Since 1992 we produce equipment for automated radiomonitoring, direction finding, measurement of radio signal parameters and compromising emanation survey.

**IRCOS JSC Today:**

- Well-knit team of high-skilled specialists
- System engineering approach
- Modern concepts of the equipment design
- Complete cycle all basic system component production
- Production facilities: 3000 m²
- Quality management system integrated in the enterprise

- Reliable high technology products
- Wide range of radiomonitoring and direction finding equipment
- State licenses for all basic company activities
- RF patents on technical solution
- Certified measuring equipment

- Participation in international and Russian exhibitions
- Honorary award and diploma
- Training center
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Dear Colleagues!

IRCOS JSC has been working in Russian and foreign markets more than 20 years. IRCOS has valuable experience of design and supply of automated radio monitoring systems and their components to Radio Frequency Service and regulatory agencies of the Russian Federations and other countries. During this period we have progressed from first generation equipment based on imported radio receivers and in-house A/D processors to 5+ generation equipment with increased performance and expanded analysis bandwidth based on digital panoramic radio receivers and ARGAMAK series modules.

Having its own specific features, functions and technical specifications each unit out of these five generations of radio monitoring equipment has found its customers in power structures, supervisory authorities and security services. Our Company's technical means are recognized and demanding not only in Russia but far outside. During the existence of the Company:

- Five generations of a wide range of automated radio monitoring equipment have been developed and put into production, technical means of the fifth generation have been upgraded.
- The quality control system has been implemented, including for fulfilling Governments' defense order.
- Modern technique based on PMI and SCRUM are used to manage the projects of developing radio monitoring means, systems and software packages.
- The company uses corporate information system, which provides for automation of company activity management, including engineering design and production of technical means and software packages, quality management and electronic document management.
- 15 Russian patents have been obtained with respect to methods of radio signal processing and their implementation devices.
- A number of the company's products have been certified as measuring equipment;
- Throughout 2002-2014, the company was awarded 7 Guarantee of Security and Safety medals by INTERPOLITEX International Forums and 6 first-class medals of the Security Technologies International Forum for radio monitoring equipment development;
- The company employees defended five doctor and nine candidate thesis's
- 6 treatises and 5 textbooks have been published with respect to design and implementation of radio monitoring systems, including the 3rd edition of Radio Monitoring: Tasks, Methods, Means (Goryachaya linya-Telekom publishing house) in Russian and Radio Monitoring Problems, Methods, and Equipment> (Springer International Publishing House).
- The company employees participate in International Telecommunications Union (ITU). They prepared seven contributions on behalf of the Russian Federation, some of which were included in Spectrum Monitoring Handbook, ITU 2011.

Now IRCOS JSC propose a wide range of modern radio monitoring equipment, including stationary, mobile, portable and manpack means based on modules and units of ARGAMAK and ARGAMAK+ families. A comprehensive cycle of radio monitoring equipment production is executed from development of equipment and software components through commissioning at the Customer's facilities with further support.

Company's activity in what is concerned with research, engineering design and manufacturing of radio monitoring means is carried along with two main directions:

- Outdoor radio monitoring (at national level, in suburb area, urban area, industrial area, airports, major events sites etc.)
- Search for illegal radio emissions within limited checked area or inside premises in this area (revealing of technical channels of information leakage over the border of checked area (e.g. inside one premise or vehicle), inside group of premises of one or several buildings, classification and localization of their transmitters).

**Within framework of first direction**, in 2009-2011 our company developed ARMADA Automated Radio Monitoring System (ARMS), which integrates radio monitoring means in single network to solve radio monitoring tasks at national, regional, city and district levels. This system complies with ITU recommendations, has client-server architecture. It's designed based on web-technologies. ARMADA ARMS comprises radio monitoring and measuring equipment of different bases (according to required hierarchy) and SMO-ARMADA Software Environment, which provides for control and communication with radio spectrum management system. Since 2011, the company has been supplying ARMADA ARMS and all its components, including control centers, stationary (attended and unattended), mobile, portable and manpack stations.

IRCOS JSC was Software & Equipment Supplier for the 27th World Summer Student Games (Universiade) in July 2013 in Kazan City. The system includes radio monitoring center (which works as control center), stationary unattended radio monitoring and direction finding stations, mobile measuring laboratories,
mobile radio monitoring stations, and manpack equipment. This system is featured by the small unattended radio monitoring stations deployed at sport objects of Universiade, which allow 24 hour monitoring of electro magnetic enviroment in the object and preventive protecting within most important frequency ranges.

At the moment, ARMADA ARMS is used in the Russian Federation and supplied abroad.

As for second direction, the company also has long-term experience of supply of the equipment designed for search for illegal radio emissions inside premises, check of data protection equipment effectiveness, remote indoor radio monitoring, which gets positive feedbacks in the Russian Federation and abroad. These technical means are integrated in AREAL ARMS. This system is intended for search for illegal emissions and localization of their sources within selected area and inside facilities in this area.

First section of the Catalogue describes main design features of ARMADA and AREAL ARMS's, and lists the included technical means and features of their application.

Second section provides details of technical means produced by the company. They are divided on stationary, mobile, portable (transportable) and manpack means. The stationary means (attended and unattended) are those positioned permanently. Mobile means are permanently or temporarily placed on ground- or air-based mobile platforms allowing performing their functions while moving. Portable (transportable) means are characterized by the possibility of their transport delivery or carriage by a certain number of operators to an operation site and by their use at stationary or temporary sites, including open terrain. One of the manpack devices' distinctive features is the possibility of carrying them by the operator and using them in motion under the operator's control or autonomously in accordance with a preset task. Manpack means can also be used for radio monitoring tasks if deployed on temporary, mobile or fixed sites. Each type of the technical means is describes in the corresponding catalogue section.

The catalogue also includes digital panoramic radio receiving equipment and their components – radio signal converters and means for radio signal digital processing and recording. Notable part of the Catalogue is occupied by the means, which featured by extended (up to 24 MHz) simultaneous bandwidth and advanced performance, preserving frequency selectivity and dynamic range parameters. Stationary and portable direction finders, as well as measuring receivers, can be realized as unattended. It implies outdoor equipment deployment and remote control functions.

Besides, measuring means are also presented. Their main function is measuring electromagnetic field strength and radio signal parameters that is necessary for radio monitoring and effectiveness control with respect to information leakage prevention. MEASUREMENT EQUIPMENT section provides description of three basic systems. First one is ARGAMAK-IS Panoramic Field Strength Meter, which has range from 9 kHz to 8 GHz. It's manufactured in designs for application as a part of stationary attended (ARCHA-I) and unattended (ARCHA-IN, ARCHA-INM) measuring stations, as well as mobile measuring monitoring system (ARGUMENT-I). ARGAMAK-M Panoramic Measuring Receiver and the ARK-NK51 Hanheld Measuring System for radio monitoring and direction finding based on the ARGAMAK-M are mainly designed for solving the "last mile" tasks on site. Using these means together with the SMO-BS Software and Hardware-Software Analyzers makes it possible to analyze wireless communication and data transfer system signal, including GSM / CDMA / TETRA / UMTS / Wi-Fi / DECT / WiMax networks and DVB-T/T2/H signals. This task is also important for both state radio monitoring services and network operators. Higher limit of these receivers frequency range can be expanded with certified ARC-KNV4 Frequency Down-Converter.

The closing section of the catalogue is the description of antennas and antenna systems, as well as customized software. ANTENNA SYSTEMS was supplemented with description of new antenna system AS-HP5, which provides for direction finding within the range from 20 to 3000 MHz in mobile and stationary operation modes. Information about software packages common for all equipment can be found in the Software section. This section also includes descriptions of hardware-software analyzers designed for analysis of wireless communication and data systems.

Catalogue includes general description of IRCOS's equipment. Actual specifications of some systems may differ from given ones because of their continuous improvement.

Sincerely yours,
IRCOS Director General
Doctor of Engineering
Anatoly Rembovsky
IRCOS is a modern design and engineering company that specializes in engineering design of highly integrated systems of automated radio monitoring and direction finding. The company develops, manufactures and tests all basic components of the above systems, including antenna-feeder devices, digital panoramic receivers, HF and VHF sections, digital and analog processing units, power supply systems and customized integrated software. The company is also a provider of electromagnetic compatibility solutions for vehicle-based radio equipment.

The company products are intended for the following:
- Automated radio monitoring, direction finding and locating of radio emitters in urban/industrial/office/residential environment
- Parameters measuring for radio facilities and energetic coverage zones, analysis of signals of wireless communication and data transmission systems
- Identification of unlicensed radio sources;
- Control of data protection effectiveness inside covered areas.

**SCIENTIFIC RESEARCH AND ENGINEERING DESIGN**

The company research and engineering activities are based on both theoretical and practical studies of radio monitoring, direction finding, data protection effectiveness control and measuring instruments. We have created a highly effective research and development system that makes us one of the most advanced companies in the industry and provides us with the most up-to-date solutions. Practical approach, close coordination with the manufacturer and feedback from end users enables us to optimally define purposes and scope of our research. Owing to our capacities, we can provide any R&D support for our engineers. Therefore our customers need not pay to any other research organizations and thus can save their time and money.

- We accumulate professional engineers and researchers. This has been our policy from the very beginning of our business and this is one of the reasons of our success. IRCOS are not just a consumer of research findings. We are also a base for development of the Russian science and engineering. Among our employees there are three doctors of science and eight candidates of science. We have also conducted several scientific studies in our core activities.
- The company employees hold number of patents for inventions and technologies. Our company is also a place where a lot of technical university graduates start their careers in the industry. The company participates in International Telecommunications Union (ITU). The company employees included in RF delegation participate in ITU-R Work Groups for development of contribution to Spectrum Monitoring Handbook. The results of the company R&D studies were used to prepare the contributions to the Spectrum Monitoring Handbook, recommendation and ITU reports. Now there are three contributions developed by the company specialists and accepted:
  - Localization by a mobile monitoring station of radio signal transmitters in city conditions taking into account results of field strength measurements
  - VHF and UHF omnidirection types
  - Automated site search for sources of electromagnetic emissions

The texts of the contributions are available at ITU official site (registration required) or at the company site in Publications.

The upgrade resulted from the emerging 3G and 4G communication mean.

**MANUFACTURING AND NEW APPLICATIONS**

IRCOS is a company that implemented a full process cycle and a certified quality control system. For our products we took the best of the process engineering and structure used in the USSR and the RF defense industry. Our company policy is to ensure the maximum possible sustainability and independence from external factors. IRCOS JSC is licensed by the RF Industry Agency and can develop, manufacture and repair defense equipment. Besides our traditional business i.e. manufacturing of equipment for radio monitoring IRCOS is also successful in new fields. In 2002 we started commercial production of certified radio signal measurement equipment. We have succeeded in that owing to our quality system, research capacities and high level of radio receiver manufacturing achieved in our previous projects. This is a new field not just for our company. In the Russian market there are just a few
domestic manufacturers of such equipment and the product range is not large by now. Therefore our progress in this business becomes especially important. At the moment in addition to the exciting measuring instruments certification of the following products was successfully completed:

- Renovated ARGAMAK-IS Panoramic Field Strength Meter featuring extended simultaneous analyzed bandwidth to 22 MHz, extended operating frequency range (9 kHz – 8 GHz), stationary attended or unattended operation options, and also a version for mobile stations.
- ARGAMAK-M Panoramic Measuring Receiver designed for measuring, reception and panoramic analysis with two modifications having operating frequency ranges 25 MHz to 3000 MHz and 9 kHz to 3000 MHz.

Measurement procedures for electronic equipment radiation parameters were certified. Currently state-of-the-art radio equipment design engineering and manufacturing processes are used in the company:

- SO, SOIC, TSOP, QFN and QFP radio components with pitch down to 0.5 mm; CSP and BGA components with 0.8 mm pitch and over 400 pins; packaged chip components up to 0201 (0.5×0.25 mm); VMMK components (AVAGO Technologies) in 0402 packages (1×0.5×0.25 mm) with 100 μm pitch;
- PCBs having up to 12 layers and up to fifth precision class inclusively are used. Elements are soldered in DIMA multizone conveyor convection oven, printed board assemblies undergo high-quality cleaning after soldering in PBT ultrasonic systems and they are dried in IMO automated drying system;
- Electronic modules are protected using polyurethane, acrylic and silicone coatings. Vision ENGINEERING system is used for optical inspection.
- Ultrasonic crystal micro-welding, high and low pressure molding of plastics, powder and enamel painting and chemical oxidation processes are used. Laser engraving and laser-beam cutting are applied to mark items made of plastic, wood, glass, etc.

TESTING

We start testing our products right from the beginning of their production cycle. For that we have implemented a comprehensive testing system that is just a must for manufacturing of any sophisticated products. Our quality management system covers development, manufacturing, service and maintenance of military equipment. It is complies with GOST RV 15.002-2003 and GOST R ISO 9001-2001.

Besides our standard internal tests, our products were repeatedly and successfully tested in the field conditions and actual environment by interested organizations and were given a lot of good references and proposal for further improvement of the equipment.

EXHIBITIONS AND PRESENTATIONS

To promote our products and keep professional community informed about our latest achievements, IRCOS actively participate in annual international exhibitions in Russia and other countries. Our company was given a lot of international awards among which are Quality & Safety medal by INTERPOLITEX Forum and First Grade medal by International Forum for Security and Safety Technologies.

Besides annual exhibitions and forums, IRCOS actively contribute to the industry development and conduct awareness events for interested persons. For that, we have developed our own presentation and training facilities. In our show room one can familiarize with our products including:

- High performance small-size digital radio receivers.
- Single-channel and multi-channel radio monitoring equipment
- Stationary, portable and handheld multi-purpose systems
- Radio signal measuring instruments and analyzers
- Above-level electromagnetic radiation and compromising emanation analysis equipment
- Tuners, frequency down-converters, data display units, antenna systems, power supply units and other equipment.

However, our show room is, for many reasons, a restricted area. To access it, please let us know beforehand about the time of your visit and the equipment you are interested in.

TRAINING

IRCOS training center was established in 2004 to facilitate users’ interaction with the company equipment. The training programs cover automated radio monitoring, products and methods to control technical vulnerability of the users’ information. The programs are proprietary, verified by the law enforcement bodies and the training itself is conducted by IRCOS qualified specialists. Besides the practical block i.e. equipment training as it is, the programs include a considerable theoretical block to cover fundamentals of the radio monitoring, pinpointing of technical vulnerabilities, stray electromagnetic radiation, legal aspects of data protection and communication equipment control. Upon completion of training, the trainees can additionally consult the company officers about the issues they need. The trainees are also provided with training handouts in hard and soft copies.
Automated Radio Monitoring Systems

Purpose

ARMADA ARMS is intended for solving radio monitoring (RM) tasks of civil and uniformed agencies on national, regional, municipal, district and departmental levels. The system is developed based on International Telecommunications Union (ITU) recommendations and it features client-server architecture with an extensive use of web technologies. System Provides:

- Provide authorities in charge of EM-spectrum managing with data about actual use of frequencies.
- Measure technical parameters of radio-electronic / high frequency equipment emissions and check them against relevant licenses, certificates and specifications.
- Operative, plan and background radio monitoring problems solving
- Detection, identification and field localization of unauthorized radio-frequency radiation sources and interference sources, and forbidden sources
- Research in radio-wave propagation and electronics electromagnetic compatibility.

The System includes radio monitoring equipment (RME), software package as shown on Figure below. Operation of the system is impossible without engineering and technical infrastructure comprising communication lines and nodes, rooters, server hardware, engineering structures, etc.

System Functions

ARMADA ARMS supports the following functions:

- Control of the equipment via an open standardized protocol, ability to control the equipment of third-party manufacturers.
- Remote diagnostics of system nodes, calibration validity and equipment performance time control
- Radio monitoring personnel and equipment management
- Interaction with external control systems operated by civil and uniformed agencies
- Operation in online and planned modes with accumulation of radio monitoring results in the central DB
- Options to modify the list and content of typical radio monitoring tasks, generation of new tasks
- Display of the structure and status of system nodes, frequency assignments, relocation of mobile nodes, and operation results on an electronic map.

ARMADA ARMS includes an interface to be integrated with other information systems, e.g. spectrum management system or automated radio monitoring systems (ARMS). When integrated with a spectrum management system, spectrum management system exchanges data with ARMADA ARMS. Spectrum management system provides ARMADA ARMS with data necessary for operation, set radio monitoring tasks, ARMADA ARMS in turns returns the results of executed tasks (see Figure below).

ARMADA ARSM allows most effective operating of software-hardware equipment produced by IRCOS. So that the maximum performance and functionality of radio monitoring are provided.

Features

The key features of the ARMADA ARMS are:

- Open client–server architecture, where the clients are automated operator workstations connected to the servers located in system nodes
- Hierarchic structure; use of uniform software in all nodes (control servers), scalability, cross-platform solutions, use of web technologies
- Independent operation of system nodes if communication channels fail
- Flexible mechanisms for generation and processing of radio monitoring events and technical events
- Software architecture open for connecting additional subsystems (including the systems produced by other vendors)

Three-level structure of ARMADA ARMS
Control of Station Nodes

Hierarchy levels. The lower hierarchy level is represented by radio monitoring stations. ARMADA ARMS is scalable with an option to expand already deployed system by adding new server nodes, radio monitoring equipment and software modules thereto.

Control stations provide for the same functions as Control Center but at lower level of hierarchy. For example, when the System has National scale, upper CS manages the System via Control Stations located in regions. If System scale is limited to separate region, distinct or area, System may include no Control Stations. All functions can be executed by Control Center, which set the tasks and receive the results directly to/from radio monitoring stations. So that System has two-level structure.

The system may also be single level, without management station as an separate unit. For example, if a mobile station works stand-alone, it doesn't communicate with other high levels (which may not exist in System). In this case, all control functions are executed by operators inside the station. In this case ARMADA works inside this stand-alone station independently. Ultimately in case of stand-alone hardware unit (e.g. single direction finder or measuring receiver), the system works on just one PC connected to the hardware directly. In this case both server and client applications should be installed to this PC.

Several radio monitoring station types can be used in the system:
- Attended and unattended stationary (fixed) stations
- Mobile radio monitoring stations
- Portable (transportable) stations
- Manpack stations.

Stations represent the next levels of system hierarchy. Stationary or mobile station can be combined with an operation center or a control center. ARMADA ARMS equipment is managed over communication channels. Automatic switching between the main, backup and emergency communication channel is supported. Normally wire or fiber channel is the main channel for a stationary node, whereas wireless channel may be used as backup or emergency channel. A possibility to manage any particular equipment and to set planned or online tasks from a particular operator automated workstation ("AWS") is defined by system administration and security settings.

Figure above shows an example of equipment control. Central control station controls the equipment of three stationary stations (orange arrows), Automated workstations of mobile stations control the equipment of the station (green arrow) as well as the equipment outside the station (red arrows) The equipment of portable stations is controlled from remote automated workstation (blue arrows), which belongs to another organization.

Stationary stations can be attended as well as unattended. In second case they have no personnel and are controlled remotely. It’s advisable to use thermostatic and moisturer proof design for unattended radiomonitoring equipment. In this case all equipment of the station can be installed outdoor. No service rooms are required. Example of unattended equipment installed on the roof are shown below.

Stationary stations are located usually in densely populated areas, cities, industrial centers. The necessary number of stations is determined by an area, a lay of land, type of used radio electronics in the given area. For determination of sources position, any point of monitored territory should be in a coverage area of at least two direction finding or measuring direction finding stations. However, such approach can result to substantial increase of stationary stations number and a system cost. Therefore, a structure with stationary, mobile and unattended transportable stations is often more preferable.

Mobile stations can quickly move to an area not covered by stationary equipment. These stations are effective for radio monitoring operations when low transmitter power, high directivity of transmitting antennas and long distance to the emitter source complicate measurements or make it impossible using stationary stations. For parameters measurement and localization of radio-frequency radiation sources, a single mobile station can be used.

Special conditions, including special premises or cars, are not required for portable (transportable) stations placing. These stations can be located in remote controllable areas and in out-of-the-way places, for example, on roofs of high-rise buildings. Portable stations are especially effective in case of fast deployment of additional radio monitoring facilities.

Manpack stations can be used as “last mile” tools for measurement, direction finding and localization of radio electronic equipment, they can also be used indoors.

Metrological Equipment:

The System provides for measurement of the following:
- Peak, quasi-peaks, mean square, and average values of the field strength and power stream density;
- Radio signal frequency (continuous wave signals, signals with analog amplitude and frequency modulation, signals with the modulation of digital types)
- Radio signal bandwidth using X dB and ß/2 methods
- Amplitude modulation factor
- Signal frequency deviation with a frequency modulation
- Signal frequency spacing with frequency shift
- Signal modulation speed with digital modulation types
- Subcarrier frequency for stereo broadcasting with FSK
- Frequency channel occupancy.

The certified measurement techniques regulate performance of measurements on a basis of the unified radio monitoring equipment control protocol with remote network control by the TCP/IP protocol.

Software
Unified SMO-ARMADA software with the same structure for all system nodes is used in ARMADA ARMS.

Software installed at system nodes having different hierarchy levels differs only in database content and control options. The more node level in a system, the more information is stored in its database, the more subordinate conformant servers presents. The node at higher level may have access to the data stored in controlled nodes, and also it has online access to radio monitoring equipment (RME) of these nodes. Furthermore, for fast reaction to local conditions, a possibility to execute radio monitoring tasks initiated at the lower hierarchy levels and possibility to control their results at higher level is retained.
System control user interfaces are based on Web-technologies to enable simplified deployment client applications at AWS and provide for their cross-platform capabilities.

SMO-ARMADA features open architecture to provide for connectivity of additional software subsystems, blocks and modules, including the ones developed by third-party vendors. The equipments is controlled based on open protocol. This enables the use of third-party equipment as a part of the System. SMO-ARMADA consists of the following functional subsystems:

- Automatic execution of planned tasks (planned mode)
- Operator controlled task execution (online mode)
- Radio monitoring data processing and display
- Accounting data storage and editing
- Reference data storage and editing
- System status monitoring
- Mapping
- Report generation
- Management.

Corresponding software modules ensure operation of each subsystem.

**Planned mode**

Automatic radio monitoring task execution subsystem provides operation in a planned mode according to a schedule, including:

- Signal parameter measurement
- Direction finding
- Search for new frequency sources
- Checking the parameters for registered emitters, comparison of the results with standards; automatic decisions on violations of radio frequency resource use.
- Using a flexible radio monitoring events system, operating using spectral and time masks
- Determination of frequency / frequency range occupancy
- Measuring parameters of the base station signals for digital transmission types for the following standards: GSM, UMTS, LTE, CDMA, Dect, Tetra, Wi-Fi, WiMax
- Detection of DVB-T/T2/H digital TV signal parameters
- Online notification of the operator about emergence of emissions of interest of threat
- Current and planned equipment load control.

**Features:**

- Simultaneous control of many radio monitoring units from a single workstation
- Possibility of the radio monitoring task execution when the operator is absent (at night, during weekends and public holidays)
- Possibility to control equipment connected over slow communication channels
- Flexible scheduling and task prioritization system
- Automatic resumption of tasks after interruptions.

**Display of results**

Radio monitoring data processing and display subsystem provides:

- Storage and review of results obtained on automated mode and online (manual) mode by an operator
- Emitter location calculation
- Displaying radio monitoring results on the electronic map
- Review of files obtained in course of task execution (demodulated signals, frequency-time diagram, time sampling)
- Display of measurement parameters
- Spectrum display with options to scale and set area and point markers
- Plotting histograms by measurement sets for any given period of time
- Obtaining of user's result samples and creating the reports based on these samples.

**Accounting data storage and editing**

Accounting data storage and editing subsystem provides:

- Accounting of frequency allocations;
- Accounting of radioelectronic equipment;
- Accounting of counterparts;
- Accounting of permits (license for frequency (radio frequency channel) use, emitter registration certificate, etc.);
- Accounting of emitters present on air that have no (do not require) any permitting documents.

**Features:**

- Option to display account data during work with spectrum in real time and in radio monitoring results;
- Option to use accounting data when assigning tasks for automatic radio monitoring;
- Displaying accounting data on the electronic map
- Option to collect user samples from accounting data and form a report based on these samples.
Reference data storage and editing subsystem

Subsystem provides:
- Storage of data on equipment used in the system
- Radio monitoring stations data storage
- Personnel data storage
- Storage of standard data on bandwidth and frequency deviations
- Displaying reference data on the electronic map.

Example of reference data display window is given above.

Features:
- Accounting of equipment parameters when assigning tasks
- Control of performance of assigned tasks
- Comparison of radio monitoring results with acceptable bandwidth and frequency standard deviations as per radio electronic station type, emission type and the date of the radio electronic station registration certificate.

Status monitoring

Status monitoring subsystem provides for:
- Control over the current status of communication channels
- Control of equipment health
- Automated diagnostics of revealed faults of radiomonitoring equipment
- Alerting users on changes of the current system element status:
  - Triggering the alarm system in radio monitoring stations (RMS)
  - Switching of communication channels
  - Switching between main and backup power supply sources
  - Permissible threshold crossover for currents, voltages and operating temperatures;
- Alerting users on necessity of the routine verification of measuring equipment
- Displaying the current locations of mobile means equipped with GPS-GGLONASS trackers on the electronic map
- Control of the current management servers' state.

Examples of system status monitoring screenshots are given below.

Cartography subsystem

The cartography subsystem provides for:
- Displaying graphical data on the electronic map with reference to geographic coordinates
- Selection of the coordinate system to be used by the user
- Displaying selected cartographic and informational layers
- Addition of user's layers to cartography background
- Measuring angles and distances
- Search for cartographic objects
- Display of main information on selected cartography or information object
- Displaying tracks of mobile objects for arbitrary time period.

Examples of mapping subsystem screenshots are given below.

Report Generation

The report generation subsystem provides:
- Generating reports according to pre-set templates
- Generating reports according to user-defined data samplings
- A possibility to generate reports with plotting diagrams based on user-defined data sampling
- Generating reports containing cartographic data.

Features:
- Option to generate reports in different formats (docx, xlsx, html, pdf) based on the same template
- System users can edit report templates online.

Examples of report generation based on measurement results is given below.

Administration subsystem

Management subsystem provides for:
- Managing user accounts: Addition, editing, disabling or deletion of valid user accounts
- Differentiation of user rights by access and data editing features.

Use of third party equipment

A promising approach is implemented in ARMADA ARMS to third party equipment. It is based on separation of equipment processes and radio monitoring database processes. Equipment operation is directly controlled by
the equipment driver while customized software (equipment communication module) interacts with the database. Thus, considering system geographically distribution, the equipment communication module sends requests to the equipment driver and receives measurement results via open network protocol. Equipment driver manufacturer ensures functioning of the module by known protocol depending only on measurement tasks, but not on the database structure. In this case, the equipment driver works just as command converter transforming requests of the communication module to internal commands for exchange with equipment based on vendor’s protocol.

The open protocol format permits changing command length depending on its contents. Depending on a command code, data bytes can contain both data (for example, signal level) and included (slave) records. The command heading unequivocally defines the command length; accordingly the equipment driver of any version can view the sequence of commands and ignore the unknown parameters. This permits not to modify the driver of already used particular equipment if additional commands will be introduced in the protocol.

AREAL
automated system of search for unauthorized radio emission sources within an area and inside facilities

Purpose:
• Automated radio monitoring and search for unauthorized radio emission sources within monitoring area and inside premises of monitoring facilities
• Automated direction finding and localization of emission sources including ones located inside facilities
• Technical analysis and identification of revealed emission sources. Can be used as a subsystem (cluster) of ARMADA ARMS.

AREAL System and its components have been successfully used in different regulatory agencies. System provides for the following function within monitoring area:
• Providing information about actual frequency use
• Measure technical parameters of radio-electronic / high frequency equipment emissions and check them against relevant licenses, certificates and specifications
• Detection, identification and localization of unauthorized radio-frequency and interference sources inside monitoring facilities, and forbidden sources
• Operative, plan and background radio monitoring problems solving.

AREAL System is intended for monitoring of radio emissions over selected area and inside premises within this area. It allows integrating separate radio monitoring means in single network

System includes radio monitoring equipment (RME), software package and engineering and technical infrastructure.

Configuration:
• ARC-POM1 Automated subsystem of search for unauthorized radio emission sources within monitoring area
• ARC-D13R Automated subsystem of search for unauthorized radio emission sources inside facilities within monitoring area.

ARC-POM1 automated subsystem of search for unauthorized radio emission sources within the checked area

Purpose:
• Online search, direction finding and localization of unauthorized radio emission sources within the checked area
• Monitoring and recording of messages in radio networks and trunks.
• Identification of emitters and database maintenance.

Typical Configuration:
• Control Station (CS), including:
  • Radio monitoring server
  • Automated Workstations (ARCHA-IN or ARCHA-INM) and mobile (ARGUMENT-I) radio monitoring stations
  • ARC-GIS Geoinformation Server to support radio monitoring application
  • ARCHA-IN, ARCHA-INM Stationary Radio Monitoring Stations, unattended design
  • ARGUMENT-I Mobile Radio Monitoring and Direction Finding Stations
  • ARENA Portable Radio Monitoring and Direction Finding Stations
  • ARTIKUL-H1, ARC-RP3M - manpack radio monitoring and direction finding means, providing for both outdoor and indoor operation.

ARC-POM1 System provides effective solution of wide variety of tasks related with revealing of unauthorized emissions, search for their sources within checked area and localization inside extended facilities.

Subsystem provides:
• Spectrum analysis within frequency range, detection of new radio emissions
• Recording and technical analysis of radio signals, measuring of signal parameters, threat evaluation
• Analysis of GSM / CDMA / TETRA / DECT / Wi-Fi / WiMax / LTE Base Stations, DVB H, DVB T, DVB T2 transmitter parameters, revealing of unauthorized transmitters, threat evaluation

Report generation with diagram plotting
**Reachable if there are optimal deployment and high-capacity channels between the ARGAMAK+ modules**

When used as a part of system of ARTIKUL-S Direction Finders based on ARTIKUL-H1, ARC-RP3M automated radio monitoring and direction finding equipment, providing for localization at places unreachable for mobile equipment: inside buildings, on roofs, on difficult terrain.

**Data exchange between system posts and station posts, remote control using radio or wire channels.**

### Features:
- **ARC-POML can function as a part of ARMADA Distributed Automated Radio Monitoring System**
- **Shared or separate operation of several stationary and mobile radio monitoring stations is provided. The number of stations in the system is taken based on Customer tasks, area size and terrain landscape**
- **Simultaneous direction finding of a given emitter by all stations in the system.**
- **High rate, accuracy and sensitivity of emitters detection and position finding; the system can solve all radio monitoring tasks.**
- **System includes transportable (ARENA or ARCHA-IT) and manpack (ARTIKUL-H1, ARC-RP3M) automated radio monitoring and direction finding equipment, providing for localization at places unreachable for mobile equipment: inside buildings, on roofs, on difficult terrain**
- **Productive exchange between system posts and station posts, remote control using radio or wire channels.**

### Basic Specifications*

<table>
<thead>
<tr>
<th>Panoramic Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency range, basic configuration</strong></td>
</tr>
<tr>
<td><strong>Frequency range, complete configuration</strong></td>
</tr>
<tr>
<td><strong>Panoramic analysis rate within operating frequency range</strong></td>
</tr>
<tr>
<td><strong>Minimum duration of the signal detected within simultaneous bandwidth (receiver tuning frequency doesn't change)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direction Finding and Transmitter Localization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency range, basic configuration</strong></td>
</tr>
<tr>
<td><strong>Frequency range, complete configuration</strong></td>
</tr>
<tr>
<td><strong>Emitter localization accuracy on open ground</strong></td>
</tr>
<tr>
<td><strong>Multi-channel direction finding rate</strong></td>
</tr>
<tr>
<td><strong>Capacity in the optimum place</strong></td>
</tr>
</tbody>
</table>

* When used as a part of system of ARTIKUL-S Direction Finders based on ARGAMAK+ modules

**Reachable if there are optimal deployment and high-capacity channels between the posts; communication. The type shall be agreed with Contractor.**

### ARC-D13R

**Subsystem of Remote Radio Monitoring in Premises**

### Purpose:
- **Radio monitoring in distant premises, including:**
  - Detection of radio signal sources
  - Detection of unauthorized emitters
  - Emitter position finding
  - Monitoring and recording of messages in radio networks and trunks.
  - Classification of radio emission sources according to source DB
  - Emitter database maintenance.
  - Radio emitter classification, threat evaluation.

