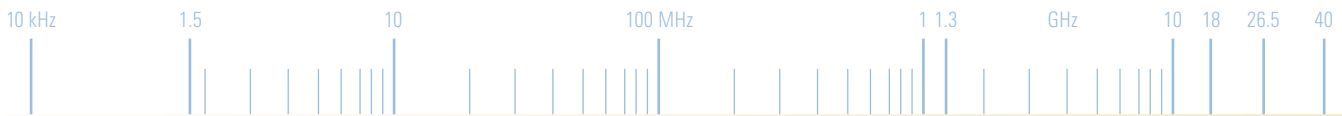


The R&S® AMMOS R&S® GX4xx HF and VHF/UHF system family consists of the following:

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 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.

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.



Contents of Chapter 4



| Type | Designation | Page |
|-----------------------|---|------|
| R&S® AMMOS | Automatic Modular Monitoring of Signals | |
| R&S®GX400 | VXI-Based Monitoring Solution | 116 |
| R&S®GX400 | VXI Boards for HF and VHF/UHF | |
| | Signal Processing | 118 |
| R&S®GX430 | PC-Based Monitoring Solution | 120 |
| R&S®GX400/R&S®GX430 | Specifications | 122 |
| R&S®GX420 | AMREC Digital Recording and | |
| | Replay System | 126 |
| R&S®GX410 | AMLAB Signal Analysis Software | 130 |

Analizers

4

Contents Overview

Type Index

Main Menu

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 wav 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

New

R&S® GX400 VXI-Based Monitoring Solution

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



4

Chapter
Overview

Type
Index

Main
Menu

Introduction

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)

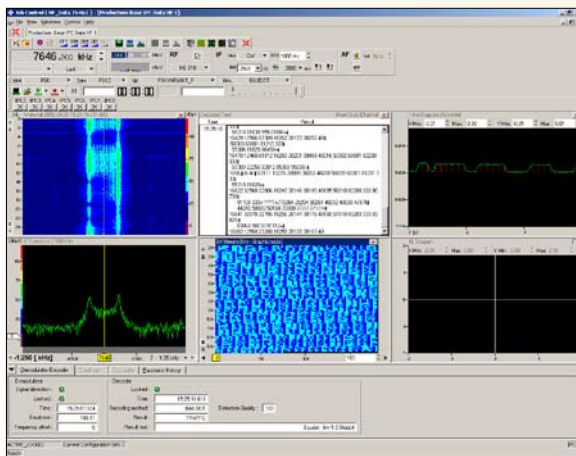
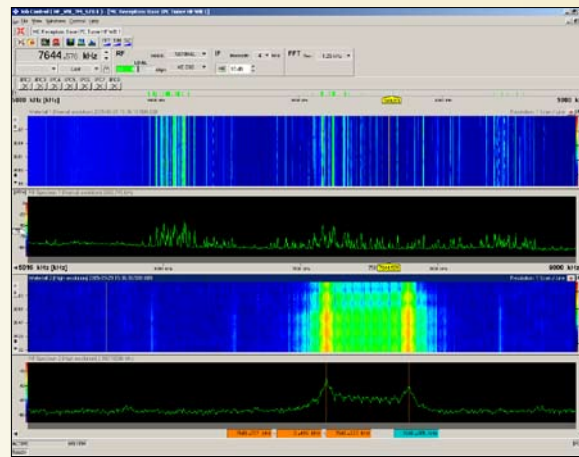
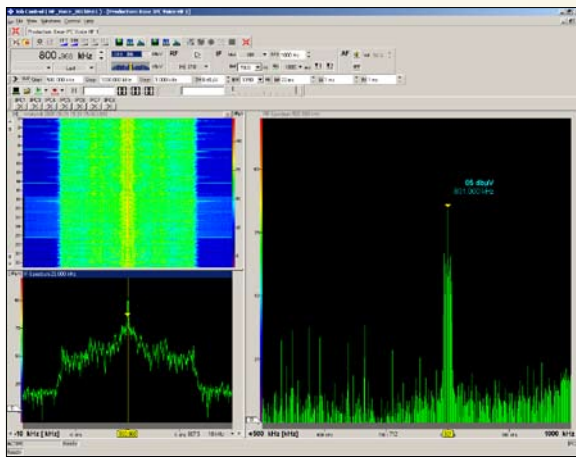


Fig. 4 to 5: (from top to bottom)

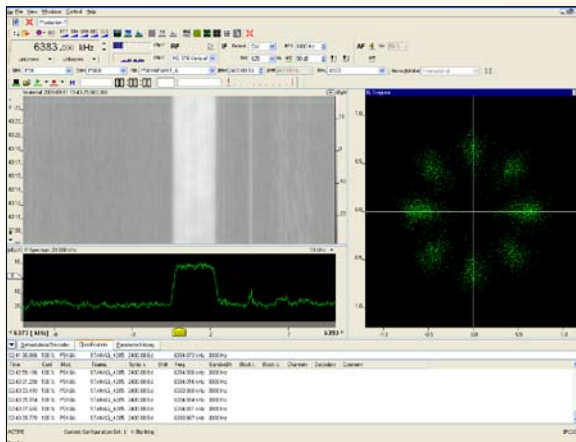


Fig. 1 to 3: (from top to bottom)

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

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.

