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The R&S[®]AMMOS R&S[®]GX4xx HF and VHF/UHF system family consists of the following:

R&S® GX400 VXI-based monitoring solution: Multichannel solution for automatic and manual interception, monitoring and analysis of radiocommunications in the HF and VHF/UHF frequency range. Signal processing functionality includes tuner control, wideband signal search and surveillance, interception of voice signals, demodulation and decoding of digital transmissions, signal classification, digital IF recording and replay with the R&S®GX420. The VXIbased sensor equipment, also called sensor group (modern VXI receivers and signal processing boards installed in a

VXI mainframe), provides high modularity, configurability and multichannel software radio capabilities.

R&S® GX430 PC-based monitoring solution: Single-channel solution for interception, monitoring and analysis of radiocommunications in the HF and VHF/UHF frequency range. Signal processing functionality includes tuner control, interception of voice signals, demodulation and decoding of digital transmissions, signal classification, basic digital IF recording and replay. The R&S®GX430 is an easy-to-use standalone monitoring solution for the Windows operating system.

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	Replay System	126
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R&S®GX420 AMREC: recording/replay unit for digital IF data. Digital IF data streams provided by the R&S®GX400 with bandwidths between 20 kHz and 20 MHz are stored, managed and replayed to the R&S®GX400 receivers by using an RAID hard disk array.

R&S®GX410 AMLAB: expert-system for technical offline analysis of unknown signals or complex signal scenarios recorded e.g. with the R&S®GX400 and R&S®GX430 monitoring solutions or imported as way file. The R&S®GX410 provides automatic and manual analysis (classification) of signals, signal sample demodulation/decoding, bit stream analysis, and statistical analysis. The R&S®GX410 is a standalone analysis solution for the skilled user and runs under the Windows operating system.

Analyzers



R&S®GX400 VXI-Based Monitoring Solution

R&S®AMMOS (automatic modular monitoring of signals)



Introduction

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The R&S[®] GX400 system family is designed for the detection, monitoring and signal analysis of radiocommunications signals in the HF and VHF/UHF frequency range.

The R&S[®]GX400 provides the following:

- Automatic and manual interception, monitoring and analysis of radiocommunications in the frequency range from 300 Hz to 3600 MHz. Signal processing functionality includes tuner scan, interception of analog modulated signals, demodulation and decoding of digital transmissions, signal classification, digital IF recording and replay
- Automatic and manual detection of LPI signals (bursts, hoppers), wideband signal search and surveillance, interception, monitoring and analysis of radiocommunications in the frequency range up to 3600 MHz (HF and VHF/UHF). Signal processing functionality includes detection of fixed-frequency and short-time signals

The R&S®GX400 VXI-based sensor equipment, also called sensor group (modern VXI receivers and signal processing boards installed in a VXI mainframe), provides high modularity, configurability and multichannel software radio capabilities. Thus, a sensor pool with R&S®GX400 sensor groups can be optimally adapted to the requirements of the investigated signal scenario: frequency ranges, number of receivers for conventional signal processing with bandwidths up to 20 kHz in the HF and up to 250 kHz in the VHF/UHF range, number of wideband receivers for wideband applications with bandwidth of up to 20 MHz in HF/VHF/UHF.

Features of the R&S®GX400

- Control of HF and VHF/UHF receivers in FFM and scan mode. IF realtime spectrum and IF recording/replay on the R&S®GX420 AMREC are supported (Fig 1)
- Classification and demodulation/decoding of HF signals (Fig 2)
- Classification and demodulation/decoding of VHF/UHF signals (Fig 3)
- Control of HF and VHF/UHF wideband receivers in FFM and step mode. Realtime wideband spectrum and wideband IF recording/replay on the R&S®GX420 AMREC are supported. A zoom function for wideband spectrum display down to 1 Hz resolution is available (Fig 4)
- Automatic detection of fixed-frequency signals and short-time signals (bursts) for monitoring and surveillance applications (Fig 5)

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Fig. 1 to 3: (from top to bottom)

Concept of virtual receivers in the R&S®GX400

The R&S®GX400 wideband receiver delivers a digital wideband IF signal that may be processed by different signal analysis/processing channels in parallel. Up to four channels are implemented on every R&S®GX401EM DDC/DSP





Fig. 4 to 5: (from top to bottom)

board by using digital downconverters (DDCs). The number and type of signal analysis functions depends on the application and the available resources in the R&S®GX400 sensor group. This allows close automatic interaction of different signal processing units, e.g. detection with parallel classification and/or demodulation/decoding.

Within the bandwidth of the wideband IF signal, the interception and analysis of fixed-frequency signals is possible without signal loss.

The R&S[®]GX400 provides the extremely high signal processing performance especially required for the interception and analysis of short-time signals.

HF decoder development with the R&S®GX400

The R&S[®]GX400ID is a complete development environment that customers can use to develop and test their own HF decoder modules. New decoders are loaded to the R&S[®]AMMOS sensor groups via software update.

For (remote) control of the R&S[®]GX400, the R&S[®]AMMOS-IT software is used (see page 167). Chapter Overview

Type Index Analyzers: R&S®GX400 VXI-Based Monitoring Solution, R&S®GX400 VXI Boards for HF and VHF/UHF Signal Processing



Example of a configuration for a monitoring system with R&S®GX400 sensor technology

R&S®GX400 VXI Boards for HF and VHF/UHF Signal

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R&S[®] EM010 VXI HF receiver

In the R&S®AMMOS HF system, the R&S®EM010 receiver serves as a digital receiver, covering the frequency range from 10 kHz (optionally 300 Hz) to 30 MHz. The R&S®EM010 digital IF output (set to 20 kHz bandwidth) is processed on the R&S®GX401EM DDC/DSP board. In wideband applications, the R&S®EM010 analog IF output (1 MHz) is processed by the R&S®GX401BP wideband A/D converter (ADC).



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R&S®EM050 VXI VHF/UHF digital wideband receiver In the R&S®AMMOS VHF/UHF system, the R&S®EM050 receiver serves as a digital receiver, covering the frequency range from 20 MHz to 3600 MHz. The R&S®EM050 digital IF output (set to 250 kHz bandwidth) is processed by the R&S®GX401EM DDC/DSP board. In wideband applications, the R&S®EM050 analog IF output (up to 20 MHz) is processed by the R&S®GX405BP wideband A/D converter (ADC).



