R&S®GX430 PC-Based Signal Analysis and Signal Processing

Standalone software solution

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ROHDE&SCHWARZ

R&S®GX430 PC-Based Signal Analysis and Signal Processing

At a glance

The R&S®GX430 is a standalone software solution for analysis, classification, demodulation, and decoding of digital and analog IF signals. The software provides powerful signal analysis and signal processing functions running on an MS Windows PC connected to modern Rohde&Schwarz receivers via LAN or to any other receivers via soundcard audio input.

The R&S®GX430 provides signal a overview using a high-speed spectrum/waterfall display; it supports the monitoring of known signals (demodulation and decoding to content level) and supports surveillance/search operation by detecting signals of interest and performing a classification (recognition of modulation type and transmission system/code) automatically.

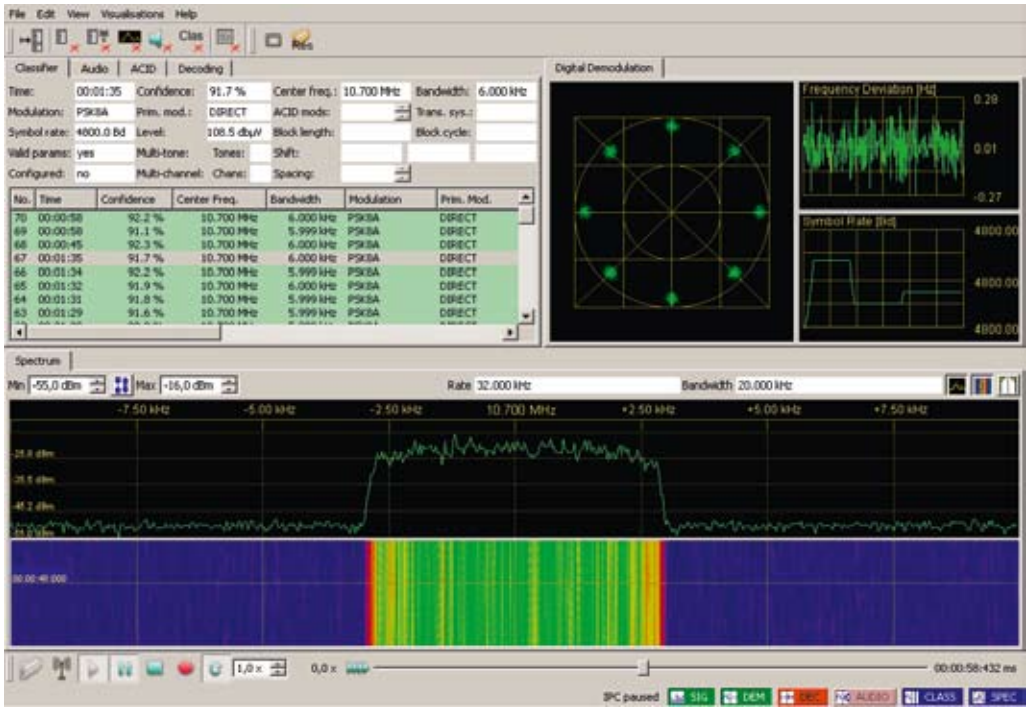
For complex (very dense, weak, or disturbed) signal scenarios, the user can overrule the automatic signal processing and set up the classifier or demodulator/decoder to the signal of interest manually. An additional time domain analysis provides manual measurement of technical signal parameters.

The search and classify application provides a fully automatic mode to scan a frequency range, detect all signals of interest, classify these signals and store the results for later processing.

Signal data (digital IF) can be recorded on the computer hard disk and replayed in offline mode for processing.

The R&S®GX430 offers the following

- Signal acquisition and receiver control
- Manual signal measurement
- Automatic modulation type and transmission system classification
- Comprehensive library of demodulators and decoders
- Automatic search and classification application
- Signal recording and replay on/from hard disk



Spectrum, demodulation and classification results

Signal acquisition and receiver control

The R&S®GX430 processes digital IF signal data, covering the following

- Online digital IF data (R&S®AMMOS IF format) provided by various Rohde&Schwarz receivers
- Online analog IF data digitized via soundcard
- Offline replay of digital IF data (R&S®AMMOS IF format); the signal sample can be an IF file recorded with the R&S®GX430 or an imported IF file (e.g. from the R&S®GX420 recording component for narrowband/ wideband interception)
- Offline replay of WAV file