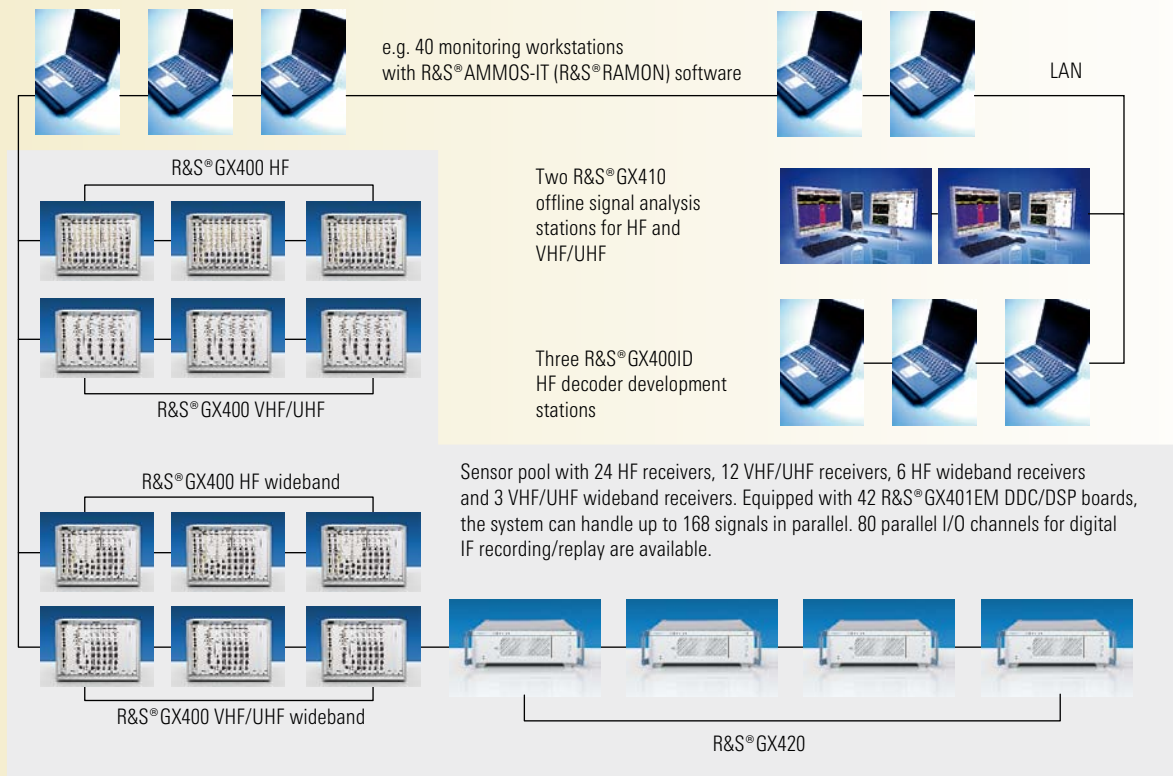
The R&S®GX400 provides the extremely high signal processing performance especially required for the interception and analysis of short-time signals.

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).

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

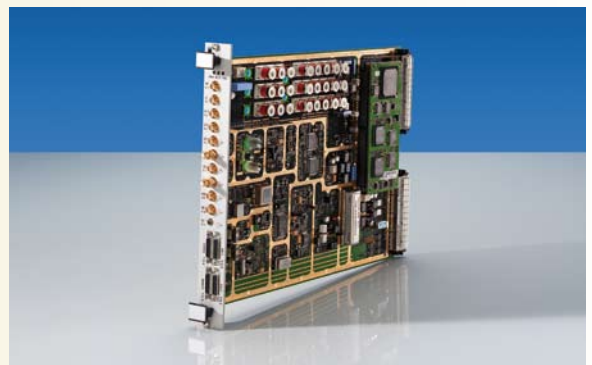


Example of a configuration for a monitoring system with R&S® GX400 sensor technology

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

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).





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

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®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.



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 narrowband and wideband signals. It contains sufficient hardware functionality for four parallel signal processing units.



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.



Analyzers

New

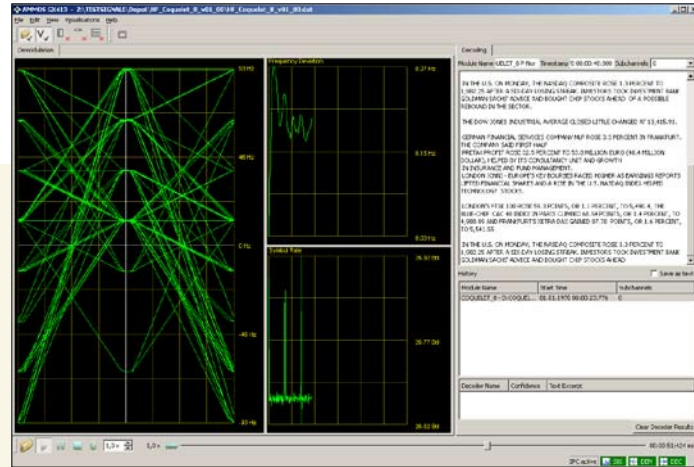
R&S® GX430

PC-Based Monitoring Solution

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

Main features

- ◆ Standalone single-channel solution
- ◆ Running on PC
- ◆ 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.