R&S®GX401EM DDC/DSP board

The R&S[®]GX401EM DDC/DSP board serves as a digital signal processing (DSP) platform for HF/VHF/UHF narrow-band and wideband signals. It contains sufficient hardware functionality for four parallel signal processing units.



R&S®GX401BP wideband A/D converter (ADC)

In mixed mode, the R&S®GX401BP serves as an A/D converter for the analog wideband signal of the R&S®EM010 (1 MHz bandwidth) and, in direct mode, as a wideband receiver with 4 MHz, 10 MHz and 20 MHz bandwidth. Additionally, the R&S®GX401BP contains a wideband DDC, a signal delay buffer and the interface to the R&S®GX420 (AMREC) recording/replay component for narrowband/ wideband interception.

10 18

Analyzers: R&S®GX400 VXI Boards for HF and VHF/UHF Signal Processing

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R&S®GX405BP wideband A/D converter (ADC)

The R&S®GX405BP serves as an A/D converter for the analog wideband signal (up to 20 MHz) of the R&S®EM050. Additionally, the R&S®GX405BP contains a wideband DDC, a signal delay buffer and the interface to the R&S®GX420 (AMREC) recording/replay component.



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R&S®GX430 PC-Based Monitoring Solution

R&S®AMMOS (automatic modular monitoring of signals)



Main features

- Standalone single-channel solution
- Running on PC

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- Processing IF provided by modern receivers
- Signal classification, demodulation, and decoding of HF and VHF/UHF
- Automatic search-and-classify applications

Brief description

In contrast to the R&S®GX400 (developed for medium- and large-size monitoring solutions with many processing channels in parallel), the R&S®GX430 has been developed for small (e.g. portable) monitoring solutions with few channels.

The R&S®GX430 is a standalone software solution for signal analysis and signal monitoring running under the Windows operating system. It processes digital IF (via LAN) and/or analog IF (via sound card input) provided by modern Rohde & Schwarz receivers (e.g. R&S®EM050, R&S®EM510, R&S®EM550, R&S®ESMB, R&S®EB200) or wav file replays.

The R&S[®] GX430 includes the same single-channel signal processing algorithms (classification, demodulation, decoding of HF and VHF/UHF) as the R&S[®] GX400 VXI monitoring solution and the R&S[®] GX410 technical analysis solution.



Analyzers: R&S®GX430 PC-Based Monitoring Solution

Due to a compact and convenient user interface, audio and IF recording directly on the computer's hard disk, reporting, and an automatic search application (automatic signal detection and classification), the R&S®GX430 is an easy-touse solution for single-channel signal processing together with a modern Rohde & Schwarz receiver.



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Demodulation and decoding of Morse signal (English text) with Cyrillic or Arabic alphabet

Type

Chapter Overview

Specifications

R&S*GX400			VHF/UHF	
Wideband receiver (ma	ax. resolution)		Analog modulation	CW, AM DSB-TC, AM DSB-SC, FM
HF range	,		Digital modulation	
Bandwidth	Panorama	Max. wideband signal	ASK2	1200 baud to 25 kbaud
bunuthath	spectrum,	delay buffer depth	FSK2	1200 baud to 25 kbaud
	maximal res.	dolay barror doptil	FSK4	1200 baud to 25 kbaud
1 MHz	<40 Hz	200 s	MSK/GMSK	1200 baud to 25 kbaud
4 MHz	<160 Hz	50 s	PSK2 A/B	1200 baud to 25 kbaud
10 MHz	<400 Hz	20 s	PSK4 A/B	1200 baud to 25 kbaud
20 MHz	<800 Hz	10 s	PSK8 A/B	1200 baud to 25 kbaud
VHF/UHF range	<000112	10.3	OQPSK	1200 baud to 25 kbaud
Bandwidth	Panorama	Max. wideband signal	QAM16	1200 baud to 25 kbaud
Danuwiutii	spectrum,	delay buffer depth	Multitone	6 tones to 32 tones, 20 baud to 330 bau
	maximal res.	uelay bullet ueptit	AM FSK	800 baud to 2400 baud
5 MHz	<200 Hz	40 s	FM FSK	800 baud to 2400 baud
10 MHz	<200 Hz <400 Hz	20 s		
20 MHz	<400 Hz	20 s 10 s		lation types will be extended in the future.
			HF	F transmission systems recognized
Automatic detection of		signais	ARQ-E3	
Detection time resolution				A DO 1000D
HF and VHF/UHF	500 ms		ARQ-E	ARQ1000D
Frequency resolution fo			ARQ-M2 242	ARO TDM 242
HF	<40 Hz at 1 MH		ARQ-M2 342	ARQ TDM 342
VHF/UHF	<200 Hz at 5 M	Hz bandwidth	ARQ-M4 242	
Decay time			ARQ-M4 342	
HF and VHF/UHF	0.5 s to 100 s		ARQ-N	ARQ1000
Detection sensitivity (C			ARQ6-70	
HF and VHF/UHF	5 dB		ARQ6-90	
Automatic detection of			ARQ6-98	
Number of frequency c			ASCII	RTTY7, IRA-ARQ
HF and VHF/UHF	512 to 4096 (po	wers of 2)	AUTOSPEC	
Min. detectable emission	-		BAUDOT	RTTY5
HF	5 ms		BULG-ASCII	
VHF/UHF	500 µs		CH4+4 Modem	
Detectable emission ba			CIS-11	TORG 10/11
HF	500 Hz to 6 kHz		CIS-12	FIRE
VHF/UHF	5 kHz to 200 kH	Z	CIS-14	PARITY 14, CIS 96, AMOR, AMOR 96,
R&S*GX400/R&S*GX4				TORG 14
HF and VHF/UHF modu	lation types reco	jnized	CIS-36	CROWD 36, Russian Piccolo,
HF				URS multitone, CIS 10-11-11 MFSK
Analog modulation	CW, AM DSB-T		CLOVER	
	AM SSB-LSB, A	M SSB-USB, FM	CODAN	
Digital modulation			COQUELET 8	Mk 2
ASK2	6 baud to 100 b	baud	COQUELET 13	Mk 1
FSK2	20 baud to 480		COQUELET 80	Coquelet 8 FEC
FSK4	20 baud to 300	0 baud	DUP-ARQ	ARQ Duplex
MSK/GMSK	20 baud to 480	0 baud	DUP-ARQ-2	
PSK2 A/B	30 baud to 480	0 baud	DUP-FEC-2	
PSK4 A/B	30 baud to 480	0 baud	FARCOS	
PSK8 A/B	30 baud to 480	0 baud	FEC-A	FEC100A
OQPSK	30 baud to 480	0 baud	FEC-S	FEC1000S, SI-FEC
QAM16	100 baud to 48	00 baud	G-TOR	
Multitone	6 tones to 32 to	ones, 5 baud to 330 baud	HF-FAX (FM)	
Multichannel		6 channels, FSK2 and PSK2,	HNG-FEC	
		0 baud, up to 240 baud	MIL-STD-188-110A Se	rial
	per channel	.,.,	MIL-STD-188-110B	