### Typical Configuration:
- **Central post equipment: distributed network, up to 4 posts based on ARC-BUVM-R Two-Channel Control Modules with maintenance-free PCs**
- **Peripheral equipment for the premises under monitoring (up to 52 sets)**
- **Reference channel equipment with due protection for outdoor mounting (1 set for each post)**
- **Control, display and storage unit**
- **SMO-DX-R Software Package**
- **ARC-D11 Two-Channel Panoramic Radio Receiver**
- **ARC-D1 Multi-Functional Portable Radio Monitoring System**
- **ARC-RP3M Handheld Direction Finder.**

### Features:
- **Synchronous analysis of the signals received from any two premises**
- **Operating frequency range up to 8 GHz**
- **Conversion to IF in remote modules will significantly reduce the trunk losses and antenna effect.**
- **ARC-BUVM Two-Channel Control Module has 8-input standardized switch**
- **Tree-structured system of antenna switches provides for cutting down the overall length of radio frequency cables**
- **ARC-D11 and ARC-D1 provide for prompt check of unequipped premises**
- **ARC-RP3M Handheld Direction Finder provides for localization of revealed emission sources inside checked premises.**

### Subsystem provides:
- **Spectrum analysis within frequency range, detection of new radio emissions**
- **Revealing of unauthorized radio emission inside checked premises**
- **Detection of noise-like signals with dynamic frequency-time structure**
- **Recording and technical analysis of radio signals, measuring of signal parameters, threat evaluation**
- **Analysis of GSM / CDMA / TETRA / DECT / Wi-Fi / WiMax / LTE Base Stations, DVB H, DVB T, DVB T2 transmitter parameters, revealing of unauthorized transmitters, threat evaluation**
- **Accumulation of radio signal data obtained through technical analysis in a database for further use.**
- **Localization of emitters inside checked premises**
- **Detection of emissions from monitored objects outdoors (as a part of AREAL System)**
- **Remote system control.**

### Basic Specifications

<table>
<thead>
<tr>
<th>Panoramic Analysis and Fast Signal Search</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of premises under control</strong></td>
</tr>
<tr>
<td><strong>Frequency range, basic configuration</strong></td>
</tr>
<tr>
<td><strong>Frequency range, complete configuration</strong></td>
</tr>
<tr>
<td><strong>System total sensitivity (wattage of a transmitter in an 8 x 8m room with 99% detection)</strong></td>
</tr>
</tbody>
</table>
Control centers

Control center (CC) is a system of hardware-software means, providing for organizational and informational interaction and functioning of ARMS components. The CC provides an opportunity to analyze system's current state, scheduling working scenarios, make managerial decisions and assign radio monitoring and processing tasks. There are stationary and mobile versions of the Control Center. CC interacts with control stations and, if necessary, with radio monitoring stations directly. Radio monitoring stations may be included in the structure of control centers where necessary.

RADIO MONITORING EQUIPMENT

ARC-CS
Stationary Control Center

Equipment of Control Center can be decomposed on a row of subsystem as it's shown in Figure below. The essential subsystems are the following ones:
- Management subsystem
- Communication and data transmission subsystem
- Power supply subsystem.

Management subsystem provides for radio monitoring facilities control, enables monitoring current system's state, diagnoses the malfunctions if any, carries out post-processing of RM task solution results, makes decisions for contingency events, ensures a possibility of data exchange with interacting agencies.

The control subsystem includes the automated workstations (AWS) and control center server equipment set. The Figure shows three servers, two of which form a cluster and used for operation of software package and basic DB. The third server is intended for storage of backup system data base copies.

The communication and data transmission subsystem provides data exchange in the control center and with external system nodes. The voice communication is provided by phones with the headsets connected to PABX and by radio stations.

Among other subsystems there should be mentioned system of visualization and teamwork with information, intended for holding a meeting, video conference, as well as display of most important actual information required to make management decisions.

Typical structure of a stationary control center

Main equipment:
- Server equipment
- Network equipment
- Operators' AWS
- Communication and data transmission facilities
- Climatic installation
- Power supply system
- Furniture set
- Fire-fighting system.

Possible structural flowchart of the control center

Operation of the control center employees
Optional Equipment:
- Data visualization subsystem (videowall)
- Conferencing subsystem
- Videoconferencing subsystem
- Conference recording subsystem
- Back-up power system
- Backup communication and data transmission facilities.

**ARC-MC**
Mobile Control Center

A mobile control center is designed to control radio monitoring system in case of failure of the stationary control center (CC), and may also be used as a control station, if it is necessary to increase system performance under complex electromagnetic conditions or in special circumstances of radio monitoring, e.g. during major international sport events or counterterrorism operations.

Mobile CC may be located immediately at the event site in order to increase efficiency of radio monitoring facility control and simplify interaction with other agencies.

Like a stationary CC, a mobile CC provides an opportunity to analyze the current system status, schedule operation scenarios, making management decisions, assign radio monitoring and processing tasks, and hold meetings in videoconference mode.

A mobile CC is based on a cross-country cargo carrier, it has insulated van body, which contains equipment necessary for system management and comfortable work of the employees.

**Typical structure of a mobile control center**
- Reequipped vehicle with life support system
- Visualization and switching control subsystem
- Server equipment
- Network equipment
- Automated workplaces of operators
- Communication and data transmission facilities
- Air conditioning system
- Power supply system
- Furniture set
- Fire-fighting system
- Security alarm and video surveillance system.

A mobile control center may be supplemented with a mobile rest station (ARC-MRS), which also has an insulated body equipped with ventilation, air conditioning, heating, fire-fighting, video surveillance systems, a kitchen and up to 6 rest places, as well as bathroom unit containing a shower cabin, a wash stand and a toilet. An exterior of a mobile rest station, which is structurally based on a trailer, is shown in Figure below.
This section describes IRCOS stationary radio monitoring equipment. The stationary equipment is designed for automated radio monitoring including search, emitter detection, direction finding, localization and radio signal measurement. 

This equipment uses standardized units with small weight and dimensions that are also applicable for mobile, portable and handheld equipment. Such standardization ensures a high reliability and maintainability of our equipment. The stationary equipment includes radio signal conversion units integrated with antenna systems. This option enables high sensitivity and broad dynamic frequency range, eliminates antenna effects and allows the use of flexible light-gauge lead-in cables up to 100 m long. 

High performance parameters of the stationary equipment including the maximum electromagnetic field coverage and DF accuracy are achieved through stationary antennae and mast structures on the one hand and increase in dimensions and height of receiving antennae on the other hand. The stationary equipment can be controlled either directly by operator or remotely via wired or wireless channels including operation as a part of automated radio monitoring system. 

Stationary radio monitoring stations can be attended or unattended. In case of attended design, operators’ workstations are located inside service room of a station. An unattended station is controlled remotely. All equipment of the station, apart from antenna systems, may be assembled in Isothermal moisture protected boxes. In this case Station doesn’t required service room for installation. All equipment of Station can be mounted outdoor, for example on building’s roof.

Stationary Equipment Provides:

- Operation as a part of geographically distributed radio monitoring systems or autonomous operation;
- Functions of direction finding, parameter measuring, signal recording and technical analysis
- Panoramic analysis within the entire operating frequency range or within separate intervals, detection of changes in ambient electromagnetic conditions.
- Radio frequency occupancy measurement
- New emitters search, measurement and comparison against the database.
- Electromagnetic field strength measurement
- Saving the radio environment to the hard drive within a specified frequency range. This procedure can function within a long period and is based on amplitude/frequency/bearing/time coordinates, unit location and the absolute time at the time of saving.
- Appending data on registered and illegal emitters and comparison of recorded data against references stored in the database;
- Single and multi-channel direction finding of radio signals with random modulation types and spectrum width
- Automated monitoring of open radiophonic channel, recording of demodulated signals and their service parameters (frequency, time, signal level, etc.), playback of demodulated records
- Localization of emitters (when operating as a part of ARMADA ARMS) and their display on electronic map.

Key features of stationary equipment:

- Technical and metrological parameters of ARCHA station radio monitoring equipment completely comply with International Telecommunication Union recommendations;
- Due to high functionality of stations and their specifications they may be used by both the Ministry of Communications and security agencies
- There are several stand-alone measurement and technical analysis workstations (for different agencies) with an option of their parallel usage;
- Stations are supplied both in attended and unattended design (operating temperature range is from -55°C to +55°C depending on design) The equipment of unattended stations has alarm sensors (impact, inclination and opening sensors);
- All equipment has Built-In Test Equipment (BITE)
- The stations can be controlled over the main and standby data communication channels including radio channels
- ARTIKUL-S direction finders based on ARGAMAK PLUS DRRD series operate with simultaneous processing range up to 24 MHz, operating range 1.5 to 8000 MHz, they feature high performance (more than 100 bearings/s) and provide multi-channel direction finding at the rate up to 1000 MHz/s
- The digital receiver of ARTIKUL-S Direction Finder is built into the antenna system (it provides accuracy, high sensitivity, dynamic range and no antenna effect), direction finder antenna system weighs about 30 kg
- Measuring workstation of Station based on digital DRR ARGAMAK-IS, has frequency range from 9 kHz to 8000 MHz (up to 43 GHz with optional equipment), and simultaneous bandwidth up to 22 MHz
- Digital DRR ARGAMAK-IS allows real-time processing of input signals. Spectrum analysis rate for spectrum resolution 25 kHz is up to 600 GH2/s, panoramic spectrum analysis rate is up to 10 GH2/s.
- Because of its small dimensions DRR of ARGAMAK-IS can be integrated with antenna system, providing for high sensetivity and accuracy. With additional coherent receiving channel it can be a base for correlative interferometer direction finder
- ARGAMAK-IS DRRD provides for all necessary measurements including electromagnetic field strength, frequency and bandwidth of radio signals. It decodes and analyzes service data used in GSM, UMTS, CDMA, TETRA, DECT digital communication networks and also in DVB-T/TH/T2;
- Provides for operation as a part of “hybrid” system of radio transmitter localization I which the position is calculated based on bearings obtained from direction finders and time differences of signal coming measured by synchronized ARGAMAK-IS receivers
- ARGAMAK-IS DRRD provides concurrent connection of two antennas remote field sensor module (RETM) and up to 5 additional antennas with an option of their switching and remote azimuth and polarization orientation change.

### ARCHA-I

**Stationary Measuring Radio Monitoring and Direction Finding Station**

**Purpose:**
ARCHA-I Stationary Station is intended for operation as a part of ARMADA ARMS or for standalone operation. The station provides functions of search, measurement of field strength and parameters of radio electronic stations, direction finding, recording, technical analysis and classification of signals used in modern communication systems and data transfer system in HF, VHF, UHF and SHF ranges, as well as when it works as a part of ARMADA ARMS) localization of their emitters. Measuring equipment of the station has certificates of Federal Technical Regulation and Metrology Agency and certified measurement procedures.
En example of ARCHA-I structural diagram is given above.

**Typical Configuration:**

- **Workstation No. 1.** Search, detection and direction finding (1.5 - 8000 MHz) ARTIKUL-S Stationary Direction Finder with AS-PP4 Antenna System mounted on a mast.
- **Workstation No. 2.** Measurement of field strength and parameters of modern communication systems and data transfer systems 9 kHz - 18 GHz, can be extended up to 43 GHz), analysis of service identifiers and parameters of GSM, UMTS, LTE, CDMA, TETRA, DECT and DVB-T/T2/H systems, automated direction finding with directional antennas. ARGAMAK-IS Panoramic Field Strength Meter with ARK-UP rotary support device, an external converter and a set of measurement antennas on a mast.
- **Workstation No. 3.** Recording, technical analysis and classification of signals (operating frequency range is 9 kHz - 18 GHz, optionally can be extended up to 43 GHz) ARGAMAK-CS Technical Analysis System for communication system signals.
- **Workstation No. 4.** Localization of radio signal emitters (when operating as a part of ARMDADA ARMS) ARC-GIS Geoinformation Server.
- **Common system equipment:**
  - Local control server (LCS);
  - Network equipment;
  - Power system with a remote control.
  - Interstation data exchange equipment.

Radio monitoring equipment is connected to the local control server where SMO-ARMADA Customized Software is installed and a station database is deployed.

Antenna systems of measurement and direction finding stations are normally mounted on masts, they can be installed both on ground surface and on the roofs of high-rise residential and administrative buildings, cellular operator towers, etc. Antenna systems of measurement stations may be equipped with tilting units for antenna position azimuth change and change of polarization. An example of Station's antenna system location is given above.

**Workstation Functions**

**Workstation No. 1:**
- Panoramic analysis within operating frequency range
- Measurement of signal frequency parameters
- Analysis and check of GSM, CDMA, TETRA, UMTS and LTE base station signal parameters with time and code division of channels
- Analysis of DVB-T/T2/H digital TV signal parameters
- Recording of radio signals, measurement of modulation parameters and technical analysis
- Automated monitoring of detected radio channels.

**Workstation No. 2:**
- Electromagnetic field strength measurement
- Measurement of radio signal parameters
- Analysis and check of GSM, CDMA, TETRA, UMTS and LTE base station signal parameters with time and code division of channels
- Analysis of DVB-T/T2/H digital TV signal parameters
- Recording of radio signals, measurement of modulation parameters and technical analysis
- Automated monitoring of detected radio channels.

**Workstation No. 3:**
- Panoramic analysis, receipt and estimation of communication signals in HF, VHF, UHF and SHF range
- Recording of the radio signals for further analysis
- Automatic recognition of radio emission with analog, frequency and phase modulation demodulation and deciphering of digital streams for a great variety of protocols and standards both in real time and based on recorded radio signal fragments
- Structure/time analysis of demodulated digital streams
- Generation of reports for each stage of technical analysis.
Workstation No. 4:
- Showing bearings and emitters data in electronic map
- Radio monitoring data collecting and processing
- Report (incl. graphical report) generation and printout
- Location data acquisition
- Field strength distribution mapping based on measurements
- Evaluation of field strength distribution subject to terrain.

### Basic Specifications

#### Panoramic Analysis

<table>
<thead>
<tr>
<th>Operating frequency range:</th>
<th>Workstation No. 1</th>
<th>20 – 3000 (1.5 – 8000) MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Workstation No. 2</td>
<td>9 kHz - 18 GHz</td>
</tr>
<tr>
<td></td>
<td>Workstation No. 3</td>
<td>9 kHz - 43 GHz</td>
</tr>
</tbody>
</table>

Panoramic analysis rate within operating frequency range up to 10 GHz

#### Single Channel and Multi-Channel Direction Finding

<table>
<thead>
<tr>
<th>DF method</th>
<th>Correlative interferometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating azimuth range</td>
<td>0° - 360°</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>20 – 3000 (1.5 – 8000) MHz</td>
</tr>
<tr>
<td>Field sensitivity depending on the signal frequency with 3.125 kHz spectrum discreteness:</td>
<td></td>
</tr>
<tr>
<td>1.5-20 MHz (HF-module)</td>
<td>30 µV/m max.</td>
</tr>
<tr>
<td>20-1000 MHz (module-1)</td>
<td>12 µV/m max.</td>
</tr>
<tr>
<td>1000-3000 MHz (module-2)</td>
<td>12 µV/m max.</td>
</tr>
<tr>
<td>3000-8000 MHz (module-3)</td>
<td>25 µV/m max.</td>
</tr>
</tbody>
</table>

Instrument accuracy (RMS), max.:
- 1.5-20 MHz (HF-module) 5°
- 20-1000 MHz (module-1) 2°
- 1000-3000 MHz (module-2) 2°
- 3000-8000 MHz (module-3) 3°

Antenna system remote location range up to 100 m

#### Radio signal recording, and technical analysis

<table>
<thead>
<tr>
<th>Max. recording bandwidth</th>
<th>up to 24 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous radio signal recording time</td>
<td>Depends on the storage volume</td>
</tr>
</tbody>
</table>

Other parameters are determined by the equipment included in the Station.

The Station is available in shorten configuration, which includes only direction finding or only measuring equipment. Examples of such stations' structural diagrams are given in Figures below.

**ARCHA-IN Stationary Unattended Measuring Radio Monitoring and Direction Finding Station**

ARCHA-IN Stationary Station is an unattended modification of ARCHA-I Station. This modification doesn’t require service personnel and service premises, which decreases related costs. Station equipment is located in thermostatic and moisture-protected cases that provide a possibility of outdoor location. Station specifications are the same as ARCHA-I Station specifications. ARCHA-IN Unattended Station doesn’t include operator’s automated workplaces. ARCHA-IN Unattended Station is remotely controlled, for example from AWS in control center. An example of Station structural diagram is presented below.

Other parameters are determined by the equipment included in the Station.

The Station is available in shorten configuration, which includes only direction finding or only measuring equipment. Examples of such stations' structural diagrams are given in Figures below.
ARCHA-INM Stationary Unattended Measuring Station of Radio Monitoring and Direction Finding

**Purpose**
The station is intended for operation as a part of ARMADA ARMS or for autonomous operation using a remote control. Station equipment does not require a separate heated room. Typical station application is the use of ARGAMAK-IS Measuring Receiver with an additional receiving channel built-in directly into a direction finding antenna system. Apart from measurement this allows to perform signal direction finding by correlation interferometry technique.

Station provides for the same functions as ARCHA-IN. The difference is that the Station doesn't include a direction finder as a separate system. That's why its performance is lower because direction finding and measuring are divided by time. On the other hand, ARCHA-INM Station provides for more simplicity in deployment and operation.

**Typical Configuration:**
- Antenna system including direction finding and measuring antenna for mounting on the mast (see Figure below)
- ARGAMAK-IS Panoramic Field Strength Meter integrated with antenna system

**Features:**
- It does not require service rooms
- ARGAMAK-IS Measuring Receiver with an additional coherent receiving channel are built-in directly into a direction finding antenna system, which allows avoiding antenna effect, provides implementation of direction finding correlation interferometry technique, high sensitivity and accuracy of measurement and direction finding
- Installation of direction finding and measuring antennas on the same mast device
- Control over wired or wireless channels (TCP/IP protocol)
- It meets the requirements of Unified Technical Policy (ETP) of RF Federal Service for Supervision in the Sphere of Telecom, Information Technologies and Mass Communications, and it comprises ARGAMAK-IS digital panoramic radio receiver certified as a measuring instrument type and there is a certified measurement procedure
- It analyzes service identifiers and parameters of GSM, UMTS, LTE, CDMA, TETRA, DECT and DVB T/T2/H systems
- It localizes the emitters based on integrated processing of amplitude, angular and differential/distance measuring data (when operating as a part of ARMADA ARSM) and their display on an electronic map.

**Basic Technical Specifications of Station in Complete Configuration**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td></td>
</tr>
<tr>
<td>Operating frequency range:</td>
<td>20 – 8000 MHz</td>
</tr>
<tr>
<td>Panoramic analysis and measuring parameters</td>
<td>1.5 – 3000 MHz</td>
</tr>
<tr>
<td>Direction finding</td>
<td>up to 10 GHz/s</td>
</tr>
<tr>
<td>Panoramic analysis rate</td>
<td>75 dB, min.</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (3rd and 2nd order)</td>
<td>75 dB, min.</td>
</tr>
<tr>
<td><strong>Panoramic Analysis</strong></td>
<td></td>
</tr>
<tr>
<td>Simultaneous analyzed bandwidth</td>
<td>Up to 22 MHz</td>
</tr>
<tr>
<td>Input radio signal level measurement limits</td>
<td>-10 – +140 dBµV</td>
</tr>
<tr>
<td>Error of input radio signal level measurement</td>
<td>±1 dB, max.</td>
</tr>
<tr>
<td>Error of field strength measurement</td>
<td>±3 dB, max.</td>
</tr>
<tr>
<td>Error of sine signal frequency measurement</td>
<td>±1×10^{-9}</td>
</tr>
<tr>
<td>Bandwidth measurement error</td>
<td>±5%</td>
</tr>
<tr>
<td>Relative error of occupancy measurement</td>
<td>±1%</td>
</tr>
</tbody>
</table>
AC-PP4 Antenna System of the ARTIKUL-S Direction Finder on a Building’s Roof
**Single Channel and Multi-Channel Direction Finding**

<table>
<thead>
<tr>
<th>DF method</th>
<th>Correlative interferometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating azimuth range</td>
<td>0° - 360°</td>
</tr>
<tr>
<td>Processed emitter signal spectrum width</td>
<td>Arbitrary</td>
</tr>
<tr>
<td>Multi-channel direction finding rate</td>
<td></td>
</tr>
<tr>
<td>• within 1.5-25 MHz range</td>
<td>10 MHz/s, min.</td>
</tr>
<tr>
<td>• within 25-8000 MHz range</td>
<td>min. 1000 MHz/s</td>
</tr>
<tr>
<td>Single-channel direction finding rate</td>
<td>more than 100 bearings/s</td>
</tr>
<tr>
<td>Minimum duration of processed single signal in 25 - 8000 MHz frequency range</td>
<td>10 ms</td>
</tr>
<tr>
<td>Minimum duration of processed repeating signal in 25 - 8000 MHz frequency range</td>
<td>1 ms</td>
</tr>
<tr>
<td>Field sensitivity for 3.125 kHz spectrum range depends on the frequency:</td>
<td></td>
</tr>
<tr>
<td>• 1.5-25 MHz</td>
<td>max. 30 µV/m, typical 5 µV/m</td>
</tr>
<tr>
<td>• 25 – 3000 MHz</td>
<td>max. 12 µV/m, typical 2 µV/m</td>
</tr>
<tr>
<td>• 3000-8000 MHz</td>
<td>max. 25 µV/m, typical 8 µV/m</td>
</tr>
<tr>
<td>Instrument accuracy (RMS), max.</td>
<td></td>
</tr>
<tr>
<td>• 1.5-25 MHz</td>
<td>5°</td>
</tr>
<tr>
<td>• 25 – 3000 MHz</td>
<td>2°</td>
</tr>
<tr>
<td>• 3000-8000 MHz</td>
<td>4°</td>
</tr>
<tr>
<td>Antenna system remote location range</td>
<td>up to 100 m</td>
</tr>
</tbody>
</table>

**Radio Channel Monitoring, Technical Analysis and Broadcast Recording**

<table>
<thead>
<tr>
<th>Types of recorded data</th>
<th>Bearing, demodulated signals, spectrograms, time, time-based signal sampling (I/Q)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum simultaneous bandwidth within the frequency range 1.5 – 5 MHz</td>
<td>1 MHz</td>
</tr>
<tr>
<td>Maximum simultaneous bandwidth within the frequency range 5 – 25 MHz</td>
<td>2 MHz</td>
</tr>
<tr>
<td>Maximum simultaneous bandwidth within the frequency range 25 – 110 MHz</td>
<td>5 MHz</td>
</tr>
<tr>
<td>Maximum simultaneous bandwidth within the frequency range 110 – 220 MHz</td>
<td>10 MHz</td>
</tr>
<tr>
<td>Maximum simultaneous bandwidth within the frequency range 220 – 3000 MHz</td>
<td>24 MHz</td>
</tr>
<tr>
<td>Max. recording bandwidth</td>
<td>Up to 40 MHz</td>
</tr>
<tr>
<td>Continuous radio signal recording time</td>
<td>Depends on the storage volume</td>
</tr>
</tbody>
</table>

**Dimensions, Weight**

| Dimensions of antenna system (diameter x height) | 2110 x 2820 mm |
| Dimensions of A/D Processing Unit | 462 x 141 x 266 mm |
| Weight of antenna system | 40 kg |
| Weight of A/D Processing Unit | 5 kg |

---

**ARGMAK-CS**

**Radio Signal Recording and Technical Analysis System**

**Purpose:**
- Receiving, measuring of parameters, recording, demodulation and decoding of radio signals
- Analysis of signal parameters of wireless communication and data transmission systems: GSM, CDMA, TETRA, UMTS, DECT, LTE, Wi-Fi and DVB-T/T2/H
- Integrated into stationary and mobile systems.

**Typical Configuration**

Configuration of ARGMAK-CS System, which is based on ARGAMAK+ modules with simultaneous bandwidth up to 24 MHz, depends on design:

**For stationary attended stations:**
- Remote Field Sensor Unit of ARGAMAK-CS
- Radio receiving unit of ARGAMAK-CS with digital radio receiver based on ARC-PSS and ARC-CO+ Modules of ARGAMAK+ family
- Thermostatic moister proof case with integrated local control server
- Lead-in cable
- AC network power supply unit
- Mounting set
- Software package.

**For stationary unattended stations:**
- Remote Field Sensor Unit of ARGAMAK-CS
- Radio receiving unit of ARGAMAK-CS with digital radio receiver based on ARC-PSS+ and ARC-CO+ Modules of ARGAMAK+ family
- Thermostatic moister proof case with integrated local control server
- 3G modem of remote control back-up channel
- Lead-in cable
- AC network power supply unit
- Mounting set.

**Options:**
- ARC-KNV4M Remote Down-Converter.
- High-stable ARC-OG1 Reference Frequency Generator integrated in radio receiving unit.

**Features:**
- Receiving and Processing Unit of ARGAMAK-CS is installed inside protected box close to measuring antennae and External Field Sensor Unit
- Data are transferred via antenna cable in digital form. It makes possible eliminating antenna effect completely, preserving the dynamic range and sensitivity, doing without calibration of the cable and using the cable up to 100 m.
- Connection and commutation of up to five external antennae
- Shared operation with external ARC-KNV4M Frequency Down-Converter enabling expansion of operating frequency band up to 20 GHz.
- Socket for external reference generator
- The software packages support standalone performance, remote control and data exchange via radio channels, wired and fiber optic lines.
- Can function as a part of ARCHA-I and ARGUMENT-I Stations.

**Main Functions:**
- Panoramic analysis, receipt and measurement of communication signals in HF, VHF, UHF and SHF range
- Continuous recording of radio signals to a storage for further analysis.
ARGAMAK-CS System, Unattended Design

- Identification and classification signals at carrier and sub-carrier in postprocessing mode
- Demodulation, digital streams structure/time analysis of great variety of protocols and standards in postprocessing mode.

**Basic Specifications**

<table>
<thead>
<tr>
<th>General Parameters of Receiving Path</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>9 kHz - 8 GHz</td>
</tr>
<tr>
<td>Sensitivity (with 3 kHz discreteness and 10 dB signal/noise ratio)</td>
<td>1 µV, max.</td>
</tr>
<tr>
<td>Spurious, Image and IF rejection</td>
<td>min. 80 dB (there can be just some frequency areas with min. 70 dB selectiveness)</td>
</tr>
<tr>
<td>IP2</td>
<td>30 dBmW min.</td>
</tr>
<tr>
<td>IP2</td>
<td>0 dBmW min.</td>
</tr>
<tr>
<td>Noise figure within 20 – 8000 MHz range</td>
<td>12 dB, max.</td>
</tr>
<tr>
<td>Noise figure within other ranges</td>
<td>15 dB, max.</td>
</tr>
<tr>
<td>IP2, IP3 (with 3 kHz spectrum discreteness)</td>
<td>75 dB, min</td>
</tr>
<tr>
<td>Maximum simultaneous bandwidth</td>
<td>24 MHz, min</td>
</tr>
<tr>
<td>Bandpass flatness within simultaneous bandwidth</td>
<td>±1 dB, max.</td>
</tr>
<tr>
<td>Relative error of tuning frequency depending on reference generator used:</td>
<td></td>
</tr>
<tr>
<td>• With internal reference generator</td>
<td>max. ±5×10^-7</td>
</tr>
<tr>
<td>• With external ARC-OG1 Reference Generator</td>
<td>max. ±1×10^-9</td>
</tr>
<tr>
<td>Input radio signal level measurement limits</td>
<td>-10 - +130 dBµV</td>
</tr>
</tbody>
</table>

**Radio Signal Recording, Technical Analysis and Parameter Measurement**

<table>
<thead>
<tr>
<th>Band of radio signal continuous recording (Limited number of discontinuity is possible. The total length is less than 3.5%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9 kHz – 10 MHz</td>
<td>1 MHz</td>
</tr>
<tr>
<td>10 – 25 MHz</td>
<td>2 MHz</td>
</tr>
<tr>
<td>25 – 110 MHz</td>
<td>5 MHz</td>
</tr>
<tr>
<td>110 – 220 MHz</td>
<td>10 MHz</td>
</tr>
<tr>
<td>220 – 18000 MHz</td>
<td>24 MHz</td>
</tr>
</tbody>
</table>

| Control interface | Ethernet |

**Operating Temperature, Weight, Dimensions and Power Consumption**

<table>
<thead>
<tr>
<th>DC supply voltage</th>
<th>From 21 to 30 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>150 W, max.</td>
</tr>
<tr>
<td>Dimensions, max.</td>
<td></td>
</tr>
<tr>
<td>• Remote sensor unit</td>
<td>800×260×180 mm</td>
</tr>
<tr>
<td>• Receiving and Processing Unit</td>
<td>600×600×300 mm</td>
</tr>
<tr>
<td>Weight without antenna cable</td>
<td>20 kg, max.</td>
</tr>
<tr>
<td>Operating temperature range:</td>
<td></td>
</tr>
<tr>
<td>• for indoor equipment</td>
<td>+5°C ... +40°C</td>
</tr>
<tr>
<td>• for outdoor equipment</td>
<td>-55°C ... +55°C</td>
</tr>
</tbody>
</table>

More detailed specifications and description are available only upon request.
This section describes mobile radio monitoring equipment produced by IRCOS. They include mobile stations, systems based on those stations, mobile radio direction finders and other equipment for mobile application. The equipment can differ in sophistication level, performance figures and price. Their functions and configuration can be modified according to Customer request. This section also includes combined radio monitoring and direction finding systems based on mobile, portable and handheld equipment. We can create such systems because we take our standardized equipment for that and use software control packets exchange via radio channels.

The mobile radio monitoring equipment can be installed as stationary or temporary units either on the ground base or on an aircraft. They are designed for automated radio monitoring in a moving or standing mode and also for search, emitter detection and direction finding and radio signal measurement. The mobile equipment can be powered from supplies installed on the same vehicle. To increase electromagnetic field coverage in a “standing mode”, the mobile units can use portable antenna systems installed on remote masts. The mobile equipment cover a wide number of working frequencies and show a high performance in a dynamic range, spectrum analysis and direction finding accuracy. They use standardized units that are also applicable for stationary, portable and handheld equipment. Such standardization ensures a high reliability and maintainability of our equipment. The other advantages of the standardized units is their low weight and small sizes. With this, they include antenna systems that can be easily and quickly installed on a vehicle or alongside of it.