Processing of signal data and calculation of a spectrum/waterfall

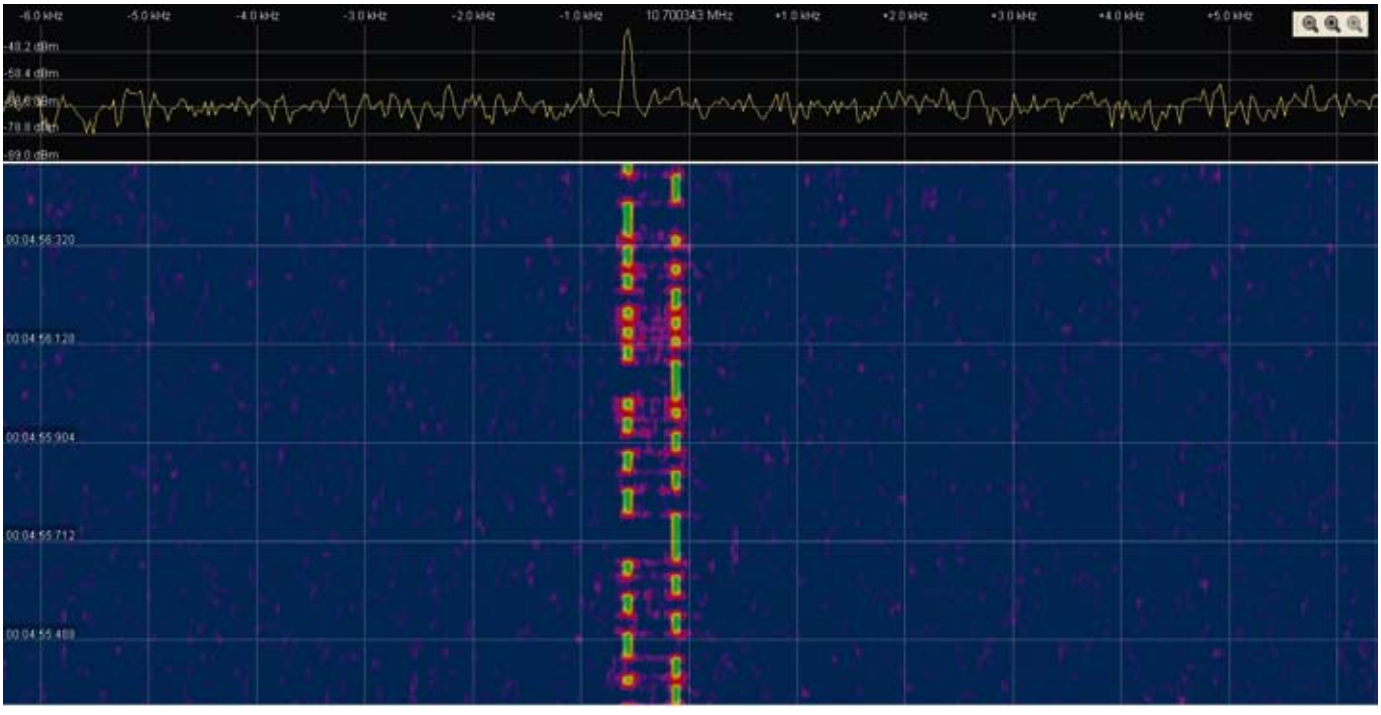
The frequency range is presented using a realtime waterfall up to 1000 lines/s. Signal attributes can be measured by using time and frequency axis cursors.

Signal recording and replay on/from hard disk

By activating the IF recording, a signal sample is stored on the computer hard disk for later IF replay or IF export (such as to the R&S®GX400 or the R&S®GX410 system).

By using an audio demodulator, (analog) emissions can be listened to and recorded to WAV files on the computer hard disk.