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PACTOR I			(per channel), total max. 4800 baud
PACTOR II		Multitone	
PACTOR III		Number of tones	6 to 64
PACKET RADIO		Transmission rate	5 baud to 330 baud
PICCOLO MK6		VHF/UHF	
PICCOLO MK12		ASK2	1200 baud to 25 kbaud
POL-ARQ		FSK2	
PSK-31	BPSK31, QPSK31	Discriminator	1200 baud to 25 kbaud
PSK-63	BPSK63, QPSK63	Matched filter	1200 baud to 25 kbaud
RUM-FEC	ROU FEC	FSK4	
SI-ARQ	ARQ-S, ARQ1000S	Discriminator	1200 baud to 25 kbaud
SITOR-A	SITOR-ARQ	Matched filter	1200 baud to 25 kbaud
SITOR-B	SITOR-FEC	MSK/GMSK	1200 baud to 25 kbaud
SKYFAX		PSK2 A/B	1200 baud to 25 kbaud
SPREAD11		PSK4 A/B	1200 baud to 25 kbaud
SPREAD21		PSK8 A/B	1200 baud to 25 kbaud
SPREAD51		OQPSK	1200 baud to 25 kbaud
STANAG 4285		AM FSK	800 baud to 2400 baud
STANAG 4415		FM FSK	800 baud to 2400 baud
STANAG 4529		Multitone	
SWED-ARQ	ARQ-SWE	Number of tones	6 to 64
TWINPLEX ARQ (F7B)	Transmission rate	20 baud to 330 baud
VHF/UHF		List of processed modula	ation types will be extended in the future.
SELCAL analog	ITU-R-1, ITU-R-2, ITU-T, DTMF, EEA, EIA,	HF codes and VHF/UHF	transmission systems processed
	EURO, NATEL, VDEW, ZVEI-1, ZVEI-2	HF	
ATIS (SELCAL digital)	ARQ-E3	
FMS-BOS (SELCAL d	igital)	ARQ-E	ARQ1000D
METEOSAT		ARQ-M2 242	ARQ TDM 242
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	baud, 9600 baud (AX.25)	ARQ-M4 242	
TAGKLI NADIO 1200		ARQ-M4 342	
POCSAG		Anu-1014 34Z	
	digital)	ARQ-N	ARQ-1000
POCSAG ZVEI-VDEW (SELCAL	digital) es and transmission systems will be extended		ARQ-1000 ARQ1000S
POCSAG ZVEI-VDEW (SELCAL		ARQ-N	
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future.	es and transmission systems will be extended	ARQ-N ARQ-S	
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future.		ARO-N ARO-S ARO6-70	
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod	es and transmission systems will be extended	ARQ-N ARQ-S ARQ6-70 ARQ6-90	
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF	as and transmission systems will be extended ulation types processed	ARQ-N ARQ-S ARQ6-70 ARQ6-90 ARQ6-98	ARQ1000S
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2	as and transmission systems will be extended ulation types processed	ARQ-N ARQ-S ARQ6-70 ARQ6-90 ARQ6-98 ASCII	ARQ1000S
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 FSK2	as and transmission systems will be extended ulation types processed 6 baud to 4800 baud	ARO-N ARO-S ARO6-70 ARO6-90 ARO6-98 ASCII AUTOSPEC	ARQ1000S RTTY7, IRA-ARQ
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 FSK2 Discriminator	as and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud	ARQ-N ARQ-S ARQ6-70 ARQ6-90 ARQ6-98 ASCII AUTOSPEC BAUDOT	ARQ1000S RTTY7, IRA-ARQ
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 FSK2 Discriminator Matched filter	as and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud	ARQ-N ARQ-S ARQ6-70 ARQ6-90 ARQ6-98 ASCII AUTOSPEC BAUDOT BULG-ASCII	ARQ1000S RTTY7, IRA-ARQ RTTY5
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 F SK2 Discriminator Matched filter FSK4	es and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud	ARQ-N ARQ-S ARQ6-70 ARQ6-90 ARQ6-98 ASCII AUTOSPEC BAUDOT BULG-ASCII CIS-11	ARQ1000S RTTY7, IRA-ARQ RTTY5 TORG 10/11
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 5 SK2 Discriminator Matched filter FSK4 Discriminator	as and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 3000 baud	ARQ-N ARQ-S ARQ6-70 ARQ6-90 ARQ6-98 ASCII AUTOSPEC BAUDOT BULG-ASCII CIS-11	ARQ1000S RTTY7, IRA-ARQ RTTY5 TORG 10/11 PARITY 14, CIS 96, AMOR, AMOR 96,
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 5 SK2 Discriminator Matched filter FSK4 Discriminator Matched filter	es and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 3000 baud 20 baud to 2400 baud	ARQ-N ARQ-S ARQ6-70 ARQ6-90 ARQ6-98 ASCII AUTOSPEC BAUDOT BULG-ASCII CIS-11 CIS-14	ARQ1000S RTTY7, IRA-ARQ RTTY5 TORG 10/11 PARITY 14, CIS 96, AMOR, AMOR 96, TORG 14
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 Discriminator Matched filter FSK4 Discriminator Matched filter MSK	es and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 3000 baud 20 baud to 2400 baud 20 baud to 4800 baud	ARQ-N ARQ-S ARQ6-70 ARQ6-90 ARQ6-98 ASCII AUTOSPEC BAUDOT BULG-ASCII CIS-11 CIS-14	ARQ1000S RTTY7, IRA-ARQ RTTY5 TORG 10/11 PARITY 14, CIS 96, AMOR, AMOR 96, TORG 14 CROWD 36, Russian Piccolo,
