

FEATURES OF IMPLEMENTATION OF MODERN IONOSONDE BASED ON USRP HARDWARE FOR THE INSTITUTE OF IONOSPHERE SITE

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Software Defined Radio (SDR) defines a integration of hardware and software technologies where some or all of the radio's operating functions are implemented through modifiable software or firmware operating on programmable processing technologies.

The Universal Software Radio Peripheral (USRP) is a variety of SDR and designed to allow general purpose computers (PC) to function as high bandwidth software radios. The basic design philosophy behind the USRP has been to do all of the waveform-specific processing, like modulation and demodulation, on the host PC. All of the high-speed general purpose operations like digital up and down conversion, decimation and interpolation are done on the field-programmable gate array of USRP.

Modern ionosonde was developed by The Institute of Radio Astronomy of the National Academy of Sciences of Ukraine (IRA NASU) and consists of Ettus Research USRP N200, HF Transeiver ICOM IC-718 (use as power amplifier only), oscillator OCXO 131-1002 10 MHz, LFRX/LFTX Daughter boards and RF Switch ZX80-DR230+. The report will show a detailed description of the structural scheme of the ionosonde, its operation scheme, choice and justification of the configuration.

This ionosonde planned to mount at the site of the Institute of the ionosphere (Zmiiv) with modernization. This applies primarily to pairing the antennas.

The existing antenna-feeder device of the ionospheric station consists of two receiving and two transmitting rhombic antennas with linear polarization. In both receiving and transmitting antennas the operating frequency band 1-20 MHz is divided into two subbands: 1-6 MHz ("the large rhombus") and 5-20 MHz ("the small rhombus"). An electromechanical switch connects the antennas of the required subband.

The antennas of the Institute have a symmetrical input with a wave impedance 150 ohm but the output impedance of the ionosonde is 50 ohm (unbalanced output). A two matching devices are proposed to be made on the windom baluns: low power, on two ferrite rings for the receiver; more powerful, on the air-core transformer for the transmitter. For the initial launch it is intended to use only a pair of antennas.

The original software of ionosonde is proprietary and belongs to IRA NASU. The source code can be changed for improve the quality of ionograms, if it will be such a possibility. In this way can used all the antennas, but it is require additional to develop a software-controlled switch.

Also, it is possible to use a more powerful amplifier (Icom IC-PW1 for example) and use more powerful RF Switch in such a case.

References:

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