Fast spectrum/waterfall



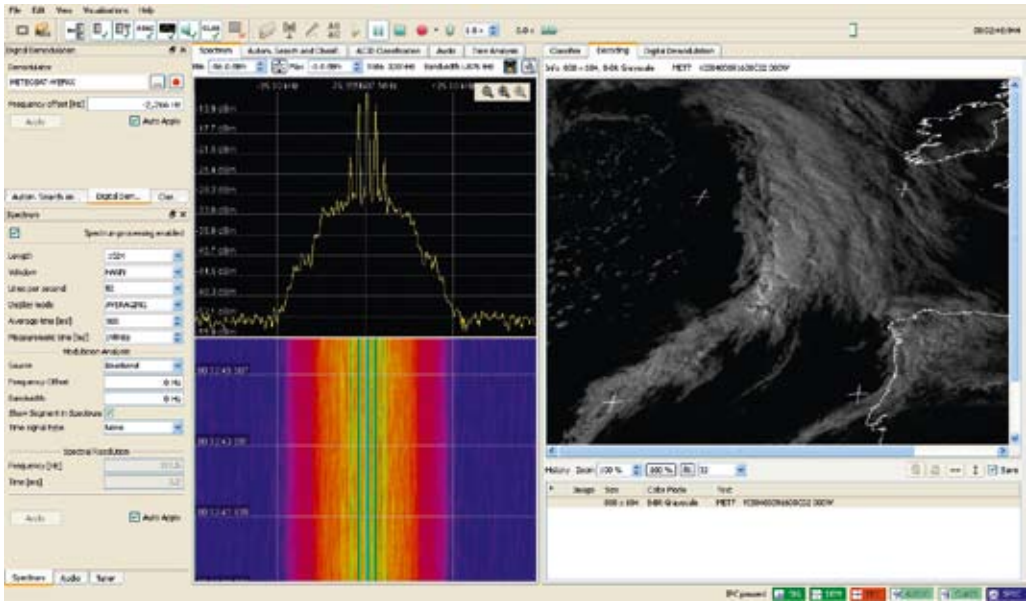
Demodulation and decoding

Manual or automatic demodulation and decoding

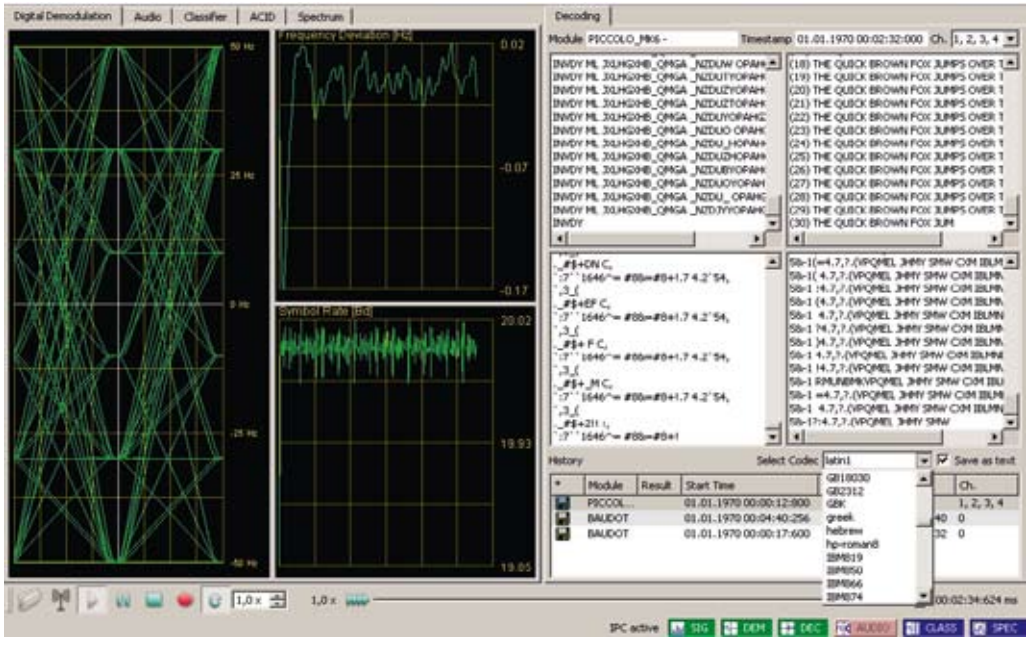
Demodulators and decoders can be set manually by the operator or automatically by the R&S®GX430 modulation and transmission system classifier. For a list of demodulators and decoders included in the R&S®GX430, please see the “Specifications” section. This list will be continuously expanded.

Customer-specific decoders

Customer-specific decoders (developed with the R&S®GX400ID decoder development equipment) and customer-specific demodulators can be installed on the R&S®GX430 to expand the demodulation/decoding capability.



Meteosat Weather Fax



Demodulation and decoding of a Piccolo MK6 signal

Automatic modulation type and transmission system classification

Powerful R&S®AMMOS classification unit

The R&S®GX430 contains the powerful R&S®AMMOS classification unit for the HF and VHF/UHF frequency range and can recognize the modulation type and transmission system of a huge variety of analog and digital signals. A list of supported modulation types included in the R&S®AMMOS classification unit is provided in the "Specifications" section at the end of this document. This list will be continuously expanded.

The classification algorithm provides a segmentation and modulation analysis result. The segmentation process determines the accurate center frequency and bandwidth of the signal. The modulation analysis determines the modulation type as well as all relevant modulation parameters (symbol rate, frequency shift, etc.).

Comprehensive library of demodulators and decoders

The classifier results are used to automatically parameterize a demodulator from the R&S®AMMOS demodulation library. The resulting symbol/bit stream can be analyzed by using the transmission system recognition and can be decoded by using the decoders of the R&S®AMMOS decoding library.

Customer-specific decoders which are developed with the R&S®GX400ID decoder development equipment and are installed on the R&S®GX430 are also used in the classification process. Symbol/bit stream data can be exported for further bit stream analysis with the R&S®GX410 system.

