PROFESSIONAL RECEIVER OF HF FREQUENCY BAND WITH DIGITAL SIGNAL PROCESSING “VOSKHOD”

Receiver “Voskhod” is designed in order to substitute stock-produced R-324K and is operated as a part of radio receiving centers or autonomously for receiving and demodulation of wide range of signals in the frequency band from 1.0 to 30.0 MHz.

Receiver has computer control via USB or RS-232 interface. Information from receiver output is presented in form of bit succession of demodulated signal of signal quadrature samples (via USB port only). Receiver also possesses traditional LF and CW ports for connecting data terminal equipment and play back of spoken information.

Receiver is equipped with control board. Control panel has color LCD for simplifying receiver control using functions menu and provides additionally spectrum indication of received signal.

Receiver is built on the scheme of direct signal transform with digitizing by 16-resolution ADC and DDC-converting into LF signal with following processing by DSP processor with floating arithmetic.

Direct digital transform and absence of analogue converting increased sufficiently phase stability, real noise immunity of receiver due to absence of side receiving channels of $\pm mf_c$ and $\pm mf_{rr}$ type, IF channel, image channel, and also increased stability and parameter repeatability. Absence of analogue heterodyne simplified measures for providing electromagnetic compatibility of receiver with other radio devices.

Built-in control signal calibrator together with spectrum analyzer makes it possible to use receiver “Voskhod” for measuring signal parameters and interferences.

Presence of matching devices “75 Ohm – 50 Ohm” and “200 Ohm – 50 Ohm” extends possibilities during receiver operation as a part of receiving complexes with different HF-circuits of antenna feeder systems.

Due to implementation of narrowband tunable preselector with splitting into 192 discrete filters with bandwidth not more than 5 % relative adjustment frequency, efficient AGC and MGC enabled operation of the receiver with efficient antennas of receiving centers.

Power supply of receiver can be provided either from vehicle power supply system or from industrial network of 220 V, 50 Hz using standard power source.

External view of “Voskhod” receiver

COMPOSITION

- Unit of narrowband tunable preselector
- Unit of received signal amplifying
- Unit of DSP-circuit and controller
- Reference frequency generating unit
- Device for generating output signals
- Unit of secondary power supply
- Control board with LCD indicator
- Housing with mains supply source
- Matching device with lines of 200 Ohm (or 75 Ohm)
- Set of connecting cables
- Complete set of operating and maintenance documentation
- CD with receiver remote control program library

TECHNICAL PARAMETERS

- Operating frequency band — **1.0 … 30.0 MHz**
- Antenna input — **Z_{in}= 50 Ohm**
- $SWR_{н}$ of antenna input — **< 1.8**
- Sensitivity (SNR = 10 dB, BW = 3 kHz) — **< 0.35 μV**
- Динамический диапазон по компрессии выходного сигнала на 1 дБ под действием односигнальных помех при отстройке:
  - by 50 kHz — **126 dB**
  - by 5 % — **132 dB**
- Dynamic range by third order intermodulation — **> 90 dB**
- Radio circuit bandpass (by level – 3 dB) — **$0.05 \cdot f_o$**
- Filter bandpass (is set with 1 Hz step) — **0.03 … 12 kHz**
- Rectangularity of amplitude-frequency characteristic RFG — **1.1 … 1.5**
- Selectivity by adjacent channel — **> 85 dB**
- Attenuation adjustment of input attenuator — **0 … 45 dB, step 3 dB**
- AGC tuning depth — **120 dB**
- Time constant of AGC:
  - «charge» — **1 … 100 ms**
  - «discharge» — **0.1/0.5/1/3/10 s**
- Resolution of digital ADC circuit — **16 bit**
- Suppression of side receiving channels — **> 90 dB**
- Relative frequency instability — **$0.5 \cdot 10^{-7}$**
- Time of frequency tuning — **0.5 ms (max)**
- Frequency tuning step — **1 Hz**
- Spectral density of heterodyne noise (1 kHz tuning) — **≤ –120 dBs/Hz**
- Estimation of received signal level quality — in **dBμV**
- Signal demodulation — **AM, ASK, FSK2, CW, PSK2, USB, LSB**
- Adjustment of tonal heterodyne frequency (BFO) — **±3 kHz, step 10 Hz**
- Volume control of LF-signal — **0 … 40 dB, step 1 dB**
- Output parameters:
  - LF-output for connecting headphones — **50 Ohm, 1 V**
  - LF-output for connecting loudspeaker 2 W — **4 Ohm, 3 V**
  - CW-output 1 — **TTL level**
  - CW-output 2 — **± 30 V**
  - IF-output — **0 … 500 kHz, 200 mV**
- Remote control — **USB, RS232**
- Sampling rate of I/Q-samples — **11.025 (22.050) kHz**
- Number of displayed spectrum components — **256**
- Consumed power — not more **20 W**
- Overall dimension (1/2 crate 3U) — **140 × 460 × 270 mm**

«Scientific-Engineering Center of Radio Engineering Systems of Applied Radioelectronics of Academy of Science» Ltd.
✉ 7/8, Zaschitnikov Ukrainy sq, Kharkov, Ukraine, 61001
☎ +38 (057) 732-25-53, fax +38 (057) 732-68-63,
E-mail: ntcrts@kharkiv.com , www.ntcrts.com