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 Discriminator FSK4 Discriminator FSK4 Discriminator Matched filter Matched filter Matched filter	es and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 3000 baud 20 baud to 2400 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud	ARQ-N ARQ-S ARQ6-70 ARQ6-90 ARQ6-98 ASCII AUTOSPEC BAUDOT BULG-ASCII CIS-11 CIS-14 CIS-36	ARQ1000S RTTY7, IRA-ARQ RTTY5 TORG 10/11 PARITY 14, CIS 96, AMOR, AMOR 96, TORG 14 CROWD 36, Russian Piccolo,
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 5 KK2 Discriminator FSK4 Discriminator Matched filter Matched filter MSK GMSK PSK2 A/B	es and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 3000 baud 20 baud to 3000 baud 20 baud to 2400 baud 20 baud to 4800 baud 20 baud to 4800 baud 30 baud to 4800 baud 30 baud to 4800 baud	AR0-N AR0-S AR06-70 AR06-90 AR06-98 ASCII AUTOSPEC BAUDOT BULG-ASCII CIS-11 CIS-36 CLOVER 2 ¹¹	ARQ1000S RTTY7, IRA-ARQ RTTY5 TORG 10/11 PARITY 14, CIS 96, AMOR, AMOR 96, TORG 14 CROWD 36, Russian Piccolo,
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 Discriminator FSK4 Discriminator SK4 Discriminator Matched filter MSK GMSK GMSK SK2 PSK2 A/B PSK4 A/B	es and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 3000 baud 20 baud to 3000 baud 20 baud to 2400 baud 20 baud to 4800 baud 20 baud to 4800 baud 30 baud to 4800 baud 30 baud to 4800 baud 30 baud to 4800 baud 30 baud to 4800 baud	AR0-N AR0-S AR06-70 AR06-90 AR06-98 ASCII AUTOSPEC BAUDOT BULG-ASCII CIS-11 CIS-14 CLOVER 2 ¹⁾ CLOVER 2000 ¹⁾	ARQ1000S RTTY7, IRA-ARQ RTTY5 TORG 10/11 PARITY 14, CIS 96, AMOR, AMOR 96, TORG 14 CROWD 36, Russian Piccolo, URS multitone, CIS 10-11-11 MFSK
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 Discriminator FSK4 Discriminator FSK4 Discriminator Matched filter MSK GMSK GMSK PSK2 A/B PSK4 A/B	es and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 3000 baud 20 baud to 3000 baud 20 baud to 2400 baud 20 baud to 4800 baud 20 baud to 4800 baud 30 baud to 4800 baud 30 baud to 4800 baud 30 baud to 4800 baud 30 baud to 4800 baud	AR0-N AR0-S AR06-70 AR06-90 AR06-98 ASCII AUTOSPEC BAUDOT BULG-ASCII CIS-11 CIS-14 CLOVER 2 ¹⁾ CLOVER 2000 ¹⁾ COQUELET 8	ARQ1000S RTTY7, IRA-ARQ RTTY5 TORG 10/11 PARITY 14, CIS 96, AMOR, AMOR 96, TORG 14 CROWD 36, Russian Piccolo, URS multitone, CIS 10-11-11 MFSK
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 5 KK2 Discriminator FSK4 Discriminator Matched filter Matched filter MSK GMSK GMSK SK2 PSK2 A/B PSK4 A/B PSK8 A/B	es and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 3000 baud 20 baud to 3000 baud 20 baud to 2400 baud 20 baud to 4800 baud 20 baud to 4800 baud 30 baud to 4800 baud	AR0-N AR0-S AR06-70 AR06-90 AR06-98 ASCII AUTOSPEC BAUDOT BULG-ASCII CIS-11 CIS-14 CLOVER 2 ¹⁾ CLOVER 2000 ¹¹ COQUELET 8 COQUELET 13	ARQ1000S RTTY7, IRA-ARQ RTTY5 TORG 10/11 PARITY 14, CIS 96, AMOR, AMOR 96, TORG 14 CROWD 36, Russian Piccolo, URS multitone, CIS 10-11-11 MFSK Mk 2 Mk 2 Mk 1 Coquelet 8 FEC
POCSAG ZVEI-VDEW (SELCAL List of recognized code in the future. HF and VHF/UHF mod HF ASK2 5 KK2 Discriminator FSK4 Discriminator Matched filter Matched filter MSK GMSK GMSK SK2 PSK2 A/B PSK4 A/B PSK8 A/B	es and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 3000 baud 20 baud to 3000 baud 20 baud to 2400 baud 20 baud to 4800 baud 20 baud to 4800 baud 30 baud to 4800 baud	AR0-N AR0-S AR06-70 AR06-90 AR06-98 ASCII AUTOSPEC BAUDOT BULG-ASCII CIS-11 CIS-14 CLOVER 2 ¹) CLOVER 2000 ¹¹ COQUELET 8 COQUELET 13 COQUELET-80	ARQ1000S RTTY7, IRA-ARQ RTTY5 TORG 10/11 PARITY 14, CIS 96, AMOR, AMOR 96, TORG 14 CROWD 36, Russian Piccolo, URS multitone, CIS 10-11-11 MFSK
POCSAG ZVEI-VDEW (SELCAL st of recognized code the future. F and VHF/UHF mod F ASK2 ASK2 Discriminator Matched filter MSK GMSK PSK2 A/B PSK4 A/B PSK8 A/B Multichannel modula	es and transmission systems will be extended ulation types processed 6 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 4800 baud 20 baud to 3000 baud 20 baud to 3000 baud 20 baud to 2400 baud 20 baud to 4800 baud 20 baud to 4800 baud 30 baud to 4800 baud	AR0-N AR0-S AR06-70 AR06-90 AR06-98 ASCII AUTOSPEC BAUDOT BULG-ASCII CIS-11 CIS-14 CLOVER 2 ¹ / CLOVER 2000 ¹¹ COQUELET 8 COQUELET 13 COQUELET-80 DUP-ARQ	ARQ1000S RTTY7, IRA-ARQ RTTY5 TORG 10/11 PARITY 14, CIS 96, AMOR, AMOR 96, TORG 14 CROWD 36, Russian Piccolo, URS multitone, CIS 10-11-11 MFSK Mk 2 Mk 2 Mk 1 Coquelet 8 FEC

