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## R&S®GX401BP HF Wideband ADC VXI Board

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

The R&S®GX401BP is the HF wideband analog-to-digital converter of the R&S®AMMOS R&S®GX400 family. In combination with the R&S®EM010 VXI HF receiver, it permits the wideband interception of signals in the HF band and subsequent signal processing.

- ◆ 16/32 VXI slave, size C
- ◆ Wideband analog IF (R&S®EM010) input path
- ◆ Wideband analog direct input path
- ◆ Realtime bandwidth 1 MHz, 4 MHz, 10 MHz<sup>1)</sup>, and 20 MHz<sup>1)</sup>
- ◆ 14 bits at 76.8 Msample/s analog-to-digital converter
- ◆ Digital filtering and decimation
- ◆ Wideband IF signal delay buffer
- ◆ R&S®AMMOS interface for digital IF recording and replay
- ◆ Simultaneous live and delayed IF signals with adjustable delay time

<sup>1)</sup> With the R&S®GX401BP-W option for bandwidth extension up to 20 MHz.



# ROHDE & SCHWARZ

## Introduction

When combined, the R&S®GX401BP module and the R&S®EM010 VXI HF receiver enable wideband interception in the HF spectrum and provide the frontend requirements for the attached complex signal processing circuitry. The high-performance analog-to-digital converter with its additional analog signal preprocessing and phase-linear digital wideband filtering provides excellent HF performance characteristics.

The R&S®GX401BP is a member of the R&S®AMMOS R&S®GX400 family. To enlarge the covered bandwidth, several pairs of the R&S®EM010 and R&S®GX401BP may be used in parallel. In combination with the fully software-configurable R&S®AMMOS R&S®GX401EM VXI DDC/DSP board, the R&S®AMMOS® R&S®GX400 family provides an extremely flexible and comprehensive wideband monitoring platform, capable of handling the most demanding modern signal scenarios.

## Overview

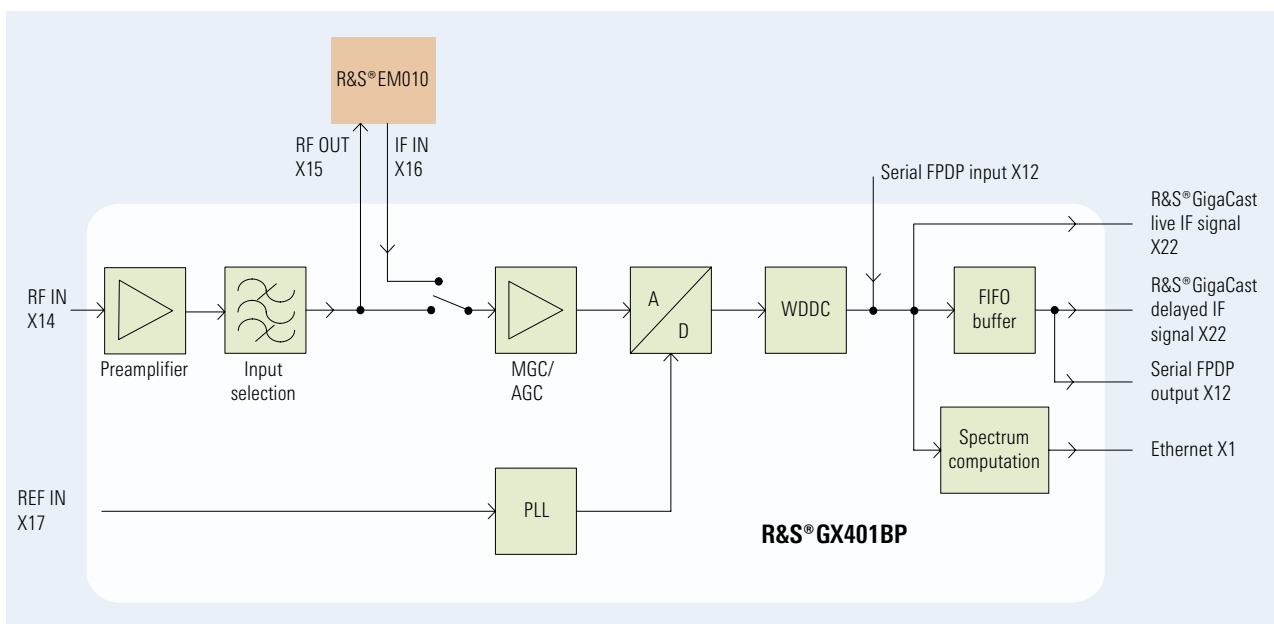
- ◆ In combination with the R&S®EM010 VXI HF receiver, the R&S®GX401BP fulfills the requirements for wideband HF signal processing
- ◆ The R&S®GX401BP supports the modular R&S®AMMOS sensor concept; flexible configurations for a large range of applications are possible
- ◆ The R&S®GX401BP features a wideband analog IF input for the R&S®EM010 VXI HF receiver, serving as a frequency converter
- ◆ The ADC sampling rate can be synchronized to an external frequency reference; it allows the synchronization of several R&S®GX401BP boards to the external reference clock provided by the R&S®EM010 VXI HF receiver
- ◆ The R&S®GX401BP offers an optical R&S®AMMOS FPDP/serial digital data interface for lossless digital IF signal recording and replay
- ◆ The R&S®GX401BP provides the live and delayed digital IF signal in parallel; the delayed signal is generated by a wideband FIFO buffer with adjustable depth

