of the receiver to the line-in input of the soundcard of the R&S®GX430 computer. Depending on the quality of the soundcard used, signals with a bandwidth of up to

FIG 1 The right instrument for every task can be found in the comprehensive range of receivers from Rohde & Schwarz. Modern receivers such as the R&S®PR100, R&S®ESMD, R&S®EM510 or the R&S®EM550 are connected to the R&S®GX430 computer via LAN. The R&S®GX430 software controls the receivers’ functions. The user can alternatively control the equipment by means of the user interfaces supplied with the receivers. Receivers with no digital interface are linked to the soundcard of the R&S®GX430 computer via their audio output.
a few kilohertz can be processed in this way. WAV files saved by other receiving devices can be imported into R&S®GX430, where they can be played and processed using the built-in playback function.

Signal search, classification and recording

R&S®GX430 offers a choice between automatic or manual signal search.

To perform an automatic search the user selects the Rohde & Schwarz receiver that is to be used, the search frequency range, and the search signal bandwidth, as well as the wanted classification depth. As regards the classification depth, the user can choose between energy detection, modulation mode recognition, and method detection. The receiver runs through the search frequency range, and the R&S®GX430 software detects the spectral energy. If detected signals are found to be within the specified range of signal bandwidths, they are inserted into the queue of signals to be classified. A classifier automatically processes the signals in this list, determining the technical parameters in accordance with the desired classification depth (FIG 2). The list of results can be used for subsequent further processing (e.g. the production of a signal).

The spectrum/waterfall display is used for the manual search (FIG 3). The received signal scenario is displayed at up to 1000 spectra/s. The user selects the signal for further processing (classification, demodulation, decoding or analysis) from the spectrum display.

The R&S®GX430 modulation mode detector analyzes a selected signal automatically, and can recognize the following modulation modes, for example: A3E, J3E, ASK2, FSK2, FSK4, multitone and multichannel systems, MSK/GMSK, OQPSK, PSK2 / 4 / 8 (A and B variants in each case), 16QAM and burst methods. It provides the following technical parameters as measurement results: center frequency, bandwidth, modulation mode, plus additional parameters such as shift, symbol rate, number of channels, channel spacing and burst length. It adds time information and a quality figure to each result. The classification of the bitstream or method checks the demodulated signal for characteristics in order to determine a code or the method.

FIG 2 The fully automatic search and classification application detects all signals in a specified frequency range on the basis of their spectral energy (○), automatically points the classifier to these signals in sequence (○), classifies each signal (○), and stores the result in a list (○).
The digital IF data supplied by the receiver can be saved to the hard disk of the R&S®GX430 computer. The storage capacity depends on the free space available on the hard disk. 10 GByte is sufficient for about 500 minutes at 20 kHZ bandwidth, or for 25 minutes if the bandwidth is 1 MHz.

These recorded signal scenarios can be replayed directly in R&S®GX430 (without using the receiver), and the signals contained in them can be processed. All the measurement and analysis facilities remain available in replay mode.
Production and analysis

After successful classification, or when the method parameters are known in advance, the software sets the appropriate digital/analog demodulator and the appropriate decoder in order to generate the contents of the signal (FIGs 4 to 7). All the content data is stored in R&S®GX430 and is available for subsequent processing. The R&S®GX430’s method library covers HF and VHF/UHF processes, and is continually expanded by Rohde & Schwarz. The open interface concept of R&S®GX430 allows process modules (demodulators, decoders) programmed by the user to be integrated and operated.

In addition to automatic processing, it is possible to analyze the time signal manually. A selected signal can be displayed for this purpose in the following diagrams (FIG 8):

- Spectrum/waterfall
- Envelope (amplitude versus time)
- Frequency versus time
- Baseband and envelope spectrum of different moments
- I/Q and eye diagram (of the demodulator)

Tools for manually measuring the technical parameters are available in these views.

The data obtained from the demodulation (symbol streams/bit streams) is stored in R&S®GX430. A powerful bit stream analyzer, the R&S®CA250, is available for the examination of unknown bit streams (bit structures, block codes, convolution codes, etc.).
Summary and outlook

The R&S®GX430 PC software is a single-channel solution for radiomonitoring that is quick to set up and simple to operate. For the in-depth analysis of unknown signals, the user can export signal samples recorded by R&S®GX430, and supply them for further processing to the R&S®GX410 AMLAB [1] technical analysis solution. The R&S®GX430 method libraries and measurement functions are being continuously enhanced (e.g., in future all the measurement functions in line with ITU Recommendation ITU-R SM.1600), which, together with the automatic procedures, offers the user a modern, powerful solution for single-channel radiomonitoring. The R&S®AMMOS R&S®GX400 [2] system family is available for multichannel radiomonitoring.

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References

FIG 8  In addition to processing with the classifier or demodulator/decoder, the user can mark a signal within the spectrum for analysis (displayed visually by a green frame). Manual analysis options such as higher-order spectra or time signal analysis (amplitude versus time / frequency versus time) are available for this signal.