100 MHz

¹⁾ Available at the end of 2007.

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HN(HEL HF-I M0 PAC PAC PAC PAC PIC PIC POL PRE PSK PSK RUN SI-A SITC SIT SPR SPR SPR SST SST

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MPT-1327	
PACKET RADIO 1200 ba	ud, 9600 baud (AX.25)
POCSAG	(t= 1)
ZVEI-VDEW (SELCAL dig	
the future.	nd transmission systems will be extended in
	ns of the R&S®GX400 sensor group
Operating	is of the R&S GX400 sensor group
temperature range	0 °C to +50 °C
temperature range	in line with DIN EN 60068-2-1,
	DIN EN 60068-2-2, MIL-STD-810E,
	method 501.3/502.3
Storage	
temperature range	-40 °C to +70 °C
1 0	in line with DIN EN 60068-2-1,
	DIN EN 60068-2-2, MIL-STD-810E,
	method 501.3/502.3
Humidity	in line with IEC 60068-2-30, operating,
	up to 95 % relative humidity at
	+25 °C/-40 °C, non-condensing, 2 cycles
Vibration	
Sinusoidal	in line with DIN EN 60068-2-6,
	DIN EN 61010-1, VG 95332, slide 24,
	grade A2: 5 Hz to 55 Hz, max 1.8 g,
	55 Hz to 150 Hz, 0.5 g const.,
	12 minutes each axis
Random	in line with DIN IEC 60068-2-64,
	10 Hz to 300 Hz, 1.2 g RMS, 5 minutes each
Chaol	axis in line with DIN EN 60068-2-27.
Shock	MIL-STD-810E, method 516.4 procedure I,
	40 g shock spectrum
Altitude (max.)	
Operating	2000 m, in line with DIN EN 61010-1
Storage	4500 m
EMC/VDE	CE mark, in line with 89/336/EEC,
	EN 55022, class A, EN 61000-3-2,
	EN 61000-3-3, EN 55024 ³⁾
Electrical safety	CE, in line with EN 61010-1
Dimensions ($W \times H \times D$)	440 mm × 600 mm × 310 mm
	(17.32 in × 23.62 in × 12.20 in),
	7 height units
Weight	22 kg to 51 kg (48.50 lb to 112.44 lb)
	(depending on number and type of installed
	VXI modules)

²⁾ Available at the end of 2007.

³⁾ Electromagnetic susceptibility classified for use in industrial environments.

Analyzers: R&S®GX400/R&S®GX430 Ordering Information

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Ordering information

R&S®GX400 VXI module			Demodulation and		
R&S®AMMOS Sensor Gro	-		Decoding of Digital		
(incl. mainframe, controll			HE Communications	R&S®GX401DC	4057,1253.02
platform software)	R&S®GX400	4062.4340.04	HF Classification	R&S®GX401CL	4057.1453.02
VXI DDC/DSP Board	R&S®GX401EM	4062.2202.02	Demodulation and Deco		4037.1433.02
VXI HF Wideband (4 MHz		4002.2202.02	Digital VHF/UHF		
A/D Converter Board	R&S®GX401BP	4061,7000,03	Communications	R&S®GX405DC	4057,1353.02
HF Wideband Extension t		4001.7000.03	VHF/UHF Classification	R&S®GX405CL	4057.1553.02
R&S®GX401BP (20 MHz)		4061.7600.02	Control for R&S®EM010		4007.1000.02
VXI VHF/UHF Wideband		1001.7000.02	and R&S®EM050/R&S®		
A/D Converter Board	R&S®GX405BP	4062,1764,02	VXI Receivers	R&S®GX403TW	4057,2050,02
VXI HF Receiver		1002.1701.02	Spectral HF and VHF/UI		100712000102
(10 kHz to 30 MHz)	R&S®EM010	4055.0008.03	Zoom	R&S®GX403SZ	4057.1953.02
LF Option		100010000100	Detection of Conventior		100711000102
(300 Hz to 60 kHz)	R&S®EM010LF	4055.0014.02	(Fixed Frequency) HF an	d	
VXI VHF/UHF Digital			VHF/UHF Signals	R&S®GX403DT	4057.1753.02
Wideband Receiver			Detection of Short-time		
(20 MHz to 3.6 GHz)	R&S®EM050	4060.3501.02	HF and VHF/UHF Signal	s R&S®GX403DS	4057.1653.02
VXI Decoder PC HF			R&S®AMMOS decoder		
(mandatory for R&S®GX4	01DC,		Decoder Development E	-	
R&S®GX401CL)	R&S®GX400VD	4057.0857.02	for HF Decoders	R&S®GX400ID	4057.0457.02
R&S®GX400 firmware o	ptions		R&S®GX430 PC-based	R&S®AMMOS	
Control for R&S®EM010			Information on request		
and R&S®EM050					
VXI Receivers	R&S®GX403RX	4057.1853.02			
HF and VHF/UHF Voice	R&S®GX403VO	4057.1153.02			

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Analyzers

R&S®GX420 AMREC Digital Recording and Replay System

R&S®AMMOS (automatic modular monitoring of signals) – AMREC





Main features

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- The R&S[®]GX420 seamlessly fits in the modular R&S[®]AMMOS R&S[®]GX400 family
- Gigabit Ethernet and optical FPDP/serial interface in line with VITA 17.1 are provided as external data interfaces
- The R&S[®]GX420 is controlled by CORBA^{®1} via Ethernet
- Loop mode for endless recording/replay
- Navigation in replays is supported
- Administration of recordings with database is supported
- For maximum performance, the R&S[®]GX420 relies on a customized RAID
- The RAID subsystem is located in a separate storage subsystem for maximum flexibility and easier maintenance
- The system is available for 19" rackmounting
- Import/export of recordings via Gigabit Ethernet

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Brief description

The R&S[®] GX420 is a high-performance recording/replay system for digital data. It can be used as a standalone device or integrated in an R&S[®] AMMOS configuration.

As the central recording/replay component of the R&S®AMMOS R&S®GX400 family, the R&S®GX420 is perfectly suited for narrowband and wideband interception applications. In these applications, the R&S®GX420 is used to collect digital narrowband and wideband IF data.

For standalone applications outside the R&S®AMMOS R&S®GX400 family, a Gigabit Ethernet interface with TCP/IP protocol is provided. The R&S®GX420 relies on a customized RAID for maximum performance.

The R&S[®]GX420 is divided into a controller part and a storage subsystem.