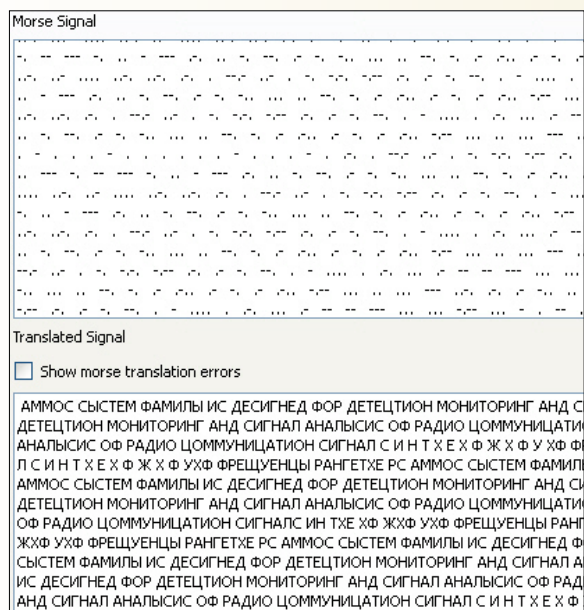
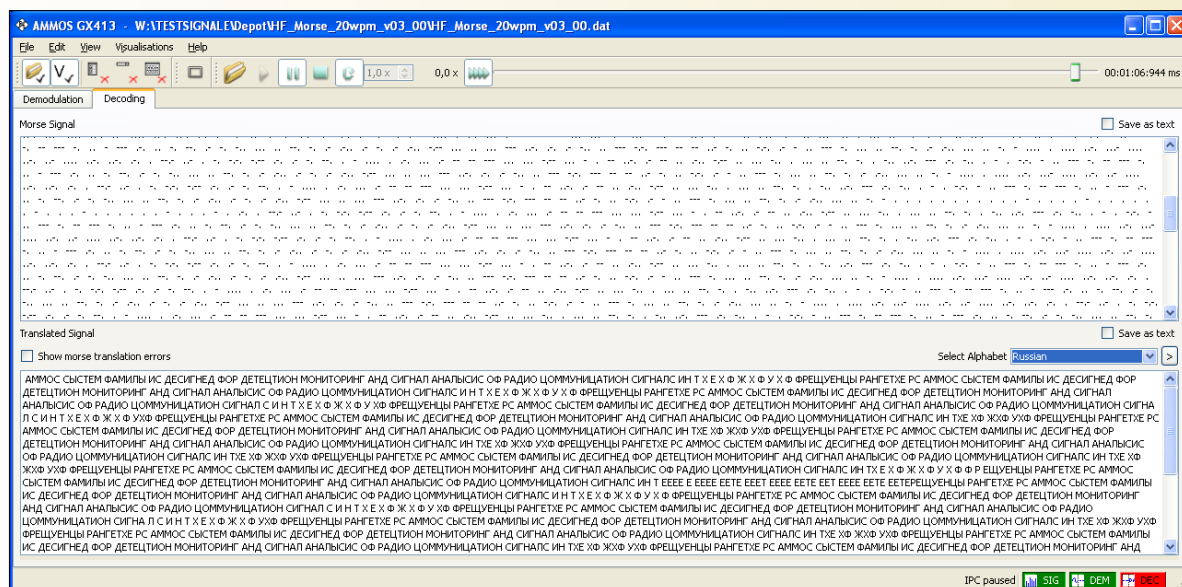
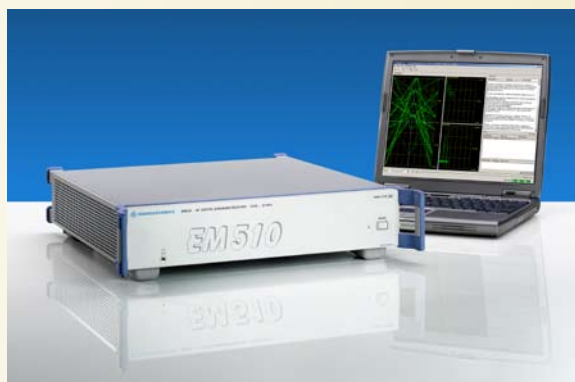
4

Chapter
Overview

Type
Index

Main
Menu

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-to-use solution for single-channel signal processing together with a modern Rohde & Schwarz receiver.



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

4

Chapter Overview

Type Index

Main Menu

Specifications

R&S®GX400

Wideband receiver (max. resolution)

HF range

| Bandwidth | Panorama spectrum, maximal res. | Max. wideband signal delay buffer depth |
|-----------|---------------------------------|---|
| 1 MHz | <40 Hz | 200 s |
| 4 MHz | <160 Hz | 50 s |
| 10 MHz | <400 Hz | 20 s |
| 20 MHz | <800 Hz | 10 s |

VHF/UHF range

| Bandwidth | Panorama spectrum, maximal res. | Max. wideband signal delay buffer depth |
|-----------|---------------------------------|---|
| 5 MHz | <200 Hz | 40 s |
| 10 MHz | <400 Hz | 20 s |
| 20 MHz | <800 Hz | 10 s |

Automatic detection of fixed-frequency signals

Detection time resolution

| | |
|----------------|--------|
| HF and VHF/UHF | 500 ms |
|----------------|--------|

Frequency resolution for detection

| | |
|---------|----------------------------|
| HF | <40 Hz at 1 MHz bandwidth |
| VHF/UHF | <200 Hz at 5 MHz bandwidth |

Decay time

| | |
|----------------|----------------|
| HF and VHF/UHF | 0.5 s to 100 s |
|----------------|----------------|

Detection sensitivity (CNR)

| | |
|----------------|------|
| HF and VHF/UHF | 5 dB |
|----------------|------|

Automatic detection of short-time signals

Number of frequency channels (FFT bins) for detection algorithm

| | |
|----------------|---------------------------|
| HF and VHF/UHF | 512 to 4096 (powers of 2) |
|----------------|---------------------------|

Min. detectable emission length

| | |
|---------|--------|
| HF | 5 ms |
| VHF/UHF | 500 µs |

Detectable emission bandwidth

| | |
|---------|------------------|
| HF | 500 Hz to 6 kHz |
| VHF/UHF | 5 kHz to 200 kHz |

