

HF Transceiver Family



R&S® XK 2000

Voice Processing Unit (VPU) R&S® GN 2130

Plug-in vocoder module with integrated crypto processor

- ◆ Digital encryption with strong crypto algorithm
- ◆ Excellent speech quality and talker recognition due to VPL vocoder implementation
- ◆ Plain override provided
- ◆ Reliable transmission of digital voice and fast synchronization by means of OFDM multicarrier modem
- ◆ FEC-protected transmission ensuring high reliability even on poor HF links
- ◆ Retrofit of existing R&S® XK 2000 transceivers possible
- ◆ R&S® GN 2110 VPU functions included



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At a glance

The R&S®GN 2130 is a plug-in vocoder module with integrated crypto processor for R&S®XK 2000 HF equipment. It can be used together with the R&S®XK 2100 150 W transceivers, the R&S®GX 2900 excitors, the R&S®EK 2000 receivers or R&S®GP 2000 remote control processors

Vocoder

The R&S®GN 2130 vocoder/modem unit allows digital voice to be transmitted with transceivers of the HF Transceiver Family R&S®XK 2000. The option considerably enhances the quality of voice links, and, above all, provides digital ciphering of voice signals.

The voice lock predict (VLP) coder is based on a high-quality, low bit-rate speech coding algorithm. It offers high speech quality at a data rate of 2400 bps. In formal listening tests, the VLP coder has proven to be clearly superior to similar LPC vocoders using binary voicing decision and no mixed excitation.

The R&S®GN 2130 was developed to meet the stringent requirements of Federal Standard FS 1016. The development focus is on the following four areas:

- ◆ Intelligibility
- ◆ Voice quality
- ◆ Talker recognizability
- ◆ Communicability

VLP is robust in difficult background noise environments such as those frequently encountered in commercial and military communications systems. In DoD testing, VLP tested well under the acoustic noise conditions of HMMWV, office, AWACS, automobile, MCE, field shelter, and quiet. The MOS (mean opinion score) measurement for VLP during testing was 3.3 out of 5.0 in a noise-free environment. VLP also earned a DRT (diagnostic rhyme test) score of 92.3.

VLP also includes bit error correction. It has been tested with error ratios of 1% bit error ratio (random errors) and 0.5% block error ratio (frame erasures).

HF modem

The R&S®GN 2130 already contains an HF modem tailored to the needs of digital voice communications on HF channels. The unit thus operates independently of the transceiver's R&S®GM 2200 modem option.

Modem implementation is based on orthogonal frequency division multiplexing. OFDM is a multicarrier approach, where many tones are used in parallel to transmit the information. The fundamental concept behind OFDM is to extend the length of a channel symbol such that the time delay spread of the signal becomes a small fraction of the total symbol length.

At the receiver, the beginning of the symbol, which is referred to as the guard interval, is ignored because it contains the symbol transitions of all the multipath components. Only the rest of the symbol is used to demodulate the transmitted data. By removing the guard interval, intersymbol interference is reduced to a minimum, which allows the transmitted information to be retrieved at low computational cost.



Voice encryption

During modem initialization, each tone is assigned a signal point constellation, i.e. 4QAM, 16QAM, 32QAM or 64QAM depending on the required bit ratio. The assigned constellation determines the possible set of amplitudes and phases that can be used during data transmission to modulate the appropriate tone.

The COMSEC part of the R&S® GN 2130 is based on a strong cipher algorithm that uses key lengths of up to 256 bits (approx. 10^{77} variants). Assuming even uninterrupted transmission, the same bit sequence would thus not be repeated for about 2×10^9 years. The algorithm can be adapted to user requirements (option). With this concept, each user can benefit from a unique user key set. The keys required for ciphering are stored inside the module but can be distributed by appropriate hardware (PC via serial interface). A stored key set contains 4096 independent keys that can be selected from the key set menu of the R&S® XK 2000 MMI.

Plain override

The R&S® GN 2130 supports plain override. This feature allows reception of analog voice on the currently selected channel with the transceiver set to digital operation. This avoids missing analog calls while working in digital voice mode. To answer an analog call, the operator simply has to temporarily switch to analog (SSB) mode.

Specifications

Vocoder specifications	
LPC filter	The LPC coefficients are quantized using vector quantization (VQ) of the line spectral frequencies (LSFs). A perceptual weighting function is used in the LSF search. The VQ codebook uses 25 bits to represent the LSFs.
Pitch	quantized to 7 bits
Gain	The two gain values for the speech frame are converted to a log scale in dB and quantized.
Bandpass voicing	quantized to 0 or 1 in each band
Fourier magnitude estimation and quantization	The 10 Fourier magnitudes are quantized using an 8-bit vector quantizer.

Modem specifications	
Bit rate	2400 bps
Bandwidth	2.7 kHz
Modulation	4QAM, 16QAM, 32QAM, 64QAM
Symbol rate	24.5
FTT frequency resolution	56.25 ms
Number of carriers	48
Guard interval	4.73 ms

Ordering information

Designation	Type	Order number
Voice Processing Unit	R&S® GN 2130	6117.4549.02



More information at
www.rohde-schwarz.com
(search term: GN2130)



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