- ◆ The R&S®GX401BP uses TigerSHARC® (Super Harvard Architecture Computer) DSPs from Analog Devices in combination with the Rohde & Schwarz wideband DDC ASIC for digital signal processing
- ◆ The R&S®GX401BP features wideband FFT spectrum computation for a high-resolution IF panorama display

## System integration

The R&S®GX401BP is fully integrated in the R&S®AMMOS R&S®GX400 family. The modular hardware and software concept of R&S®AMMOS allows flexible application- and user-specific configurations, which provide narrowband and wideband signal monitoring throughout the entire HF to VHF/UHF range within one single R&S®GX400 sensor group.

The R&S®GX400 sensor group is fully remote-controlled via CORBA and TCP/IP connections by the R&S®AMMOS IT software.



## Specifications

Frequency	
Frequency range	100 kHz to 30 MHz via direct path 3 MHz to 30 MHz via the R&S®EM010 path
Frequency accuracy	$1.5 \times 10^{-6}$
Aging	$1.0 \times 10^{-6}$ /year
External frequency synchronization	SMA female connector, 50 $\Omega$ (X17) 10 MHz 0 dBm $\pm$ 10 dB
Sampling rate	51.2 MHz bandpass undersampling for 1 MHz bandwidth 76.8 MHz Nyquist sampling for up to 4 MHz (20 MHz <sup>1)</sup> bandwidth
Antenna input	SMA female connector, 50 $\Omega$ (X14), VSWR <2.0 at preselector bandpass, 50 $\Omega$ at RF <sub>out</sub> , 3 MHz to 30 MHz VSWR <2.5 at preselector activated except for highpass 2 MHz, direct path VSWR <2.9, typ. 2.5 at R&S®EM010 path, preselection activated
Input selection	highpass 2 MHz lowpass filters 3 MHz, 6 MHz bandpass filters 3 MHz to 30 MHz
Oscillator reradiation	$\leq -90$ dBm, typ. 120 dBm
Overvoltage protection	overvoltage protection of antenna input $\leq 50$ V EMF ( $Z_{in} = 50 \Omega$ )
RF output	SMA female connector, 50 $\Omega$ (X15)
IF input	SMA female connector, 50 $\Omega$ (X16)
IF input bandwidth	1 MHz at R&S®EM010 path 4 MHz, 10 MHz <sup>1)</sup> , 20 MHz <sup>1)</sup> at direct path
Gain control	
Mode	automatic (AGC) and manual (MGC) gain control
Attenuation	max. 45 dB manual or automatic, switchable
Tuner mode	normal low distortion: with RF attenuator low noise: with preamplifier
ADC	
Resolution	14 bits at 76.8 MHz and 51.2 MHz sampling rate
Oscillator phase noise	$< -140$ dBc (1 Hz) at 10 kHz offset
Nonlinearities, sensitivity	
Direct path	4 MHz, 10 MHz <sup>1)</sup> , 20 MHz <sup>1)</sup> bandwidth
2nd order intercept point	$\geq +40$ dBm, typ. +44 dBm
3rd order intercept point	$\geq +30$ dBm, typ. +35 dBm
Noise figure	$\leq 15$ dB, typ. 12 dB $\leq 11$ dB, typ. 8 dB, with preamplifier

<sup>1)</sup> With the R&S®GX401BP-W option for bandwidth extension up to 20 MHz.