R&S®GX400/R&S®GX430

HF and VHF/UHF modulation types recognized

HF

| | |
|-------------------|--|
| Analog modulation | CW, AM DSB-TC, AM DSB-SC, AM SSB-LSB, AM SSB-USB, FM |
|-------------------|--|

Digital modulation

| | |
|--------------|--|
| ASK2 | 6 baud to 100 baud |
| FSK2 | 20 baud to 4800 baud |
| FSK4 | 20 baud to 3000 baud |
| MSK/GMSK | 20 baud to 4800 baud |
| PSK2 A/B | 30 baud to 4800 baud |
| PSK4 A/B | 30 baud to 4800 baud |
| PSK8 A/B | 30 baud to 4800 baud |
| OQPSK | 30 baud to 4800 baud |
| QAM16 | 100 baud to 4800 baud |
| Multitone | 6 tones to 32 tones, 5 baud to 330 baud |
| Multichannel | 2 channels to 16 channels, FSK2 and PSK2, 30 baud to 4800 baud, up to 240 baud per channel |

VHF/UHF

| | |
|-------------------|------------------------------|
| Analog modulation | CW, AM DSB-TC, AM DSB-SC, FM |
|-------------------|------------------------------|

Digital modulation

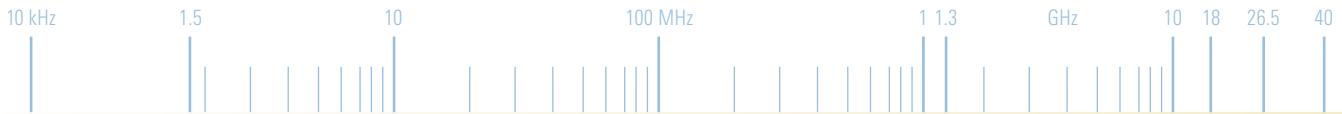
| | |
|-----------|--|
| ASK2 | 1200 baud to 25 kbaud |
| FSK2 | 1200 baud to 25 kbaud |
| FSK4 | 1200 baud to 25 kbaud |
| MSK/GMSK | 1200 baud to 25 kbaud |
| PSK2 A/B | 1200 baud to 25 kbaud |
| PSK4 A/B | 1200 baud to 25 kbaud |
| PSK8 A/B | 1200 baud to 25 kbaud |
| OQPSK | 1200 baud to 25 kbaud |
| QAM16 | 1200 baud to 25 kbaud |
| Multitone | 6 tones to 32 tones, 20 baud to 330 baud |
| AM FSK | 800 baud to 2400 baud |
| FM FSK | 800 baud to 2400 baud |

List of recognized modulation types will be extended in the future.

HF codes and VHF/UHF transmission systems recognized

HF

| | |
|-------------------------|---|
| 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 |
| ARQ6-70 | |
| ARQ6-90 | |
| ARQ6-98 | |
| 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 |
| CLOVER | |
| CODAN | |
| 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 | |
| MIL-STD-188-110A Serial | |
| MIL-STD-188-110B | |
| MIL-STD-188-141A (ALE) | |



Analyzers: R&S®GX400/R&S®GX430 Specifications

| | | | |
|---|--|--|--|
| MORSE | | PSK2/4 A/B | 2 channels to 64 channels, max. 240 baud (per channel), total max. 4800 baud |
| PACTOR I | | Multitone | |
| PACTOR II | | Number of tones | 6 to 64 |
| PACTOR III | | Transmission rate | 5 baud to 330 baud |
| PACKET RADIO | | VHF/UHF | |
| PICCOLO MK6 | | ASK2 | 1200 baud to 25 kbaud |
| PICCOLO MK12 | | FSK2 | |
| POL-ARQ | | Discriminator | 1200 baud to 25 kbaud |
| PSK-31 | BPSK31, QPSK31 | Matched filter | 1200 baud to 25 kbaud |
| PSK-63 | BPSK63, QPSK63 | FSK4 | |
| RUM-FEC | ROU FEC | Discriminator | 1200 baud to 25 kbaud |
| SI-ARQ | ARQ-S, ARQ1000S | Matched filter | 1200 baud to 25 kbaud |
| SITOR-A | SITOR-ARQ | MSK/GMSK | 1200 baud to 25 kbaud |
| SITOR-B | SITOR-FEC | PSK2 A/B | 1200 baud to 25 kbaud |
| SKYFAX | | PSK4 A/B | 1200 baud to 25 kbaud |
| SPREAD11 | | PSK8 A/B | 1200 baud to 25 kbaud |
| SPREAD21 | | OQPSK | 1200 baud to 25 kbaud |
| SPREAD51 | | AM FSK | 800 baud to 2400 baud |
| STANAG 4285 | | FM FSK | 800 baud to 2400 baud |
| STANAG 4415 | | Multitone | |
| STANAG 4529 | | Number of tones | 6 to 64 |
| SWED-ARQ | ARQ-SWE | Transmission rate | 20 baud to 330 baud |
| TWINPLEX ARQ (F7B) | | List of processed modulation types will be extended in the future. | |
| VHF/UHF | | HF codes and VHF/UHF transmission systems processed | |
| SELCAL analog | ITU-R-1, ITU-R-2, ITU-T, DTMF, EEA, EIA, EURO, NATEL, VDEW, ZVEI-1, ZVEI-2 | HF | |
| ATIS (SELCAL digital) | | ARQ-E3 | |
| FMS-BOS (SELCAL digital) | | ARQ-E | ARQ1000D |
| METEOSAT | | ARQ-M2 242 | ARQ TDM 242 |
| MPT-1327 | | ARQ-M2 342 | ARQ TDM 342 |
| PACKET RADIO 1200 baud, 9600 baud (AX.25) | | ARQ-M4 242 | |
| POCSAG | | ARQ-M4 342 | |
| ZVEI-VDEW (SELCAL digital) | | ARQ-N | ARQ-1000 |
| List of recognized codes and transmission systems will be extended in the future. | | ARQ-S | ARQ1000S |
| HF and VHF/UHF modulation types processed | | ARQ6-70 | |
| HF | | ARQ6-90 | |
| ASK2 | 6 baud to 4800 baud | ARQ6-98 | |
| FSK2 | | ASCII | RTTY7, IRA-ARQ |
| Discriminator | 20 baud to 4800 baud | AUTOSPEC | |
| Matched filter | 20 baud to 4800 baud | BAUDOT | RTTY5 |
| FSK4 | | BULG-ASCII | |
| Discriminator | 20 baud to 3000 baud | CIS-11 | TORG 10/11 |
| Matched filter | 20 baud to 2400 baud | CIS-14 | PARITY 14, CIS 96, AMOR, AMOR 96, TORG 14 |
| MSK | 20 baud to 4800 baud | CIS-36 | CROWD 36, Russian Piccolo, URS multitone, CIS 10-11-11 MFSK |
| GMSK | 20 baud to 4800 baud | CLOVER 2 ¹⁾ | |
| PSK2 A/B | 30 baud to 4800 baud | CLOVER 2000 ¹⁾ | |
| PSK4 A/B | 30 baud to 4800 baud | COQUELET 8 | Mk 2 |
| PSK8 A/B | 30 baud to 4800 baud | COQUELET 13 | Mk 1 |
| Multichannel modulation types | | COQUELET-80 | Coquelet 8 FEC |
| FSK2 | 2 channels to 64 channels, max. 240 baud (per channel), total max. 4800 baud | DUP-ARQ | ARQ Duplex |
| | | DUP-ARQ-2 | |
| | | DUP-FEC-2 | |