The mobile radio monitoring stations may also include ARC-KN2M - an integrated satellite and inertial navigation system, ARC-KN2M Navigation System can precisely find station coordinates and azimuth in the moving or standing mode (including slow manoeuvring) thus ensuring an automatic reference to the north in any conditions and increasing emitter acquisition accuracy.

ARGUMENT-I Mobile Stations are intended both for autonomous solution of radio monitoring tasks, and for operation as a part of ARMADA ARMS. They perform the same functions as stationary stations of ARCHA family. In contrast to stationary stations they can move to the area of radio transmitter operation, working on the move. It’s especially important for detection, parameter measuring, signal technical analysis and localization of transmitters with low power or transmitters, which use directional antennae, e.g. Wi-Fi access points. The mobile station allows determining coverage areas both by field strength level and by immediate analysis of received signal quality. Even single stand-alone mobile station can provide for localization of radio emitting sources.

Key features of ARGUMENT Mobile Stations:

- All measuring radio monitoring equipment of the stations has technical and metrological parameters, which comply with International Telecommunication Union recommendations
- Due to high functionality of stations and their specifications they may be used by both the Ministry of Communications and security agencies
- Software packages support autonomous operation, remote control and data exchange over radio channels, wired and fiber optic lines.
- Mobile radio direction finders based on ARGAMAK PLUS DRRD series operate in simultaneous processing range up to 24 MHz, operating range 1.5 - 8000 MHz (covered by one antenna system which weighs up to 50 kg), have high performance parameters (more than 100 bearings/s), provide multi-channel direction finding at the rates up to 1000 MHz/s
- Antenna system of the direction finder is installed inside radio transparent radome and can be either removable (in this case the radome covers only the antenna system) or fixed (in this case the radome is integrated with vehicle body and covers vehicle roof completely).
- ARGAMAK-IS DRRD for mobile facilities has instantaneous bandwidth 22 MHz, it permits to process input signals in real time. Spectrum analysis rate within simultaneous bandwidth is up to 600 GHz/s, within entire frequency range of 20 – 8000 MHz - up to 10 GHz/s
- ARGAMAK-IS DRRD for mobile facilities ensures all necessary measurements of radio signal parameters, including electromagnetic field strength, frequency and bandwidth of radio signals. It decodes and analyzes service data used in GSM, UMTS, CDMA, TETRA, DECT, Wi-Fi, WiMAX, LTE digital communication networks and also in DVB-T/H/T2
- ARGAMAK-IS DRRD ensures concurrent connection of up to five antennas with a possibility of their switching and remote change of azimuth and polarization orientation
- Mobile station equipment has relatively small dimensions and weight.

<table>
<thead>
<tr>
<th>ARC-POM2 Multistation Radio Monitoring and Radio Transmitter Localization System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose:</strong></td>
</tr>
<tr>
<td>Radio monitoring</td>
</tr>
<tr>
<td>Direction finding</td>
</tr>
<tr>
<td>Emitter position finding.</td>
</tr>
<tr>
<td><strong>Configuration:</strong></td>
</tr>
<tr>
<td>ARGUMENT-I or ARGUMENT-P master station in complete configuration</td>
</tr>
<tr>
<td>ARGUMENT-I mobile slave stations - same configuration as the master stations or shortened configuration</td>
</tr>
<tr>
<td>Handheld direction finding equipment: ARTIKUL-H1 and/or ARC-RP3M.</td>
</tr>
<tr>
<td><strong>Features:</strong></td>
</tr>
<tr>
<td>ARC-POM2 can function as a part of ARMADA Automated Radio Monitoring System</td>
</tr>
<tr>
<td>Joint or individual operation of several automated ARGUMENT Mobile Radio Monitoring Stations. The number of stations in the system is taken based on executing tasks and terrain.</td>
</tr>
<tr>
<td>Simultaneous direction finding of a given emitter by all stations in the system.</td>
</tr>
<tr>
<td>The master station may be any station included in the system</td>
</tr>
<tr>
<td>High search speed, sensitivity of emitters detection and localization accuracy.</td>
</tr>
</tbody>
</table>

*Can handle all radio monitoring tasks. System includes manual direction finding equipment and/or handheld automatic radio monitoring and direction finding devices enabling localization of emitters in places unreachable for the mobile equipment. inside buildings, on roofs, on difficult terrain* |
| Data exchange between system posts and station posts, remote radio channel control. |
System Provides:
- Prompt signal search, detection and localization.
- Emitter database maintenance.
- Other functions including panoramic analysis, radio environment recording within a specified frequency, signal technical analysis and measurement, single-channel and multi-channel simultaneous direction finding, automated radio channel control, field strength intensity estimation.

System specifications are determined by system equipment parameters.

**ARGUMENT-I**

**Mobile Measuring Radio Monitoring and Direction Finding Station**

**Purpose**
The station is intended for search, detection, measurement of field strength and parameters of REE signals, direction finding, recording, technical analysis and classification of signals used in modern communication systems and data transfer system in HF, VHF, UHF and SHF ranges, as well as localization of their emitters. The last function is provided both when the station works in stand alone mode or as a part of ARMADA ARMS. Measuring equipment has certificates of Federal Technical Regulation and Metrology Agency. Measurement procedures are certified.

**Typical Configuration:**
- **Workstation No. 1:** Search, detection, direction finding (1.5 - 8000 MHz), ARTIKUL-M Automated Mobile Direction Finder with removable (AS-MP1) or fixed (AS-MP6) antenna system under radio transparent radome and additional mast-mounted antenna system for operation at stops.
- **Workstation No. 2:** Measurement of field strength and parameters of communication and data transmission systems (operating frequency range is 9 kHz - 18 GHz, can be extended up to 43 GHz), decoding and analysis of service information of GSM, UMTS, CDMA, TETRA, DECT, Wi-Fi, WiMAX systems and signals of DVB-T1/H/T2 digital TV, amplitude automated direction finding. ARGAMAK-IS Panoramic Field Strength Meter for mobile facilities with ARC-UP2 rotary support device, external APK-KNB4 Frequency Down-Converter and a set of measurement antennas for installation on a mast.
- **Workstation No. 3:** Recording, technical analysis and classification of signals (operating frequency range is 9 kHz - 18 GHz, can be extended up to 43 GHz) ARGAMAK-CS System for recording and technical analysis of communication system signals for mobile facilities.
- **Workstation No. 4:** Radio signal source localization ARC-GIS Geoinformation Server.
- **Common system equipment:**
  - Local control server
  - Communication and data transmission equipment
  - Power supply system with a back-up battery
  - Personnel life support system for autonomous operation.
- **Optional Equipment:**
  - ARC-RP3M Handheld Direction Finder
  - ARC-IG Video facilities for visualization of emitters in spatially distributed locations.

**Station provides:**
- Search for new emitters, measurement and comparison against the database
- Automatic position finding and e-mapping of emitters both in real time and in postprocessing mode.
- Panoramic analysis within the entire operating frequency range or within separate intervals under complex electromagnetic conditions, detection of its changes.
- Recording radio environment within a specified frequency range. This procedure can function within a long period and is based on amplitude/frequency/bearing/time coordinates, unit location and the absolute time at the time of saving.
- Databases maintenance.
- Single and multi-channel direction finding of radio signals with random modulation types and spectrum width.
- Automated monitoring of open radiodimensional channel within specific range sections and/or fixed frequencies, simultaneous recording of demodulated signals and their service parameters.
- Recording and technical analysis of radio signals in real time mode and in postprocessing mode.
- Demodulated signals playback.
- Accumulation of data for further analysis in the postprocessing mode.
- Station coordinate and course finding, display station path in the map both in real-time mode and postprocessing mode.
- Field strength measuring and its distribution mapping.
- Showing emitters in spatially distributed locations.
- Evaluation of field strength distribution around emitters subject to terrain and presenting of the results in the map.
- Localization of emitters based on field strength measurement.
- Verification of emitter parameters.

**ARGUMENT-I Station with antenna system concealed under radome**

An example of structural diagram of Mobile Radio Monitoring Station

In this configuration the station provides simultaneously for direction finding, measuring and technical analysis. Configuration of mobile station can vary depending of the purposes. Figures below present the structural diagrams of the station in case it includes only measuring equipment and in case it includes only equipment ARGAMAK-CS System of Technical Analysis.
Station Post Functions

Workstation No. 1:
- Single-channel and multi-channel direction finding
- Search for emitters
- Panoramic analysis within operating frequency range
- Radio environment recording within a specified frequency range based on amplitude/frequency/bearing/time coordinates
- Radio signal recording, parameter estimation and technical analysis
- Automated monitoring of detected radio channels
- Sending operational information through a LAN to the other posts for further entry to the database
- Radio channel monitoring data collecting and processing
- Tasks/data transmission to slave stations
- Data acquisition from slave stations
- Database management (archivation, recovery, filtering, etc.)
- Report (incl. graphical report) generation and printout
- Data acquisition from the navigation equipment.

Post No. 1 is primarily intended for single-channel and multi-channel direction finding. If the number of posts is limited (e.g. when posts No.2-4 are not available) their tasks can be partially handled using only post No. 1.

Workstation No. 2:
- Panoramic analysis within operating frequency range
- Search for emitters
- Field strength measurement
- Sending operational information through a LAN to the other posts for further entry to the database and task setting
- Radio environment recording within a specified frequency range based on amplitude/frequency/time coordinates
- Recording radio signals, their technical analysis and parameter measurement
- Automated monitoring of detected radio channels.

Post No. 2 is primarily intended for measuring of radio signal parameters.

Workstation No. 3:
- Panoramic analysis within operating frequency range
- Demodulated signal listening
- Recording of radio signals
- Technical analysis of radio signals in real time and in postprocessing mode
- Recognition and Classification of the Radio Signals
- Technical analysis and demodulation of radio emission of following types: AM, WFM, NFM, LSBB, USSB, FSK2, FSK4, FSK6, FSK8, FSK12, FSK16, FSK32, MFSK, PSK2, PSK4, PSK8, QAM16, QAM32, QAM64, QAM128, DQPSK;
- Digital streams structure/time analysis both in real time and in post-processing mode.

Operator of post No. 3 performs the tasks from post No. 1 or 2 or on his/her own.

Workstation No. 4:
- Emitter position finding
- Showing bearings and emitters in electronic map
- Field strength distribution mapping based on measurements
- Evaluation of field strength distribution around emitters subject to terrain and presenting of the results in the map
- Showing emitters in spatially distributed locations
- Forming and maintenance of database of emitters in spatially distributed locations
- Showing current position and path of the Station.

Basic Technical Specifications of Station in Complete Configuration

<table>
<thead>
<tr>
<th>Panoramic Analysis</th>
<th>Operating frequency range:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Workstation No.1 based on ARTIKUL-M8 or ARTIKUL-M8+</td>
<td>1.5 – 8000 MHz</td>
</tr>
<tr>
<td>• Workstation No.2 based on ARGAMAK-IS (design for mobile application)</td>
<td>9 kHz - 18(43) GHz</td>
</tr>
<tr>
<td>• Workstation No.3 based on ARGAMAK-CS</td>
<td>9 kHz - 18(43) GHz</td>
</tr>
<tr>
<td>Panoramic analysis rate within operating frequency range</td>
<td>up to 10 GHz/s</td>
</tr>
</tbody>
</table>
**Single Channel and Multi-Channel Direction Finding**

<table>
<thead>
<tr>
<th>DF method</th>
<th>Correlative interferometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating azimuth range</td>
<td>0° - 360°</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>1.5 – 8000 MHz</td>
</tr>
</tbody>
</table>

Field sensitivity for vehicle-mounted antenna systems (spectrum discrete is 3.125 kHz) for following frequency ranges:

- **1.5 – 20 MHz (HF-module)**: 30 µV/m max.
- **20 – 1000 MHz (module-1)**: 2 -10 µV/m
- **1000 – 3000 MHz (module-2)**: 3 -15 µV/m
- **3000-8000 MHz (module-3)**: 25 µV/m max.

Field sensitivity for mast-mounted antenna systems (spectrum discrete is 3.125 kHz) for following frequency ranges:

- **1.5 – 20 MHz (HF-module)**: 30 µV/m max.
- **20 – 1000 MHz (module-1)**: 1 -10 µV/m
- **1000 – 3000 MHz (module-2)**: 3 -15 µV/m
- **3000-8000 MHz (module-3)**: 25 µV/m max.

Instrument accuracy (RMS) for vehicle-mounted antenna systems (spectrum discrete is 3.125 kHz), max.:

- **1.5 – 20 MHz (HF-module)**: 5°
- **20 – 1000 MHz (module-1)**: 2.5°
- **1000 – 3000 MHz (module-2)**: 2°
- **3000-8000 MHz (module-3)**: 3°

Instrument accuracy (RMS) for mast-mounted antenna systems (spectrum discrete is 3.125 kHz), max.:

- **1.5 – 20 MHz (HF-module)**: 5°
- **20 – 1000 MHz (module-1)**: 2°
- **1000 – 3000 MHz (module-2)**: 2°
- **3000-8000 MHz (module-3)**: 3°

Antenna system remote location range up to 100 m

**Radio signal recording & technical analysis**

<table>
<thead>
<tr>
<th>Max. recording bandwidth</th>
<th>Up to 40 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous radio signal recording time</td>
<td>Depends on the storage volume</td>
</tr>
</tbody>
</table>

Other parameters are determined by the equipment included in the Station.

**ARGUMENT-P Mobile Radio Monitoring and Direction Finding Station**

**Purpose**

ARGUMENT-P Radio Monitoring Station is intended for all scale radio monitoring task solution being operated stand alone or as a part of ARMADA system. ARGUMENT-P Station is designed based on all-wheel drive truck with isothermal van. An example of Station structural diagram is presented below. Compare to ARGUMENT-I station, ARGUMENT-P station provides more functionality including measuring of satellite communication signal parameters, monitoring of broadcasting and analogue/digital TV signals.

**Typical Configuration:**

- **Workstation No. 1:** Search, detection, direction finding (1.5 - 8000 MHz), ARTIKUL-M Automated Mobile Direction Finder with removable (AS-MP1) or fixed (AS-MP6) antenna system under radio transparent radome and additional mast-mounted antenna system for operation at stops.
- **Workstation No. 2:** Measurement of field strength and parameters of communication and data transmission systems (9 kHz - 43 GHz), decoding and analysis of service information of GSM, UMTS, CDMA, TETRA, DECT, WiFi, WiMax systems and signals of DVB-T1/H/T2 digital TV, amplitude automated direction finding. ARGAMAK-IS Panoramic Field Strength Meter for mobile facilities with ARC-UP2 rotary support device, external APK-KNB4 Frequency Down-Converter and a set of measurement antennas for installation on a mast.
- **Workstation No. 3:** Monitoring of terrestrial and satellite TV and radio broadcasting signals.
- **Workstation No. 4:** Receipt and measurement of parameters of satellite communication line signals.

**Common system equipment:**

- Local control server
- Communication and data transmission equipment
- Power supply system with a back-up battery
- Personnel life support system for autonomous operation
- Automated fire fighting system
- Security and video surveillance system.

**Optional Equipment:**

- ARC-RP3M Handheld Direction Finder
- ARC-IG Video facilities for visualization of emitters in spatially distributed locations.

As option ARGUMENT-P may be supplemented with a mobile rest station equipped with 6 rest places for operators, a kitchen, and bathroom unit containing a shower cabin, and a toilet.

**ARTIKUL-M Mobile Direction Finder**

**Purpose**

- Direction finding
- Radio transmitters location
- Panoramic spectrum analysis
- Electromagnetic field strength estimation
- Radio signal parameter estimation
- Radio signal technical analysis
- Radio channel monitoring.
Mobile direction finder may be used as a part of mobile radio monitoring and direction finding stations for operation at stops and on the move.

**Typical Configuration:**
- AS-MP17 (removable) or AS-MP6 (fixed) vehicle roof mounted antenna system covered with radio-transparent radome
- ARC-KN2M navigation equipment built in antenna system
- Analog-digital processing unit
- PC with software package
- Power system with charger and battery.

**Direction Finder Provides:**
- Single and multi-channel direction finding of radio emissions with any modulation types and spectrum width in the range from 1.5 to 8000 MHz
- Displaying the emitter bearing and localization of detected emitter on the electronic map
- Search for emission, measurement of their parameters and comparison with the database
- Creation of databases, their extension and comparing of the recorded data with the references in the database
- Recording of radio signals to a storage device
- Panoramic analysis within the entire operating frequency range or within separate intervals under complicated electromagnetic conditions, detection of changes in ambient electromagnetic conditions
- Recording the radio environment to the hard drive within a specified frequency range. This procedure can function within a long period and is based on amplitude/frequency/bearing/time coordinates, the station location and the absolute time at the time of saving
- Accumulation of data for further analysis in the post-processing mode, simultaneous recording of demodulated signals and their service parameters (frequency, time, signal level, etc.)
- Demodulated signals playback.

**Basic Specifications**

<table>
<thead>
<tr>
<th>General</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>1.5 – 8000 MHz</td>
</tr>
<tr>
<td>Single channel dynamical range</td>
<td>110 dB, min</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (3rd and 2nd order)</td>
<td>75 dB, min</td>
</tr>
<tr>
<td>Attenuators</td>
<td>0 - 30 dB with 2 dB increment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panoramic Analysis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Panoramic analysis rate within operating frequency range</td>
<td>up to 10 GHz/s</td>
</tr>
<tr>
<td>Minimum duration of the signal detected within simultaneous bandwidth (receiver tuning frequency doesn’t change)</td>
<td>from 0.5 µs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Single Channel and Multi-Channel Direction Finding</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DF method</td>
<td>Correlative interferometer</td>
</tr>
<tr>
<td>Operating azimuth range</td>
<td>0° - 360°</td>
</tr>
<tr>
<td>Multi-channel direction finding rate</td>
<td>1000 MHz/s</td>
</tr>
<tr>
<td>Single-channel direction finding rate</td>
<td>more than 100 bearing/s</td>
</tr>
<tr>
<td>Processed emitter signal spectrum width</td>
<td>Arbitrary</td>
</tr>
<tr>
<td>Processed single signal minimum duration</td>
<td>10 ms</td>
</tr>
<tr>
<td>Processed repeat signal minimum duration</td>
<td>2 ms</td>
</tr>
<tr>
<td>Field sensitivity for antenna system (depending on the frequency)</td>
<td></td>
</tr>
<tr>
<td>• 1.5 – 25 MHz</td>
<td>30 µ V/m, max.</td>
</tr>
<tr>
<td>• 25 – 3000 MHz</td>
<td>2 - 15 µ V/m</td>
</tr>
<tr>
<td>• 3000 – 8000 MHz</td>
<td>2 - 25 µ V/m</td>
</tr>
<tr>
<td>Instrument accuracy (RMS) for antenna system, max.</td>
<td></td>
</tr>
<tr>
<td>• 1.5 – 25 MHz</td>
<td>5°</td>
</tr>
<tr>
<td>• 25 – 3000 MHz</td>
<td>2.5°</td>
</tr>
<tr>
<td>• 3000 – 8000 MHz</td>
<td>3°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Radio Channel Monitoring, Technical Analysis and Broadcast Recording</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. recording bandwidth</td>
<td>Up to 40 MHz</td>
</tr>
<tr>
<td>Types of recorded data</td>
<td>Bearing, demodulated signals, spectrograms, time, time-based signal sampling (I/Q)</td>
</tr>
<tr>
<td>Continuous radio signal recording time</td>
<td>depends on HDD capacity</td>
</tr>
<tr>
<td>Maximum simultaneous bandwidth within the frequency range:</td>
<td></td>
</tr>
<tr>
<td>• 1.5 – 5 MHz</td>
<td>1 MHz</td>
</tr>
<tr>
<td>• 5 – 25 MHz</td>
<td>2 MHz</td>
</tr>
<tr>
<td>• 25 – 110 MHz</td>
<td>5 MHz</td>
</tr>
<tr>
<td>• 110 – 220 MHz</td>
<td>10 MHz</td>
</tr>
<tr>
<td>• 220 – 8000 MHz</td>
<td>24 MHz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions, Weight</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna system dimensions</td>
<td>1550×1110×550 mm, max.</td>
</tr>
<tr>
<td>Dimensions of A/D Processing Unit or Interface Unit</td>
<td>268 x 256 x 140 mm</td>
</tr>
<tr>
<td>Weight of antenna system</td>
<td>50 kg, max.</td>
</tr>
<tr>
<td>Weight of A/D Processing Unit or Interface Unit</td>
<td>5 kg, max.</td>
</tr>
</tbody>
</table>

Mobile radio monitoring station with ARTIKUL-M Mobile Direction Finder, radiotransparent radome over entire vehicle roof.
Portable Equipment

The portable (transportable) automated radio monitoring equipment is based on standard modules, which are also used in stationary, mobile and handheld equipment. They are designed for transportation by vehicles to the deployment area or for carrying by one or several operators. These stations can be deployed in stationary workstations, temporary workstation and on the open ground. The equipment is not intended for functioning on the move. There are some limitations on the weight, power consumption and dimensions. The portable equipment, when necessary, can be powered from a standalone power supply.

Features:
- Portable (transportable) station equipment has small dimensions and weight below 50 – 100 kg. It makes possible to carry the equipment to hard-to-reach area without mechanical transport means.
- The station includes automatic direction finders based on two-channel panoramic digital receiver with two physical receiving channels, providing for correlative interferometer DF technique. This technique is the most effective in case of interferences occur. It provides for high accuracy and field sensitivity.
- Radiomonitoring equipment of the stations operating in 9 kHz - 8000 MHz frequency range provides full-scale radio monitoring, including quick search of new signals, their recording and technical analysis, automated direction finding, localization of emitters with their mapping.
- The possibility to use ARTIKUL-H1 automatic direction finder in manpack, mobile versions, and also on a temporary stations (when the antenna system raises 12 m high and above) opens extensive prospects in solution of tasks being of interest for both the Ministry of Communications and security agencies.
- Even more options are provided by ARCHA-IT Transportable Station with simultaneous bandwidth up to 24 MHz and high performance. This station can be used on mobile operation mode or at temporary stops. Because two-channel DRRU is located close to antenna system, antenna system can be moved from control and display unit at distance up to 80 m.
- Autonomous operation of the stations powered from built-in batteries, standalone power units and also by vehicle battery with voltage ranging from 9 to 36 V.
- It is possible to install the equipment of the station at unprepared sites with minimal (within 20 minutes) time of deployment and removal of all workstations of the station.
- It is possible to operate antenna systems and radio receiving equipment in severe climatic and natural conditions (including high mountain areas, strong winds and heavy precipitation) without any additional preventive measures.
- Software supports autonomous operation, remote control and data exchange over radio channels, wired and fiber optic lines.

**ARC-POM3**
Portable Multistation Radio Monitoring and Position Finding System

**Purpose:**
- Radio monitoring
- Direction finding
- Emitter position finding.

**Configuration:**
- Master ARENA Radio Monitoring and Direction Finding Station in complete configuration
- Slave ARENA Portable Radio Monitoring and Direction Finding Station - in shortened or in the same configuration as above.

**Features:**
- ARC-POM3 can function as a part of ARMADA Distributed Automated Radiomonitoring System
- Option of individual operation of ARENA Stations included in the System
- Simultaneous direction finding of a given emitter by all stations in the system
- Can handle all radio monitoring tasks.
- Includes handheld manual and automatic direction finding equipment enabling a more precise emitter scanning.

**ARCHA-IT**
Transportable Radio Monitoring and Direction Finding Station

**Purpose**
The station provides functions of search, detection, measurement of field strength and parameters of radio electronic stations, direction finding, recording, technical analysis and classification of signals used in modern communication systems and data transfer system in HF, VHF, UHF and SHF ranges, as well as (when it works as a part of DF pair or as a part of ARMADA ARMS) localization of their emitters.

**Typical Configuration:**
- ARGAMAK-I Panoramic Measuring Receiver with additional coherent receiving channel (frequency range 20-3000 MHz, integrated high-stable reference frequency generator, Certificate of Approval of Measuring Equipment Type No 47238, certified measuring procedure), installed inside antenna and radio receiving unit (ARRU)
- AS-HP5 Antenna System for direction finding (operating frequency range 20 – 3000 MHz)
- External Field Sensor Unit (EFSU) - omni-directional measuring antenna (operating frequency range 20 – 3000 MHz)
- Control and display unit with software packages for direction finding, parameter measuring and technical analysis of the signals
- Common system equipment (cables, petroleum generator, power supply unit, foldable mast with height up to 3 m).

**Options:**
- Navigation and timing equipment GLONASS/GPS for location finding and synchronization of workstations when operating as a part of multi-station system.

**Features:**
- Operation stand-alone and as a part of multi-station system or as a part of ARMADA system.
Panoramic spectrum analysis within the entire operating frequency range
When stand-alone operation:
- Panoramic spectrum analysis within the entire operating frequency range or within separate intervals in complicated electromagnetic environment, accommodation to ambient radio environment and detection of its changes
- Search for emission sources within selected frequency ranges, including frequency hopping signals
- Signal parameter measurement
- Technical analysis, including revealing of central frequency, signal type, modulation type, signal bandwidth
- Automatic single and multichannel direction finding of radio signal sources with random modulation types and spectrum width
- Building of bearing panorama within operating frequency range with speed up to 1 GHz/s
- Real-time display of bearings, spectrum panorama, bearing history and signal amplitude history
- Review and processing of the data from DB

ARRU with AS-HP5 Antenna System deployed for operation

Basic Specifications

<table>
<thead>
<tr>
<th>Panoramic Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
</tr>
<tr>
<td>Rate within operating range</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (3rd and 2nd order)</td>
</tr>
<tr>
<td>Simultaneous analyzed bandwidth</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Single Channel and Multi-Channel Direction Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating azimuth range</td>
</tr>
<tr>
<td>Operating frequency range</td>
</tr>
<tr>
<td>Multi-channel direction finding rate</td>
</tr>
<tr>
<td>Simultaneous DF bandwidth within the range</td>
</tr>
<tr>
<td>20-110 MHz</td>
</tr>
<tr>
<td>110-220 MHz</td>
</tr>
<tr>
<td>220-3000 MHz</td>
</tr>
<tr>
<td>Processed signal minimum duration</td>
</tr>
<tr>
<td>single</td>
</tr>
<tr>
<td>repeating pulse</td>
</tr>
<tr>
<td>Field sensitivity depending on the signal frequency with 6.25 kHz spectrum discreteness</td>
</tr>
<tr>
<td>20 – 200 MHz</td>
</tr>
<tr>
<td>200 – 3000 MHz</td>
</tr>
<tr>
<td>Instrument accuracy (RMS), max.</td>
</tr>
<tr>
<td>20 – 200 MHz</td>
</tr>
<tr>
<td>200 – 3000 MHz</td>
</tr>
<tr>
<td>Processed signal spectrum width</td>
</tr>
</tbody>
</table>

Recording, Technical Analysis, Radio Channel Monitoring

| Types of recorded data | radio signal sampling (IQ), bearing, demodulated signals, spectrograms, time |
|------------------------|
| Max. processing bandwidth within the range: | |
| 20 – 110 MHz | 10 MHz |
| 110 – 220 MHz | 20 MHz |
| 220 – 3000 MHz | 40 MHz |
Purpose:
- Search, detection, measurement of field strength and parameters of radio electronic stations, direction finding, recording, technical analysis and classification of signals used in modern communication systems and data transfer system in HF, VHF, UHF and SHF ranges, as well as (when it works as a part of DF pair or as a part of ARMADA ARMS) localization of their emitters.

Configuration:
- ARTIKUL-T Transportable Automatic Direction Finder operating within 20 - 3000 MHz frequency range, with foldable AS-PP4 Antenna System, a telescopic mast
- ARTIKUL-P Transportable Automatic Direction Finder operating within 20 - 3000 MHz frequency range, with foldable AS-PP17 Antenna System, a telescopic mast and a mast transportation tube
- ARTIKUL-H1 Manpack Broadband Automatic Direction Finder with AS-HP1 (110-3000 MHz), AS-HP2 (3-8 GHz) Antenna Systems for manpack, mobile and stationary operation, AS-HP-KV (1.5 – 30 MHz), AS-HP0 (20-300 MHz), and AS-HP5 (20-3000 MHz) Antenna Systems for mobile and stationary operation
- ARC-RP3M Handheld Direction Finder with ARC-A3A directional antenna set (300 kHz – 3 GHz) and ARC-KNV4M external radio signal converter extending operating frequency range up to 18 GHz.
- Communication and data transfer set for provision of interaction with other ARMADA ARMS nodes
- Self-contained power supply unit.

Capabilities:
The station provides automated performance of radio monitoring tasks, including:
- Panoramic spectrum analysis and fast search for signals
- Direction finding and localization of emitters in the field and displaying them on the map:
  - Automatic localization within the range from 1.5 to 8000 MHz (ARTIKUL-H1) or from 20 to 3000 MHz (ARTIKUL-P) in case of simultaneous operation of automatic direction finders at several ARENA stations if they are installed on temporary stationary sites
- Recording, technical analysis and automated post-processing of radio signals.

Use of communication and data transmission set allows extending station capabilities by direction finding coupled with other ARENA Radio Monitoring Stations or as a part of ARMADA ARMS. Application options in case of interaction with other ARENA stations are shown in Figures.

**ARTIKUL-T**
Transportable Automated Direction Finder

**Purpose:**
- Outdoor radio monitoring applications including:
  - Direction finding
  - Panoramic spectrum analysis
  - Electromagnetic field strength estimation
  - Radio signal parameter estimation
  - Radio signal recording, and technical analysis.
  - Radio channel monitoring.

**Typical Configuration:**
- With simultaneous bandwidth up to 24 MHz
  - Foldable AS-PP4+ Antenna System with integrated two-channel tuner and digital processing module for mounting on an mast
  - Interface block
  - With simultaneous bandwidth up to 5 MHz
    - AS-PP4 or AS-PP17 antenna system with integrated two-channel tuner for mounting on a mast
    - ARC-ACO-M11 two-channel A/D processing unit
  - Antenna cable, up to 50 m long.
Control and display unit with software package
Power unit.

**Options:**
- ARC-SS Special Processor
- Power system with charger and battery
- Navigation equipment
- Communication equipment.

**Features:**
- Remote wireless control and data exchange via radio channel are supported by the software packs
- May be included into:
  - ARGUMENT-I Mobile Radio Monitoring and Direction Finding Station for operation at stops
  - ARENA Portable Station for operation at stops.

**Direction Finder Provides:**
- Search for emissions, their parameters evaluation, technical analysis and comparison with the database
- Creation of databases, their extension and comparing of the recorded data with the references in the database
- Field strength estimation
- Recording of radio signals
- Panoramic analysis within the entire operating frequency range or within separate intervals under complicated electromagnetic conditions, detection of changes in ambient electromagnetic conditions
- Recording radio environment within a specified frequency range. This procedure can function within a long period and is based on amplitude/frequency/bearing/time coordinates, unit location and the absolute time at the time of saving.
- Single and multi-channel direction finding of radio signals with random modulation types and spectrum width
- Demodulated signals playback
- Accumulation of data for further analysis in the post-processing mode, simultaneous recording of demodulated signals and their service parameters (frequency, time, signal level, etc.)
- Displaying of the bearing in electronic map.