Classification, demodulation, and decoding

Manual measurements of signals

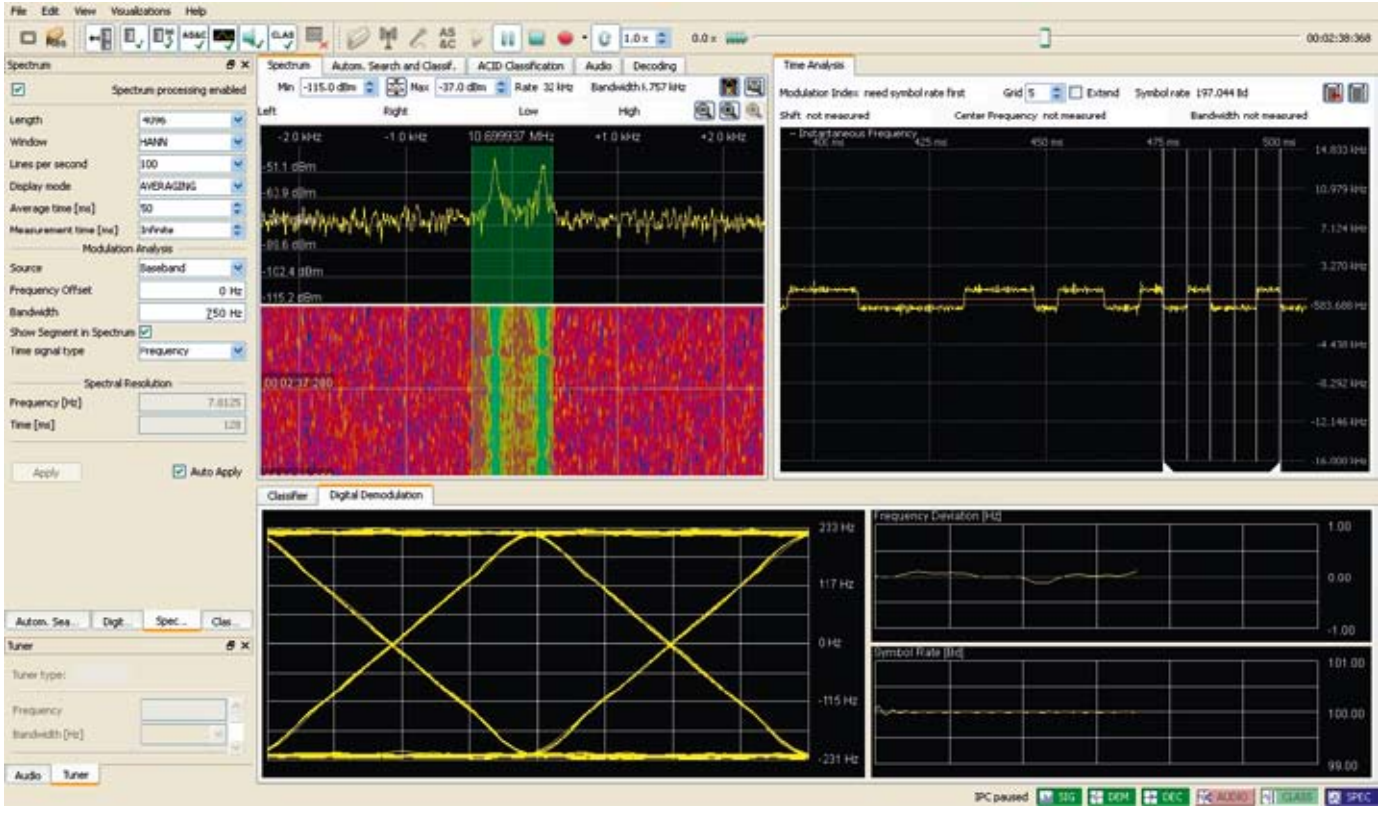
Manual measurements of emission characteristics

Manual measurements of emission characteristics (bandwidth, duration, S/N ratio) can be performed with measurement cursors in the zoomable spectrum. The filter bandwidth is automatically adapted to filter out all disturbing out-of-band emissions and noise.

Emission analysis

Emissions are analyzed using the time domain analysis part of the R&S®GX430. Zoomable level, envelope, frequency, phase, and spectrum plots make it possible to measure technical parameters such as level range, frequency shift, and symbol rate.