<sup>2)</sup> With R&S®EM010 EFEK mod. index 4.17 or higher.

Internal spurious	$\leq -120$ dBm, $f > 300$ kHz, referenced to antenna, except for two spurious $\leq -100$ dBm, $f > 300$ kHz, referenced to antenna, max. two spurious
Direct path	1 MHz bandwidth, at 100 kHz to 3 MHz
2nd order intercept point	$\geq +40$ dBm, $\geq +80$ dBm at both intermodulating signals $\geq 5$ MHz
3rd order intercept point, in-band	$\geq +30$ dBm, typ. +35 dBm at $f \geq 1$ MHz $\geq +28$ dBm at $f < 1$ MHz
R&S®EM010 path, with the R&S®EM010 <sup>2)</sup>	1 MHz bandwidth, at 3 MHz to 30 MHz
2nd order intercept point	$\geq +80$ dBm, typ. 100 dBm with preselector, without preamplifier $\geq +75$ dBm, typ. 90 dBm with preselector, with preamplifier
3rd order intercept point, out-of-band $\Delta_{f1} = 1$ MHz, $\Delta_{f2} = 2$ MHz	$\geq +40$ dBm
3rd order intercept point, in-band	$\geq +28$ dBm, typ. 31 dBm $\geq +17$ dBm, typ. 21 dBm, with preamplifier
Noise figure	$\leq 23$ dB, typ. 19 dB, without preamplifier $\leq 13$ dB, typ. 9 dB, with preamplifier
Internal spurious	$\leq -100$ dBm, referenced to antenna, $\leq -120$ dBm, referenced to antenna, except for two spurious
Digital signal processing	
DSP	ADSP TS101 TigerSHARC® 1.44 GFLOPS 32 bits at 240 Mcycle/s 6144 kbit on-chip memory
DDC	Rohde & Schwarz WDDC ASIC
Spectral computation	
FFT length	64 to 32k FFT (powers of two)
Max. frequency resolution	approx. 40 Hz at 1 MHz bandwidth
Max. spectrum output rate	300/s at 64k to 2k FFT length 20/s at 4k to 32k FFT length
Display modes	averaging, min hold, peak hold, min hold short time, peak hold short time, difference
Wideband signal delay buffer	
Max. signal delay time	200 s at 1 MHz bandwidth 50 s at 4 MHz bandwidth 20 s at 10 MHz <sup>1)</sup> bandwidth 10 s at 20 MHz <sup>1)</sup> bandwidth
Control interface	R&S® AMMOS VXI
Data interface	SFP optics FPDP/serial interface in line with VITA 17.1 (X12) for digital IF data recording and replay R&S® GigaCast interface (X22) RJ-45 Ethernet 100 Mbit/s (X1)

Displays	FAIL LED ACCE VXI bus access LED PWR LED
VXI module type	16/32 VXI slave, shielded, single slot, size C VXI module
Weight	2.3 kg (5.07 lb)
Power supply	+12 V, 1 A (max.) -12 V, 0.25 A (max.) +5 V, 5 A (max.)
Power consumption	40 W (max.)
Environmental data	
Operating temperature range	0 °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	-40 °C to +70 °C in line with EN 60068-2-1, EN 60068-2-2, MIL-STD-810E, method 501.3/502.3

Shock	EN 60068-2-27, MIL-STD-810E, method 516.4, procedure I, 40 g shock spectrum
Vibration, sinusoidal	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
Vibration, random	IEC 60068-2-64 10 Hz to 300 Hz, 1.2 g (rms), 5 min each axis
Humidity	IEC 60068-2-30, operating, up to 95 % relative humidity at +25 °C to +40 °C, noncondensing, 2 cycles
Operating altitude	2000 m, EN 61010-1
Storage altitude	4500 m
EMC/VDE	CE mark, in line with 89/336/EEC, EN 55022, class B, EN 61000-3-2, EN 61000-3-3, EN 55024

If not explicitly mentioned, parameters are specified for tuner mode "normal" without attenuation or preamplification.

## Ordering information

Designation	Type	Order No.
HF Wideband ADC VXI Board (4 MHz)	R&S®GX401BP	4061.7000.03
HF Wideband Extension for R&S®GX401BP (20 MHz)	R&S®GX401BP-W	4061.7600.02



More information at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
 (search terms: GX401BP, AMMOS)



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