**Basic Technical Specifications of Direction Finders in Complete Configuration**

<table>
<thead>
<tr>
<th></th>
<th>Panoramic Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range of the basic set</td>
<td>20 - 3000 MHz (1.5 – 3000 MHz)</td>
</tr>
<tr>
<td>Attenuators</td>
<td>0 - 30 dB with 2 dB increment</td>
</tr>
</tbody>
</table>

**ARTIKUL-P Portable Automatic Direction Finder**

Direction finding techniques and equipment are protected by the RF patents
First Grade medal awarded by the XII Moscow International Forum & Exhibition «Security and Safety Technologies» (2007)

**Purpose:**
- Automatic direction finding
- Localization of emitters (when used as a part of direction finding network)
- Electromagnetic field strength estimation
- Panoramic spectrum analysis
- Radio signal parameter estimation
- Radio signal recording and technical analysis
- Radio channel monitoring

The portable direction finder may be used as a part of portable stations for operation at stops.

**Typical Configuration:**
- Portable foldable antenna system with a built-in two-channel receiver
- Telescopic mast
- Two-channel digital processing unit
ARTIKUL-P Direction Finder on the roof in the city and in a field

- Antenna system and mast transportation tube
- Backpacks.

**Direction Finder Provides:**
- Single and multi-channel direction finding of radio signals with random modulation types and spectrum width
- Displaying the emitter bearing and localization of the emitter on the electronic map
- Search for emission, measurement of their parameters and comparison with the database
- Creation of databases, their extension and comparing of the recorded data with the references in the database
- Recording of radio signals to a storage device
- Panoramic analysis within the entire operating frequency range or within separate intervals under complicated electromagnetic conditions, detection of changes in ambient electromagnetic conditions
- Recording the radio environment within a specified frequency range. This procedure can function within a long period and is based on amplitude/frequency/bearing/time coordinates, the station location and the absolute time at the time of saving
- Accumulation of data for further analysis in the post-processing mode, simultaneous recording of demodulated signals and their service parameters (frequency, time, signal level, etc.)
- Demodulated signals playback.

Antenna system of the direction finder comprises two arrays: basic and additional ones. The basic array consists of nine flat antenna elements mounted on foldable cross-arms. The additional array extends frequency range up to 3 GHz. It comprises seven antenna elements installed inside protective radome. Antenna system contains integrated satellite navigation module, which provides for true north calibration of the antenna system and its localization.

**Basic Specifications**

### Panoramic analysis and detection
- Operating frequency range: 25 - 3000 MHz
- Intermodulation free dynamic range (3rd and 2nd order): 75 dB, min
- Panoramic analysis rate within operating frequency range: min. 3200 MHz/s

### Single-channel and multi-channel automatic direction finding
- DF method: Correlative interferometer
  - Operating azimuth range: 0° - 360°
  - Operating frequency range: 25 - 3000 MHz
  - Processed emitter signal spectrum width: Arbitrary
  - Field sensitivity for antenna system: 1 - 10 µV/m
  - Instrument accuracy (RMS): 2°
  - Multi-channel direction finding rate: min. 120 MHz/s
  - Single-channel direction finding rate: min. 30 bearings/s

### Operating Parameters
- Total weight of equipment and accessories: max. 65 kg
- Required number of operators for transportation: up to 3

---

**Operating Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of the antenna system (with cased mast)</td>
<td>max. 24 kg</td>
</tr>
<tr>
<td>Weight of the backpack with spare parts and accessories</td>
<td>max. 5 kg</td>
</tr>
<tr>
<td>Weight of power generator with reeled 20 m cable</td>
<td>max. 18 kg</td>
</tr>
<tr>
<td>Time of deployment by two operators</td>
<td>max. 15 minutes</td>
</tr>
<tr>
<td>Deployment site preparation</td>
<td>Not required</td>
</tr>
</tbody>
</table>

**ARC-D11 Two-Channel Panoramic Radio Receiver**

Processing techniques and equipment are protected by the RF patents

**Purpose:**
- Variety of functions related with search for radio emissions inside facilities and outdoor radio monitoring, including:
  - Detection of data leakage technical channels indoors
  - Wire network monitoring
  - Automatic direction finding of active radio signal sources
  - External radio monitoring of extended facilities
  - Radio signal recording and technical analysis
  - Radio signal spectrum analysis and parameters measurement.
  - Search of intermodulation interferences
  - Analaysis of parameters of wireless communication and data transmission network base stations (GSM, CDMA, TETRA, UMTS, LTE, Wi-Fi, WiMAX, DECT), as well as DVB-T/T2/H;
  - Evaluation of emission sources coordinates (based on signal levels measured in different points or based on bearings obtained from optional DF antenna system).

**Basic Configuration:**
- Central unit of ARC-D11, including:
  - Antenna switches
  - Two ARC-PS5+ Tuner Modules
  - Two modules of ARC-KNV3 Frequency Down-Converter
  - Two-Channel ARC-CO+ Digital Processing Module
  - AC and vehicle on-board power unit with charger and battery.
- Case with accessories:
  - Set of ARC-A2M Broadband Antennae
  - ARC-A34K (3 – 8 GHz) Widerange Antenna
  - ARC-ASP2 Active Network Probe
  - ARC-PSP2 Passive Network Probe
  - Control and display module
  - Set of connection cables

Central Unit of ARC-D11
**Options:**
- ARC-A7A-3 Broadband Antenna for Installation on Vehicle (active)
- ARC-KNV4M Frequency Down-Converter
- AS-HP-KV, AS-HP0, AS-HP1, AS-HP2, AS-HP5 Antenna Systems providing for automatic direction finding with tools to mount them on the mast or vehicle
- Vehicle luggage box with fasteners to mount DF antenna systems
- AS-MP17 Antenna System, removable vehicle-mounted
- ARC-A3A Directional Antenna Set and handle provided for amplitude direction finding
- High-stable (1×10-9) ARC-OG1 Reference Frequency Generator
- ARC-GIS Geoinformation Server and navigation equipment.

**Features**
- Broad operating frequency range
  - 9 kHz - 8 GHz (up to 18 GHz with ARC-KNV4M Down-Converter)
- High efficiency:
  - Panoramic analysis rate
    - within operating frequency range up to 10 GHz/s
    - within simultaneous bandwidth up to 600 GHz/s
- Multi-Functionality:
  - Indoor radio monitoring (from 9 kHz to 18 GHz)
  - External radio monitoring of extended facilities (25-MHz – 3GHz)
  - Outdoor radio monitoring (from 9 kHz to 18 GHz)
  - Automated direction finding (20 MHz ... 8 GHz)
  - Radio transmitters location:
    - Analogue VHF/UHF communication equipment
    - GSM, CDMA, DECT, TETRA, UMTS, LTE, Wi-Fi, WiMAX base stations
    - Satellite system surface transmitters in L-, S-, C-, X-, and Ku ranges;
  - Continuous radio signal recording within the band up to 40 MHz
  - Radio signal technical analysis
  - Search for intermodulation interferences .
- Option of wire/wireless control and data exchange supported by the software packages

**Main Functions:**
- Real-time two-channel synchronous radio monitoring
- Two-channel synchronous or single-channel search, accumulation and maintenance of signal source database and processing of results
- Detection of noise-like signals
- Recording radio signal within the band up to 40 MHz
- Technical analysis, determination of modulation type and measurement of radio signal parameters
- Wire network monitoring.

**Additional Functions:**
- Single and multi-channel direction finding with an optional antenna system, signal level estimation with arbitrary spectrum width
- Remote indoor radio monitoring.

**Basic Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range for each channel (basic configuration)</td>
<td>9 kHz – 8000 MHz</td>
</tr>
<tr>
<td>Frequency range, complete configuration (for one channel only)</td>
<td>9 kHz - 18 GHz</td>
</tr>
<tr>
<td>Input attenuator</td>
<td>0 to -30 dB with 2 dB increment</td>
</tr>
<tr>
<td>Maximum allowable input voltage</td>
<td>23 dBm</td>
</tr>
</tbody>
</table>

**When Operated with Internal Reference Generator**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative error of frequency tuning</td>
<td>±5×10^{-7}</td>
</tr>
<tr>
<td>Temperature fluctuations</td>
<td>±5×10^{-7}</td>
</tr>
<tr>
<td>Frequency fluctuations per day</td>
<td>±5×10^{-7}</td>
</tr>
</tbody>
</table>

**When Operated with External Reference Generator**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative error of frequency tuning</td>
<td>±1×10^{-9}</td>
</tr>
<tr>
<td>Temperature fluctuations</td>
<td>±1×10^{-9}</td>
</tr>
<tr>
<td>Frequency fluctuations per day</td>
<td>±1×10^{-9}</td>
</tr>
</tbody>
</table>

**Panoramic Analysis**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panoramic analysis rate within operating frequency range</td>
<td>up to 10 GHz/s*</td>
</tr>
<tr>
<td>Minimum duration of the signal detected within simultaneous bandwidth (receiver tuning frequency doesn't change)</td>
<td>from 0.5 µs</td>
</tr>
<tr>
<td>Sensitivity with 3.125 kHz discreteness depending on the frequency</td>
<td>0.8 - 1.5 µV</td>
</tr>
</tbody>
</table>

**Automated single-channel and multi-channel direction finding**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF method</td>
<td>Correlative interferometer</td>
</tr>
<tr>
<td>Operating azimuth range</td>
<td>0° - 360°</td>
</tr>
<tr>
<td>Operating frequency range</td>
<td>1.5-8000 MHz (depending on antenna system used)</td>
</tr>
<tr>
<td>Field sensitivity</td>
<td>Depends on antenna system used</td>
</tr>
<tr>
<td>Instrument accuracy (RMS)</td>
<td>Depends on antenna system used</td>
</tr>
<tr>
<td>Processed signal minimum duration</td>
<td>10 ms</td>
</tr>
</tbody>
</table>

**Indoor Radio Monitoring**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling attenuation of antenna switches between channels (within range 25 – 3000 MHz), min.</td>
<td>40 dB</td>
</tr>
<tr>
<td>System total sensitivity (wattage of a transmitter in an 8 x 8m room with 99% detection)</td>
<td>50 µW</td>
</tr>
</tbody>
</table>

**Wire network monitoring**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal detection level</td>
<td></td>
</tr>
<tr>
<td>within 0.05 - 10 kHz</td>
<td>1 mV, max.</td>
</tr>
<tr>
<td>within 10 kHz - 1 MHz</td>
<td>100 µV, max.</td>
</tr>
<tr>
<td>within 1 MHz - 30 MHz</td>
<td>10 µV, max.</td>
</tr>
<tr>
<td>Input impedance of the probe</td>
<td></td>
</tr>
<tr>
<td>ARC-ASP2</td>
<td>1 MOhm, max.</td>
</tr>
<tr>
<td>ARC-PS2</td>
<td>1 KOhm, max.</td>
</tr>
<tr>
<td>Max. input voltage of ARC-ASP2 network probe</td>
<td>400 V</td>
</tr>
<tr>
<td>below 60 Hz</td>
<td>400 V</td>
</tr>
<tr>
<td>from 60 Hz to 20 kHz</td>
<td>50 V</td>
</tr>
<tr>
<td>from 20 kHz to 5 MHz</td>
<td>10 V</td>
</tr>
<tr>
<td>Max. input voltage of ARC-PS2 network probe</td>
<td>400 V</td>
</tr>
</tbody>
</table>

**Radio Channel Monitoring, Technical Analysis and Broadcast Recording**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. processing bandwidth for each channel within the range:</td>
<td></td>
</tr>
<tr>
<td>9 kHz – 25 MHz</td>
<td>1 MHz</td>
</tr>
<tr>
<td>25 – 110 MHz</td>
<td>5 MHz</td>
</tr>
<tr>
<td>110 – 220 MHz</td>
<td>10 MHz</td>
</tr>
<tr>
<td>220 – 8000 MHz</td>
<td>24 MHz</td>
</tr>
<tr>
<td>Types of recorded data</td>
<td></td>
</tr>
<tr>
<td>radio signal sampling (I/Q), bearing</td>
<td></td>
</tr>
<tr>
<td>demodulated signals, spectograms, time</td>
<td></td>
</tr>
<tr>
<td>Max. recording bandwidth</td>
<td>Up to 40 MHz</td>
</tr>
<tr>
<td>Continuous radio signal recording time</td>
<td>Depends on storage volume</td>
</tr>
</tbody>
</table>

**Demodulated signal recording**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demodulator bandwidth</td>
<td></td>
</tr>
<tr>
<td>250 kHz, 100 kHz, 50 kHz, 12 kHz, 6 kHz, 3 kHz</td>
<td></td>
</tr>
<tr>
<td>Receiver sensitivity in AM mode</td>
<td>1.5 µV, max.</td>
</tr>
</tbody>
</table>

---

**Options:**
- ARC-MA2 Magnetic Receive Antenna for HF range
- ARC-A12 Broadband Antenna

**Features**
- Operation documents.
- ARC-MA2 Magnetic Receive Antenna for HF range
- ARC-A12 Broadband Antenna
**Demodulated signal recording**

- Receiver sensitivity in FM (narrow) mode: 0.8 µV, max.
- Receiver tuning discrete: 1 Hz
- Demodulation types: AM, FM, SSB, AT

**Operating Parameters**

- Operating temperature range: 0°C ... +45°C
- AC network power supply: 90 - 250 V
- Vehicle power supply: 10 - 15 V
- Power consumption (without PC), max.: 70 W
- Dimensions of central unit, max.: 490 x 400 x 200 mm
- Weight of central unit, max.: 12 kg

**ARC-D1**

Portable Multi-Functional Radio Monitoring System

Processing techniques and equipment are protected by the RF patents

**Purpose:**
- Outdoor/indoor radio monitoring applications including:
  - Panoramic spectrum analysis
  - Radio signal parameter estimation
  - Radio signal recording and technical analysis
  - Analysis of parameters of wireless communication and data transmission network base stations (GSM, CDMA, TETRA, UMTS, LTE, Wi-Fi, WiMax, DECT), as well as DVB-T/T2/H.

**Basic Configuration:**
- Central unit of ARC-D1, including:
  - Antenna switch module
  - ARC-PS+ Tuner Module
  - ARC-CO+ Digital Processing Module
  - ARC-KNV3 Frequency Down-Converter module
  - AC and vehicle on-board power unit with charger and battery.
- Case with accessories:
  - Set of ARC-A2M Broadband Antennae
  - ARC-A14K (3 – 8 GHz) Broadband Antenna
  - ARC-ASP2 Active Network Probe
  - ARC-PSP2 Passive Network Probe
  - Control and display unit with software packages
  - Set of connection cables
  - Operation documents.
- ARC-MA2 Magnetic Receive Antenna for HF range
- ARC-A12 Broadband Antenna

**Options:**
- ARC-A3A Directional Antenna Set and handle provided for amplitude direction finding in hard-to-reach areas
- Remote-controlled ARC-KNV4M Frequency Down-Converter.

**Features:**
- IF analogue output 70 MHz
- PC-controlled operation
- Wire/wireless control and data exchange supported by the software packs.

**System provides:**
- Real-time radio monitoring
- Search, accumulation and maintenance of signal source database and processing of results.
- Indoor emission detecting
- Continues recording radio signal within the band up to 24 MHz
- Technical analysis, determination of modulation type and evaluation of radio signal parameters
- Localization of GSM, CDMA, DECT, TETRA, UMTS, LTE, Wi-Fi, WiMax base stations
- Wire network monitoring.

### Basic Specifications

#### Panoramic Analysis

- Operating frequency range of the basic set: 9 kHz - 8 GHz
- Operating frequency range with ARC-KNV4M: 9 kHz - 18 GHz
- Input attenuator: 0 to -30 dB with 2 dB increment
- Maximum allowable input voltage: 23 dBm
- Panoramic analysis rate within operating frequency range: up to 10 GHz/s*
- Minimum duration of the signal detected within simultaneous bandwidth (receiver tuning frequency doesn’t change): 0.5 µs
- Sensitivity with 3.125 kHz discreteness depending on the frequency: 0.8 - 1.5 µV

#### When Operated with Internal Reference Generator

- Relative error of frequency tuning: ±5x10⁻⁷
- Temperature fluctuations: ±5x10⁻⁷
- Frequency fluctuations per day: ±5x10⁻⁷

#### Selectivity and Harmonic Distortions

- IF rejection, min.: 70 dB
- Image rejection, min.: 70 dB
- Intermodulation free dynamic range (3rd and 2nd order): 75 dB
- Input IP3, attenuator off, min.: 0 dBm
- Input IP3 with 30 dB attenuator, min.: 30 dBm
- Transfer factor irregularity at operating frequencies of the basic configuration, max.: ±3 dB

#### IF Signal

- IF analogue signal frequency: 70 MHz
- IF output bandpass, ±1.5 dB variation: 5 MHz, min.
- IF output bandpass, ±3 dB variation: up to 24 MHz

#### Indoor radio monitoring (from 9 kHz to 8000 MHz)

- Antenna switch coupling attenuation, min.: 40 dB
- System total sensitivity (wattage of a transmitter in an 8 x 8m room with 99% detection): 50 µW

#### Wire network monitoring

- Signal detection level:
  - within 0.05 - 10 kHz: 1 mV, max.
  - within 10 kHz - 1 MHz: 100 µV, max.
  - within 1 MHz - 30 MHz: 10 µV, max.
- Input impedance of the probe:
  - ARC-ASP2: 1 MOhm, max.
  - ARC-PSP2: 1 kOhm, max.
- Max. input voltage of ARC-ASP2 network probe:
  - below 60 Hz: 400 V
  - from 60 Hz to 20 kHz: 50 V
  - from 20 kHz to 5 MHz: 10 V
- Max. input voltage of ARC-PSP2 network probe: 400 V

---

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info@ircos.ru
Radio Channel Monitoring, Technical Analysis and Broadcast Recording

<table>
<thead>
<tr>
<th>Max. processing bandwidth within the range:</th>
<th>1 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 9 kHz – 25 MHz</td>
<td></td>
</tr>
<tr>
<td>• 25 – 110 MHz</td>
<td>5 MHz</td>
</tr>
<tr>
<td>• 110 – 220 MHz</td>
<td>10 MHz</td>
</tr>
<tr>
<td>• 220 – 8000 MHz</td>
<td>24 MHz</td>
</tr>
</tbody>
</table>

Types of recorded data: radio signal sampling (I/Q), demodulated signals, spectrograms, time

Max. recording bandwidth: up to 24 MHz

Continuous radio signal recording time: Depends on storage volume

Demodulated signal recording

<table>
<thead>
<tr>
<th>Demodulator bandwidth</th>
<th>250 kHz, 100 kHz, 50 kHz, 12 kHz, 6 kHz, 3 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver sensitivity in AM mode</td>
<td>1.5 µV, max.</td>
</tr>
<tr>
<td>Receiver sensitivity in FM (narrow) mode</td>
<td>0.8 µV, max.</td>
</tr>
<tr>
<td>Receiver tuning discrete</td>
<td>1 Hz</td>
</tr>
<tr>
<td>Demodulation types</td>
<td>AM, FM, SSB, AT</td>
</tr>
</tbody>
</table>

Operating Parameters

<table>
<thead>
<tr>
<th>Operating temperature range</th>
<th>0°C … +45°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC network power supply</td>
<td>90 - 250 V</td>
</tr>
<tr>
<td>Vehicle power supply</td>
<td>10 - 15 V</td>
</tr>
<tr>
<td>Power consumption (without PC), max.</td>
<td>60 W</td>
</tr>
<tr>
<td>Dimensions of central unit, max.</td>
<td>490 x 400 x 200 mm</td>
</tr>
<tr>
<td>Weight, max.</td>
<td>12 kg</td>
</tr>
</tbody>
</table>

ARGAMAK-C2
Portable System of Signal Technical Analysis

Purpose:
- Receiving, parameter measuring, communication system signal recording.

Typical Configuration:
- ARGAMAK-MN Panoramic Digital Radio Receiver (20–3000 MHz) in compact case
- ARC-A7A-3 Broadband Antenna for Installation on Vehicle (20 – 3000 MHz)
- ARC-A12 Broadband Outdoor Antenna (20 – 3000 MHz) for Installation on Mast
- Lead-in cable, 10 m long
- PC and software packages for panoramic analysis, signal recording and technical analysis of recorded samples
- Battery, AC and DC vehicle on-board power supply unit

Main Functions:
- Panoramic analysis, receipt and measuring of parameters of communication system signals
- Continuous recording of radio signals to a PC hard disk for further analysis
- Processing of recorded radio signals fragments
- Recognition and classification at carrying and subcarrier frequency
- Radio signal technical analysis
- Digital streams structure/time analysis in a great variety of protocols and standards

Features:
- Demodulation, decoding and technical analysis of radio signals are executed in postprocessing mode
- Can function as a part of stationary or mobile station

Basic Specifications

General Parameters of Receiving Path

<table>
<thead>
<tr>
<th>Operating frequency range</th>
<th>20 MHz – 3 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-channel dynamic range with over the frequency range (with attenuators)</td>
<td>115 dB, min</td>
</tr>
<tr>
<td>Image rejection</td>
<td>70 dB, min</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (3rd and 2nd order)</td>
<td>75 dB, min</td>
</tr>
<tr>
<td>Input IP3 with 30 dB (attenuator's off/30 dB)</td>
<td>0 / 30 dB, min</td>
</tr>
<tr>
<td>Input attenuator</td>
<td>0 - 30 dB</td>
</tr>
<tr>
<td>Relative error of frequency tuning</td>
<td>±5x10^-7</td>
</tr>
<tr>
<td>Radio signal tuning discreteness</td>
<td>1 Hz</td>
</tr>
<tr>
<td>IF output pass band</td>
<td>10 MHz</td>
</tr>
</tbody>
</table>

Panoramic Spectrum Analysis

| Panoramic spectrum analysis rate | 3500 MHz/s |
| Spectrum discreteness            | 12.5 kHz    |
| Receiver sensitivity             | 1 µV        |
| Analysed band                    | Arbitrary    |

Radio Signal Recording

| Frequency band width for continuous signal recording: Up to 2 MHz |
| Frequency band width for signal fragment recording: up to 10 MHz |

Signal Technical Analysis and Measurement

| Simultaneous analyzed bandwidth | 10 MHz, 2 MHz, 250 kHz, 120 kHz, 50 kHz, 25 kHz, 8 kHz, 6 kHz |
| Data transmission interface    | USB 2.0      |
### Purpose:
- Automated monitoring of TV and radio broadcasts when stand-alone operation, as an optional workstation of ARCHA-IN, ARCHA-INM stations ans as a part of ARMADA ARMS.

### System provides

#### When stand-alone operation:
- Revealing of information component of TV and radio broadcast signals
- Recording of demodulated TV and radio signals, and geographic coordinates, data and time of the record, 24/7
- Recording of subtitles of digital channels
- Simultaneous monitoring up to 16 analogue and up to 20 digital TV and radio channels and recording of content and parameters based on pre-set trigger events

- Sequential monitoring of arbitrary number of analogue and digital TV and radio channels and recording of frames and parameters based on pre-set trigger events
- Simultaneous recording of up to 8 arbitrary chosen analogue, digital TV and radio channels
- Visual and audio monitoring of TV and radio broadcast signals
- Monitoring of fade and scattering if DTV picture
- Generation of reports as per operation results.
- Support of control via (Ethernet) and back-up (3G/4G) communication channel with automatic switch between them
- Adjustable notifications of the operator about external power interruption, activation of intrusion sensors, communication channel switch
- Remote diagnostics and system reboot in case of contingency event.

#### When operated as a part of stationary stations:
- When operated as a part of ARCHA-IN, ARCHA-INM stations, ARC-TVRR provides additionally for measuring of technical parameters of TV and radio broadcasts signals (levels, frequency, bandwidth, modulation parameters) At this, for DVB-T2 signals the following functions are provided additionally:
  - Automatic determination of distribution scheme of dispersed pilot signals (PP1; PP2; PP3; PP4; PP5; PP6; PP7)
  - Determination of modulation type (QPSK; 16-QAM; 64-QAM; 256-QAM) of PLP single stream in single stream mode A or PLP selected stream in multistream mode B
  - Determination of relative rate of code with low density of parity checks (LDPC) for PLP single stream in single stream mode A or selected PLP stream in multistream mode B. Relative code rate should correspond to series of allowable values: 1/4; 1/2; 2/3; 3/4; 4/5; 5/6.
  - Determination of frame length (16K; 64K) with noiseless coding (FECFRAME)
  - Imaging signal constellation for:
    - Single PLP stream in single stream mode A;
    - Selected PLP stream in multimode stream B;
    - P1 preamble symbols;
    - L3 signaling;
  - Determination of spatial separation mode for transmitting set antennas (SISO; MISO)
  - Determination of per bit error rate before Bose-Chaudhuri-Hocquenghem code (hereinafter, BCH code) decoder
  - Determination of relative amount of erroneous streaming frames (BBFRAME)
  - Determination of relative amount of erroneous packages of transport stream
  - Determination of modulation error ratio for single PLP stream in single stream mode A or selected PLP stream in multistream mode B
  - Measurement of amount of received PLP streams in multistream mode B
  - Analysis of transport stream structure and relevant service information tables (SI/PSI)
  - Measurement of full transport stream rate, actual rate of each transport stream program and each package type having data package identifier (PID), separately.

### Basic Specifications

- **Operating frequency range**: 48-862 MHz
- **Number of analogue TV and radio broadcasts channels monitored simultaneously**: 16
- **Number of digital TV channels monitored simultaneously**: \( N^2 \), where \( N \) - number of channels in PLP stream
- **Number of arbitrary analogue and digital TV and radio broadcasts channels recorded simultaneously**: 8, min.
- **TV and radio broadcasts standards**: Analogue TV SECAM, PAL, NTSC DTV, DVB-T, DVB-T2, analogue FM radio broadcasts
- **Continuous run-time of back-up battery**: 30 dB, min
- **Operating temperature range**: -40°C ... +45°C
- **Dimensions**: 740x740x440 mm
- **Weight**: 55 kg

More detailed specifications and description are available only upon request.
Handheld Equipment

In order to handle "the last mile" task ARMADA ARMS uses manpack equipment produced by IRCOS. They are intended for operation when the operator is on the move or at stops. They can be used afield or indoor. They can be placed on the operator's body (held in his/her hands), and can also be used at temporary/stationary stations or on mobile carriers. These devices assume universal application. They are designed for operation in hard-to-reach areas, as well as for concealed operation. Manpack means use the same modules and units as those used in stationary, mobile and portable equipment and therefore they provide high performance.

ARTIKUL-H1
Manpack Broadband Automatic Direction Finder

Purpose:
- Automatic direction finding
- Radio transmitters location
- Panoramic spectrum analysis
- Electromagnetic field strength estimation
- Radio signal parameter estimation
- Radio signal recording and technical analysis
- Radio channel monitoring.

It is used both independently and as a part of portable radio monitoring and direction finding stations for operation at stops and on the move.

Typical Configuration:
- ARGAMAK-2K Two-Channel Panoramic Radio Receiver
- AS-HP1 Antenna System for automatic direction finding within 110 – 3000 MHz, with integrated navigation equipment
- PC with automated radio monitoring software packages
- PC holding pad
- Set of cables
- Battery set, AC power supply, vehicle-based power supply and charger
- Vehicle luggage box with fasteners to mount antenna systems
- Tripod (mast) for antenna system mounting when operated at temporary workstations
- Frame used to mount equipment and place the antenna systems when operation in the manpack version
- Backpack for accessories (frame-mounted);
- Operation documents.

Options:
- Broadband radio-monitoring antennas
- AS-HP-KV Antenna System for automatic direction finding within 1.5 – 30 MHz, with integrated navigation equipment
- AS-HP0 Antenna System for automatic direction finding in 20 - 300 MHz range (manpack, mobile and stationary operation modes), with integrated navigation equipment
- AS-HP2 Antenna System for automatic direction finding within 3 – 8 GHz, with integrated navigation equipment
- AS-HP5 Antenna System for automatic direction finding in 20 - 3000 MHz range (manpack, mobile and stationary operation modes), with integrated navigation equipment

ARTIKUL-H1 in the mobile operation mode, antenna system is inside the luggage box

ARTIKUL-H1, Ready for operation (with AS-HP2 Antenna System) and in operation (with AS-HP1 Antenna System)

ARTIKUL-H1 at a temporary workstation
Direction Finder provides:

- Single- and multi-channel automatic direction finding of RF emissions with any modulation type and spectrum width in 1.5 to 8000 MHz range
- Manual direction finding in 0.3 – 18 000 MHz range (if converter is available)
- Displaying the emitter bearing and localization of detected emitter on the electronic map (as a part of DF pair or network)
- Search for emission, measurement of their parameters and comparison with the database
- Creation of databases, their extension and comparing of the recorded data with the references in the database
- Panoramic analysis within the entire operating frequency range or within separate intervals under complicated electromagnetic conditions, detection of changes in ambient electromagnetic conditions
- Recording the radio environment to the hard drive within a specified frequency range. This procedure can function within a long period and is based on amplitude/frequency/bearing/time coordinates, the station location and the absolute time at the time of saving
- Accumulation of data for further analysis in the post-processing mode, simultaneous recording of demodulated signals and their service parameters (frequency, time, signal level, etc.)
- Demodulated signals playback.

Examples of deployment of ARTIKUL-H1 Direction Finder on a vehicle and stationary work are presented in Figures. Antenna systems include integrated navigation equipment. Their cases are made of radiotransparent material. ARGAMAK-2K Digital Radio Receiver has sockets for additional equipment (antenna switches, converters, etc.).

**Basic Specifications**

<table>
<thead>
<tr>
<th>Operating frequency range:</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base configuration</td>
<td>9 kHz - 3 GHz</td>
</tr>
<tr>
<td>With maximum configuration</td>
<td>9 kHz - 18 GHz</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (3rd and 2nd order)</td>
<td>75 dB</td>
</tr>
<tr>
<td>Receiver sensitivity</td>
<td>0.8 - 1.5 µV</td>
</tr>
<tr>
<td>Receiver tuning resolution</td>
<td>1 Hz</td>
</tr>
<tr>
<td>Operating set weight (backpack variant), max.</td>
<td>15 kg</td>
</tr>
<tr>
<td>Internal battery power supply</td>
<td>Available</td>
</tr>
<tr>
<td>Vehicle power supply</td>
<td>10 - 32 V</td>
</tr>
<tr>
<td>AC network power supply</td>
<td>90 - 250 V</td>
</tr>
<tr>
<td>Continuous battery run-time for basic configuration, depending on total battery capacity</td>
<td>4 hours, min.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panoramic analysis and load recording</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Simultaneous bandwidth</td>
<td>5 MHz</td>
</tr>
<tr>
<td>Panoramic analysis rate (with 6.25 kHz spectrum discreteness)</td>
<td>min. 3200 MHz/s</td>
</tr>
<tr>
<td>Frequency range load recording time</td>
<td>24 hours</td>
</tr>
<tr>
<td>Registered parameters</td>
<td>Amplitude-Frequency-Time</td>
</tr>
</tbody>
</table>

**Signal technical analysis**

- Decoding service information of digital communications
gsm, cdma, umts, lte, tetra, dect

<table>
<thead>
<tr>
<th>Field sensitivity:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Within the range from 1.5 to 30 MHz (with AS-HP-KV)</td>
<td>50 µV/m max.</td>
</tr>
<tr>
<td>Within the range from 20 to 300 MHz (with AS-HP0)</td>
<td>10 - 30 µV/m</td>
</tr>
<tr>
<td>Within the range from 110 to 3000 MHz (with AS-HP1)</td>
<td>1 - 10 µV/m</td>
</tr>
<tr>
<td>Within the range from 3 to 8 GHz (with AS-HP2)</td>
<td>5 - 15 µV/m</td>
</tr>
<tr>
<td>Within the range from 20 to 3000 MHz (with AS-HP5)</td>
<td>1 - 20 µV/m</td>
</tr>
<tr>
<td>Within the range from 8 to 18 GHz (with ARC-KNV4)</td>
<td>50 µV/m max.</td>
</tr>
</tbody>
</table>

**Single-channel and multi-channel automatic direction finding**

- Instrument accuracy (RMS): max. 5°
- **Frequency band width for signal fragment recording:**
  - Continuous** | Up to 2 MHz |
  - Fragments | up to 10 MHz |

**Purpose:**

- Manual direction finding
- Radio transmitters location
- Electromagnetic field strength estimation
- Panoramic spectrum analysis
- Radio signal parameter estimation
- Radio signal recording and technical analysis
- Radio channel monitoring.