¹⁾ Available at the end of 2007.

| | | | |
|--------------------------|------------------|--|--|
| FEC-A | FEC100, FEC100A | SWED-ARQ | ARQ-SWE |
| FEC-S | FEC1000S, SI-FEC | TWINPLEX ARQ (F7B) | |
| G-TOR | | VHF/UHF | |
| HNG-FEC | | SELCAL analog | ITU-R-1, ITU-R-2, ITU-T, DTMF, EEA, EIA, EURO, NATEL, VDEW, ZVEI-1, ZVEI-2 |
| HELLSCHREIBER | | ATIS (SELCAL digital) | |
| HF-FAX | AM FAX, FM FAX | FMS-BOS (SELCAL digital) | |
| MORSE | | METEOSAT | |
| PACTOR I | | MPT-1327 | |
| PACTOR II ²⁾ | | PACKET RADIO 1200 baud, 9600 baud (AX.25) | |
| PACTOR III ²⁾ | | POCSAG | |
| PACKET RADIO | | ZVEI-VDEW (SELCAL digital) | |
| PICCOLO MK6 | | List of processed codes and transmission systems will be extended in the future. | |
| PICCOLO MK12 | | Environmental conditions of the R&S®GX400 sensor group | |
| POL-ARQ | | Operating | |
| PRESSFAX | | temperature range | 0 °C to +50 °C |
| PSK-31 | BPSK31, QPSK31 | | in line with DIN EN 60068-2-1, DIN EN 60068-2-2, MIL-STD-810E, method 501.3/502.3 |
| PSK-63 | BPSK63, QPSK63 | Storage | |
| RUM-FEC | ROU FEC | temperature range | -40 °C to +70 °C |
| SI-ARQ | | | in line with DIN EN 60068-2-1, DIN EN 60068-2-2, MIL-STD-810E, method 501.3/502.3 |
| SITOR-A | SITOR-ARQ | Humidity | in line with IEC 60068-2-30, operating, up to 95% relative humidity at +25 °C/-40 °C, non-condensing, 2 cycles |
| SITOR-B | SITOR-FEC | Vibration | |
| SPREAD11 | | 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 |
| SPREAD21 | | Random | in line with DIN IEC 60068-2-64, 10 Hz to 300 Hz, 1.2 g RMS, 5 minutes each axis |
| SPREAD51 | | Shock | in line with DIN EN 60068-2-27, MIL-STD-810E, method 516.4 procedure I, 40 g shock spectrum |
| SSTV | | Altitude (max.) | |
| SSTV Auto | | Operating | 2000 m, in line with DIN EN 61010-1 |
| SSTV Acorn PD 180YUV | | Storage | 4500 m |
| SSTV Acorn PD 290YUV | | 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⁾ |
| SSTV Martin 1&3 | | Electrical safety | CE, in line with EN 61010-1 |
| SSTV Martin 2&4 | | Dimensions (W × H × D) | 440 mm × 600 mm × 310 mm (17.32 in × 23.62 in × 12.20 in), 7 height units |
| SSTV Pasokon TV3 | | Weight | 22 kg to 51 kg (48.50 lb to 112.44 lb) (depending on number and type of installed VXI modules) |
| SSTV Pasokon TV5 | | | |
| SSTV Pasokon TV7 | | | |
| SSTV Robot 8BW | | | |
| 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&16BW | | | |
| SSTV Wraase SC-1 16&32BW | | | |
| SSTV Wraase SC-1 24BW | | | |
| SSTV Wraase SC-1 24&48 | | | |
| SSTV Wraase SC-1 48&96 | | | |
| SSTV Wraase SC-2 20&60 | | | |
| SSTV Wraase SC-2 120 | | | |
| SSTV Wraase SC-2 180 | | | |

²⁾ Available at the end of 2007.