Analyzers: R&S®GX420 AMREC Digital Recording and Replay System

System integration

The R&S®GX420 can be used as a standalone recording system for digital data (TCP/IP) of any type. The R&S®GX420 is perfectly suited for recording R&S®AMMOS R&S®GX400 IF narrowband and wideband signals from the R&S®EM010 VXI HF receiver, R&S®EM050 VXI VHF/UHF digital wideband receiver, R&S®GX401BP VXI HF wideband (4 MHz) A/D converter board and R&S®GX405BP VXI VHF/UHF wideband (20 MHz) A/D converter board.

Interfaces

- Gigabit Ethernet for recording/replay, archiving and administration purposes
- Optical FPDP/serial interface in accordance with VITA 17.1 for recording/replay

Functionality

Administration

- Output a list of all recordings on the storage subsystem
- Delete recordings
- Handle write protection of recordings
- Check status of storage subsystem (free, used disk space)
- Trigger the reliable erasure of all recordings

Control interface

CORBA[®] via Gigabit Ethernet

Import/export of recordings

- Recordings can be exported via FTP for archiving purposes
- Archived recordings can be imported via FTP

Recording

- Digital data can be recorded via Gigabit Ethernet or FPDP/serial interface (depending on the bandwidth)
- Recordings can be made in loop mode

Replay

- Recorded data can be replayed via Gigabit Ethernet or optical FPDP/serial interface in line with VITA 17.1 (depending on the bandwidth)
- The beginning and end of a replay can be configured
- Replay can be repeated 1 to n times (loop mode)
- Fault management
- Faults are collected in a log file
- Faults are announced via the CORBA[®] interface

Built-in test (BITE)

- An initial BITE and consistency check is performed after power-on
- ◆ A runtime BITE monitors operation of the R&S[®]GX420
- BITE-on-demand ensures exhaustive testing of the R&S[®]GX420

System clock

- Timing source for recordings
- Can be synchronized via the CORBA[®] interface
- Can be synchronized with network time protocol (NTP)

Remote shutdown

Shutdown via the CORBA[®] interface

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Specifications

Max. sustained total		Shock ¹⁾	in line with EN 60068-2-27, MIL-STD-810E
data rate ¹⁾	100 Mbyte/s ²⁾		method 516.4, procedure I,
Max. hard disk capacity	230 Gbyte ³⁾		40 g shock spectrum
Recording capacity for	digital IF data (R&S®AMMOS IF format):	Vibration, sinusoidal ¹⁾	in line with EN 60068-2-6, EN 61010-1,
Bandwidth			VG 95332, slide 24, grade A2: 5 Hz to 55 H
20 MHz	30 min		max 1.8 g, 55 Hz to 150 Hz, 0.5 g const.,
10 MHz	1 h		12 min each axis
5 MHz	2 h	Vibration, random ¹⁾	in line with IEC 60068-2-64
4 MHz	2.5 h		10 Hz to 300 Hz, 1.2 g RMS, 5 min each
1 MHz	10 h		axis
250 kHz	40 h	Humidity	in line with IEC 60068-2-30, operating,
20 kHz	200 h		up to 95 % relative humidity at +25 °C to
Recordings/replays in p	parallel:		+40 °C, noncondensing, 2 cycles
Bandwidth		Operating altitude	2000 m, in line with EN 61010-1
1 MHz to 20 MHz	1	Storage altitude	4500 m
250 kHz	8	Power supply	nominal, 100 V to 240 V AC, 50 Hz to 60 H
20 kHz	20	Power usage (max.)	
Loop mode		R&S®GX420	
Min. size	1 Mbyte	AMREC controller	85 W
Max. size	230 Gbyte ³⁾	R&S®GX420 hard disk	90 W
Control interface	Gigabit Ethernet	Chassis type	19" rackmount,
Available data interfaces	RJ-45 Gigabit Ethernet, SFP optics,		5 height units (179 mm (7.05 in))
	FPDP/serial interface in line with VITA 17.1	Weight	20 kg (44.09 lb)
Control protocol	CORBA®	Mate/unmate cycles	50 mate/unmate cycles for each SCSI HD
Data protocol	FPDP/serial, TCP/IP		connector on the R&S®GX420 AMREC
General data			controller and R&S®GX420 hard disk in
Operating			line with ANSI INCITS 336-2000
temperature range	+5 °C to +50 °C in line with		(Information Technology – SCSI Parallel
	EN 60068-2-1, EN 60068-2-2,		Interface – 3)
	MIL-STD-810E, method 501.3/502.3	EMC/VDE	CE mark, in line with 89/336/EEC,
Storage			EN 55022, class B, EN 61000-3-2,
temperature range	-20 °C to $+70$ °C in line with		EN 61000-3-3, EN 55024
	EN 60068-2-1, EN 60068-2-2,		
	MIL-STD-810E, method 501.3/502.3		

Performance degradation possible in case of shock or vibration.
 1 Mbyte ≏ 1 × 10⁶ bytes.
 1200 Gbyte version available as of July 2007.

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Analyzers: R&S®GX420 AMREC Digital Recording and Replay System

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Ordering information

AMREC Digital Recordin	g and	
Replay System	R&S®GX420	4064.4525.02
Ruggedized Hard Disk		
Subsystem	R&S®GX420HD	4063.1768.02
Digital I/O Channel TCP/IF)	
2 Mbit/s (R&S®AMMOS:		
digital IF data stream		
with 20 kHz bandwidth)	R&S®GX421MB	4064.3706.02
Digital I/O Channel TCP/IF)	
10 Mbit/s (R&S®AMMOS:		
digital IF data stream		
with 250 kHz bandwidth)	R&S®GX421TE	4064.3758.02
Digital I/O Channel TCP/IF)	
1 Gbit/s (R&S®AMMOS:		
digital IF data stream		
with 1 MHz to 20 MHz		
bandwidth)1)	R&S®GX422GB	4064.3806.02

¹⁾ Includes FPDP hardware extension.

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Analyzers

R&S®GX410 AMLAB Signal Analysis Software

R&S®AMMOS (automatic modular monitoring of signals) – AMLAB





Main features

- Automatic measurement/classification of fixed-frequency signals
- Bit stream analysis
- Manual measurements of fixed-frequency signals
- Analysis of short-time signals
- System integration

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Brief description

The R&S[®]GX410 is an expert system for offline technical analysis of unknown or complex signal scenarios. It provides automatic and manual analysis solutions for conventional fixed-frequency emission as well as for shorttime, frequency-agile emissions. The R&S®GX410 provides a library of classifiers, demodulators and decoders for the HF and VHF/UHF range. These tools are used to automatically measure the parameters of emissions and verify the results by demodulation/decoding the signal samples. In case of difficult signal scenarios that cannot be handled by automatic measurement tools, switching to manual mode makes it possible to investigate the physical behavior of the signal and directly measure the technical parameters. The final result of the analysis process can be transferred to the monitoring equipment (see R&S®GX400 and R&S®GX430) to set up monitoring/surveillance jobs.