**Typical Configuration:**

- ARGAMAK-MN Panoramic Radio Receiver
- Mobile control and display unit (an smartphone based on OS Android) with software package

**ARC-RP3M**

Handheld Direction Finder

**Single-channel and multi-channel automatic direction finding**

<table>
<thead>
<tr>
<th>Direction finding method:</th>
<th>Correlative interferometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>within 1.5 - 8000 MHz range</td>
<td></td>
</tr>
<tr>
<td>within 8 - 18 MHz</td>
<td>Amplitude</td>
</tr>
</tbody>
</table>

**GSM, CDMA, UMTS, LTE, TETRA, DECT**

* - Instrument accuracy (RMS) of direction finding pertains to the cases when the DF antenna system is mounted on a roof of a road vehicle or borne by operator. When the antenna system is mounted on other mobile carrier (helicopter, delta plane, aircraft or air drone), the direction finding error may be higher due to carrier influence.

** - Limited number of discontinuities is possible. Their total length is less then 3% of total recording time.
Set of cables
ARC-A3A Antenna System with handle, compass or fastening for smartphone, active directional antenna modules for manual direction finding:
• ARC-A3-KV (0.3 - 30 MHz) Active Frame Antenna Loop
• ARC-A3-1A Active Antenna Loop (25 – 500 MHz)
• ARC-A3-2A Active Log-Periodic Antenna (400 – 850 MHz)
• ARC-A3-3A Active Log-Periodic Antenna (800 – 3000 MHz);
• AC network power supply unit
• Battery set
• Charger
• Set of cables
• Equipment carry bag for concealed mode operation
• Backpack for equipment
• Operation documents.

ARGAMAK-MN Receiver is a hardware basis for ARC-RP3M Handheld Direction Finder. ARGAMAK-M Receiver (which is analogue if certified ARGAMAK-MN) is used in handheld measuring station ARC-NKSI.

Manual direction finding operating pack includes a handle with a built-in compass and set of ARC-A3A replaceable directional active antennas for frequency range from 0.3 to 3000 MHz. The antennae can be used both in active and passive mode.

Android OS based mobile device (e.g. a mobile phone) is also used for data visualization and control. During operation, the unit is fixed on the operator’s hand by means of a special wristband or on antenna handle. The design of the handle and antenna elements enables detection of RF emitters with vertical and horizontal polarization. The handle is optimized for operation in the field conditions. The weight of the handle with the antenna is 700 gram max., the center of gravity is located below the palm level thus enabling to work longer without getting tired.

To extend the operating frequency range, direction finder may include ARC-KNV3M Frequency Down-Converter (3-8 GHz) or ARC-KNV4M Down-Converter (3-18 GHz), each of them has its own built-in directional antenna. Optionally Direction Finder may include the following:
• Antenna set for concealed direction finding
• PC and software for automatic radio monitoring, technical analysis and postprocessing
• Additional batteries.

If an Android based smartphone or tablet is used as a control and display unit then ANDROMEDA software is used that provides operation in the following modes: Spectrum, Review, Search, Panorama and Map, and it supports integration with ARMADA ARMS (transmission of the tasks and results), displays real-time signal spectra, shows tracks of handheld direction finder motion, signal levels, indicates location of the RF emitter in the electronic map.

**Spectrum mode provides:**
• Real-time displaying results of fast panoramic spectrum analysis and readings of signal level linear indicator
• Demodulated radio signal listening
• Search for active radio channels, saving of the detected frequencies in the database
• Background monitoring of the detected radio channels.
• Generating of reports with active channel search results.

**Review mode provides:**
• Cyclic scanning of active channels
• Simultaneous operation in several ranges
• Receiving tasks from SMO ARMADA
• Sending measurement results to SMO-ARMADA.
Panorama mode provides:
- Simultaneous operation in several ranges
- Panoramic analysis with simultaneous display of several spectrum types (normal, average, maximum and minimum accumulated)
- Receiving tasks from SMO ARMADA.

Search mode provides:
- Automatic detection and audio interception of demodulated radio signals
- Simultaneous operation in several ranges
- Receiving tasks for search from SMO-ARMADA.

Map mode provides:
- Automatic localization of RF emitters based on direction finding results
- Display of location and orientation of the unit based on cardinal directions
- Displaying measurement results in the map
- Displaying and saving movement track in the memory
- Plotting current bearings on a map
- Azimuth-Amplitude circular indicator and color signal level indication on the movement track facilitating direction finding in difficult city conditions
- Work with OpenStreetMap
- Online loading of detailed satellite images.

Under control of Android OS smartphone of tablet, it is possible to operate both in open and concealed direction finding modes.

### Basic Specifications

<table>
<thead>
<tr>
<th>Operating frequency range:</th>
<th>9 kHz - 3 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base configuration</td>
<td></td>
</tr>
<tr>
<td>with ARC-KNV3M</td>
<td>9 kHz - 8 GHz</td>
</tr>
<tr>
<td>with ARC-KNV4M</td>
<td>9 kHz - 18 GHz</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (3rd and 2nd order)</td>
<td>75 dB, min</td>
</tr>
<tr>
<td>Receiver tuning resolution</td>
<td>1 Hz</td>
</tr>
<tr>
<td>Internal battery power supply</td>
<td>Available</td>
</tr>
<tr>
<td>Vehicle power supply</td>
<td>10 - 32 V</td>
</tr>
<tr>
<td>AC network power supply</td>
<td>90 - 250 V</td>
</tr>
</tbody>
</table>
Basic Configuration:
- ARGAMAK-I Panoramic Measuring Receiver (Entered into State Register of Measuring Equipment, Reg. No. 27325-04) with an additional coherent receiving channel
- ARC-A7A-3 Antenna quasi-isotropic, non-calibrated
- ARC-A3A Antenna System (non-calibrated) with handle, compass and active directional antenna modules for manual direction finding:
  - ARC-A3-1A Active Antenna Loop (25 – 500 MHz)
  - ARC-A3-2A Active Log-Periodic Antenna (400 – 850 MHz)
  - ARC-A3-3A Active Log-Periodic Antenna (800 – 3000 MHz)
- Shoulder bag for equipment for operation when moving
- Backpack for accessories
- Set of cables
- Battery set, AC power supply, vehicle-based power supply and charger
- Subnotebook and holder to carry it
- Software for automated radio monitoring, technical analysis and postprocessing, transmitter localization
- Operation documents.

Options:
- Measurement antenna set
- AS-HP1 Antenna System for automatic direction finding within 110 – 3000 MHz, with integrated navigation equipment
- Mounting set with magnetic insertions to mount AS-HP1 Antenna System on the vehicle roof
- Frame to mount the equipment when operation in manpack mode
- Backpack for accessories
- Additional battery set
- Remote ARK-KNV4 Frequency Down-Converter with built-in directional antenna system
- Tripods provided for antenna mounting when operated at temporary posts.

Features:
- System is operated being handled by operator.

System provides:
- Cross talk detection and detection of the sources of intermodulation interferences
- Two-channel panoramic analysis
- Search for emitters inside the premises
- Automated radio channel monitoring
- Recording of demodulated broadcasts and service parameters.
- Technical analysis in postprocessing mode
- Playback of demodulated broadcasts and service parameters.

Basic Specifications

<table>
<thead>
<tr>
<th>General</th>
<th>Operating frequency range:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Basic configuration</td>
<td>25 – 3000 MHz</td>
</tr>
<tr>
<td>• With optional external ARC-KNV4 Frequency Down-Converter</td>
<td>25 – 18000 MHz</td>
</tr>
<tr>
<td>Receiver frequency tuning resolution</td>
<td>1 Hz</td>
</tr>
<tr>
<td>Power from internal battery set</td>
<td>12 V</td>
</tr>
<tr>
<td>AC network power supply</td>
<td>90 - 250 V</td>
</tr>
<tr>
<td>Vehicle power supply</td>
<td>10 - 32 V</td>
</tr>
<tr>
<td>Continuous battery run-time for the basic configuration</td>
<td>2 hours, min.</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>From-20°C to +55°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direction finding</th>
<th>DF method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic set of the frequency range</td>
<td>Amplitude</td>
</tr>
<tr>
<td>Frequency range with ARC-KNV4M</td>
<td>25 – 18000 MHz</td>
</tr>
<tr>
<td>Signal level evaluation limits (with attenuators)</td>
<td>-10 - 110 dB</td>
</tr>
<tr>
<td>Direction finding instrument accuracy (basic configuration)</td>
<td>7° – 15°</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Under PC Control</th>
<th>Panoramic analysis and load recording</th>
</tr>
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<tbody>
<tr>
<td>Frequency range load recording time</td>
<td>24 hours</td>
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<tr>
<td>Registered parameters</td>
<td>Recording based on «amplitude/frequency/time coordinates»</td>
</tr>
<tr>
<td>Panorama rate (with 3.125 kHz discreteness)</td>
<td>700 MHz/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Radio channel monitoring and broadcast recording</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver sensitivity</td>
</tr>
<tr>
<td>Continuous recording time</td>
</tr>
<tr>
<td>Types of recorded data</td>
</tr>
</tbody>
</table>
### ARC-NK5I

#### Portable Radiomonitoring and Direction Finding Measuring System

**Purpose:**
- Measurement of standard radio equipment parameters and electromagnetic field strength; outdoor radio monitoring, including:
  - Panoramic spectrum analysis
  - Direction finding
  - Radio transmitters location
  - Radio signal technical analysis
  - Radio channel monitoring.

**Basic Configuration:**
- ARGAMAK-M Panoramic Measuring Receiver;
- ARC-A3A Antenna System (uncalibrated) with handle, compass or fastening for smartphone, active directional antenna modules for manual direction finding:
  - ARC-A3-1A Active Antenna Loop (25 – 500 MHz)
  - ARC-A3-2A Active Log-Periodic Antenna (400 – 850 MHz)
  - ARC-A3-3A Active Log-Periodic Antenna (800 – 3000 MHz);
- Control and display unit (a smartphone based on OS Android)
- Shoulder bag for equipment for operation when moving
- Backpack for equipment.

**Options:**
- High-stable external reference generator
- Measurement antenna set
- Battery set
- Remote ARK-KNV4 Frequency Down-Converter with built-in directional antenna system
- PC with software for automatic radio monitoring, technical analysis and postprocessing at temporary or stationary workstation
- Tripod
- Broadband radio-monitoring antennas.

### Technical analysis, radio signal recording and postprocessing

| Band width for signal recording | 320 kHz, 250 kHz, 100 kHz, 50 kHz, 25 kHz, 12 kHz, 6 kHz |

### Measuring of Electromagnetic Field Strength and Radio Signal Parameters

| Field strength and radio signal parameters measuring accuracy | Depends on ARGAMAK-I parameters |
| Operating temperature range | From +5°C to +40°C |

### System provides:
- Detection, direction finding, localization and technical analysis, and for measuring of radio signal parameters based on certified technique.

### Features:
- System is operated while moving
- The system also provides for direction finding in concealed mode. Details are available upon request.

### Basic Specifications

#### General

<table>
<thead>
<tr>
<th>Operating frequency range:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Basic configuration</td>
</tr>
<tr>
<td>- Complete configuration</td>
</tr>
<tr>
<td>Receiver frequency tuning resolution</td>
</tr>
<tr>
<td>Power from internal battery set</td>
</tr>
<tr>
<td>AC network power supply</td>
</tr>
<tr>
<td>Vehicle power supply</td>
</tr>
<tr>
<td>Continuous battery run-time for the basic configuration</td>
</tr>
<tr>
<td>Operating temperature range</td>
</tr>
</tbody>
</table>

#### Direction finding

<table>
<thead>
<tr>
<th>DF method</th>
<th>Amplitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic set of the frequency range</td>
<td>25 – 3000 MHz</td>
</tr>
<tr>
<td>Frequency range with ARK-KNV4M</td>
<td>25 – 18000 MHz</td>
</tr>
<tr>
<td>Signal level evaluation limits (with attenuators)</td>
<td>-10 - 110 dB</td>
</tr>
<tr>
<td>Direction finding instrument accuracy (basic configuration)</td>
<td>7° – 15°</td>
</tr>
</tbody>
</table>
**Signal Parameter Measuring Errors**

<table>
<thead>
<tr>
<th>Error Description</th>
<th>Error Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error of sine signal level measurement</td>
<td>3 dB max.; (with calibration - 1.5 dB, max.)</td>
</tr>
<tr>
<td>Error of field strength measurement (ΔK means measuring antenna calibration factor error)</td>
<td>max. (3+ΔK) dB; max. (1.5+ΔK) dB with calibration</td>
</tr>
<tr>
<td>Error of power flux density of radio signal electromagnetic field (ΔK means measuring antenna calibration factor error)</td>
<td>max. (3+ΔK) dB; max. (1.5+ΔK) dB with calibration</td>
</tr>
<tr>
<td>Relative error of non-modulated signal and AM-signal frequency measurement (at 20 dBµV min. signal level when no stray signals are found)</td>
<td>max. 5×10⁻⁷; max. 2×10⁻⁸ with an external reference generator</td>
</tr>
<tr>
<td>Frequency measurement error for signals with broadband frequency modulation (broadcast stations) (at 20 dBµV min. signal level when no stray signals are found in the band in question)</td>
<td>max. ±10 Hz with ext. reference generator</td>
</tr>
<tr>
<td>Relative frequency measurement error for signals with narrow-band frequency modulation (at 20 dBµV min. signal level when no stray signals are found in the band in question)</td>
<td>max. 5×10⁻⁷; max. 2×10⁻⁸ with an external reference generator</td>
</tr>
<tr>
<td>Relative frequency measurement error for digital signals with non-coherent modulation (FMn) (at 20 dBµV min. signal level when no stray signals are found in the band in question)</td>
<td>max. 5×10⁻⁷; max. 2×10⁻⁸ with an external reference generator</td>
</tr>
<tr>
<td>Relative frequency measurement error for digital signals with coherent modulation (MMS, FM) (at 20 dBµV min. signal level when no stray signals are found in the band in question)</td>
<td>max. 5×10⁻⁷; max. 2×10⁻⁸ with an external reference generator</td>
</tr>
<tr>
<td>Frequency measurement error for digital signals without specific frequencies and with the bandwidth above 300 kHz (the pre-set X-deb level shall exceed that of the noise by 10 dB)</td>
<td>max. ±5 kHz</td>
</tr>
<tr>
<td>Bandwidth measurement error for X-deb method (the pre-set X-deb level shall exceed that of the noise by 10 dB)</td>
<td>max. ±5%</td>
</tr>
<tr>
<td>Bandwidth measurement error for p2/2 method Maximum signal level should exceed the level of the extreme frequencies (noise level) by 30 dB</td>
<td>max. ±5%</td>
</tr>
<tr>
<td>Amplitude modulation factor measurement error (at 20 dBµV min. signal level when no stray signals are found in the band in question)</td>
<td>max. ±7%</td>
</tr>
<tr>
<td>Frequency deviation measurement error for signals with frequency modulation (at 20 dBµV min. signal level when no stray signals are found in the band in question)</td>
<td>max. ±5%</td>
</tr>
<tr>
<td>Error of FMn-signal frequency distribution measurement (at 20 dBµV min. signal level when no stray signals are found in the band in question)</td>
<td>max. ±5%</td>
</tr>
<tr>
<td>Modulation rate measurement error (at 20 dBµV min. signal level when no stray signals are found in the band in question)</td>
<td>max. ±1%</td>
</tr>
</tbody>
</table>

**Purpose:**

- Receipt, parameters measuring, demodulation and decoding of VHF, UHF and SHF signals in postprocessing mode.
- Operation as a part of stationary, mobile and temporary workstations.

**Configuration:**

- ARC-KNV3M Tuning, Digital Processing and Signal Recording Module in compact case
- ARC-KNV4M (3 - 8 GHz) Frequency Down-Converter
- ARC-ATA-3 Broadband Antenna for Installation on Vehicle (20 – 3000 MHz)
- ARC-A12 Broadband Outdoor Antenna (25 – 3000 MHz) for Installation on Mast with lead-in cable, 10 m long
- Battery set
- Charger
- Software Development Kit

**Options:**

- ARC-KNV3M (3 - 8 GHz) Frequency Down-Converter
- ARC-KNV4M (3 - 18 GHz) Frequency Down-Converter
- ARC-ATA-3 Broadband Antenna for Installation on Vehicle (20 – 3000 MHz)
- ARC-A12 Broadband Outdoor Antenna (25 – 3000 MHz) for Installation on Mast with lead-in cable, 10 m long
- Battery set
- Charger
- Software Development Kit

**Main Functions:**

- Panoramic analysis, receipt and estimation of communication signals in VHF, UHF and SHF range
- Recording of radio signals to an internal storage
- Real time operation and postprocessing
- Recognition and classification at carrying and subcarrier frequency
- Radio signal technical analysis
- Demodulation, digital streams structure/time analysis

**Basic Specifications**

<table>
<thead>
<tr>
<th><strong>General</strong></th>
<th><strong>Value</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range:</td>
<td>20 – 3000 MHz</td>
</tr>
<tr>
<td>with ARC-KNV3M</td>
<td>20 – 8000 MHz</td>
</tr>
<tr>
<td>with ARC-KNV4M</td>
<td>20 – 18000 MHz</td>
</tr>
<tr>
<td>Image rejection</td>
<td>70 dB, min</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (3rd and 2nd order)</td>
<td>75 dB, min</td>
</tr>
<tr>
<td>Input IP3 within the frequency range (without attenuator / with 30 dB attenuator's on)</td>
<td>0 / 30 dBm, min</td>
</tr>
<tr>
<td>Input attenuator</td>
<td>0 - 30 dB</td>
</tr>
</tbody>
</table>
ARGAMAK-CA
Compact Radio Monitoring System

Purpose:
• Radio monitoring in urban area
• Panoramic spectrum analysis
• Radio signal parameter estimation
• Radio signal recording and technical analysis
• Radio channel monitoring.

Configuration
Radio monitoring module
• Reception and Processing Unit of ARGAMAK-CA, including:
  • ARC-CPS2M Tuning and Digital Processing Module
  • Frequency extension modules (0,009-20 MHz; 3-8 GHz)
  • Storage unit (SSD)
  • Power supply and charging module with batteries;
• Compact wideband active antenna.

Stationary set
• PC with software package for postprocessing
• AC charging and power supply unit.

Features:
• Designed both for standalone operation and integration with user’s equipment
• Provides for both unattended operation in accordance with pre-defined task and attended real time operation under local or remote control
• Broadband antenna is integrated with receiving and processing unit of ARGAMAK-CA, which eliminates completely antenna effect, preserving dynamic range and sensitivity because antenna cable is not required
• Option to connect and switch remote controlled ARC-KNV3 Frequency Down-Converter with antenna (3-8 GHz)
• Can function as a part of ARMADA Automated Radio Monitoring System.

Main Functions
Task or schedule based operation:
• Cyclic scanning within a frequency range or over separate frequencies
• Panoramic spectrum analysis of radio signals, panoramic spectrum accumulation for a given frequency range
• Recording of radio signals at IF in vector form to PC hard disk.

Real time control operation:
• Search for new signals
• Panoramic analysis within the entire operating frequency range
• Signal digital demodulation
• Calculation of spectrum, estimation of frequency, level and band of the received signal
• Radio signal spectrum displaying
• Recording of radio signals to a external storage
• Radio signal technical analysis.

Basic Specifications

<table>
<thead>
<tr>
<th>Operating Temperature, Weight, Dimensions and Power Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range (without PC)</td>
</tr>
<tr>
<td>Power supply voltage</td>
</tr>
<tr>
<td>Power consumption</td>
</tr>
<tr>
<td>Dimensions</td>
</tr>
<tr>
<td>Weight (with batteries)</td>
</tr>
<tr>
<td>Maximum simultaneous bandwidth</td>
</tr>
<tr>
<td>Panoramic analysis rate</td>
</tr>
<tr>
<td>Channel monitoring rate</td>
</tr>
<tr>
<td>Minimum duration of signal detected with level above 60 dBµV</td>
</tr>
<tr>
<td>Directional diagram of antenna</td>
</tr>
</tbody>
</table>

Radio signal recording & technical analysis

Length of continuous radio signal recording within a band of 25/10 MHz 120/60/30 minute
Storage available volume up to 106 GB

Power consumption, Weight, Dimensions

| DC power supply voltage | 10 - 15 V |
| Continuous run-time of battery (LiPo) | up to 4 hours |
| Power supply voltage of power supply and charging unit | From 9 to 32 V |
| Power supply voltage of AC power supply and charging unit | From 90 to 250 V |
| Power consumption | 15 W, max. |
| Operating temperature range | From -20°C to +45°C |
| Dimensions: |
  • Receiving and Processing Unit of ARGAMAK-CA | 110 x 60 x 240 mm, max. |
  • Mobile unit with antenna system | 110 x 100 x 240 mm, max. |
| Weight: |
  • ARC-CPS2M Tuning and Digital Processing Module | 0.3 kg, max. |
  • ARGAMAK-CA Reception and Processing Unit, w/o batteries | 0.7 kg, max. |
  • Reception and Processing Unit of ARGAMAK-CA, w/ batteries | 1.5 kg, max. |
  • Mobile unit with antenna system | 2 kg, max. |

More detailed specifications and description are available only upon request.
ARGAMAK-IS
Panoramic Field Strength Meter


Certificate of measurement procedure qualification No. 206/000265/2011 as 01.02.2011. It is also registered in the Federal Metrology and Standardization Foundation with No. ФР.1.38.2011.10001.


Purpose:
● Measuring of electromagnetic field strength and radio signal parameters within a broad frequency range
● Panoramic spectrum analysis
● Recording of radio signals and broadcasts
● Technical analysis
● Analysis of service parameters of communication and data transmission systems: GSM, CDMA, TETRA, UMTS, DECT, LTE, Wi-Fi and DVB-T/T2/H
● Operation as a part of stationary (attended and unattended) and mobile measuring radio monitoring stations as well as standalone measuring radio monitoring workstations.

Configuration:
● ARGAMAK-IS Panoramic Field Strength Meter
● Set of connection cables
● AC network power supply unit
● Local control server with software package
● Control and display unit with software package (for attended stations).

Designs
For stationary attended and unattended stations: ARCHAI, ARCHAIN and ARCHAINM:
● Remote Field Sensor Unit of ARGAMAK-IS
● ARGAMAK-IS Reception and Processing Unit inside protected cabinet, including:
  • Radio receiving unit of ARGAMAK-IS with digital radio receiver based on ARC-PSS+ and ARC-CO+ Modules of ARGAMAK+ family and integrated high-stable ARC-OG1 Reference Frequency Generator
  • Local control server with software package;
• Antenna cable.

For Mobile Stations:
● Remote Field Sensor Unit of ARGAMAK-IS

Options:
● Measurement antenna set
● ARC-KNV4 Frequency Down-Converter.

Features:
● In case of stationary design, Receiving and Processing Unit is installed inside protected box close to measuring antennae and External Field Sensor Unit
● The signal Receiving and Processing Unit is transferred in digital form via Ethernet protocol, which allows using cable up to 80 m length
● Signal level measuring range is 0 to +140 dBµV without external attenuators
● Connection and commutation of up to five external measuring antennae
● Socket for external reference generator

A measuring radio receiver should ensure stable metrologic parameters within its operating range, required accuracy of measurement and it should be certified as an instrument by relevant national authorities.

A family of digital panoramic measuring radio receivers for measuring systems and stations with 2, 8 and 22 MHz simultaneous bandwidth were developed on the basis of ARGAMAK digital panoramic radio receivers by implementing state-of-the-art structural, circuit and software level design solutions and well-adjusted manufacturing and tuning processes.

Produced measuring receivers are intended not only for signal measurements, but also for signal detection, technical analysis, radio source localization, parameters control tasks for mobile radio communication base stations and digital television transmitters and they may be used in stationary, mobile and portable systems.
ARGAMAK-IS Panoramic Field Strength Meter consists of external field sensor (EFSU) and radio receiving unit (RRU) housed in a thermostated moisture protected box of the receiving and processing unit (RPU) (for unattended stations). RPU also includes ARC-KNV4 Frequency Down Converter, an option of shared operation with ARC-KNB4 Frequency Down-Converter enabling expansion of operating frequency range up to 18 GHz.

ARGAMAK-IS Panoramic Field Strength Meter consists of external field sensor (EFSU) and radio receiving unit (RRU) housed in a thermostated moisture protected box of the receiving and processing unit (RPU) (for unattended version). RPU also includes ARC-KNV4 Frequency Down Converter, an option of shared operation with ARC-KNB4 Frequency Down-Converter enabling expansion of operating frequency range up to 18 GHz.

**Basic Specifications**

- Operating frequency range: 9 kHz - 8 GHz
- Sensitivity (with 3 kHz discreteness and 10 dB signal/noise ratio): 1 µV, max.

**Signal Parameter Measuring Errors**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Error Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error of sine signal level measurement (with calibration)</td>
<td>±1.5 dB, max.</td>
</tr>
<tr>
<td>Error of field strength measurement (ΔK means measuring antenna calibration factor error)</td>
<td>max. ±3 dB when using the integrated field sensor; max. ±(1.5+ΔK) dB when using switch inputs for external antennae; max. ±0.5+ΔK) dB when using switch inputs for calibrated external antennae</td>
</tr>
<tr>
<td>Error of power flux density of radio signal electromagnetic field (ΔK means measuring antenna calibration factor error)</td>
<td>max. ±3 dB when using the integrated field sensor; max. ±(1.5+ΔK) dB when using switch inputs for external antennae; max. ±0.5+ΔK) dB when using switch inputs for calibrated external antennae</td>
</tr>
<tr>
<td>Error of frequency measurement for signals with AM modulation</td>
<td>max. ±1x10^7</td>
</tr>
<tr>
<td>Frequency measurement error for signals with broadband frequency modulation (broadcast stations)</td>
<td>max. ±10 Hz</td>
</tr>
<tr>
<td>Relative frequency measurement error for signals with narrow-band frequency modulation</td>
<td>max. ±10^6</td>
</tr>
<tr>
<td>Relative frequency measurement error for digital signals without coherent modulation (FMn)</td>
<td>max. ±2x10^7</td>
</tr>
<tr>
<td>Relative frequency measurement error for digital signals with coherent modulation (MMS, FMn)</td>
<td>max. ±10^8</td>
</tr>
<tr>
<td>Frequency measurement error for digital signals without specific frequencies and with the bandwidth above 300 kHz</td>
<td>±5 kHz, max.</td>
</tr>
<tr>
<td>Bandwidth measurement error using X dB method</td>
<td>max. ±5%</td>
</tr>
<tr>
<td>Bandwidth measurement error for β/2 method</td>
<td>max. ±5%</td>
</tr>
</tbody>
</table>
ARGAMAK-I Measuring Receiver

Certificate of Federal Agency for Technical Regulation and Metrology

Certificate of measurement procedure qualification No. 206/000265/2011 as 01.02.2011. It is also registered in the Federal Metrology and Standardization Foundation with No. ФР.1.38.2011.10001.

Purpose:
- Measurement of radio signal & electromagnetic field strength. Used in a handheld measurement systems, mobile stations and stationary (temporary) posts.
- Search for emitting sources
- Analysis of service parameters of communication and data transmission systems: GSM, CDMA, TETRA, UMTS, DECT;
- Panoramic spectrum analysis
- Recording of radio signals and broadcasts.

Configuration:
- ARGAMAK-I Panoramic Measuring Receiver
- Power supply unit
- Control and display unit and software for automatic radio monitoring, technical analysis, cross-talks detection and postprocessing
- Additional attenuators
- Set of connection cables.

Options:
- Second coherent receipt channel providing for additional functions
- High-stable external reference generator
- Measurement antenna set
- ARC-KNV4 Frequency Down-Converter.

ARGAMAK-I Measuring Receiver with two coherent receipt channels additionally provides for the following:
- Detection of the sources of intermodulation interferences caused by non-linear properties of radio receiving and transmitting equipment and wave distribution media.
- Operation with AS-HP-KV, AS-HP0, AS-HP1, AS-HP2, AS-HP5 Antenna Systems providing for automatic direction finding within the frequency range from 1.5 to 8000 MHz.