³⁾ Electromagnetic susceptibility classified for use in industrial environments.



Ordering information

R&S®GX400 VXI modules

| | | |
|---|-------------|--------------|
| R&S®AMMOS Sensor Group (incl. mainframe, controller, platform software) | | |
| R&S®GX400 | | 4062.4340.04 |
| VXI DDC/DSP Board | R&S®GX401EM | 4062.2202.02 |
| VXI HF Wideband (4 MHz) | | |
| A/D Converter Board | R&S®GX401BP | 4061.7000.03 |
| HF Wideband Extension for R&S®GX401BP (20 MHz) | | |
| R&S®GX401BP-W | | 4061.7600.02 |
| VXI VHF/UHF Wideband (20 MHz) | | |
| A/D Converter Board | R&S®GX405BP | 4062.1764.02 |
| VXI HF Receiver (10 kHz to 30 MHz) | | |
| R&S®EM010 | | 4055.0008.03 |
| LF Option (300 Hz to 60 kHz) | | |
| R&S®EM010LF | | 4055.0014.02 |
| VXI VHF/UHF Digital Wideband Receiver (20 MHz to 3.6 GHz) | | |
| R&S®EM050 | | 4060.3501.02 |
| VXI Decoder PC HF (mandatory for R&S®GX401DC, R&S®GX401CL) | | |
| R&S®GX400VD | | 4057.0857.02 |
| R&S®GX400 firmware options | | |
| Control for R&S®EM010 and R&S®EM050 | | |
| VXI Receivers | R&S®GX403RX | 4057.1853.02 |
| HF and VHF/UHF Voice | R&S®GX403VO | 4057.1153.02 |

| | | |
|--|-------------|--------------|
| Demodulation and Decoding of Digital HF Communications | | |
| R&S®GX401DC | | 4057.1253.02 |
| HF Classification | R&S®GX401CL | 4057.1453.02 |
| Demodulation and Decoding of Digital VHF/UHF Communications | | |
| R&S®GX405DC | | 4057.1353.02 |
| VHF/UHF Classification | R&S®GX405CL | 4057.1553.02 |
| Control for R&S®EM010/R&S®GX401BP and R&S®EM050/R&S®GX405BP | | |
| VXI Receivers | R&S®GX403TW | 4057.2050.02 |
| Spectral HF and VHF/UHF Zoom | | |
| R&S®GX403SZ | | 4057.1953.02 |
| Detection of Conventional (Fixed Frequency) HF and VHF/UHF Signals | | |
| R&S®GX403DT | | 4057.1753.02 |
| Detection of Short-time HF and VHF/UHF Signals | | |
| R&S®GX403DS | | 4057.1653.02 |
| R&S®AMMOS decoder development Decoder Development Equipment for HF Decoders | | |
| R&S®GX400ID | | 4057.0457.02 |
| R&S®GX430 PC-based R&S®AMMOS Information on request | | |

Analyzers

R&S® GX420 AMREC Digital Recording and Replay System

New

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



4

Main features

- ◆ 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

¹⁾ CORBA® is a registered trademark of the Object Management Group, Inc. Trademark Information.

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.

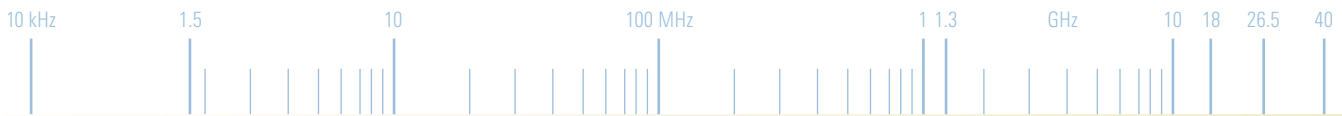
For standalone applications outside the R&S® AMMOS R&S® GX400 family, a Gigabit Ethernet interface with TCP/IP protocol is provided. The R&S® GX420 relies on a customized RAID for maximum performance.