Analyzers: R&S®GX410 AMLAB Signal Analysis Software



Main view: ① Spectrogram showing an overview of the complete signal sample. ② Time domain analysis for selected emissions. ③ Case-sensitive controls for the R&S[®]AMLAB processing steps (signal acquisition, detectors, demodulators, decoders, etc). ④ Navigation center showing all signal samples and calculated analysis results.

Concept and workflow

The R&S®GX410 graphical user interface makes it possible to control all analysis functions. Collected signal samples and all processing results of the offline analysis are organized in a project (file tree) structure that is used for navigation and for starting the following processing steps. All relevant data is stored in an SQL database. The workflows allow the use of automatic detectors and automatic classifiers to measure the signal parameters and, if necessary, the use of fully manual measurement tools.

Automatic detection of fixed-frequency signals

The R&S®GX410 provides an automatic detection algorithm for fixed-frequency emissions detecting all signals that are included in a wideband scenario and comply with a predefined search pattern (bandwidth, S/N, etc). All detected emissions are graphically marked in the spectrogram and stored in an emission result list where they can be sorted, evaluated and selected for the next processing steps.

Automatic measurement/classification of fixedfrequency signals

The R&S®GX410 contains the powerful R&S®AMMOS classification unit for HF and VHF/UHF and is able to recognize the modulation type and transmission system of a wide variety of analog and digital signals. The library of supported modulation types and codes will be continuously extended. The classification algorithm provides a segmentation and modulation analysis result for every signal previously selected in the emission list. 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 (such as symbol rate, frequency shift).

The classification results are used to parameterize a demodulator from the R&S®AMMOS demodulation library. A signal sample is demodulated to evaluate and verify the results of the classification/analysis process. The resulting symbol/bit stream is further analyzed by using the bit stream analysis tool or is decoded by using the decoders of the R&S®AMMOS decoding library. The generated symbol



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Analyzers: R&S[®]GX410 AMLAB Signal Analysis Software

data files can be exported to other customer-specific tools for further analysis.

Manual measurements of fixed-frequency signals

The purpose of manual measurements is to verify the results of the automatic analysis or to handle signals that cannot be analyzed successfully by the automatic classifier. Emission characteristics (bandwidth, duration, S/N ratio) can be measured with measurement cursors in the zoomable spectrogram. For an in-depth analysis or highly precise parameter measurement, the selected emission is transferred (using digital downconversion – DDC) to a high-resolution modulation analysis tool. The filter bandwidth is adapted to filter out all disturbing out-of-band emissions and/or noise.

The interactive manual signal analysis guides the user through a sequence of five processing steps (time segmentation, frequency segmentation, analog demodulation, modulation analysis, timing recovery) to perform a successful manual analysis of the unknown signal.

Time segmentation ensures the exact selection of the signal segment in the time domain, the investigation and measurement of blocked transmission modes, and the measurement of the signal level over time.

Frequency segmentation ensures the exact selection of the signal segment in the frequency domain, the exact measurement of center frequency and bandwidth, and the analysis of multichannel and multitone signals.

Analog demodulation is used for the audio demodulation of the signal and removes the primary modulation of a double-modulated signal.

Modulation analysis allows the measurement of modulation parameters such as modulation type, symbol rate, frequency shift (for frequency-modulated signals), amplitude shift (for amplitude-modulated signals), tone/channel spacing (for multitone/multichannel signals).



Timing recovery furnishes time/eye/phase diagrams that show detailed signal behavior (after baseband filtering and recovery of the sample time). For phase-modulated signals, an equalizer can be parameterized.

Analysis of short-time signals

The R&S® GX410 provides an automatic detection algorithm for short-time emissions. By means of a manual or automatic measurement of some of the emissions (duration, bandwidth, S/N ratio), the operator can set up a emission pattern for the detection algorithm. The algorithm will scan the signal sample to detect all emissions that match the defined pattern. All detected emissions are graphically marked in the spectrogram and stored in an emission result list where they can be sorted, evaluated and selected for the next processing steps.

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	ID	Start time	Stop time	Duration	Center freq.	Bandwidth	Level	Symbol rate	F 🔺
	5800	277.467 ms	279.24 ms	1.773 ms	54.025 MHZ	25.310 KHZ	-60.5 abm		Ē
140	5801	279.422 ms	281.195 ms	1.773 ms	44.500 MHz	25.310 kHz	-62.4 dBm		L
141	5802	281.377 ms	283.15 ms	1.773 ms	51.250 MHz	25.310 kHz	-64.9 dBm		⊢
142	5803	283.332 ms	285.105 ms	1.773 ms	50.550 MHz	25.310 kHz	-57.8 dBm		L
143	5804	285.287 ms	287.06 ms	1.773 ms	58.150 MHz	25.310 kHz	-56.4 dBm		L
144	5805	287.242 ms	289.015 ms	1.773 ms	52.400 MHz	25.310 kHz	-52.3 dBm		
145	5806	289.197 ms	290.97 ms	1.773 ms	52.300 MHz	25.310 kHz	-52.7 dBm		
146	5807	291.152 ms	292.925 ms	1.773 ms	40.350 MHz	25.310 kHz	-63.8 dBm		
147	5808	293.107 ms	294.88 ms	1.773 ms	58.525 MHz	25.310 kHz	-53.9 dBm		
148	5809	295.062 ms	296.835 ms	1.773 ms	41.000 MHz	25.310 kHz	-59.3 dBm		
149	5810	297.017 ms	298.79 ms	1.773 ms	52.825 MHz	25.310 kHz	-53.0 dBm		
150	5811	298.972 ms	300.745 ms	1.773 ms	43.775 MHz	25.310 kHz	-70.2 dBm		
151	5812	300.927 ms	302.7 ms	1.773 ms	45.975 MHz	25.310 kHz	-60.5 dBm		
152	5813	302.882 ms	304.655 ms	1.773 ms	54.100 MHz	25.310 kHz	-60.8 dBm		
153	5814	304.837 ms	306.61 ms	1.773 ms	53.275 MHz	25.310 kHz	-58.5 dBm		
154	5815	306.792 ms	308.565 ms	1.773 ms	56.900 MHz	25.310 kHz	-59.4 dBm		
155	5816	308.747 ms	310.52 ms	1.773 ms	42.975 MHz	25.310 kHz	-65.6 dBm		ī
156	5817	310.702 ms	312.475 ms	1.773 ms	46.000 MHz	25.310 kHz	-60.4 dBm		
157	5818	312.657 ms	314.43 ms	1.773 ms	51.300 MHz	25.310 kHz	-65.8 dBm		
158	5819	314.612 ms	316.385 ms	1.773 ms	54.425 MHz	25.310 kHz	-58.1 dBm		ī
159	5820	316.567 ms	318.34 ms	1.773 ms	55.350 MHz	25.310 kHz	-55.4 dBm		
160	5821	318.522 ms	320.295 ms	1.773 ms	41.050 MHz	25.310 kHz	-60.1 dBm		
161	5822	320.477 ms	322.25 ms	1.773 ms	56.250 MHz	25.310 kHz	-55.2 dBm		
162	5823	322.432 ms	324.205 ms	1.773 ms	55.700 MHz	25.310 kHz	-48.8 dBm		-
•									١Ē
	Export	a Sun	thesize	Delete	Quantize	1			
		it syn	unesize	Delete	guantize				