### Basic Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>20 - 3000 MHz</td>
</tr>
<tr>
<td>IF output bandpass at ±1 dB AFC variations</td>
<td>5 kHz, min.</td>
</tr>
<tr>
<td>Spurious rejection</td>
<td>70 dB, min</td>
</tr>
<tr>
<td>Frequency tuning discreteness in measurement mode</td>
<td>±1 Hz</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (3rd and 2nd order) within 3.125 kHz bandpass</td>
<td>75 dB, min.</td>
</tr>
<tr>
<td>Input signal level dynamic measuring range</td>
<td>103 dB, min</td>
</tr>
<tr>
<td>Resolution for detection of two same-level signals:</td>
<td></td>
</tr>
<tr>
<td>- At 5 MHz simultaneous bandwidth</td>
<td>12 kHz, max.</td>
</tr>
<tr>
<td>- At 2 MHz simultaneous bandwidth</td>
<td>7 kHz, max.</td>
</tr>
<tr>
<td>- At 320 kHz simultaneous bandwidth</td>
<td>650 Hz, max.</td>
</tr>
<tr>
<td>- At 250 kHz simultaneous bandwidth</td>
<td>500 Hz, max.</td>
</tr>
<tr>
<td>- At 120 kHz simultaneous bandwidth</td>
<td>200 Hz, max.</td>
</tr>
<tr>
<td>- At 50 kHz simultaneous bandwidth</td>
<td>200 Hz, max.</td>
</tr>
<tr>
<td>- within 25 kHz simultaneous bandwidth</td>
<td>100 Hz, max.</td>
</tr>
<tr>
<td>- At 9 kHz simultaneous bandwidth</td>
<td>50 Hz, max.</td>
</tr>
<tr>
<td>- At 6.25 kHz simultaneous bandwidth</td>
<td>30 Hz, max.</td>
</tr>
<tr>
<td>Power consumption (provided that batteries are fully loaded)</td>
<td>25 W, max.</td>
</tr>
<tr>
<td>Power supply from external DC source</td>
<td>9 - 32 V</td>
</tr>
<tr>
<td>Continuous battery run-time for the basic configuration</td>
<td>3 hour, min</td>
</tr>
<tr>
<td>Ambient air temperature</td>
<td>from +5°C to +45°C</td>
</tr>
<tr>
<td>Atmospheric pressure</td>
<td>84 - 107 kPa</td>
</tr>
<tr>
<td>Receiver dimensions in case, max.</td>
<td>280 x 250 x 170 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>5.5 kg, max.</td>
</tr>
</tbody>
</table>

### Signal Parameter Measuring Errors

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amplitude modulation factor measurement error</td>
<td>±3 dB max. (with calibration - ±0.5 dB, max.)</td>
</tr>
<tr>
<td>Frequency deviation measurement error for signals with frequency modulation</td>
<td>±(3+ΔK) dB, max. ±(0.5+ΔK) dB with calibration</td>
</tr>
<tr>
<td>Error of FMn signal frequency distribution measurement</td>
<td>±(3+ΔK) dB, max. ±(0.5+ΔK) dB with calibration</td>
</tr>
<tr>
<td>Modulation rate measurement error</td>
<td>±3 dB max. (with calibration - ±0.5 dB, max.)</td>
</tr>
<tr>
<td>Relative error of sub-carrier frequency for stereo FM broadcasting</td>
<td>±0.1°</td>
</tr>
<tr>
<td>Limits of allowable error of frequency channel occupancy measurement</td>
<td>±1%</td>
</tr>
<tr>
<td>Error of sine signal level measurement</td>
<td>±0.1°</td>
</tr>
<tr>
<td>Error of field strength measurement (ΔK means measuring antenna calibration factor error)</td>
<td>±0.1°</td>
</tr>
<tr>
<td>Error of power flux density of radio signal electromagnetic field (ΔK means measuring antenna calibration factor error)</td>
<td>±0.1°</td>
</tr>
<tr>
<td>Relative error of non-modulated signal and AM-signal frequency measurement</td>
<td>±2×10⁻⁹</td>
</tr>
<tr>
<td>Relative frequency measurement error for signals with narrow-band frequency modulation</td>
<td>±2×10⁻⁹</td>
</tr>
<tr>
<td>Relative frequency measurement error for digital signals with non-coherent modulation (FMn)</td>
<td>±10⁻⁹</td>
</tr>
<tr>
<td>Relative frequency measurement error for digital signals with coherent modulation (MMS, FMn)</td>
<td>±2×10⁻⁹</td>
</tr>
<tr>
<td>Frequency measurement error for digital signals without specific frequencies and with the bandwidth above 300 kHz (the pre-set X-deb level shall exceed that of the noise by 10 dB)</td>
<td>±5 kHz, max.</td>
</tr>
<tr>
<td>Bandwidth measurement error for X-db method (the pre-set X-deb level shall exceed that of the noise by 10 dB)</td>
<td>±5 kHz, max.</td>
</tr>
<tr>
<td>Bandwidth measurement error for X2 method Maximum signal level should exceed the level of the extreme frequencies (noise level) by 30 dB</td>
<td>±5%</td>
</tr>
<tr>
<td>Amplitude modulation factor measurement error</td>
<td>±7%</td>
</tr>
<tr>
<td>Frequency deviation measurement error for signals with frequency modulation</td>
<td>±7%</td>
</tr>
</tbody>
</table>
ARGAMAK-M
Panoramic Measuring Receiver

Certificate of measurement procedure qualification No. 002/2013 as 11.10.2013. It is also registered in the Federal Metrology and Standardization Foundation with No. ФП.1.35.2014.17680.

Purpose:
- Measurement of radio signal & electromagnetic field strength. Used in a handheld measurement systems, mobile stations and temporary workstations.
- Panoramic analysis and receipt at fixed frequencies
- Recording radio signals fragments in a vector form to a PC hard disk
- Radio signal technical analysis.

Features and Advantages
- **High performance:**
  - Panoramic analysis rate within operation frequency range is 3500 MHz/s
  - Minimum duration of the signal detected within simultaneous bandwidth is 1 µs.
- **Multi-Functionality:**
  - Measuring of electromagnetic field strength and radio signal parameters when using as a part of a handheld measuring system
  - Outdoor and indoor radio monitoring from 9 kHz to 3 GHz (up to 18 GHz with optional equipment)
  - Manual direction finding from 0.3 MHz to 3 GHz (up to 18 GHz with optional equipment)
  - Analysis of signals of wireless communication and data transmission systems
  - Detection and position finding: Surface radio facilities; wireless communication and data transmission system; VSAT C, VSAT Ku satellite systems
  - Radio signal recording and technical analysis within the band up to 10 MHz.
- **Small weight and dimensions:** max. weight is 1.5 kg (including battery);
- **Low energy consumption:** 15 W, max;
- **Option of synchronization with external reference generator:**
- **Option to connect optional equipment** (antenna switches, converters, etc.).

Basic Configuration:
- Reception and Processing Unit of ARGAMAK-M, with battery set
- AC network power supply unit
- Charger
- Set of cables
- Control and display module
- PC and software packages
- Operation documents.

Options:
- High-stable external reference generator
- ARC-3A3 (0.3 – 3000 MHz) Directional Antenna Set and handle
- ARC-KNV3M Frequency Down-Converter (3 – 8 GHz) for amplitude manual direction finding
- ARC-KNV4M Frequency Down-Converter (3 – 18 GHz) for amplitude manual direction finding
- ARC-MA2 HF Magnetic Receive Antenna (9 kHz – 30 MHz)
- Wireless user interface to control the equipment and display the data using Android OS mobile device.

### Basic Specifications

<table>
<thead>
<tr>
<th>Operating frequency range:</th>
</tr>
</thead>
<tbody>
<tr>
<td>without HF range</td>
</tr>
<tr>
<td>with HF range</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating frequency range when KNV4 is used</th>
</tr>
</thead>
<tbody>
<tr>
<td>with HF range</td>
</tr>
<tr>
<td>with HF range</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IP2 and IP3 with attenuation off</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP2</td>
</tr>
<tr>
<td>IP3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Noise figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing Wave Ratio (SWR) at external antenna input with input resistance 50 Ohm</td>
</tr>
<tr>
<td>Switched bandwidths, maximum bandwidth at ± 0.5 dB variation</td>
</tr>
<tr>
<td>Sensitivity for narrow FM (12.5 kHz), SINAD above 12 dB</td>
</tr>
<tr>
<td>Panoramic rate (with 12.5 kHz discreteness)</td>
</tr>
<tr>
<td>Minimum duration of detection of signal with level above 60 dBµV within simultaneous bandwidth of 8 MHz</td>
</tr>
<tr>
<td>Spurious rejection</td>
</tr>
<tr>
<td>Continuous recording of the signals to PC within the bandwidth up to 2 MHz</td>
</tr>
<tr>
<td>Continuous recording of the signal fragments (max. 64 MB ) to integrated data storage (flash-disc) within the bandwidth up to 10 MHz</td>
</tr>
<tr>
<td>Storage available volume</td>
</tr>
<tr>
<td>Control interface and digital IQ output</td>
</tr>
<tr>
<td>External equipment control interface</td>
</tr>
<tr>
<td>Interface to connect display and control unit</td>
</tr>
<tr>
<td>Detection, modulation types</td>
</tr>
<tr>
<td>Headphones socket</td>
</tr>
<tr>
<td>Equipment shall be operated when powered from:</td>
</tr>
<tr>
<td>Internal batteries</td>
</tr>
<tr>
<td>External DC network</td>
</tr>
</tbody>
</table>
**Signal Parameter Measuring Errors**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Error Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error of sine signal level measurement (within 5 MHz bandpass)</td>
<td>±3 dB max.; max. ±5×10⁻⁸ with an external Reference Generator</td>
</tr>
<tr>
<td>Field strength measurement error (within 5 MHz bandpass; ΔK means measuring antenna calibration factor error)</td>
<td>max. ±(3+ΔK) dB; max. ±(1.5+ΔK) dB with calibration</td>
</tr>
<tr>
<td>EMF power flux measurement error (within 5 MHz bandpass; ΔK means measuring antenna calibration factor error)</td>
<td>max. ±(3+ΔK) dB; max. ±(1.5+ΔK) dB with calibration</td>
</tr>
<tr>
<td>Relative error of non-modulated signal and AM-signal frequency measurement</td>
<td>max. ±5×10⁻⁷; max. ±2×10⁻⁷ with an external Reference Generator</td>
</tr>
<tr>
<td>Frequency measurement error for signals with broadband frequency modulation (broadcast stations)</td>
<td>max. ±0.1 Hz with ext. Reference Generator</td>
</tr>
<tr>
<td>Relative frequency measurement error for signals with narrow-band frequency modulation</td>
<td>max. ±5×10⁻⁸; max. ±1×10⁻⁸ with an external Reference Generator</td>
</tr>
<tr>
<td>Relative frequency measurement error for signals with non-coherent modulation (FMn)</td>
<td>max. ±5×10⁻⁷; max. ±2×10⁻⁷ with an external Reference Generator</td>
</tr>
<tr>
<td>Relative frequency measurement error for digital signals with coherent modulation (MMs, FMn)</td>
<td>max. ±5×10⁻⁷; max. ±1×10⁻⁸ with an external Reference Generator</td>
</tr>
<tr>
<td>Frequency measurement error for digital signals without specific frequencies and with the bandwidth above 300 kHz (the pre-set X-deb level shall exceed that of the noise by 10 dB)</td>
<td>±5 kHz, max.</td>
</tr>
<tr>
<td>Bandwidth measurement error for X-deb method (the pre-set X-deb level shall exceed that of the noise by 10 dB)</td>
<td>max. ±5%</td>
</tr>
<tr>
<td>Bandwidth measurement error for pre-set signal level should exceed the level of the extreme frequencies (noise level) by 30 dB</td>
<td>max. ±5%</td>
</tr>
<tr>
<td>Amplitude modulation factor measurement error *</td>
<td>max. ±7%</td>
</tr>
<tr>
<td>Frequency deviation measurement error for signals with frequency modulation</td>
<td>max. ±5%</td>
</tr>
<tr>
<td>Error of FMn signal frequency distribution measurement *</td>
<td>max. ±5%</td>
</tr>
<tr>
<td>Modulation rate measurement error *</td>
<td>max. ±1%</td>
</tr>
<tr>
<td>Relative error of sub-carrier frequency for stereo FM broadcasting *</td>
<td>max. ±10⁵</td>
</tr>
<tr>
<td>Error of frequency channel occupancy measurement</td>
<td>max. ±1%</td>
</tr>
</tbody>
</table>

* at 20 dBµV min. signal level when no stray signals are found

**ARC-KNV4 Frequency Down-Converter for Measuring Equipment**

**Certificate of Federal Agency for Technical Regulation and Metrology – Approval of Measuring Equipment Type RU.E.35.018.A No. 48021 as of 11.09.2012.**

**Certificate of measurement procedure qualification No. 206/000265/2011 as 01.02.2011.**

**Purpose:**
- Conversion of UHF and SHF signals to an intermediate frequency.

**Basic Configuration:**
- Remote converter module
- Set of cables
- Operation documents

**Basic Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received frequency range</td>
<td>3 – 18 GHz</td>
</tr>
<tr>
<td>• with internal antenna</td>
<td>1 – 18 GHz</td>
</tr>
<tr>
<td>Output signal frequency (1F)</td>
<td>70 (41.6) MHz</td>
</tr>
<tr>
<td>Bandpass at -3 dB level</td>
<td>24 (10) MHz, min.</td>
</tr>
<tr>
<td>Relative error of sine signal frequency measurement within operating frequency range</td>
<td>±5×10⁻⁷</td>
</tr>
<tr>
<td>• When using internal reference generator</td>
<td>±5×10⁻⁷</td>
</tr>
<tr>
<td>• When using external reference generator</td>
<td>Depends on external reference generator parameters</td>
</tr>
<tr>
<td>Error of sine signal level measurement at external antenna inputs</td>
<td>±3 dB, max.</td>
</tr>
<tr>
<td>IP3 at SNR equal to 1 within 3 kHz bandwidth</td>
<td>68 dB, max.</td>
</tr>
<tr>
<td>Self-noise average level within 3 kHz bandwidth</td>
<td>-100 dB, max.</td>
</tr>
<tr>
<td>Standing Wave Ratio (SWR) at external antenna input with input resistance 50 Ohm</td>
<td>3 max</td>
</tr>
<tr>
<td>Field sensitivity of built-in antenna at SNR equal to 1 within 3 kHz bandwidth</td>
<td>max. 50 µV/m</td>
</tr>
<tr>
<td>Spurious rejection when using internal antenna</td>
<td>45 dB, min</td>
</tr>
<tr>
<td>Aperture angle of internal antenna at minus 3 dB level</td>
<td>max. 100°</td>
</tr>
<tr>
<td>Control interface</td>
<td>RS-485</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>From 10 to 30 V</td>
</tr>
<tr>
<td>Power consumption</td>
<td>20 VA max</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>From 0°C to +50°C</td>
</tr>
<tr>
<td>Dimensions of ARRU of ARC-KNV4 without handle</td>
<td>240×220×65 mm</td>
</tr>
<tr>
<td>Dimensions of ARRU of ARC-KNV4 with handle</td>
<td>max. 1.8 kg</td>
</tr>
</tbody>
</table>

Supplied only as a part of IRCOS measuring equipment.
Digital Receivers, Frequency Converters

All basic component of the equipment manufactured by IRCOS are designed and produced by the company itself. In 1999 the company started manufacturing of proprietary professional digital radio receiving equipment and from that time became one of the leaders in the industry in Russia. Our success was mainly based on the design efforts of our specialists who developed the analog part of the receiver (signal pre-selection, spurious channel level, signal conversion linearity, output filtration and amplification) and the digital part of the receiver using SDR approach, modern digital signal processors, programmable logic integral diagram and analog-digital converters.

Following the system design philosophy applied to the whole range of the equipment produced by our company, digital radio receivers support basic operating frequency range from 9 kHz to 3000 MHz. This range can be further extended by means of signal frequency tuners. In 2011 the company started manufacturing of radio receivers based on ARGAMAK+ modules with IF bandpass up to 24 MHz and improved sensitivity, linearity and dynamic range.

IRCOS designs not only ready solutions but also provides user with opportunity to design his own software and hardware for his individual tasks. According to this strategy, the company supplies not only ready-made radio receiving units for both analogue and digital signal processing but also radio signal converters that enable selection and transfer of radio signals to intermediate frequency.

This section presents digital panoramic radio receivers, tuners, frequency down-convertors, and test generators purposely to verify and calibrate direction finders and to test the receiving equipment. Part of them can be delivered separately, though there are some devices that can function only as a part of equipment-software systems.

ARGAMAK, ARGAMAK-K
Panoramic Radio Receivers

First Grade medal awarded by the X Moscow International Forum & Exhibition «Security and Safety Technologies» (2005)

Purpose:
● Panoramic spectrum analysis
● Estimation of electromagnetic field strength and radio signal parameters
● Radio signal recording, and technical analysis.

Basic Configuration:
● Radio receiver, including:
  • Either ARC-PS5 or ARC-PS5+Tuner, controlled
  • Digital processing module with processing bandwidth of either 5 MHz (ARC-CO5) or 24 MHz (ARC-CO+);
  • AC network power supply unit
  • PC and software packages
  • Operation documents.

Options:
● Broadband radio-monitoring antennas
● Software Development Kit
● ARC-KNV3M or ARC-KNV4M Frequency Down-Converter.

Features:
● Synchronization with external reference generator
● Sockets for optional equipment (antenna switches, converters, etc.).

The Receiver Provides:
● Search and detection of radio signals
● Panoramic analysis within the entire operating frequency range
● Signal digital demodulation
● Calculation of spectrum, estimation of frequency, level and band of the received signal
● Radio signal spectrum displaying

Options:
● Recording of radio signals to a external storage
● Radio signal technical analysis
● Output of IF analogue signal for connecting optional equipment.

Basic Specifications

<table>
<thead>
<tr>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simultaneous bandwidth:</td>
</tr>
<tr>
<td>• For ARC-PS5 and ARC-CO modules</td>
</tr>
<tr>
<td>• For ARC-PS5+ and ARC-CO+ modules</td>
</tr>
<tr>
<td>Operating frequency range of the basic set</td>
</tr>
<tr>
<td>Frequency range, complete configuration</td>
</tr>
</tbody>
</table>

ADPU Features

<table>
<thead>
<tr>
<th>Detection, modulation types</th>
<th>AM, FM, SSB, AT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal level estimation range in a 250 kHz pass band (with automatic attenuators)</td>
<td>-20 ... +110 dBµV</td>
</tr>
<tr>
<td>Input signal level estimation range in a 5 kHz pass band (with automatic attenuators)</td>
<td>-5 ... +110 dBµV</td>
</tr>
<tr>
<td>Limit of allowable absolute error of signal level estimation</td>
<td>±3 dB</td>
</tr>
<tr>
<td>Panoramic analysis rate</td>
<td>1500 MHz/s, min</td>
</tr>
<tr>
<td>For ARC-PS5+ and ARC-CO+ modules</td>
<td>up to 10 GHz/s</td>
</tr>
</tbody>
</table>

Radio Signal Recording, Technical Analysis and Parameter Measurement

<table>
<thead>
<tr>
<th>Band of radio signal continuous recording (Limited number of discontinuity is possible. The total length is less than 3 %.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• For ARC-PS5 and ARC-CO5 modules</td>
</tr>
<tr>
<td>• For ARC-PS5+ and ARC-CO+ modules</td>
</tr>
</tbody>
</table>
### Input, Outputs, Remote Control and Data Transmission Interface

<table>
<thead>
<tr>
<th>PC control interface</th>
<th>• For ARC-PS5 and ARC-CO modules</th>
<th>USB 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• For ARC-PS5+ and ARC-CO+ modules</td>
<td>Ethernet, USB 2.0</td>
</tr>
<tr>
<td>IF signal output for connection of external equipment</td>
<td>• For ARC-PS5 and ARC-CO modules</td>
<td>10.7 MHz, 41.6 MHz</td>
</tr>
<tr>
<td></td>
<td>• For ARC-PS5+ and ARC-CO+ modules</td>
<td>70 MHz</td>
</tr>
<tr>
<td>Line-out</td>
<td>Available</td>
<td></td>
</tr>
<tr>
<td>Headphones socket</td>
<td>Available</td>
<td></td>
</tr>
<tr>
<td>Optional equipment control interface</td>
<td>RS485</td>
<td></td>
</tr>
</tbody>
</table>
Basic Configuration:

- Antenna splitters
- Up to six ARC-PS5 Tuner Modules
- Up to three ARC-COS Digital Processing Module, double channel
- Up to three two-channel modules of IF output;
- AC network power supply unit
- ARC-A12 Broadband Antenna with antenna cable, 10 m long.
- Control and display unit with software package
- Operation documents.

Options:

- ARC-AT3-3 Broadband Antenna for Installation on Vehicle
- ARC-MA2 Magnetic Broadband Antenna.
- ARC-KNV3M Frequency Down-Converter (for one channel)
- ARC-KNV4M Frequency Down-Converter.

Features:

- Up to 6 channels in simultaneous operation
- Remote wire/wireless control supported by the software packages
- Can function as a part of stationary and mobile radio monitoring station.

The Unit Provides:

- Panoramic spectrum analysis of radio signals obtained through all channels and single antenna, panoramic spectrum accumulation for a given frequency range and saving the range loading panorama for further analysis
- Panoramic spectrum analysis of radio signals obtained per each channel, panoramic spectrum accumulation for a given frequency range and saving the range loading panorama for further analysis
- Postprocessing of panorama analysis results
- Stepwise browsing of the frequency band list and automatic recording of the emitters detected
- Searching active emitters as per frequency list
- Recording of radio signals
- Technical analysis, determination of modulation type and measurement of radio signal parameters
- Recording of radio signals at IF in a vector form to a PC hard disk
- Playing the recorded sound data from the hard drive and real-time listening to active emitters
- Generation of reports including results of radio channel monitoring and signal analysis.

Basic Specifications

Panoramic Analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>0.009 - 3000 MHz</td>
</tr>
<tr>
<td>Attenuator</td>
<td>0 - 30 dB with 2 dB increment</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>0.8 - 1.5 µV</td>
</tr>
<tr>
<td>Intermodulation free dynamic range</td>
<td>75 dB, min</td>
</tr>
<tr>
<td>IF rejection</td>
<td>70 dB, min</td>
</tr>
<tr>
<td>Image rejection</td>
<td>70 dB, min</td>
</tr>
<tr>
<td>Total rate (with 6.25 kHz spectrum discreteness)</td>
<td>7000 MHz/s</td>
</tr>
<tr>
<td>Rate per each channel (with 6.25 kHz spectrum discreteness), min.</td>
<td>1600 MHz/s</td>
</tr>
<tr>
<td>Power supply AC network power supply</td>
<td>90 - 250 V</td>
</tr>
<tr>
<td>Power supply vehicle power supply</td>
<td>10 - 30 V</td>
</tr>
</tbody>
</table>

Real-time radio channel monitoring and demodulated broadcast recording

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of channels under control</td>
<td>2 - 6</td>
</tr>
<tr>
<td>Number of frequencies in task</td>
<td>255</td>
</tr>
<tr>
<td>No. of ranges per task</td>
<td>255</td>
</tr>
<tr>
<td>Receiver tuning discrete</td>
<td>1 Hz</td>
</tr>
<tr>
<td>Demodulation types</td>
<td>AM, FM, SSB, AT</td>
</tr>
</tbody>
</table>

Radio signal recording & technical analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processed frequency bandwidth</td>
<td>up to 5 MHz</td>
</tr>
<tr>
<td>Recording of radio signal fragments within the band</td>
<td>up to 5 MHz</td>
</tr>
<tr>
<td>Continuous recording of radio signals within the band of (for 6 channels simultaneously)</td>
<td>320 kHz, 250 kHz, 100 kHz, 50 kHz, 25 kHz</td>
</tr>
<tr>
<td>Continuous recording of radio signals within the band of (for one channel)</td>
<td>7 MHz, 320 kHz, 250 kHz, 100 kHz, 50 kHz, 25 kHz, 12 kHz, 6 kHz</td>
</tr>
</tbody>
</table>

* Limited number of discontinuities is possible. Their total length is less than 3% of total recording time.
ARGAMAK-MN
Panoramic Radio Receiver

Purpose:
- Operation as a part of handheld systems, including:
  - Panoramic analysis and receipt at fixed frequencies
  - Signal digital demodulation
  - Recording radio signal fragments in a vector form
  - Radio signal technical analysis.

Features and Advantages:
- **High performance:** Panoramic analysis rate within operation frequency range is 3500 MHz/s, minimum duration of the signal detected within simultaneous bandwidth is 1 µs;
- **Multi-Functionality:**
  - Outdoor and indoor radio monitoring from 9 kHz to 3 GHz (up to 18 GHz with optional equipment)
  - Manual direction finding from 0.3 MHz to 18 GHz (with optional equipment)
  - Analysis of signals of wireless communication and data transmission systems
  - Detection and position finding: Surface radio facilities; wireless communication and data transmission systems
  - Detection and position finding: Surface radio facilities; wireless communication and data transmission systems
  - Analysis of DVB T/T2/H digital TV signals
  - Radio signal recording and technical analysis within the band up to 22 MHz;
- **Small weight and dimensions:** max. weight is 1.5 kg (including battery);
- **Low energy consumption:** 15 W, max (without control unit).
- Option of synchronization with external ARC-OG1 Reference Generator (optionally).
- Sockets for optional equipment (antenna switches, converters, etc.)

Basic configuration, functions and specifications are similar to those of ARGAMAK-M.

ARGAMAK-U
Compact Panoramic Radio Receiver

Purpose:
- Panoramic analysis and receipt at fixed frequencies
- Signal digital demodulation
- Recording of signal fragments
- Radio signal technical analysis.

Features and Advantages:
- **High performance:** Panoramic analysis rate within entire operating frequency range is 3 500 MHz/s; up to 200 GHz within simultaneous bandwidth of 8 MHz;
- **Multi-Functionality:**
  - Outdoor and indoor radio monitoring from 25 MHz to 3 GHz (up to 18 GHz with optional equipment)
  - Manual direction finding from 25 MHz to 18 GHz (with optional equipment)
  - Analysis of signals of wireless communication and data transmission systems
  - Detection and position finding: Surface radio facilities; wireless communication and data transmission systems
  - Radio signal recording and technical analysis within the band up to 10 MHz;
- **Small weight and dimensions:** max. weight is 0.7 kg (including battery);
- **Low energy consumption:** 15 W, max (without PC).

Configuration:
- ARC-CPS2M Tuning and Digital Processing Module in compact case
- AC network power supply unit
- Control and display unit with software package
- Operation documents.

Options:
- Software Development Kit
- ARC-A3A (25 – 3000 MHz) Directional Antenna Set and handle
- ARC-KNV3M Frequency Down-Converter (3 – 8 GHz) for amplitude
- ARC-KNV4M Frequency Down-Converter (3 – 18 GHz) for amplitude
- Wireless user interface to control the equipment and display the data using Android OS mobile device (smartphone or tablet)
- Navigation equipment with software package for transmitter localization.

The Receiver Provides:
- Search and detection of radio signals
- Panoramic analysis within the entire operating frequency range
- Signal digital demodulation
- Calculation of spectrum, estimation of frequency, level and band of the received signal
- Recording of radio signals
- Radio signal technical analysis.

### Basic Specifications

<table>
<thead>
<tr>
<th>General</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>20 – 3000 MHz</td>
</tr>
<tr>
<td>Image rejection</td>
<td>70 dB, min</td>
</tr>
<tr>
<td>Intermodulation free dynamic</td>
<td>75 dB, min</td>
</tr>
<tr>
<td>range (3rd and 2nd order)</td>
<td></td>
</tr>
<tr>
<td>Input IP3 within the frequency</td>
<td>0 / 30 dBm, min</td>
</tr>
<tr>
<td>range (without attenuator / with 30 dB attenuator's on)</td>
<td></td>
</tr>
<tr>
<td>Input attenuator</td>
<td>0 - 30 dB</td>
</tr>
<tr>
<td>Relative error of frequency</td>
<td>±5x10^{-7}</td>
</tr>
<tr>
<td>tuning discreteness</td>
<td>1 Hz</td>
</tr>
<tr>
<td>Panoramic analysis rate</td>
<td>3500 MHz/s, min</td>
</tr>
<tr>
<td>(with 6.25 kHz spectrum</td>
<td></td>
</tr>
<tr>
<td>discreteness)</td>
<td></td>
</tr>
</tbody>
</table>

### Technical Specifications

| Detection, modulation types     | AM, FM, SSB, AT  |
| Limit of allowable absolute    | ±3 dB            |
| error of signal level estimation|                  |
Radio Signal Recording, Technical Analysis and Parameter Measurement
Continuous recording of the signals to PC
• Continuous up to 2 MHz
• max. 64 MB fragments up to 10 MHz
Continuous recording of the signals to integrated data storage (flash-disc) within the bandwidth
up to 10 MHz
Storage available volume
up to 106 GB
Simultaneous bandwidth
up to 10 MHz

Input, Outputs, Remote Control and Data Transmission Interface
Control interface and digital IQ output USB 2.0
Headphones socket Available

Operating Temperature, Weight, Dimensions and Power Consumption
Operating frequency range (without PC and flash disc) -40°C ... +45°C
Power supply voltage 9 - 16 V
Power consumption 15 W, max.
Dimensions, max. 200 x 25 x 140 mm
Weight 0.7 kg, max.

When Operated with Internal Reference Generator
Frequency fluctuations per day ±5x10⁻⁷
Synthesizer tuning time 2 ms, max.
Heterodyne phase noise when mistuning at 10 kHz
• within 0.009 - 30 MHz range -100 dB/Hz
• within 25 - 1000 MHz range -95 dB/Hz
• within 1000 - 3000 MHz range -85 dB/Hz

Selectivity and Harmonic Distortions
IF rejection 70 dB, min.
Image rejection 70 dB, min.
Intermodulation free dynamic range (3rd and 2nd order)
• within 0.009 - 30 MHz range 80 dB
• within 25 - 3000 MHz range 75 dB
Input IP3, without attenuators
• within 0.009 - 30 MHz range 6 dBm, min
• within 25 - 3000 MHz range 0 dBm, min
Input IP3 with 30 dB attenuator running
• within 0.009 - 30 MHz range 36 dBm, min
• within 25 - 3000 MHz range 30 dBm, min
Gain from input to IF output 10 dB
Transfer factor irregularity within operating frequency range of basic modification ±3 dB, max.

IF Signal
IF analogue signal frequency 10.7 or 41.6 MHz
IF output pass band
• 10.7 MHz with ±1 dB variation 2 MHz
• 41.6 MHz with ±1.5 dB variation 5 MHz

Operating Temperature, Weight, Dimensions and Power Consumption
Operating temperature range -40°C ... +70°C
Power supply voltage 9 - 16 V
Power consumption 6 W, max.
Dimensions 100 x 16 x 168 mm
Operating set weight 0.5 kg, max.

ARC-PS5 Tuner Module
Purpose:
• Filtering, amplification and conversion of VLF, LF, IF, HF, VHF and UHF signals to an intermediate frequency.

Configuration:
• ARC-PS5+ controlled tuner printboard for installation in user equipment
• Command system description
• Operation documents.

Features:
• Synchronization with external reference generator.

The Module Provides:
• Tuning to the set frequency
• IF analog signal output for connection of optional equipment.

Basic Specifications

<table>
<thead>
<tr>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range of the basic set 25 – 3000 MHz</td>
</tr>
<tr>
<td>Operating frequency range, extended configuration 9 kHz - 3 GHz</td>
</tr>
<tr>
<td>Frequency tuning discreteness 100 kHz</td>
</tr>
<tr>
<td>Noise figure, max.</td>
</tr>
<tr>
<td>• within 0.009 - 30 MHz range 12 dB</td>
</tr>
<tr>
<td>• within 25 - 465 MHz range 12 dB</td>
</tr>
<tr>
<td>• within 465 - 3000 MHz range 12 - 14 dB</td>
</tr>
<tr>
<td>Maximum allowable input voltage 23 dBm</td>
</tr>
<tr>
<td>Input attenuator 0 - 30 dB with 2 dB increment</td>
</tr>
</tbody>
</table>

When Operated with Internal Reference Generator
Relative error of frequency tuning ±5x10⁻⁷
Temperature fluctuations at minus -20°C to +50°C ±5x10⁻⁷

ARC-PS5+ Tuner Module
(ARGAMAK+ family)
Purpose:
• Filtering, amplification and conversion of VLF, LF, IF, HF, VHF and UHF signals to an intermediate frequency.

Configuration:
• ARC-PS5+ controlled tuner printboard for installation in user equipment
• Software Development Kit
• Operation documents.

Features:
• Synchronization with external reference generator.

The Module Provides:
• Tuning to the set frequency
• IF analog signal output for connection of optional equipment.