Time analysis



Automatic search and classification

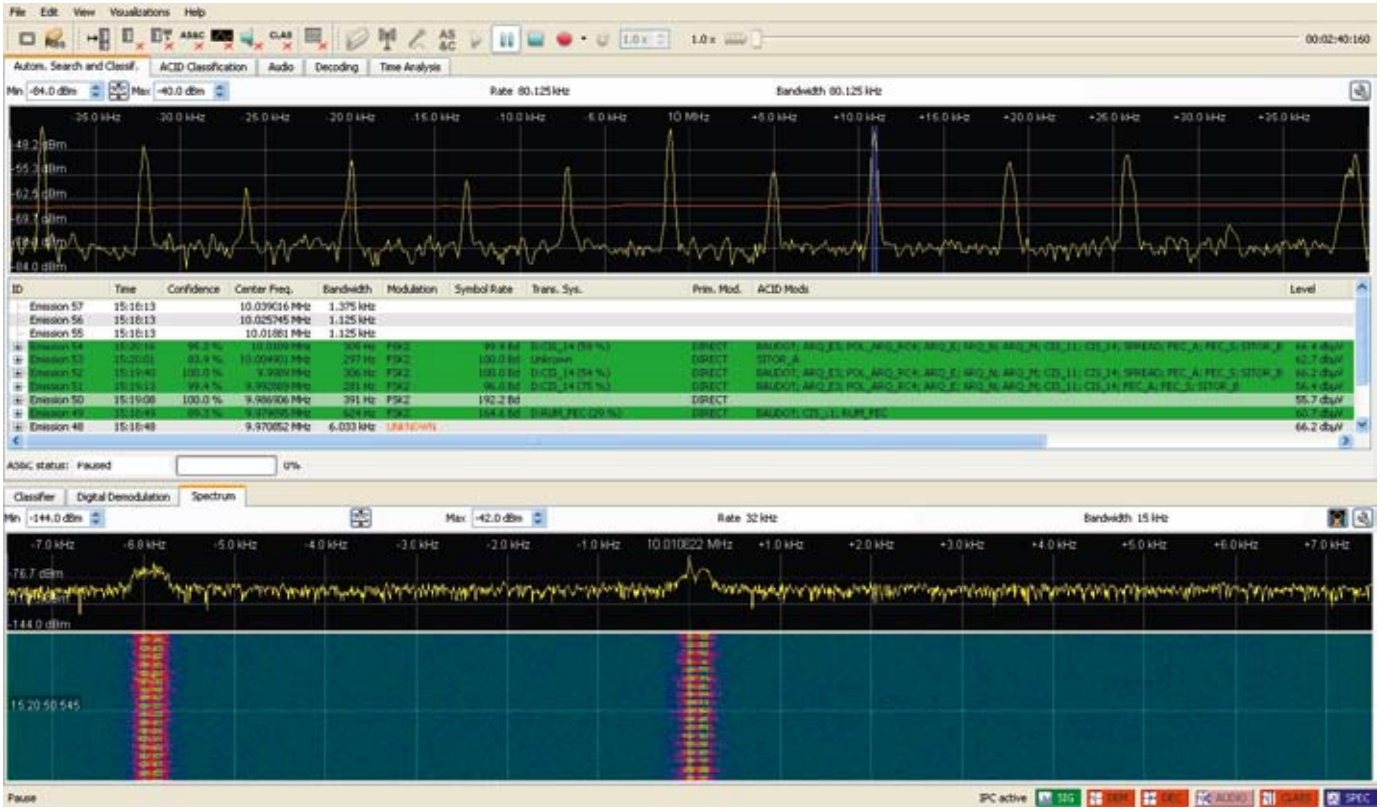
Automatic signal search and classification

The R&S®GX430 can define a frequency range for automatic signal search and classification. Detected signals are automatically processed with the R&S®GX430 modulation and transmission system classifier. If connected to a Rohde&Schwarz receiver, the search process makes use of the high-performance frequency scan mode.

Detection and classification results

The detection and classification results are displayed in a list together with all measured parameters (e.g. center frequency, bandwidth, modulation type, shift, baud rate, code). Using this list, the operator can select signals for reclassification or demodulation/decoding based on the measured signal parameters. The list can be exported from the R&S®GX430.

Search panorama spectrum and classification result list



Specifications

Data acquisition (R&S®GX430)		
Digital IF (complex baseband I/Q)	compatible with R&S®GX400, R&S®GX410	R&S®AMMOS IF format
	using left and right channel with 16 bit	or WAV format
Maximal bandwidth of processed IF data	depending on computer performance	1 MHz
Analog IF		via soundcard
Maximal bandwidth	depending on soundcard performance	15 kHz
Digital AF		WAV with 16 bit
Processing IF from receivers	R&S®GX430RX	R&S®EM050 R&S®EM510 R&S®EM550 R&S®ESMB R&S®EB200 R&S®ESMD R&S®PR100 [1]
Resolution for realtime waterfall		128 points to 32k points
Speed for realtime waterfall		up to 1000 lines/sec

[1] Currently being developed.