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

Chapter
Overview

Type
Index

Main
Menu



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

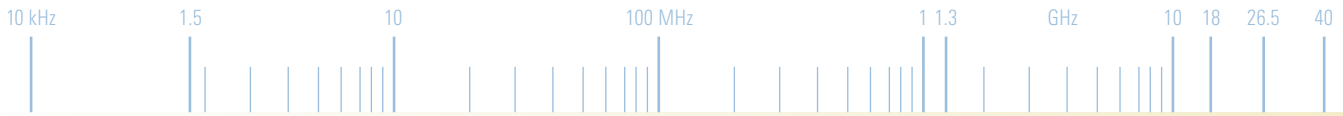
Specifications

| | | | |
|--|--|-------------------------------------|---|
| Max. sustained total data rate ¹⁾ | 100 Mbyte/s ²⁾ | Shock ¹⁾ | in line with EN 60068-2-27, MIL-STD-810E, 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, 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 min each axis |
| Bandwidth | | Vibration, random ¹⁾ | in line with IEC 60068-2-64 10 Hz to 300 Hz, 1.2 g RMS, 5 min each axis |
| 20 MHz | 30 min | Humidity | in line with IEC 60068-2-30, operating, up to 95% relative humidity at +25 °C to +40 °C, noncondensing, 2 cycles |
| 10 MHz | 1 h | Operating altitude | 2000 m, in line with EN 61010-1 |
| 5 MHz | 2 h | Storage altitude | 4500 m |
| 4 MHz | 2.5 h | Power supply | nominal, 100 V to 240 V AC, 50 Hz to 60 Hz |
| 1 MHz | 10 h | Power usage (max.) | R&S®GX420 |
| 250 kHz | 40 h | | AMREC controller 85 W |
| 20 kHz | 200 h | | R&S®GX420 hard disk 90 W |
| Recordings/replays in parallel: | | Chassis type | 19" rackmount, 5 height units (179 mm (7.05 in)) |
| Bandwidth | | Weight | 20 kg (44.09 lb) |
| 1 MHz to 20 MHz | 1 | Mate/unmate cycles | 50 mate/unmate cycles for each SCSI HD68 connector on the R&S®GX420 AMREC controller and R&S®GX420 hard disk in line with ANSI INCITS 336-2000 (Information Technology – SCSI Parallel Interface – 3) |
| 250 kHz | 8 | EMC/VDE | CE mark, in line with 89/336/EEC, EN 55022, class B, EN 61000-3-2, EN 61000-3-3, EN 55024 |
| 20 kHz | 20 | | |
| Loop mode | | | |
| Min. size | 1 Mbyte | | |
| Max. size | 230 Gbyte ³⁾ | | |
| Control interface | Gigabit Ethernet | | |
| Available data interfaces | RJ-45 Gigabit Ethernet, SFP optics, FPDP/serial interface in line with VITA 17.1 | | |
| Control protocol | CORBA® | | |
| Data protocol | FPDP/serial, TCP/IP | | |
| General data | | | |
| Operating | | | |
| temperature range | +5 °C to +50 °C in line with EN 60068-2-1, EN 60068-2-2, MIL-STD-810E, method 501.3/502.3 | | |
| Storage | | | |
| temperature range | –20 °C to +70 °C in line with EN 60068-2-1, EN 60068-2-2, MIL-STD-810E, method 501.3/502.3 | | |

¹⁾ Performance degradation possible in case of shock or vibration.

²⁾ 1 Mbyte \pm 1 \times 10⁶ bytes.

³⁾ 1200 Gbyte version available as of July 2007.



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

Ordering information

| | | |
|---|-------------|--------------|
| AMREC Digital Recording and Replay System | | |
| Ruggedized Hard Disk | R&S®GX420 | 4064.4525.02 |
| Subsystem | R&S®GX420HD | 4063.1768.02 |
| Digital I/O Channel TCP/IP | | |
| 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/IP | | |
| 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/IP | | |
| 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.

4

Chapter Overview

Type Index

Main Menu

Analyzers

R&S® GX410 AMLAB Signal Analysis Software

New

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



4

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

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 short-time, 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.

Chapter
Overview

Type
Index

Main
Menu

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.

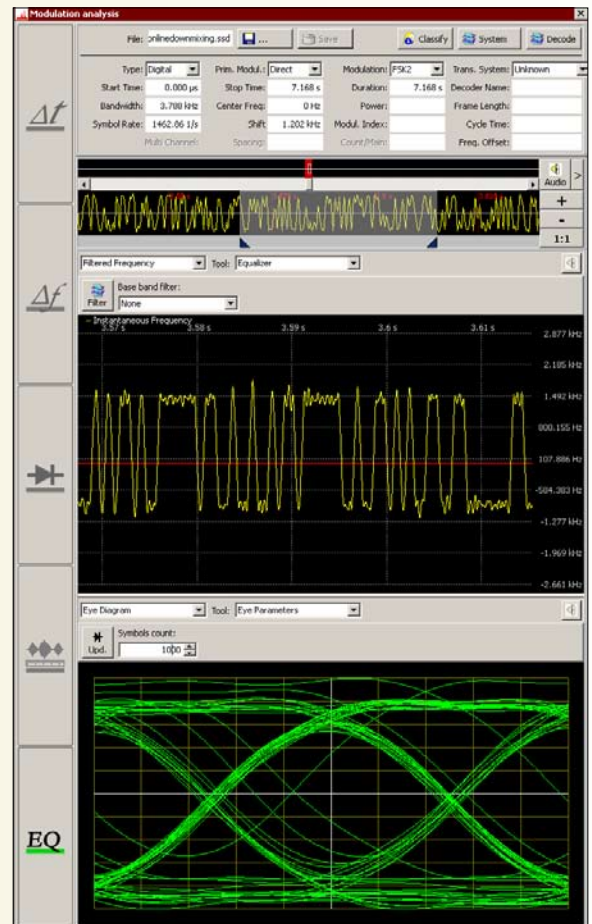
The interactive manual signal analysis guides the user through a sequence of five processing steps (time segmentation, frequency segmentation, analog demodulation, modulation analysis, timing recovery) to perform a successful manual analysis of the unknown signal.

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.

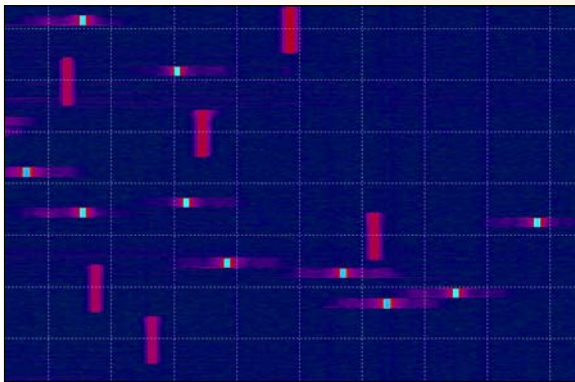
Modulation analysis allows the measurement of modulation parameters such as modulation type, symbol rate, frequency shift (for frequency-modulated signals), amplitude shift (for amplitude-modulated signals), tone/channel spacing (for multitone/multichannel signals).