Basic Specifications

<table>
<thead>
<tr>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range of the basic set 25 – 3000 MHz</td>
</tr>
<tr>
<td>Operating frequency range, extended configuration 9 kHz - 3 GHz</td>
</tr>
<tr>
<td>Noise figure, max.</td>
</tr>
<tr>
<td>• within 0.009 - 30 MHz range 12 dB</td>
</tr>
<tr>
<td>• within 25 - 465 MHz range 12 dB</td>
</tr>
<tr>
<td>• within 465 - 3000 MHz range 12 - 14 dB</td>
</tr>
<tr>
<td>Maximum allowable input voltage 23 dBm</td>
</tr>
<tr>
<td>Input attenuator 0 - 30 dB with 2 dB increment</td>
</tr>
</tbody>
</table>
When Operated with Internal Reference Generator

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative error of frequency tuning</td>
<td>±5x10^{-7}</td>
</tr>
<tr>
<td>Temperature fluctuations at minus -20°C to +50°C</td>
<td>±5x10^{-7}</td>
</tr>
<tr>
<td>Frequency fluctuations per day</td>
<td>±5x10^{-7}</td>
</tr>
<tr>
<td>Synthesizer tuning time</td>
<td>2 ms, max.</td>
</tr>
<tr>
<td>Heterodyne phase noise when mistuning at 10 kHz</td>
<td></td>
</tr>
<tr>
<td>- within 0.009 - 30 MHz range</td>
<td>-100 dB/Hz</td>
</tr>
<tr>
<td>- within 25 - 3000 MHz range</td>
<td>-95 dB/Hz</td>
</tr>
<tr>
<td>- within 1000 - 3000 MHz range</td>
<td>-85 dB/Hz</td>
</tr>
</tbody>
</table>

Selectivity and Harmonic Distortions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF rejection</td>
<td>70 dB, min.</td>
</tr>
<tr>
<td>Image rejection</td>
<td>70 dB, min.</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (3rd and 2nd order)</td>
<td></td>
</tr>
<tr>
<td>- within 0.009 - 30 MHz range</td>
<td>80 dB</td>
</tr>
<tr>
<td>- within 25 - 3000 MHz range</td>
<td>75 dB</td>
</tr>
<tr>
<td>Input IP3, without attenuators</td>
<td></td>
</tr>
<tr>
<td>- within 0.009 - 30 MHz range</td>
<td>6 dBm, min.</td>
</tr>
<tr>
<td>- within 25 - 3000 MHz range</td>
<td>0 dBm, min.</td>
</tr>
<tr>
<td>Input IP3 with 30 dB attenuator running</td>
<td></td>
</tr>
<tr>
<td>- within 0.009 - 30 MHz range</td>
<td>36 dBm, min</td>
</tr>
<tr>
<td>- within 25 - 3000 MHz range</td>
<td>30 dBm, min</td>
</tr>
<tr>
<td>Gain from input to IF output</td>
<td>27 dB</td>
</tr>
<tr>
<td>Transfer factor irregularity within operating frequency range of basic modification</td>
<td>±3 dB, max.</td>
</tr>
</tbody>
</table>

IF Signal

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF analogue signal frequency</td>
<td>70 MHz</td>
</tr>
<tr>
<td>IF output bandpass ±1.5 dB variation</td>
<td></td>
</tr>
<tr>
<td>- within 0.009 - 30 MHz range</td>
<td>1 MHz</td>
</tr>
<tr>
<td>- within 25 - 465 MHz range</td>
<td>2 MHz</td>
</tr>
<tr>
<td>- within 465 - 3000 MHz range</td>
<td>5 MHz</td>
</tr>
<tr>
<td>Bandpass before IF output ±3 dB variation</td>
<td></td>
</tr>
<tr>
<td>- within 110 - 220 MHz range</td>
<td>10 MHz</td>
</tr>
<tr>
<td>- within 220 - 3000 MHz range</td>
<td>24 MHz</td>
</tr>
</tbody>
</table>

Operating Temperature, Weight, Dimensions and Power Consumption

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-40°C ... +70°C</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>9 - 16 V</td>
</tr>
<tr>
<td>Power consumption</td>
<td>6 W, max.</td>
</tr>
<tr>
<td>Dimensions</td>
<td>100 x 16 x 168 mm</td>
</tr>
<tr>
<td>Operating set weight</td>
<td>0.5 kg, max.</td>
</tr>
</tbody>
</table>

ARC-CPS2M
Tuning and Digital Processing Module

Purpose:
- Radio signal filtering, amplifying, transfer to the intermediate frequency and A/D conversion of IF radio signal
- Multifunctional signal digital processing
- Continuous recording of the signals to integrated data storage.

Configuration:
- ARC-CPS2M Module in one of the following designs:
  - Basic – frequency range of 20 MHz – 3 GHz;
  - Extended – frequency range of 9 kHz – 3 GHz;
- Operation documents
- Software Development Kit.

Options:
- Integrated flash-disc
- Control and display unit with software packages for panoramic and technical analysis.

The Module Provides:
- Scheduled cyclic scanning within a frequency range or over separate frequencies
- Scheduled panoramic spectrum analysis of radio signals, panoramic spectrum accumulation for a given frequency range
- Postprocessing of panorama analysis results
- Recording of radio signals at IF in vector form to flash disk
- Technical analysis, determination of modulation type and measurement of radio signal parameters
- PC-controlled operation.

Basic Specifications

<table>
<thead>
<tr>
<th>Operating frequency range:</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic design</td>
<td>20 – 3000 MHz</td>
</tr>
<tr>
<td>Extended design</td>
<td>9 kHz – 3 GHz</td>
</tr>
<tr>
<td>Maximum allowable input voltage</td>
<td>23 dBm, min</td>
</tr>
<tr>
<td>Input attenuator</td>
<td>0 - 30 dB with 2 dB increment</td>
</tr>
<tr>
<td>Antenna input sensitivity @measuring bandwidth 1 kHz and signal to noise ratio 12 dB</td>
<td>1 µV, max.</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (3rd and 2nd order) within 10 MHz simultaneous bandwidth</td>
<td>75 dB, min</td>
</tr>
<tr>
<td>Spurious rejection</td>
<td>70 dB, min.</td>
</tr>
<tr>
<td>Noise figure (preamplifier on)</td>
<td>75 dB, min</td>
</tr>
<tr>
<td>Frequency fluctuations of reference generator within operating frequency range</td>
<td>±5x10^{-7}</td>
</tr>
<tr>
<td>Panoramic analysis rate (@10 MHz simultaneous bandwidth)</td>
<td>3500 MHz/s, min</td>
</tr>
<tr>
<td>Channel monitoring rate</td>
<td>30 channel/s, min</td>
</tr>
<tr>
<td>Max. real-time analysis bandwidth</td>
<td>22 MHz</td>
</tr>
</tbody>
</table>

Board of ARC-PS5+ Module
Phone. +7 495-615-0523, 495-615-7302

www.ircos.ru
info@ircos.ru

Phase noise when mistuning at 10 kHz

- within 0.009 - 30 MHz range -110 dBs/Hz, max.
- within 20 - 1000 MHz range -90 dBs/Hz, max.
- within 1000 - 3000 MHz range -85 dBs/Hz, max.

Length of continuous radio signal recording within a band of 2 MHz 120 minute, min
Length of continuous radio signal recording within a band of 5 MHz 60 minute, min

Length of continuous radio signal recording within a band of 10 MHz 30 minute, min

Storage available volume up to 106 GB
Control interface and digital IQ output USB 2.0
Power supply voltage 10 - 15 V
Power consumption:
- Basic design 15 W, max.
- Extended design 17 W, max.

Weight:
- Basic design 0.3 kg, max.
- Extended design 0.4 kg, max.

Dimensions:
- Basic design 145x100x13 mm
- Extended design 170x100x13 mm

Operating temperature range:
- Basic design From -40°C to +55°C
- Extended design From 0°C to +55°C

---

ARC-KNV4M Remote Controlled Frequency Down-Converter

Phase noise when mistuning at 10 kHz

- within 0.009 - 30 MHz range -110 dBs/Hz, max.
- within 20 - 1000 MHz range -90 dBs/Hz, max.
- within 1000 - 3000 MHz range -85 dBs/Hz, max.

Length of continuous radio signal recording within a band of 2 MHz 120 minute, min
Length of continuous radio signal recording within a band of 5 MHz 60 minute, min

Length of continuous radio signal recording within a band of 10 MHz 30 minute, min

Storage available volume up to 106 GB
Control interface and digital IQ output USB 2.0
Power supply voltage 10 - 15 V
Power consumption:
- Basic design 15 W, max.
- Extended design 17 W, max.

Weight:
- Basic design 0.3 kg, max.
- Extended design 0.4 kg, max.

Dimensions:
- Basic design 145x100x13 mm
- Extended design 170x100x13 mm

Operating temperature range:
- Basic design From -40°C to +55°C
- Extended design From 0°C to +55°C

---

ARC-KNV3 Remote Controlled Frequency Down-Converter

Purpose:
- Filtering, amplification and conversion of UHF and SHF signals to an intermediate frequency.

Basic Configuration:
- Remote-mounted block with a frequency down-converter
- Set of cables
- Operation documents.

Options:
- Command system description
- USB or Ethernet to RS485 converter
- Utility software package
- AC network power supply unit.

Basic Specifications
- Operating frequency range 3 - 8 GHz
- Output signal frequency 41.6 MHz
- Rated transfer factor 10 dB
- Spurious rejection 70 dB, min
- Amplitude-frequency response overall ripple ±3 dB
- SWR at input and output 3, max
- Input impedance 50 Ohm
- Output impedance 50 Ohm
- Heterodyne phase noise when mistuning at 10 kHz -80 dBs/Hz, max.
- Noise figure 14 dB, max.
- Control interface RS485
- Dimensions 106 x 56 x 236 mm
- Power supply voltage 10 - 15 V
- Power consumption 8 W
- Operating temperature range -20°C...+55°C

---

ARC-KNV3M Remote Controlled Frequency Down-Converter

Purpose:
- Filtering, amplification and conversion of UHF and SHF signals to an intermediate frequency.

Basic Configuration:
- Remote-mounted block with a frequency down-converter
- Built-in directional antenna
- Set of cables
- Operation documents.

Options:
- Command system description
- USB or Ethernet to RS485 converter
- Utility software package
- AC network power supply unit.

Basic Specifications
- Received frequency range with internal antenna 3 – 8 GHz
- Received frequency range with external antenna 1 – 8 GHz
- Output signal frequency (IF) 70 (41.6) MHz
- Relative error of frequency tuning ±5x10^-7
- Bandpass at -3 dB level 24 (10) MHz
**ARC-TG3**

**Test Generator**

**Purpose:**
- Generation of modulated/non-modulated radio signals
- Functional testing of panoramic and direction finding equipment afield.

**Configuration:**
- Test generator unit
- Remote control panel
- Battery set
- Power supply and charging unit
- Telescopic rod antenna
- Software package
- Set of cables
- Carry bag
- Operation documents.

**The Unit Provides:**
- PC-controlled or stand-alone operation
- Recording of tasks for stand-alone operation from a PC or from a remote control unit
- Stand-alone retuning within the given frequency range as per the list of frequencies or the pre-set pitch.

**Features:**
- Programming using a PC via USB 2.0

---

**Basic Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>25 - 3000 MHz</td>
</tr>
<tr>
<td>Output power</td>
<td>50 mW min.</td>
</tr>
<tr>
<td>Modulation Modes</td>
<td>Non-modulated or angle modulation</td>
</tr>
<tr>
<td>Minimum tuning step</td>
<td>100 kHz</td>
</tr>
<tr>
<td>Relative error of frequency tuning</td>
<td>±5×10⁻⁷</td>
</tr>
<tr>
<td>Temperature fluctuations in operating temperature range</td>
<td>±5×10⁻⁷</td>
</tr>
<tr>
<td>Stray emissions level in the operating frequency range (vs. the level of the basic signal)</td>
<td></td>
</tr>
<tr>
<td>- Quadratic component</td>
<td>minus 25 dBs max.</td>
</tr>
<tr>
<td>- Other frequencies</td>
<td>minus 30 dBs max.</td>
</tr>
<tr>
<td>Phase noise level (within 10 kHz interval from the basic signal level)</td>
<td>minus 75 dBs max.</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td></td>
</tr>
<tr>
<td>- from AC network 50 Hz</td>
<td>90 - 250 V</td>
</tr>
<tr>
<td>- DC</td>
<td>9 - 32 V</td>
</tr>
<tr>
<td>Power consumption in signal generation mode</td>
<td>7 W, max.</td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>330 x 250 x 130 mm, max.</td>
</tr>
<tr>
<td>Weight with battery</td>
<td>4 kg, max.</td>
</tr>
</tbody>
</table>
Equipment for Radio Signal Digital Processing and Recording

This section presents signal digital processing blocks and modules, digital units for radio signal recording for postprocessing. Some of them can be delivered separately, the others are used only as a part of hardware-software systems.

The system approach to design of radio monitoring and direction finding equipment manufactured by IRCOS is based on standardization of analog and digital signal processing modules, thorough mathematical modeling from single modules to radio monitoring and direction finding systems. Due to coordination and harmonization of all equipment components, we achieved high performance of both receivers and all our equipment on the whole.

The digital signal processing modules that we use in our equipment are based on the software-defined radio (SDR) design approach. Conversion of radio signals including filtration, demodulation and spectrum analysis are performed by software in special digital signal processors and programmable logic arrays.

The number of available processing functions depends on the installed software, ensures flexibility of the digital module, enables application of different signal processing algorithms and increase of digital receiver performance without hardware modifications.

To maximize applicability of our equipment and meet requirements of our customers, IRCOS manufacture a number of various modules, units and products for signal digital processing in the real time mode. Besides, we offer equipment for radio signal digital recording to enable their further analysis and post-processing.

### ARC-ACO-M11
Two-channel A/D Processing Unit

**Purpose:**
- Filtration and A/D conversion of IF radio signals
- Multifunctional digital processing of the IF-converted signal
- Powering and control of antenna and receiving units.

**Basic Configuration:**
- Board of ARC-CO5 Digital Signal Processing Module
- Set of cables
- Operation documents.

**Options:**
- ARC-C5 Special Processor Module

**Features:**
- Input for synchronization with user equipment
- Stand-alone operation (without PC) using control and display module.

The unit provides (as a part of radiomonitoring equipment):
- Incoming signal spectrum calculation
- Radio signal detection
- Bearing calculation
- Estimation of receiving signal parameters
- Signal digital demodulation
- Detection of the position and antenna system azimuth when standing and when moving (available with ARC-KN2 Module).

![ARC-ACO-M11 - Basic Configuration](image)

### Basic Specifications

<table>
<thead>
<tr>
<th>General</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal central frequency</td>
<td>41.6 MHz</td>
</tr>
<tr>
<td>Simultaneous bandwidth</td>
<td>5 MHz</td>
</tr>
<tr>
<td>Central frequency tuning interval</td>
<td>1 Hz</td>
</tr>
<tr>
<td>Input signal level measuring range:</td>
<td></td>
</tr>
<tr>
<td>● Within 5 MHz band</td>
<td>0…+90 dB/µV</td>
</tr>
<tr>
<td>● Within 250 kHz Band</td>
<td>-15…+90 dB/µV</td>
</tr>
<tr>
<td>One-signal dynamic range within the 5 kHz band</td>
<td>90 dB, min</td>
</tr>
<tr>
<td>One-signal dynamic range within the 250 kHz band</td>
<td>105 dB, min</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (3rd and 2nd order)</td>
<td>80 dB, min</td>
</tr>
</tbody>
</table>

### Input, Outputs and Interfaces

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PC control interface</td>
<td>USB 2.0</td>
</tr>
<tr>
<td>Line-out</td>
<td>Yes</td>
</tr>
<tr>
<td>Headphones socket</td>
<td>Yes</td>
</tr>
<tr>
<td>Interface for antenna-receiver unit control</td>
<td>RS485</td>
</tr>
<tr>
<td>Communication interface with display and control unit</td>
<td>RS485</td>
</tr>
<tr>
<td>Detecting, modulation types</td>
<td>AM, FM, SSB, AT</td>
</tr>
</tbody>
</table>

### Operating Temperature, Weight, Dimensions and Power Consumption

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-20°C ... +55°C</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>21 - 32 V</td>
</tr>
<tr>
<td>Power consumption:</td>
<td></td>
</tr>
<tr>
<td>● Basic configuration</td>
<td>15 W, max.</td>
</tr>
<tr>
<td>● With ARC-C5 special processor</td>
<td>35 W, max.</td>
</tr>
<tr>
<td>Dimensions</td>
<td>240x150x270 mm, max.</td>
</tr>
<tr>
<td>Operating set weight, max</td>
<td>5 kg</td>
</tr>
</tbody>
</table>

### ARC-CO2, ARC-CO5, ARC-CO10
Digital Signal Processing Modules

**Purpose:**
- Filtration and A/D conversion of IF radio signals
- Multifunctional signal digital processing.
Basic Configuration:
- Digital Processing Module
- Operation documents
- Software Development Kit.

Features:
- PC-controlled and stand-alone operation
- Synchronization with external reference generator
- Coherent functioning of two or more modules.

The Module Provides:
- Tuning to the set frequency
- Signal digital demodulation
- Calculation of spectrum, estimation of frequency, level and band of the received signal.

Basic Specifications

<table>
<thead>
<tr>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal central frequency:</td>
</tr>
<tr>
<td>- ARC-CO2 10.7 or 41.6 MHz</td>
</tr>
<tr>
<td>- ARC-CO5 41.6 MHz</td>
</tr>
<tr>
<td>- ARC-CO10 41.6 MHz</td>
</tr>
<tr>
<td>Simultaneous bandwidth:</td>
</tr>
<tr>
<td>- ARC-CO2 2 MHz</td>
</tr>
<tr>
<td>- ARC-CO5 5 MHz</td>
</tr>
<tr>
<td>- ARC-CO10 10 MHz</td>
</tr>
<tr>
<td>Central frequency tuning interval</td>
</tr>
<tr>
<td>Input signal level measuring range:</td>
</tr>
<tr>
<td>- Within simultaneous bandwidth - 0...+90 dB/µV</td>
</tr>
<tr>
<td>- Within 250 kHz Band</td>
</tr>
<tr>
<td>Spectrum analysis rate, min.</td>
</tr>
<tr>
<td>- ARC-CO2 (3 kHz discreteness)</td>
</tr>
<tr>
<td>- ARC-CO5 (6 kHz discreteness)</td>
</tr>
<tr>
<td>- ARC-CO10 (12.5 kHz discreteness)</td>
</tr>
<tr>
<td>One-signal dynamic range within a simultaneous bandwidth - 90 dB, min</td>
</tr>
<tr>
<td>One-signal dynamic range within the 250 kHz band</td>
</tr>
<tr>
<td>Intermodulation free dynamic range (2nd and 3rd order)</td>
</tr>
<tr>
<td>- ARC-CO2 80 dB, min</td>
</tr>
<tr>
<td>- ARC-CO5 75 dB, min</td>
</tr>
<tr>
<td>- ARC-CO10 70 dB, min</td>
</tr>
<tr>
<td>Detecting, modulation types</td>
</tr>
</tbody>
</table>

Input, Outputs and Interfaces

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PC control interface</td>
<td>USB 2.0</td>
</tr>
<tr>
<td>Line-out</td>
<td>Yes</td>
</tr>
<tr>
<td>Headphones socket</td>
<td>Yes</td>
</tr>
<tr>
<td>Peripheral equipment control interface</td>
<td>RS485</td>
</tr>
</tbody>
</table>

Operating Temperature, Weight, Dimensions and Power Consumption

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-40°C ... +70°C</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>9 - 16 V</td>
</tr>
<tr>
<td>Power consumption</td>
<td>9 W, max.</td>
</tr>
<tr>
<td>Dimensions, max.</td>
<td>100x25x190 mm</td>
</tr>
<tr>
<td>Operating set weight</td>
<td>0.5 kg, max.</td>
</tr>
</tbody>
</table>

ARC-CO+ Digital Signal Processing Module

Purpose:
- Filtration and A/D conversion of IF radio signals
- Multifunctional signal digital processing.

Basic Configuration:
- Digital Processing Module
- Operation documents
- Software Development Kit.

Features:
- PC-controlled and stand-alone operation
- Synchronization with external reference generator
- Coherent functioning of two or more modules
- Software-based setting of main selection digital filters:
  - Basic (see Table 1 on page 58);
  - In accordance with equipment and data processing system requirements (PEMIN)
  - In accordance with GOST R 52536-2006 for radio monitoring equipment.

The Module Provides:
- Tuning to the set frequency
- Signal digital demodulation
- Calculation of spectrum, estimation of frequency, level and band of the received signal.
Basic Specifications

**General**
- Input signal central frequency: 70 MHz
- Maximum simultaneous bandwidth: 24 MHz
- Central frequency tuning interval: 0.1 Hz
- Panoramic rate, simultaneous bandwidth, spectrum discreteness, dynamic range: see Table 1
- Intermodulation free dynamic range (3rd and 2nd order): 80 dB, min
- Detecting, modulation types: AM, FM, SSB, AT

**Interface**
- Control and data transfer interface: Ethernet 1000Base-T
- Peripheral equipment control interface: RS-485, LVDS
- Headphones socket: Yes

**Operating Temperature, Weight, Dimensions and Power Consumption**
- Operating temperature range: -40°C ... +70°C
- Power supply voltage: 9 - 16 V
- Power consumption: 15 W, max.
- Dimensions, max.: 100x25x190 mm
- Operating set weight: 0.7 kg, max.

**ARC-S5 Special Processor Module**

**Purpose:**
- High-performance signal digital processing.

**Configuration:**
- ARC-S5 Module on a printed circuit board with cooler
- Software Development Kit
- Operation documents.

**Table 1**

**Basic Modes for ARC-CO+ Spectrum Analysis Module**

<table>
<thead>
<tr>
<th>Spectrum discreteness</th>
<th>Single channel dynamical range</th>
<th>Main selection band</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>24 MHz</td>
<td>10 MHz</td>
</tr>
<tr>
<td>25 kHz</td>
<td>87 dB</td>
<td>600000</td>
<td>250000</td>
</tr>
<tr>
<td>12.5 kHz</td>
<td>90 dB</td>
<td>300000</td>
<td>125000</td>
</tr>
<tr>
<td>6.25 kHz</td>
<td>93 dB</td>
<td>150000</td>
<td>62500</td>
</tr>
<tr>
<td>3.125 kHz</td>
<td>96 dB</td>
<td>75000</td>
<td>31250</td>
</tr>
<tr>
<td>1.5625 kHz</td>
<td>99 dB</td>
<td>37500</td>
<td>15600</td>
</tr>
<tr>
<td>781.25 Hz</td>
<td>102 dB</td>
<td>18750</td>
<td>7800</td>
</tr>
<tr>
<td>390.63 Hz</td>
<td>105 dB</td>
<td>9375</td>
<td>3900</td>
</tr>
<tr>
<td>195.31 Hz</td>
<td>108 dB</td>
<td>4600</td>
<td>1900</td>
</tr>
<tr>
<td>97.65 Hz</td>
<td>111 dB</td>
<td>1500</td>
<td>970</td>
</tr>
<tr>
<td>48.83 Hz</td>
<td>114 dB</td>
<td>500</td>
<td>480</td>
</tr>
<tr>
<td>24.41 Hz</td>
<td>117 dB</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>12.21 Hz</td>
<td>120 dB</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>6.10 Hz</td>
<td>123 dB</td>
<td>19</td>
<td>20</td>
</tr>
</tbody>
</table>

Comments:
1. High rate of spectrum analysis. Detection of short pulse signals. FFT hardware calculation = 1024 points
2. High spectrum resolution. Extended dynamic range. FFT hardware calculation: from 2k to 16k points
3. Ultrahigh spectrum resolution. FFT software calculation: 32k and above
Antennas and Antenna Systems

All basic components of IRCOS equipment and software systems are designed and produced by the company itself. In 1999 the company started manufacturing of proprietary professional digital radio receiving equipment and from that time became one of the leaders in the industry in Russia. Besides the company manufactures antenna-fider units, as well as HF and SHF circuits.

This section presents a number of listed units. Most of them can be delivered separately, though there are some devices that can function only as a part of equipment-software systems.

### ARC-MA2

**HF Magnetic Receive Antenna**

**Purpose:**
- Small-sized magnetic antenna for short-wave frequency radio monitoring systems.

**Basic Configuration:**
- ARC-MA2 Antenna in radio transparent case
- Lead-in cable
- AC network power supply adapter.

**Basic Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>0.009 – 30 MHz</td>
</tr>
<tr>
<td>Directional diagram</td>
<td>Quasi-isotropic</td>
</tr>
<tr>
<td>Output impedance</td>
<td>50 Ohm</td>
</tr>
<tr>
<td>SWR</td>
<td>1.5 max.</td>
</tr>
<tr>
<td>Input IP2</td>
<td>50 dBm, min</td>
</tr>
<tr>
<td>Input IP3</td>
<td>25 dBm, min</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>9 – 16 V</td>
</tr>
<tr>
<td>Current consumption</td>
<td>200 mA, max.</td>
</tr>
<tr>
<td>AC adapter power supply voltage (50 Hz)</td>
<td>220 V ±10%</td>
</tr>
<tr>
<td>Antenna socket type</td>
<td>Fischer DBE104A093</td>
</tr>
</tbody>
</table>

Note: The antenna calibration factor (K) is measured in dB/m and represents a proportion between E & U, i.e. respectively between the field strength [dBµV/m] and the voltage on antenna loaded output [dBµV]. E=U+K.

Antenna quieting sensitivity is the minimum level of signal at antenna input with the same signal and noise levels at antenna output (as per GOST 24375-80).

### ARC-A2M

**Low-Profile Indoor Antenna**

**Purpose:**
- Receipt of signals in VHF/UHF range; included into TSCM equipment configuration.

**Basic Configuration:**
- Antenna is supplied with 5-m N-type socket lead-in cable.

**Basic Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>25 - 3000 MHz</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear</td>
</tr>
<tr>
<td>Directional diagram</td>
<td>Quasi-isotropic</td>
</tr>
</tbody>
</table>

Note: The antenna calibration factor (K) is measured in dB/m and represents a proportion between E & U, i.e. respectively between the field strength [dBµV/m] and the voltage on antenna loaded output [dBµV]. E=U+K.

Antenna quieting sensitivity is the minimum level of signal at antenna input with the same signal and noise levels at antenna output (as per GOST 24375-80).
### ARC-A7A-3

**Broadband Antenna for Installation on Vehicle**

**Purpose:**
- Receipt of signals with vertical polarization in VHF/UHF range; included into mobile radio monitoring posts configuration.

**Basic Configuration:**
- ARC-A7A-3 Antenna with lead-in cable
- ARC-FP Power Supply Filter with cables
- Carry bag for transportation.

**Options:**
- AC network power supply adapter.

### Basic Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>20 - 3000 MHz</td>
</tr>
<tr>
<td>Directional diagram</td>
<td>Quasi-isotropic in azimuth plane</td>
</tr>
<tr>
<td>Output impedance</td>
<td>50 Ohm</td>
</tr>
<tr>
<td>SWR</td>
<td>3 max.</td>
</tr>
<tr>
<td>ARC-FP power supply voltage</td>
<td>9-16 V</td>
</tr>
<tr>
<td>Current consumption</td>
<td>200 mA, max.</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-40°C...+55°C</td>
</tr>
<tr>
<td>Dimensions (height x diameter)</td>
<td>185 x 175 mm</td>
</tr>
</tbody>
</table>

### ARC-A12

**Broadband Outdoor Antenna for Installation on Mast**

**Purpose:**
- Brackets for mounting on the mast.

**Basic Configuration:**
- ARC-A12 Antenna
- Lead-in cable, 10 m long
- Mounting set.
### Basic Specifications

**Operating frequency range**: 25 - 3000 MHz

**Directional diagram**: Quazi-isotropic

**SWR**: 3 max.

**Antenna socket type**: N-type socket

**Dimensions**: 635 x 470 x 96 mm

---

### Antenna System

**Purpose:**
- Two-channel coherent receiving, selection, amplification and transfer of radio signal to intermediate frequency.

**Configuration:**
- Foldable antenna system with integrated two-channel tuner (based on ARC-PPS5)
- Lead-in cable, 25 m long.

**Options:**
- Transportation and deployment set including:
  - Telescopic mast, 4 m height
  - Carry tube
  - Set of guy-lines.
- Lead-in cable, up to 50 m long.

**Features:**
- The antenna system may be installed on a mast or based on the transportation and deployment case
- Antenna system can be operated at stops and stationary
- IF signal output, power supply and control is provided via two differential lead-in cables.

---

### AS-PP4

**Purpose:**
- Two-channel coherent receiving, selection, amplification and transfer of radio signal to intermediate frequency.

**Configuration:**
- Antenna system with integrated two-channel tuner
- Antenna cable, 25 m long (upon request, up to 100 m).

**Features:**
- Antenna system is foldable and can be used in mobile equipment
- Antenna System is designed to be installed on a mast
- Antenna system can be operated at stops and stationary
- For AS-PP4 with bandpass of 5 MHz:
  - Output signal frequency (IF) is 41.6 MHz
  - IF signal output, power supply and control is provided via two differential lead-in cables.
- For AS-PP4 with bandpass of 24 MHz:
  - Antenna System contains digital signal processing module (based on ARC-CO+) as integrated part
  - Control and data transfer via Ethernet interface.

**Basic Specifications**

| Operating frequency range, basic configuration | 25 - 3000 MHz |
| Operating frequency range, complete configuration | 1.5 – 8000 MHz |
| DF method | Correlative interferometer |

---

### AS-PP17

**Purpose:**
- Two-channel coherent receiving, selection, amplification and transfer of radio signal to intermediate frequency.

**Configuration:**
- Foldable antenna system with integrated two-channel tuner (based on ARC-PS5)
- Lead-in cable, 25 m long.

**Options:**
- Transportation and deployment set including:
  - Telescopic mast, 4 m height
  - Carry tube
  - Set of guy-lines.
- Lead-in cable, up to 50 m long.

**Features:**
- The antenna system may be installed on a mast or based on the transportation and deployment case
- Antenna system can be operated at stops and stationary
- IF signal output, power supply and control is provided via two differential lead-in cables.

**Basic Specifications**

| Operating frequency range | 25 - 3000 MHz |
| Power supply voltage | 21 - 32 V |
| Power consumption | 70 W, max. |
| Operating temperature range | -40°C ... +55°C |
| Weight | 20 kg, max. |
**Features:**
- Antenna System is compact and allows easy mounting/dismounting on a light vehicle’s roof
- Antenna system can be operated when moving and at stops
- For AS-MP1 with bandpass of 5 MHz:
  - Output signal frequency (IF) is 41.6 MHz
  - IF signal output, power supply and control is provided via two differential lead-in cables.
- For AS-MP1 with bandpass of 24 MHz:
  - Antenna System contains digital signal processing module (based on ARC-CO+) as integrated part
  - Control and data transfer via Ethernet interface.

**Basic Specifications**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range, basic configuration</td>
<td>25 - 3000 MHz</td>
</tr>
<tr>
<td>Operating frequency range, complete configuration</td>
<td>1.5 – 8000 MHz</td>
</tr>
<tr>
<td>DF method</td>
<td>Correlative interferometer</td>
</tr>
<tr>
<td>Operating azimuth range</td>
<td>360°</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>21 - 32 V</td>
</tr>
<tr>
<td>Power consumption in complete configuration</td>
<td>80 W, max.</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>- 40° ... +55°C</td>
</tr>
<tr>
<td>Dimensions, basic configuration (length x width x height)</td>
<td>1550 x 1100 x 350 mm, max.</td>
</tr>
<tr>
<td>Dimensions, complete configuration (length x width x height)</td>
<td>1550 x 1100 x 550 mm, max.</td>
</tr>
<tr>
<td>Weight, basic configuration</td>
<td>35 kg, max.</td>
</tr>
<tr>
<td>Weight, complete configuration</td>
<td>50 kg, max.</td>
</tr>
</tbody>
</table>

**AS-HP-KV**

**Antenna System**

**Purpose:**
- Two-channel receipt of radio signals; any antenna pair can be selected as receiving.

**Configuration:**
- Antenna system inside radome with integrated navigation equipment
- Antenna cable.

**Options:**
- Antenna mounting set for vehicles
- Antenna mounting set for masts (tripod).

**Features:**
- Antenna System is compact and allows easy mounting/dismounting on a light vehicle or a mast (tripod)
- Can be operated when moving and at stops.