Manual measurement capabilities (R&S®GX430MM)	
FFT resolution for modulation analysis spectrum	128 to 32k points
Display and measurement functions	investigation of instantaneous frequency and envelope; spectrum of envelope; high-order spectra (e.g. spectrum of 2nd momentum of baseband signals)

R&S®GX430MA: recognized HF and VHF/UHF modulation types					
HF			**VHF/UHF**		
Analog modulation	**Digital modulation**		**Analog modulation**	**Digital modulation**	
CW	ASK2	6 Bd to 100 Bd	CW	ASK2	1200 Bd to 25 kBd
AM DSB-TC	FSK2	20 Bd to 4800 Bd	AM DSB-TC	FSK2	1200 Bd to 25 kBd
AM DSB-SC	FSK4	20 Bd to 3000 Bd	AM DSB-SC	FSK4	1200 Bd to 25 kBd
AM SSB-LSB	MSK/GMSK	20 Bd to 4800 Bd	FM	MSK/GMSK	1200 Bd to 25 kBd
AM SSB-USB	PSK2 A/B	30 Bd to 4800 Bd		PSK2 A/B	1200 Bd to 25 kBd
FM	PSK4 A/B	30 Bd to 4800 Bd		PSK4 A/B	1200 Bd to 25 kBd
	PSK8 A/B	30 Bd to 4800 Bd		PSK8 A/B	1200 Bd to 25 kBd
	PSK16A	30 Bd to 4800 Bd		PSK16A	1200 Bd to 25 kBd
	OQPSK	30 Bd to 4800 Bd		OQPSK	1200 Bd to 25 kBd
	QAM16	100 Bd to 4800 Bd		QAM16	1200 Bd to 25 kBd
	multitone	6 to 64 tones, 5 Bd to 330 Bd		multitone	6 to 64 tones, 20 Bd to 330 Bd
	multichannel	2 to 20 channels, FSK2 and PSK2, 40 Bd to 4800 Bd, 20 Bd to 240 Bd per channel, channel spacing ≥1.5 × baud rate		AM-FSK/ FM-FSK	800 Bd to 2400 Bd

List of recognized modulation types will be expanded in the future. Baud rate ranges depend on the performance of the computer. The values shown here are valid for recommended PC configuration (see page 11). Depending on PC configuration higher baudrates are achievable.

R&S®GX430SR: recognized HF codes and VHF/UHF transmission systems

HF				VHF/UHF
ARQ-E3 ARQ-E ARQ1000D ARQ-M2 242 ARQ TDM 242 ARQ-M2 342 ARQ TDM 342 ARQ-M4 242 ARQ-M4 342 ARQ-N ARQ1000 ARQ 6-70 ARQ 6-90 ARQ 6-98 ASCII RTTY7 IRA-ARQ AUTOSPEC BAUDOT RTTY5 BULG-ASCII CH4+4 modem	CIS-11 TORG 10/11 CIS-12 FIRE CIS-14 PARITY 14 CIS 96 AMOR AMOR 96 TORG 14 CIS-36 CROWD 36 Russian Piccolo URS multitone CIS 10-11-11 MFSK COQUELET 8 Mk 2 COQUELET 13 Mk 1 COQUELET 80 Coquelet 8 FEC DUP-ARQ ARQ duplex	DUP-ARQ-2 DUP-FEC-2 FARCOS FEC-A FEC100A FEC-S FEC1000S SI-FEC G-TOR HF-FAX (FM) HNG-FEC MORSE PACTOR I PACKET RADIO PICCOLO MK6 PICCOLO MK12 POL-ARQ PSK-31 BPSK31 QPSK31	PSK-63 BPSK63 QPSK63 RUM-FEC ROU FEC SI-ARQ ARQ-S ARQ1000S SITOR-A SITOR-ARQ SITOR-B SITOR-FEC SPREAD11 SPREAD21 SPREAD51 SWED-ARQ ARQ-SWE TWINPLEX ARQ (F7B)	SELCAL analog: CCIR-1, CCIR-2, CCITT, DTMF, EEA, EIA, EURO, NATEL, VDEW, ZVEI-1, ZVEI-2 ACARS ATIS FMS-BOS METEOSAT MPT-1327 PACKET RADIO 1200 Bd, 9600 Bd (AX.25) POCSAG ZVEI-VDEW

List of recognized codes and transmission systems will be expanded in the future.

R&S®GX430SR-E: recognized expanded HF codes and VHF/UHF transmission systems

HF			VHF/UHF
ACARS [1] CLOVER 2/2000 CODAN (16 channels)	MIL-STD-188-110A Serial MIL-STD-188-110B MIL-STD-188-141A (ALE) PACTOR II PACTOR III	SKYFAX STANAG 4285 STANAG 4415 STANAG 4529	GSM TETRA

[1] Currently being developed.