The evaluated emission result list can be used, for example, for recombining selected baseband emissions to build a continuous narrowband digital IF signal for further analysis, e.g. classification, demodulation, and bit stream analysis.

Signal analysis Start true	6533 ne Endline	66.81 ms Duration.	1.78 m		F
Gid court 10	Estend " Sunded rate	0 Spediato/s			4
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					707.556
					500.064V
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Bit stream analysis

The demodulated symbol stream/bit stream is displayed in different graphical representations (e.g. hex or pulselength diagram), revealing code structures and periodic elements.



A large set of bit stream analysis functions supports the operator in analyzing block codes and searching for preambles, synchronization frames, convolutional coders, and scrambler polynoms. The bit stream can also be manipulated using a tool set covering most of the operations used for bit coding and channel coding. A direct feedback will allow the operator to verify the analysis steps and the progress in the clearance process of the signal of interest. Bit stream analysis is a powerful tool in the field of code identification, content analysis, and development of custom decoder modules.

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Analyzers: R&S[®]GX410 AMLAB Signal Analysis Software

System integration

The R&S[®]GX410 can be used as a standalone system for HF and VHF/UHF technical analysis. Signal samples may be archived using the built-in DVD/CD writer.

An optionally connected R&S®AMMOS R&S®GX420 recording unit allows recording of digital wideband and narrowband IF data streams. These recorded data streams may be imported to the R&S®GX410. Similarly, recordings with the R&S®AMMOS R&S®GX400 VXI-based monitoring solution made on the R&S®GX420 (AMREC) may be replayed to the R&S®GX410 (AMLAB) for technical analysis. Using the included D/A converter board, any detected, extracted or recombined signal can be replayed as analog IF for further processing in customer-specific analysis equipment (not included in the R&S®GX410).



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Data acquisition	
Imported digital IF	
(complex baseband I/Q)	R&S®AMMOS IF format and binary format
Maximum bandwidth of	
imported IF data	unlimited
Import of wav file	real and complex data (using left and
	right channel), 16 bit
Bandwidth for wideband	reception
(if used with R&S®AMMC	IS R&S®GX400
wideband receivers)	
HF	1 MHz, 4 MHz, 10 MHz, 20 MHz
VHF/UHF	5 MHz, 10 MHz, 20 MHz
Resolution for realtime	
waterfall	2048 points; 30/60/100/200 lines/s
Measurement capabilitie	S
FFT resolution for offline	
spectrogram	256 points to 32k points
FFT resolution for modula	tion
analysis spectrum	64 points to 256k points



LAN infrastructure and FPDP optical infrastructure

	Minimum signal duration						
	for reliable detection						
	of short-time signals						
	HF	5 ms					
	VHF/UHF	0.5 ms					
Modulation analysis, code recognition, demodulation,							
decoding of HF and VHF/UHF							
	Library of HF and VHF/UHF						
	classifiers, demodulators,						
	decoders	R&S®GX410 uses the same library					
		of classifiers, demodulators, and decoders					
		as the R&S [®] AMMOS R&S [®] GX400					
		VXI-based monitoring solution					
		(see R&S®GX400)					
Analog output (D/A converter)							
	Carrier frequency for						
	analog IF output	1 kHz to 1 MHz					
	Maximum bandwidth for						
	analog IF output	1 MHz					
Environment (PC workstation)							
	Upper operating						
	temperature	+30°C					
	Lower operating						
	temperature	+5°C					
	Power consumption	700 W					

Analyzers: R&S®GX410 AMLAB Signal Analysis Software

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Ordering information

AMLAB Signal Analysis Software		Technical and Statistical Analysis of			
(R&S®GX410 applicati	on		Short-Time Signals	R&S®GX410DS	4063.0107.02
base software)1)	R&S®GX410	4063.9681.02	Classification of		
AMLAB Workstation ²⁾	R&S®GX410WS	4063.9869.02	Modulation Type		
AMREC and HF/VHF/L	JHF		(modulation analysis)	R&S®GX413MA	4069.4317.02
Wideband Receiver			System Recognition		
Control ³⁾	R&S®GX410AR	4063.9930.02	(code classification) ⁵⁾	R&S®GX413SR	4069.4498.02
D/A Converter Board a	and		Demodulation of Signals	R&S®GX413DM	4069.4430.02
Control Software	R&S®GX410DA	4063.9969.02	Decoding of Signals and		
Control for HF VXI Wid	deband		Symbol Streams ⁶⁾	R&S®GX413DC	4069.4552.02
Receivers and FPDP Ir	nterface		Bit Stream Analysis ⁶⁾	R&S®GX413BA	4069.4375.02
Module ⁴⁾	R&S®GX410HF	4063.0013.02			
Control for VHF/UHF V	/XI		5) Requires R&S®GX413MA.		

4063.0071.02

6) Requires R&S®GX413DM.

¹⁾ Requires R&S®GX410WS.

Wideband Receivers and

2) Mandatory for R&S®GX410.

³⁾ Requires R&S®GX420 and R&S®GX400 sensor group.

FPDP Interface Module⁴⁾ R&S®GX410VU

⁴⁾ Requires R&S®GX400 sensor group.

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