# AIR-ROUTE RADAR COMPLEX "SOPKA-2"

**S-band Air-Route Radar Complex (ARRC) "Sopka-2"** is designed for provision the air traffic control and airspace monitoring systems with radar data.

In addition, the ARRC has a separate channel for obtaining meteorological information similar to the one obtained from the purpose-designed meteorological radars.

**ARRC "Sopka-2"** ensures detection of air objects, measurements of range, azimuth and elevation angle (altitude) of targets, identification of state-belonging; receipt of additional information via MSSR channel transmitted by on-board transponders, multiplexing of radar data obtained from the PSR and SSR, as well as output of the processed information to the data consumers via specified protocols onto displaying means.

At the request of the Customer, the ARRC can be equipped with ADS-B equipment.

**PSR antenna device** is a phased antenna array with beam frequency steering in vertical plane; the MSSR antenna is a monopulse antenna array installed at the rear side of the PSR antenna (in "back-to-back" position). Azimuthal rotation is ensured by a gearless motor drive.

**PSR transmitting device** is a solid-state device built on the principle of coherent power summation of 64 modules equipped with air cooling system, with average radiated power at the transmitter output of 4 kW at least. Amplitude-phase stability of the transmitter provides local clutter suppression ratio of 50 dB at least . The transmitter operates in "soft failure" mode. Replacement of faulty modules can be performed in the course of operation of the radar without switching the radiation off.

**PSR receiving device** is a multichannel device consisting of 4 main and 4 standby channels (100% redundancy). Each channel has a single-frequency conversion with a noise factor of 3 dB at most.

**Dynamic range of the receiving device** is 60 dB at least at the intermediate frequency output . Each channel is implemented as a separate integrated unit (module). The failure of one or several receiving channels will not lead to PSR failure, as in this case, the system will automatically switch to the standby set . Replacement of faulty receiving modules can be done in the course of the PSR operation.

**Multichannel equipment** for digital signal processing is based on digital signal processors and programmable logic devices (PLD). Analog-to-digital conversion of the received signal is performed at an intermediate frequency with formation of amplitude-frequency response by means of digital filters that ensure high identity of channel characteristics and their phase stability. Intra-period signal processing (compression, suppression of asynchronous pulse noise) is performed by the PLDs.

**Inter-period processing** (moving target indication, adaptation to wind speed, type and parameters of clutters) is performed by signal processors. The primary information processor performs assembling of packets and calculation of coordinates of air objects, as well as direction finding of jammers and generation of clutter maps.

**Secondary information processor** performs trajectory processing and matching of the PSR data with the MSSR data. Tracking of trajectories of air objects is done using the information obtained from any channel (PSR or MSSR).

**Built-in monopulse secondary radar** "Lira-VM" complies with the ICAO standards (Annex 10) and state standards of the Russian Federation and provides determination of coordinates and receipt of additional (flight) information via the MSSR channel, transmitted by on-board transponders of RBS standard , including in "S" mode.

**Built-in control system provides** automatic surveillance in all modes ensuring detection and tracking of air objects equipped with corresponding transponders.

**The distinctive feature of the MSSR** equipment design is the use of fully-digital redundant equipment for response signal processing with encoding at intermediate frequency and digital phase detection.

**Control of switching on/off and interrogation mode sequencing** is performed automatically using the data from the secondary information processor.

The automated control and monitoring system provides diagnostics of the radar equipment for detection and localization of malfunctions and failures down to the level of a line-replaceable unit and automatic or manual reconfiguration of the system according to the results of the radar operation monitoring, as well as remote control of switching on/off and operation mode.

## BASIC SPECIFICATIONS

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|---|---|
| Coverage zone: | |
| » in range, km (PSR/MSSR) | 370 / 450 |
| » in azimuth, deg | 360 |
| » in elevation, deg | 45 |
| » in altitude, km | 35 |
| Accuracy of coordinate determination (RMSE): | |
| PSR: | |
| » in range, m | 50 |
| » in azimuth, min | 10 |
| » in elevation, arc min | 15 |
| MSSR: | |
| » in range, m | 50 |
| » in azimuth, arc min | 6 |
| Resolution capability: | |
| PSR: | |
| » in range, m | 250 |
| » in azimuth, deg | 1.3 |
| MSSR: | |
| » in range, m | 100 |
| » in azimuth, deg | 0.6 |
| Probability of PSR and MSSR coordinate combination from the output of PIP: | |
| » for one aircraft, at least | 0.95 |
| » for flight information | 0.96 |
| Data update rate, s | 10 |
| Number of simultaneously tracked targets, at least | 300 |
| Power consumption, kVA, at most | 40 |
| Mean time between failures, hours | 20 000 |

High reliability is ensured by full equipment redundancy and automatic switching between the main and stand-by equipment. Remote control and monitoring ensure operation of the radar without constant presence of the service personnel.

The ARRC equipment is installed in a Universal-type container that ensures all necessary conditions for equipment operation and personnel (air ventilation, air conditioning, heating, lighting, fire and security alarm, automatic firefighting system, etc.).

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