R&S®GX430DM: processed HF and VHF/UHF modulation types

HF		VHF/UHF	
ASK2	6 Bd to 4800 Bd	ASK2	1200 Bd to 25 kBd
FSK2		FSK2	
Discriminator	20 Bd to 4800 Bd	Discriminator	1200 Bd to 25 kBd
Matched filter	20 Bd to 4800 Bd	Matched filter	1200 Bd to 25 kBd
FSK4		FSK4	
Discriminator	20 Bd to 3000 Bd	Discriminator	1200 Bd to 25 kBd
Matched filter	20 Bd to 2400 Bd	Matched filter	1200 Bd to 25 kBd
(G)MSK	20 Bd to 4800 Bd	(G)MSK	1200 Bd to 25 kBd
PSK2 A/B	30 Bd to 4800 Bd	PSK2 A/B	1200 Bd to 25 kBd
PSK4 A/B	30 Bd to 4800 Bd	PSK4 A/B	1200 Bd to 25 kBd
PSK8 A/B	30 Bd to 4800 Bd	PSK8 A/B	1200 Bd to 25 kBd
		OQPSK [1]	1200 Bd to 25 kBd
Multichannel modulation types			
FSK2		Multitone	
2 to 64 channels	max. 240 Bd (per channel) max. 4800 Bd (total)	Number of tones	6 to 64
PSK2/4 A/B		Transmission rate	5 Bd to 330 Bd
2 to 64 channels	max. 240 Bd (per channel) max. 4800 Bd (total)		
Multitone			
Number of tones	6 to 64		
Transmission rate	20 Bd to 330 Bd		

List of processed modulation types will be expanded in the future. Baud rate ranges depend on the performance of the computer. The values shown here are valid for recommended PC configuration (see page 11). Depending on PC configuration higher baudrates are achievable.

R&S®GX430DM-E: expanded HF and VHF/UHF demodulation parameters

Selection of equalizer type (e.g. CMA, DFE*)
Manual adjustment of equalizer parameters
Display of symbol rate tracking, center frequency tracking, equalizer coefficients*
Manual adjustment of symbol and frequency tracking parameters
Selection of single channel from a multichannel system for further processing
Display of demodulation quality, EVM diagram
Demodulation of signals with primary/secondary modulation – AM FSK: 800 Bd to 2400 Bd – FM FSK: 800 Bd to 2400 Bd – Baud rate ranges depend on the performance of the computer – Values shown here are valid for recommended PC configuration (see page 11)

* Available on request.

R&S®GX430DC: HF and VHF/UHF decoding

HF				VHF/UHF
ACARS [1)] ARQ-E3 ARQ-E *ARQ1000D* ARQ-M2 242 *ARQ TDM 242* ARQ-M2 342 *ARQ TDM 342* ARQ-M4 242 ARQ-M4 342 ARQ-N *ARQ-1000* ARQ-S *ARQ1000S* ARQ 6-70 ARQ 6-90 ARQ 6-98 ASCII *RTTY7* *IRA-ARQ* AUTOSPEC BAUDOT *RTTY5* BULG-ASCII CIS-11 *TORG 10/11* CIS-14 *PARITY 14* *CIS 96* *AMOR* *AMOR 96* *TORG 14*	CIS-36 *CROWD 36* *Russian Piccolo* *URS multitone* *CIS 10-11-11 MFSK* COQUELET 8 *Mk 2* COQUELET 13 *Mk 1* COQUELET-80 *Coquelet 8 FEC* DUP-ARQ ARQ duplex DUP-ARQ-2 DUP-FEC-2 FEC-A FEC100 FEC100A FEC-S FEC1000S SI-FEC G-TOR HNG-FEC HELLSCHREIBER HF-FAX AM FAX FM FAX	MORSE PACTOR I PACKET RADIO 300 PICCOLO MK6 PICCOLO MK12 POL-ARQ PRESSFAX PSK-31 BPSK31 QPSK31 PSK-63 BPSK63 QPSK63 RUM-FEC ROU FEC SI-ARQ SITOR-A SITOR-ARQ SITOR-B SITOR-FEC SPREAD11 SPREAD21 SPREAD51 SSTV SSTV Auto SSTV Acorn PD 180 YUV SSTV Acorn PD 290 YUV SSTV Martin 1&3 SSTV Martin 2&4 SSTV Pasokon TV 3 SSTV Wraase SC-2 120 SSTV Wraase SC-2 180 SWED-ARQ ARQ-SWE TWINPLEX ARQ (F7B)	SSTV Pasokon TV 5 SSTV Pasokon TV 7 SSTV Robot 8 BW SSTV Robot 12BW SSTV Robot 24BW SSTV Robot 36BW SSTV Robot 43BW SSTV Robot 12YUV SSTV Robot 24YUV SSTV Robot 36YUV SSTV Robot 72YUV SSTV Scottie 1&3 SSTV Scottie 2&4 SSTV Scottie DX SSTV Scottie DX2 SSTV Wraase SC-1 8&16 BW SSTV Wraase SC-1 16&32 BW SSTV Wraase SC-1 24 BW SSTV Wraase SC-1 24&48 SSTV Wraase SC-1 48&96 SSTV Wraase SC-2 20&60	SELCAL analog: CCIR-1, CCIR-2, CCITT, DTMF, EEA, EIA, EURO, NATEL, VDEW, ZVEI-1, ZVEI-2 ACARS ATIS FMS-BOS METEOSAT MPT-1327 PACKET RADIO 1200 Bd, 9600 Bd (AX.25) POCSAG ZVEI-VDEW

