HF Receiver EM010

Digital VXI-based HF receiver with broadband IF output

For a number of years Rohde & Schwarz has been producing digital receivers for search and monitoring applications. HF Receiver EM010 is the first receiver based on the VXI standard for use as a plug-in in medium-sized to large radio reconnaissance systems with multiple receiving channels.

Digital receivers with a future

Digital search and monitoring receivers have a long tradition at Rohde & Schwarz. Models EK895/EK896 have a proven record as radio-communications and monitoring receivers in professional applications. Thanks to digital signal processing, the receivers are open-ended for new modulation modes and transmission methods. The A/D conversion meets the most stringent requirements, while the linearity and dynamic range of the detected signals are retained in full.

Digital HF Receiver EM010 based on the VXI standard is a brand-new development, a unique combination of linearity, dynamic range and high functionality within compact dimensions:

- SOI typ. 95 dBm
- TOI typ. 40 dBm
- Phase noise better than 
  \[-110 \text{ dBC/Hz (1 kHz offset)}\]
- Sensitivity better than \[-113 \text{ dBm}\] for SSB (2.75 kHz bandwidth) and 10 dB SINAD

EM010 is designed as a plug-in for use in extensive radio reconnaissance systems where multiple channels are monitored simultaneously (FIG).

The VXI standard (VME bus extension for instrumentation; VME: versa modular Eurocard IEEE 1014) allows extremely flexible combination of digital receivers with further signal processing components, e.g., DSP Board GX400DP from Rohde & Schwarz.

Narrowband or broadband?

Radio reconnaissance is increasingly confronted with extremely complex signal scenarios that make great demands on the flexibility of receiving systems. Given the enormous variety of signals encountered, the following question is more relevant than ever: How can I detect emissions accurately and maintain high signal quality without sacrifices in subsequent demodulation and analysis? In other words, receiver filters should be as narrowband as possible and as broadband as necessary.

For instance, weak signals travelling in a disturbed environment or near strong fields must be detected and processed in narrow bands. HF Receiver EM010 is ideal for such critical applications.

The receiver’s digital IF filters afford virtually unlimited adaptability to complex signal scenarios. Functions like gain control, noise blanking or squelch are more precise and reproducible than ever before thanks to fully digital signal processing.

These characteristics make EM010 the ideal narrowband receiver for radio scenarios in the shortwave range.

The requirements for the detection of FH (frequency hopping) and DSSS (direct...
signal spread spectrum) are completely different, calling for broadband receivers.

Thanks to its versatile digital technology, EM010 is best suited for this purpose too. It comes with a 4 MHz broadband output in addition to an AF output and a narrowband IF output. Used together with another VXI module, a broadband add-on board with A/D converter and an adequate number of digital downconverters (DDCs), EM010 becomes a powerful broadband, digital multichannel receiver. In this case the DDCs serve as digital handoff receivers.

Numerous applications

Fitted with the broadband add-on board, EM010 covers a variety of additional applications:

• Intermediate storage of broadband signals
• Signal-adapted detection
• Visualization of broadband spectrum versus time
• Monitoring of broadband frequency occupancy
• Implementation of filters for time, level, frequency and direction (in combination with direction finders)
• Statistics for level/frequency or dwell time/frequency and other user-defined applications

HF Receiver EM010 with its digital versatility opens up the way to processing new and complex signal transmission methods in future communications intelligence.

Theodor Fokken

The receiver's most important features

Operating modes
• Fixed frequency
• Memory scan
• Frequency scan
• Replay (IF/AF)
• Test

Data output
• Baseband signal (I and Q) in digital form, maximum bandwidth 20 kHz
• IF analog (455 kHz)
• IF analog (38 kHz to 58 kHz or 40.048 MHz ±2 MHz)
• DAT recorder connector AES/EBU
• AF digital
• AF analog (line 600 Ω and headphones)

Demodulation in fixed frequency mode
• AM
• FM
• SSB
• CW

IF bandwidth is selectable in 70 steps from 52 Hz to 20 kHz.

BFO can be set in 1 Hz steps in the frequency range from ±10 kHz.

Squelch selection between language and level. The latter can be set within the limits from −20 dBµV to 100 dBµV in 1 dB steps.

Preamplifier can be switched on and off.

Gain control either automatic (AGC) or manual (MGC).

Two notch filters can be selected independently of each other.

Memory scan allows setup of all relevant parameters per channel:
• Memory location
• Frequency
• Demodulation mode
• Bandwidth
• BFO frequency
• Preamplifier
• AGC/MGC settings
• Squelch parameters

In replay mode recorded IF data can be fed back via data interfaces, e.g. to process them with a different bandwidth or demodulation mode.

The test mode carries out an extensive selftest of the receiver. This is possible either full-length or abbreviated, but the abbreviated version only signals go or nogo.

Condensed data EM010

Frequency range
1.5 MHz to 30 MHz (10 kHz to 1.5 MHz with limited specs)

Tuning time
<10 ms (bandwidth 20 kHz)

SOI typ. 95 dBm
TOI typ. 40 dBm
Noise figure typ. 9 dB (with preamplifier)

Digital IF filters
70 bandwidths from 52 Hz to 20 kHz

Reader service card 168/08