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.

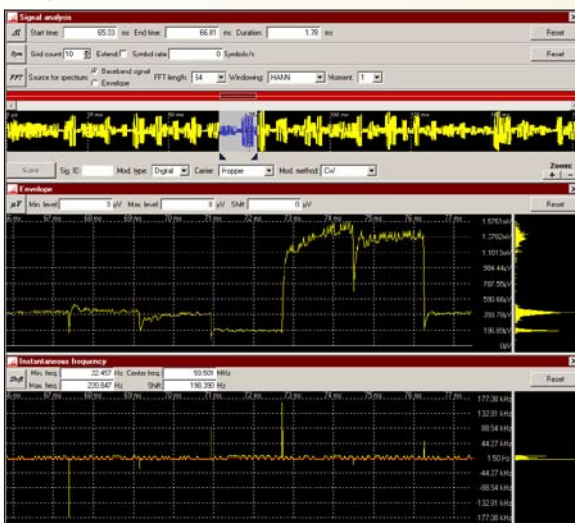
Analysis of short-time signals

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 an 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.



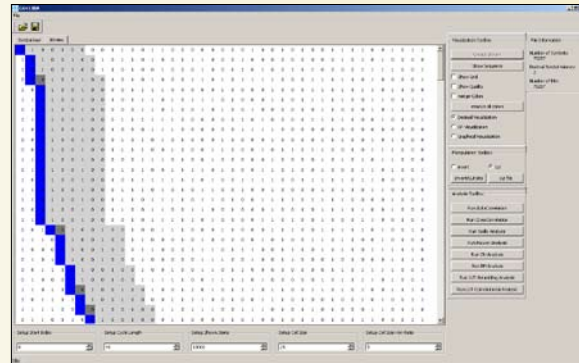
| ID | Start time | Stop time | Duration | Center freq. | Bandwidth | Level | Symbol rate | F |
|------|------------|------------|------------|--------------|------------|------------|-------------|---|
| 5800 | 277.467 ms | 279.24 ms | 1.773 ms | 54.025 MHz | 25.310 kHz | -60.5 dBm | | |
| 140 | 5801 | 279.422 ms | 281.195 ms | 1.773 ms | 44.500 MHz | 25.310 kHz | -62.4 dBm | |
| 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 | |
| 143 | 5804 | 285.287 ms | 287.06 ms | 1.773 ms | 58.150 MHz | 25.310 kHz | -56.4 dBm | |
| 144 | 5805 | 287.242 ms | 289.015 ms | 1.773 ms | 52.400 MHz | 25.310 kHz | -52.3 dBm | |
| 146 | 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 | |
| 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 | |
| 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 | |

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.



Bit stream analysis

The demodulated symbol stream/bit stream is displayed in different graphical representations (e.g. hex or pulse-length 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.

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).



4

Specifications

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®AMMOS 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 capabilities

| | |
|---|--------------------------|
| FFT resolution for offline spectrogram | 256 points to 32k points |
| FFT resolution for modulation analysis spectrum | 64 points to 256k points |

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 |

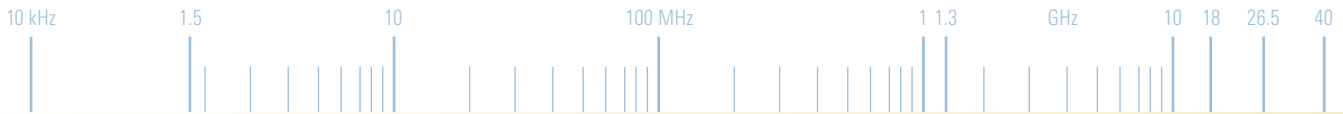
Environment (PC workstation)

| | |
|-----------------------------|--------|
| Upper operating temperature | +30 °C |
| Lower operating temperature | +5 °C |
| Power consumption | 700 W |

Chapter Overview

Type Index

Main Menu



Ordering information

AMLAB Signal Analysis Software

| | | |
|--|-------------|--------------|
| (R&S®GX410 application base software) ¹⁾ | R&S®GX410 | 4063.9681.02 |
| AMLAB Workstation ²⁾ | R&S®GX410WS | 4063.9869.02 |
| AMREC and HF/VHF/UHF Wideband Receiver Control ³⁾ | R&S®GX410AR | 4063.9930.02 |
| D/A Converter Board and Control Software | R&S®GX410DA | 4063.9969.02 |
| Control for HF VXI Wideband Receivers and FPDP Interface Module ⁴⁾ | R&S®GX410HF | 4063.0013.02 |
| Control for VHF/UHF VXI Wideband Receivers and FPDP Interface Module ⁴⁾ | R&S®GX410VU | 4063.0071.02 |

| | | |
|--|-------------|--------------|
| Technical and Statistical Analysis of Short-Time Signals | R&S®GX410DS | 4063.0107.02 |
| Classification of Modulation Type (modulation analysis) | R&S®GX413MA | 4069.4317.02 |
| System Recognition (code classification) ⁵⁾ | R&S®GX413SR | 4069.4498.02 |
| Demodulation of Signals | R&S®GX413DM | 4069.4430.02 |
| Decoding of Signals and Symbol Streams ⁶⁾ | R&S®GX413DC | 4069.4552.02 |
| Bit Stream Analysis ⁶⁾ | R&S®GX413BA | 4069.4375.02 |

⁵⁾ Requires R&S®GX413MA.

⁶⁾ Requires R&S®GX413DM.

¹⁾ Requires R&S®GX410WS.

²⁾ Mandatory for R&S®GX410.

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

⁴⁾ Requires R&S®GX400 sensor group.