List of processed codes and transmission systems will be expanded in the future.

R&S®GX430DC-E: expanded HF decoding

HF
PACTOR II
PACTOR III
CLOVER-2
CLOVER-2000

[1)] Currently being developed.

Search and classify application (R&S®GX430SC)	
Search parameters	start frequency, stop frequency, min. bandwidth, max. bandwidth, min. SNR, max. SNR
Detection sensitivity (CNR)	5 dB
Maximal classification bandwidth (will be expanded on request for specific signal types)	HF: 16 kHz VHF/UHF: 50 kHz
Depth of classification	modulation classification only; transmission system classification

Specifications	
Data export	
Digital IF	R&S®AMMOS IF format (complex baseband I/Q, compatible with R&S®GX400, R&S®GX410)
Digital AF	WAV format, 16 bit
Demodulated audio	WAV format, 16 bit
Symbol data	R&S®AMMOS symbol data format (compatible with R&S®GX413BA bit stream analysis option)
Decoded text	ASCII format
Reports	XML format (R&S®AMMOS-IT-compatible)
Customer-specific demodulators and decoders	
Development of customer-specific demodulators	R&S®GX430 interface structure and steps necessary for programming and installing a customer-specific demodulator in the R&S®GX430 are described in the R&S®GX430 manual.
Import of demodulator library	via upload of MS Windows .DLL file
Development of customer-specific decoders	see data sheet titled "R&S®AMMOS GX400ID – decoder development equipment"
Import of decoder library	via upload of MS Windows .dll file provided by R&S®AMMOS R&S®GX400ID
Recommended PC	
Operating system	MS Windows
CPU (minimum)	Intel Pentium IV 3 GHz or equivalent
Memory (minimum)	1 Gbyte
Graphics card	Open GL 1.4 is mandatory
Hard disk capacity (minimum)	150 Mbyte (for installation of R&S®GX430)
Minimum screen resolution	1024 x 768 pixels
Interface for digital IF input from receiver	Fast Ethernet
Interface for analog IF input from receiver	soundcard

For further information about the R&S®AMMOS system family, refer to the Technical Information for the R&S®AMMOS system family.

Ordering information

Designation	Type	Order No.
PC-Based Signal Analysis and Signal Processing	R&S®GX430	4071.5500.02
Options		
Control for Receivers (requires R&S®EM050, R&S®EM510, R&S®EM550, R&S®ESMB, R&S®EB200 receiver)	R&S®GX430RX	4071.5700.02
Automatic Modulation Classification HF and VHF/UHF	R&S®GX430MA	4071.5717.02
Automatic Transmission System/Code Classification HF and VHF/UHF (requires R&S®GX430MA)	R&S®GX430SR	4071.5723.02
Expanded Classification Capability for automatic transmission system and code recognition HF and VHF/UHF expansion (requires R&S®GX430SR)	R&S®GX430SR-E	4071.5730.02
Demodulation HF and VHF/UHF	R&S®GX430DM	4071.5746.02
Expanded Capability for Demodulation HF and VHF/UHF (requires R&S®GX430DM)	R&S®GX430DM-E	4071.5752.02
Decoding HF and VHF/UHF (requires R&S®GX430DM)	R&S®GX430DC	4071.5769.02
Expanded Capability for Decoding HF and VHF/UHF (requires R&S®GX430DC)	R&S®GX430DC-E	4071.5775.02
Manual Modulation Analysis	R&S®GX430MM	4071.5781.02
Search and Classify Application (requires R&S®GX430MA and R&S®GX430SR option)	R&S®GX430SC	4071.5798.02
Signal measurement in accordance with Recommendation ITU-R SM.1600	R&S®GX430IS	4071.5817.02

Service you can rely on

- In 70 countries
- Person-to-person
- Customized and flexible
- Quality with a warranty
- No hidden terms

About Rohde&Schwarz

Rohde&Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established 75 years ago, Rohde&Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

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Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

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DQS REG. NO 1954 UM

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Subject to change

*0.14 €/min within German wireline network; rates may vary in other networks (wireline and mobile) and countries.