**Basic Specifications**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>20 - 300 MHz</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>21 - 32 V</td>
</tr>
<tr>
<td>Power consumption</td>
<td>20 W, max.</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>- 40°C ... +55°C</td>
</tr>
<tr>
<td>Antenna system dimensions (diameter x height)</td>
<td>600 x 165 mm</td>
</tr>
<tr>
<td>Antenna System weight, max.</td>
<td>4 kg</td>
</tr>
</tbody>
</table>

**AS-HP0**

**Antenna System**

**Purpose:**
- Two-channel receipt of radio signals; any antenna pair can be selected as receiving.

**Configuration:**
- Antenna system inside radome with integrated navigation equipment
- Antenna cable.

**Options:**
- Antenna mounting set for vehicles
- Antenna mounting set for masts (tripod).

**Features:**
- Antenna System is compact and allows easy mounting/dismounting on a light vehicle or a mast (tripod)
- Can be operated when moving and at stops.

**Basic Specifications**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>20 - 300 MHz</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>21 - 32 V</td>
</tr>
<tr>
<td>Power consumption</td>
<td>20 W, max.</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>- 40°C ... +55°C</td>
</tr>
<tr>
<td>Antenna system dimensions (diameter x height)</td>
<td>465 x 170 mm</td>
</tr>
<tr>
<td>Antenna System weight, max.</td>
<td>6.2 kg</td>
</tr>
</tbody>
</table>

**AS-HP1**

**Antenna System**

**Purpose:**
- Two-channel receipt of radio signals; any antenna pair can be selected as receiving.

**Options:**
- Antenna mounting set for vehicles
- Antenna mounting set for masts (tripod).

**Features:**
- Antenna System is compact and allows easy mounting/dismounting on a light vehicle or a mast (tripod)
- Can be operated when moving and at stops.

**Basic Specifications**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>20 - 300 MHz</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>21 - 32 V</td>
</tr>
<tr>
<td>Power consumption</td>
<td>20 W, max.</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>- 40°C ... +55°C</td>
</tr>
<tr>
<td>Antenna system dimensions (diameter x height)</td>
<td>600 x 165 mm</td>
</tr>
<tr>
<td>Antenna System weight, max.</td>
<td>4 kg</td>
</tr>
</tbody>
</table>

AC-MP1 Antenna System
Configuration:
- Antenna system inside radome with integrated navigation equipment
- Antenna cable

Options:
- Antenna mounting set for vehicles
- Antenna mounting set for masts (tripod).

Features:
- Antenna System is compact and allows easy mounting/dismounting on a light vehicle or a mast (tripod)
- Can be operated when moving and at stops.

<table>
<thead>
<tr>
<th>Basic Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
</tr>
<tr>
<td>Power supply voltage</td>
</tr>
<tr>
<td>Power consumption</td>
</tr>
<tr>
<td>Operating temperature range</td>
</tr>
<tr>
<td>Antenna system dimensions (diameter x height)</td>
</tr>
<tr>
<td>Antenna System weight, max.</td>
</tr>
<tr>
<td>Transportation length</td>
</tr>
<tr>
<td>Maximum lift height</td>
</tr>
<tr>
<td>Mast weight, max.</td>
</tr>
</tbody>
</table>

AS-HP2 Antenna System

Purpose:
- Two-channel coherent receiving, selection, amplification and transfer of radio signal to intermediate frequency.

Configuration:
- Antenna system inside radome with integrated navigation equipment
- Antenna cable.

Options:
- Antenna mounting set for vehicles
- Antenna mounting set for masts (tripod).

Features:
- Antenna System is compact and allows easy mounting/dismounting on a light vehicle or a mast (tripod)
- Can be operated when moving and at stops.

<table>
<thead>
<tr>
<th>Basic Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
</tr>
<tr>
<td>Power supply voltage</td>
</tr>
<tr>
<td>Power consumption</td>
</tr>
<tr>
<td>Operating temperature range</td>
</tr>
<tr>
<td>Antenna system dimensions (diameter x height)</td>
</tr>
<tr>
<td>Antenna System weight, max.</td>
</tr>
</tbody>
</table>

ARC-APS Antenna and Receiver Unit

Purpose:
- Receiving, filtering, amplification and conversion of VLF, LF, IF, HF, VHF and UHF signals to an intermediate frequency.

Basic Configuration:
- Remote field sensor unit with non-directional antenna and ARC-PS5 Radio Signal Tuner
- Lead-in cable, 25 m long (upon request, up to 100 m).
- Mounting set.

Options:
- ARC-KNV4 Frequency Down-Converter.

Features:
- Remote electromagnetic transducer unit contains omni-directional antenna and ARC-PS5 Tuner as integrated parts
- The signal is transmitted via antenna cable at IF thus eliminating antenna effect and preserving dynamic frequency range. Also, with this option, the lead-in cable needs to be calibrated just at one frequency and the cable can be up to 100 m long.
- Connection and commutation of max. 3 external measuring antennae
Shared operation with ARC-KNV4 Frequency Down Converter enabling expansion of operating frequency range up to 18 GHz.

### Basic Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency range</td>
<td>25 - 3000 MHz</td>
</tr>
<tr>
<td>Spurious, Image and IF rejection</td>
<td>70 dB, min</td>
</tr>
<tr>
<td>IP2, IP3 (with 3.125 kHz discreteness)</td>
<td>75 dB, min</td>
</tr>
<tr>
<td>DC supply voltage</td>
<td>21 - 30 V</td>
</tr>
<tr>
<td>Power consumption</td>
<td>60 VA max</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-40°C … +55°C</td>
</tr>
<tr>
<td>Dimensions, max.</td>
<td>800×260×180 mm</td>
</tr>
<tr>
<td>Weight without lead-in cable</td>
<td>10 kg, max.</td>
</tr>
</tbody>
</table>

The other specifications correspond to ARC-PC5 Tuner Module parameters.

Options:
- Dielectric liner provided for increasing antenna lifting height
- ARC-UP2 Remote Controlled Antenna Rotator.

Features:
- The Mast has telescopic dielectric section
- Can be installed on the ground or on a vehicle
- Operable at the speed up to 10 km/h when mounted on a vehicle and when the upper section is lowered
- Manual hoist included.

The mast provides:
- Minimum body effect on measurement antennas and mast equipment
- Remote controlled azimuth rotation enabling amplitude direction finding with directional antennas (when ARC-UP2 available).

### Basic Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum height (with dielectric section)</td>
<td>5.8 (6.9) m</td>
</tr>
<tr>
<td>Transportation length</td>
<td>2.9 m</td>
</tr>
<tr>
<td>Body basic diameter</td>
<td>100 mm</td>
</tr>
<tr>
<td>Azimuth rotation angle (with ARC-UP2)</td>
<td>±180°</td>
</tr>
<tr>
<td>Positioning accuracy</td>
<td>±1°</td>
</tr>
<tr>
<td>Add-on equipment (including cabling), weight max.</td>
<td>20 kg</td>
</tr>
<tr>
<td>Stick force</td>
<td>3 kg, max.</td>
</tr>
<tr>
<td>Installation time</td>
<td>less 15 min.</td>
</tr>
<tr>
<td>Mast weight without guy-lines, anchors and dielectric section</td>
<td>14 kg, max.</td>
</tr>
</tbody>
</table>
**ARC-MT3**
Telescopic mast

**Purpose:**
- Direction finding antenna support
- Measurement antenna support (with dielectric section).

**Configuration:**
- Telescopic mast
- Ground installation pad
- Set of pad fixing pins
- Set of anchors
- Set of guy-lines
- Brackets for mounting on a van
- Van transportation box
- Utility pad for antenna system mounting.

**Features:**
- Dural four-sectional body
- Two-stage moving out mechanism
- Maximum height indicators
- Manual hoist
- Can be installed on the ground or on a vehicle.

**Options:**
- Dielectric liner for measurement antenna installation (min. length 1 m).

**Basic Specifications**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum height</td>
<td>11 m</td>
</tr>
<tr>
<td>Transportation length</td>
<td>3.3 m</td>
</tr>
<tr>
<td>Body basic diameter</td>
<td>100 mm</td>
</tr>
<tr>
<td>Supported equipment weight (incl. cables)</td>
<td>up to 35 kg</td>
</tr>
<tr>
<td>Stick force</td>
<td>8 kg, max.</td>
</tr>
<tr>
<td>Installation time</td>
<td>less 20 min.</td>
</tr>
<tr>
<td>Mast weight without guy-lines and anchors</td>
<td>35 kg, max.</td>
</tr>
</tbody>
</table>

**ARC-UP1M, ARC-UP2**
Remote Controlled Antenna Rotators

**Purpose:**
- Changing measurement antenna orientation (azimuth and polarization).

**Configuration:**
- Davit
- Brackets for mounting on the mast
- Measurement antenna installation brackets set
- Controller
- Operation documents.

**Features:**
- ARC-UP1M is design for operation as a part of stationary radio monitoring stations and ASC-UP2 - as a part of mobile ones
- May be used to change dimensional orientation of ARC-KNV4, ARC-KNV4M and ARC-KNV3M Frequency Down-Converters
- Control via RS-485 protocol.

**Basic Specifications**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Azimuth rotation angle</td>
<td>±180°</td>
</tr>
<tr>
<td>Angle slew time</td>
<td>100 s, max.</td>
</tr>
<tr>
<td>Antenna + bracket maximum weight for ARC-UP1M, max</td>
<td>30 kg</td>
</tr>
<tr>
<td>Antenna + bracket maximum weight for ARC-UP2</td>
<td>10 kg</td>
</tr>
<tr>
<td>ARC-UP1M deadweight</td>
<td>12 kg, max.</td>
</tr>
<tr>
<td>ARC-UP2 deadweight</td>
<td>7 kg, max.</td>
</tr>
<tr>
<td>Power supply voltage for ARC-UP1M</td>
<td>200 - 240 V AC</td>
</tr>
<tr>
<td>Power supply voltage for ARC-UP2</td>
<td>10 – 16 V DC</td>
</tr>
</tbody>
</table>
Most of IRCOS equipment is hardware and software combined systems. Most of calculations are conducted at the hardware level. However, control of radio monitoring equipment, final data processing and output as required by user are performed by PC via proprietary customized software.

The feature of IRCOS radio monitoring equipment is multi-tasking supported just by the software, without any optional hardware. Equipment functions can be grouped as follows: radio signal panoramic analysis and direction finding, radio signal measurement, radio signal technical analysis, indoor radio monitoring, analysis of stray electromagnetic radiation and cross talks, emitter position finding, development of network coverage zone. Each group of functions is supported by its appropriate software pack. For all equipment, the software interface is similar though there can be some differences subject to equipment.

This section describes the general software packages designed for the equipment manufactured by our company.

### Software Package of ARMADA Automated Radio Monitoring System

**Purpose:**
- Software package is design for radio monitoring equipment management at all levels of hierarchical structure of the ARMADA automated radio monitoring system (ARMS).

**Features:**
- Option to develop hierarchy systems, in which each lower node is accessed by higher nodes
- Use of the same software at all System levels
- Radio monitoring equipment is controlled via an open standard protocol
- Option to control radio monitoring equipment from other manufacturers
- Options to connect additional software subsystems, units and modules including those from other manufacturers
- Automatic (scheduled) execution of typical radio monitoring tasks
- Options to modify the list and content of typical radio monitoring tasks.

**The Software Package Provides for the Following Functions:**
- Radio monitoring functions in manual (online), automatic (scheduled) and background modes
- Multi-task measurement mode
- Setting radio monitoring tasks for remotely controlled stations
- Task execution monitoring
- Saving tasks and their performance results to database
- Automated analysis of results for a given time period
- Creating the reports based on customized templates
- Data exchange operation with with frequency allocation database
- Use of geo-information technologies to represent the system structure and status, frequency allocations, radio monitoring results
- Storage of organizational and regulatory documents, measurement procedures, reference data
- Remote diagnostics of system nodes and radio monitoring equipment
- Automatic control of calibration validity and equipment performance time.

**Features of Architecture:**
- Software package consists of the following functional subsystems:
  - Data communications
  - Equipment interface
  - Data storage (TADB)
  - User interface
  - Document circulation
  - Cartography (GIS)
- Package has module structure. Each subsystem consists of software modules. New function is implemented by adding a module. Modules are independent: Changing functionality of a module doesn’t require changing other modules.
- Package has open architecture. Third party developers are able to change or extend functionality of each sub-system. For each sub-system there are rules of new modules adding and software interfaces that shall be supported.
- Software is scalable. All levels of hierarchy structure of the system have architecture of same type. Difference in functions of software set on different levels of hierarchy is achieved by using different module set in sub-systems.
- Software package is provided with detailed description both as Operator’s and System Programmer’s Manual as well as on-line Help. The manual covers not only user interface but also provides description of typical scenario of system operation.
- External software interface of the system is described in manuals. Manuals include examples of operation scenario and header files from common development tools.

More detailed specifications and description of SMO-ARMADA are available only upon request.

### Panoramic Analysis, Measuring and Direction Finding Software Package

**Purpose:**
- The software package forms a part of the system mathematic software (SMO) and is designed for panoramic (spectrum) analysis and radio signal analysis, detection, direction finding and parameters measurement.

**Features:**
- Can be operated in local and network application
- Designed for operation within automated radio monitoring system.

**Software Package Includes the Following Applications:**
- **SMO-PA** - Software Package to control radio monitoring equipment. Supports interaction of all units in panoramic analysis mode in real-time and postprocessing modes. Modes: Spectrum, Panorama, Measurement and Review.
- **SMO-PAI** - Software Package to control the measuring equipment Supports interaction of all units in panoramic analysis mode in real-time and postprocessing modes. Modes: Spectrum, Panorama, Measurement and Review.
The Software Package Provides for the Following Functions

**Spectrum and Panorama mode:**
- Real-time displaying of results of fast panoramic spectrum analysis.
- Probability spectrum display
- Display of the data on recorded emitters in spectrumogram
- Recording of accumulated spectrum files and frequency-time distribution.
- Radio signals listening and saving demodulated signals to the hard disk.
- Automatic search for active radio channels, saving of the detected frequencies in the database.
- Background monitoring of the detected radio channels.
- Generating of reports with active channel search results.

**Measurement mode:**
- Automated technical analysis of radio signals
- Operation in spectral lens mode with resolution ranging between several dozens of kHz to few Hz.
- Measurement of peak, quasipeak, root-mean-square and average signal level.
- Measurement of electromagnetic field strength (if calibrated antennas are available).
- Generating of measurement protocol for the coverage zone based on geographical coordinates (if calibrated antennas and navigation equipment are available).
- Automated and automatic measuring of signal frequency, bandwidth, frequency distribution and comparing of the deviation with standard.
- Automatic and simultaneous identification of the type and parameters of radio signal modulation at the carrying frequency and subcarrier frequency.

**Bearing Mode:**
- Single channel direction finding of radio signal sources
- Multi-channel (parallel) direction finding of radio signal sources
- Amplitude direction finding using directional antenna and remotely controlled rotator
- Displaying of bearings panorama, its saving to the database and to the frequency-time range loading file.
- Filtering of radio signal sources for the set angle range and their displaying on spectrum and bearing panoramas.
- Transfer of direction finding results to mapper application.

**Review mode:**
- Scanning of the preset list of frequencies, storage of scanning results (spectra, time-based samplings and sounds) in databases
- Generating of reports with review results
- Operation with database of recorded sources.

**SMO-DX Software Package for Indoor Radio Monitoring and Signal Parameter Evaluation**

**Purpose:**
- SMO-DX Software Package forms a part of the system mathematical software for signal parameter evaluation and radio monitoring indoors. It ensures interaction of all equipment in the system during signal detection and identification.

**Features:**
- Can be operated in local and network application
- Provides for the following modes of operation:
  - With «reference» panorama
  - With reference antenna.
Software Package provides:

Main Functions:
- Hardware control
- On-line radio environment analysis
- Real-time spectrum analysis of radio signals and measuring their levels
- Recording accumulated spectrum files to the database
- Review and operations with the previously accumulated spectrum panorama
- Finding and identification of new radio emitters
- Identification of different radio emissions
- Saving of the new and identified emitter parameters to the database
- Operations with recorded emitters database
- Report generation based on operation results.

Functions Available with Wire Network Analysis:
- High-frequency signal spectrum analysis in AC network and other wire networks
- High/low-frequency signal detection in wire networks.

Package is designed for operation with following radio monitoring equipment:
ARC-D1TM-8, ARC-D1, ARC-D11, ARC-D13, ARC-D13R.

SMO-STA software package supports any equipment produced by IRCOS.

Purpose:
- SMO-STA software is designed for radio signals technical analysis, measurement and identification of their modulation type.
- The software provides for signal saving in a vector form, their analysis at a given frequency, analysis of detected signals and subcarrier signals.

Features:
- Can be operated in local and network application
- Can perform analysis in real time and in post-processing mode.

The Software Package Provides for the Following Functions:
- Recording radio signal fragments in a vector form
- Signal displaying with time and amplitude scaling
- Signal spectra displaying with arbitrary scaling
- Signal band filtration
- Signal frequency shift (for more accurate tuning and demodulation of subcarrier signals)
- Detection of carrier frequency signals (amplitude, frequency and phase detectors)
- Detection of subcarrier frequency signals (amplitude, frequency and phase detectors)
- Identification of signal frequency and time parameters
- Identification of signal band width
- Signal special conversion to determine phase modulation
- Displaying of signal time-and-amplitude histograms to determine digital modulation types
- Displaying of maximum and minimum deviation curves to determine the signal structure
- Equipment control and signal recording to the hard disk.

SMO-STA software package supports any equipment produced by IRCOS.

SMO-ASPD

Software Package for Spectrum and Direction Finding Data Analysis

Purpose:
- SMO-ASPD Software Package is designed for playback and post-processing of spectrum analysis results obtained during operation with SMO-PA Software Package.

The Software Package Provides for the Following Functions:
- Display of accumulated spectrum and direction finding data with adjustable frequency and time resolution as:
  - Current spectrum diagrams
  - Current bearing diagrams
  - Peak spectrum diagrams
  - Frequency-time diagram
- Search for communication sessions and evaluation of main radio environment parameters for a given channel set
- Processing results displaying as:
  - Radio channel load diagram
  - Diagram of average communication session time
  - Inter-correlation and simplex-correlation diagram.

The software is compatible with all equipment controlled via SMO-PA Software Package.

SMO-KN

Navigation and Cartography Software Package

Purpose:
- SMO-KN Software Package is a special geoinformational system designed to locate emitters, show them in electronic maps and display
the EM field strength values based on theoretical calculations and on-site measurement.

Features:
- Can be operated in local and network application
- Manual and automatic operation modes
- Can be included into:
  - Separate systems (stationary, mobile, portable, handheld)
  - Distributed systems comprising several systems or stations
  - Standalone units.

The Software Package Provides for the Following Functions:
- Simultaneous loading of geographic map, radio environment map, emitters map and matrix map of levels
- Showing in the map the bearings, bearing pie charts, routes, direction finding and station position history, data on recorded emitters and emitters detected in different sessions of operation
- Adjustment of station position and route, adjustment of current bearings
- Static bearing routing and correction
- Bearing set control for position calculation, emitter position finding based on the bearing set
- Manual addition of emitters
- Saving bearing history for post-processing or current calculations
- Data statistical processing and calculation of emitters positions
- Showing potential positions of emitters in the map
- Mathematical evaluation of field strength distribution around emitters subject to terrain and field strength in the map
- Field strength distribution mapping based on measurements
- Localization of emitters based on field strength measurement
- Verification of emitter parameters including its coordinates and power based on field strength measurement

Purpose:
- Mapping support for automated radio monitoring system including automated distributed radio monitoring systems, stationary, portable and handheld stations.
- Displaying radio monitoring intermediate data and task results on the electronic map in the real-time and in the postprocessing mode, localization of radio emitters, coverage area plotting
- Displaying of frequency/area distribution maps, own position, station tracks, etc.

Configuration:
- PC
- SMO-KN Mapping and Navigation Software Package.

Features:
- When installed on the equipment control PC, it can work at lowered throughput and reduced functions simultaneously with radio monitoring programs (SMO-PPK, SMO-SECTOR, etc.).

SMO-PRANA, SMO-TEST, SMO-RAPIRA Software Package Set

Purpose:
- To handle studies tasks and check equipment for stray EM emissions and pick-ups
- Hardware control of stray emissions and pickup measuring equipment
- Calculation of data processing equipment protection parameters in accordance with data safety requirements.

Features:
- The software can be also used with panoramic analysis equipment produced by other manufacturers
- The software is developed in accordance with statutory document “Monitoring Procedures for Protection of Computer-Processed Data from Leakages due to Stray EM Emissions and Pick-ups” issued by the RF FSTEK in 2005, edition of Dec. 2007.
- The software ensures a high level of automation of stray emissions/pick-ups recording and parameters measurement
- SMO-RAPIRA and SMO-PRANA software automatically transmits results of measurement into SMO-PRANA calculation application
- Besides traditional stray emissions/pickup detection algorithm, the software includes an additional testing and detection algorithm that detects only informative emissions.
The Software Package includes:

- SMO-RAPIRA - stray emissions registration and analysis software for communications and electronic equipment
- SMO-TEST – software to be installed to computer equipment and designed for switching to the test mode ensuring maximally accurate detection and identification of informative stray emissions. Switching to the test mode of SMO-TEST is performed automatically while the operation of SMO-RAPIRA Software Package. When SMO-TEST is used in a standalone mode, the test mode can be launched by the operator.

SMO-RAPIRA Basic Functions:

- Automatic registration of stray emissions/pick-up spectrum components using ARC-D1 and ARC-D11
- Automatic measurement of stray emissions and pick-up parameters
- SMO-PRANA - calculation software for data processing equipment protection in accordance with SMO-PRANA data safety requirements.

SMO-TEST Basic Functions:

- Switching to the test mode for several types of tested equipment and data transmission links
- Enabling automatic control of mode switching from SMO-RAPIRA master software
- Manual test mode switching
- Test mode parameters adjustment.

SMO-PRANA Basic Functions:

- Calculation of all basic parameters describing potential of information leakages through stray electromagnetic emissions and pick-ups; perform calculations based on equipment field tests (including the fields with data protection systems)
- Calculations in the following modes:
  - Lab tests of computer equipment
  - Field tests w/o active protection equipment impact
  - Field tests considering active protection equipment impact;
- Calculation of intermediate parameters:
  - Real signal distribution factors on air and in transmission lines
  - Active protection equipment parameters
  - Antenna effective height for calculation of pick-up levels in random antenna;
- The software saves measurement and calculation results in its own database and can generate standard measurement reports as HTML and RTF files in compliance with statutory documents.

SMO-BS
Software Package for Wireless Data Communication System Analysis

Purpose:

- Search and analysis of wireless communication system signals, receipt of service data and measurement of signal parameters.

Features:

- Can be operated in local and network application
- Used with ARGAMAK-I, ARGAMAK-M and ARGAMAK-IS equipment.

The Software Package Provides for the Following Functions:

- Real-time detection signals of base stations of communication and data transmission system on air
- Signal spectrum display
- Broadcast service data receipt and decoding
- Signal parameters and transmission channels measurement
- Saving results to the database
- Plotting of network coverage zones based on available digital maps of the area
- Localization of base stations detected
- Check of compliance between base stations on the air and frequency/area plan
- Search and view of measurement results in the database as per given parameters
- Export of results from databases
- Generation of reports as per operation results.
The package includes the following programs:

- **BS-GSM**: analysis of GSM/DCS base station signals with temporary channel separation;
- **BS-CDMA**: analysis of CDMA base station signals with temporary channel separation as per IS95A, IS95B, IMT-MC-450;
- **BS TETRA**: analysis of TETRA base station signal parameters;
- **BS DECT**: analysis of DECT base station signal parameters;
- **BS UMTS**: software analyzer of UMTS base station signal parameters;
- **BS 3GPP**: analysis of GSM/UMTS, UMTS, LTE base station signal parameters;
- **BS Wi-Fi**: analysis of access points of IEEE 802.11 a/b/g/n (Wi-Fi) wireless broadband communication system signals;
- **BS WiMax**: hardware-software analyzer of 802.16e access point signal parameters.

**BS GSM provides:**

- Receipt of synchronous and broadcast channel messages and acquisition of:
  - Basic base station ID including NCC network unique code and BCC base station unique code
  - LAI position ID including MCC country ID, MNC network GSM ID and local area ID within LAC network
  - Cell ID (CI)
  - Frequency channel numbers allocated to given CA cells
  - Numbers of broadcast frequency channels from adjacent cells
- Measurement of spectra including frequency offset, frequency band width, spectrum display
- Measurement of the average base station signal power within the GSM band
- Signal symbol power measurement (average base station signal power within the GSM band when transmitting content-rich part of packets)
- Showing time vs. packet power dependency
- Measurement of signal-noise/interferences ratio and calculation of bit error rate and packet error rate
- Measurement of phase error and carrier frequency signal feed through level
- Finding frequency channel conflicts used by several base stations (from one or several networks) and calculation of relative signal power from those stations
- BS localization Finding base station positions via the amplitude method and measurement of signal power in several point (shared operation with SMO-KN) or via direction finding (shared operation with SMO-KN and SMO-PPK)
- Measurement of Base Stations field strength (if calibrated antennas are available)
- Measurement of transmission channel parameters and its multipath propagation charting
- Plotting the coverage area as per field strength measurement results (shared operation with SMO-KN)
- Evaluation of base station sector antenna emission power (shared operation with SMO-KN).

**BS CDMA provides:**

- Receipt of synchronous channel data for each base station detected and acquisition of:
  - System ID (SID)
- Network ID (NID)
- Protocol (standard) level P_REV
- Minimum mobile station level supported by the given base station, MIN_P_REV
- Pilot signal PRS shift index (PILOT_PN)
- Receipt of paging channel data for each base station detected and acquisition of:
  - Base station ID (BASE_ID)
  - Numbers of CDMA_FREQ network frequency channels
  - Registration zone (REG_ZONE)
  - Base station site longitude and latitude (BASE_LONG, BASE_LAT)
  - Access channel number, ACC_CHAN
- Measurement of signal quality including EVM error vector and level of carrier frequency feed through
- Evaluation of transmission channel data: Multipath propagation profile, effective channel length, multipath propagation level and cross-cell interferences level
- Evaluation of reception quality including measurement of signal vs. noise/interferences ratio, pilot signal, and calculation of bit and packet error frequency
- Amplitude-based localization of base stations through measurement of signal power in different spots of the area
- Measurement of BS Stations field strength (if calibrated antennas are available)
- Plotting the coverage area as per field strength measurement results (shared operation with SMO-KN)
- Evaluation of the regional frequency allocation plan by comparing analysis results with data base.

**BS TETRA provides:**

- Receipt of synchronous and broadcast channel messages and acquisition of:
  - NCC network unique code and Color Code BCC scrambler type included in base station code identifier (BSIC)
  - Country code (MCC), network code (MNC) and local area code (LA), included in location ID (LAI)
  - Cell ID (CID)
  - Frequency channel numbers allocated to given BCCH cells
- Amplitude-based localization of base stations through measurement of signal power in different spots of the area
- Check of the regional frequency allocation plan by comparing analysis results with data base.
BS UMTS provides:
- Search and detection of UMTS signals
- For each detected base station the following service parameters are extracted:
  - MNC network identifier
  - Country code (MCC)
  - Cell ID (CID)
  - Local area ID LAC, FACH and RACH;
- Spectrum display
- Determination of the level of detected base stations
- Amplitude-based localization of base stations through measurement of signal power in different spots of the area.
- Saving analysis results to the database with an option of further automatic control of changes.

BS 3GPP provides:
- GSM/DCS and UMTS signal analysis providing similar functions as BS GSM and BS UMTS software packages do
- Search and detection of LTE base station signals with acquisition of the following service parameters for each detected base station:
  - MNC network identifier
  - Country code (MCC)
  - ECI (cellIdentity), which includes base station eNB ID and base station cell ID (CI)
  - Tracking area code (TAC)
  - Cell Barred flag;
- Measuring emission parameters of base stations and repeaters of LTE based mobile wireless communication networks (hereinafter, LTE standard based networks) in FDD and TDD duplex modes
- Monitoring of service information contained in signals of base stations and repeaters of LTE standard based networks in FDD and TDD duplex modes

BS Wi-Fi Provides:
- Detection of IEEE 802.11 a/b/g/n wireless data communication networks within the range of 2.412 - 2.484 GHz and 5.17 - 5.905 GHz, using external adapter
- Detection of IEEE 802.11 a/b/g/n wireless data communication networks within the range of 5, 10, 20 MHz for ARGAMAK-IS and 5, 10, 20, 40 MHz for ARC-D11
- Getting parameters of radio stations included into the broadband wireless data communication networks:
  - Wireless network SSID
  - Radio station network equipment MAC
  - Numbers of channels in use and rated frequencies
  - Signal levels
  - Types of devices;
● Analysis of network topology based on intercepted packets: Automatic definition of the number of devices connected, their MAC addresses and type of connection.
● Recognition and identification of signals from legal wireless broadband stations and illegal transmitters after comparison against the database.
● Localization of wireless broadband stations, plotting areas of their probable location and displaying the results on electronic map with location based on GPS/GLONASS data.
● Option to filter and select the deliverables based on different criteria (including the area, current activity, affiliation with the given network, availability of license, etc.)
● Saving analysis results to the database with an option of further automatic control of changes.

**BS DECT provides:**
● Detection of active DECT base stations
● Scanning and acquisition of system parameters of all stations within 1880 – 1900 MHz up to 30 second
● Acquisition of the following parameters:
  • Network ID (NID)
  • Network class
  • RFPI-parameter
  • Modulation type
  • Number of transmitter-receiver in the network
  • Signal/noise ratio
  • Transmitter channel index
  • Fixed part number (FPN)
  • Radio part number (RPN)
  • Equipment manufacturer's code (EMC)
  • Frequency deviation
  • Signal level;
● Check of the regional frequency allocation plan by comparing analysis results with data base
● Amplitude-based localization of base stations through measurement of signal power in different spots of the area.

**BS WiMax hardware–software analyzer provides:**
● Analysis of WiMax (IEEE 802.16e) signals and detection of the following parameters without connection to the network:
  • NCP ID
  • BSID of radioelectronic equipment, masked
  • Signal level (RSSI)
  • Signal/noise ratio (CINR);
● Analysis of WiMax (IEEE 802.16e) signals and detection of the following parameters with connection to the network:
  • NCP ID
  • BSID of radioelectronic equipment
  • Sector ID
  • BS frequency
  • BS bandwidth
  • Signal level (RSSI)
  • Signal/noise ratio (CINR)
  • TX Power
  • FTT length
  ● List of neighbor BS channels, including frequencies, bandwidths and FTT lengths;
● Amplitude-based localization of base stations through measurement of signal power in different spots of the area.
● Saving analysis results to the database and their accumulation with an option of further automatic control of changes.

**SMO-CT Software Package for Digital TV Signal Analysis**

**Purpose:**
● SMO-CT Software Package is designed for search for DVB-T/H digital TV signals, signal parameter estimation, control data acquisition, decoding and analysis of traffic stream, separating of different channel substream.

**The Software Package Provides for the Following Functions:**
● Real-time detection of DVB-T/T2/H signals
● Signal spectrum display
● Control data acquisition, including detection of:
  • Signal type (DVB-T/T2/H);
  • Transmitting station ID
  • Program names and ID's (PID), including PID's of audio and video streams, decoded from transport stream
  • Coding rate for high and low priority stream
  • Guard time length
  • Transfer mode (1K, 2K, 4K, 8K, 16K, 32K).
● Measurement of spectra including frequency offset, frequency band width, OFDM signal linearity (attenuation branches) identification of narrow-band interferences within the signal band
● Measurement of signal quality (I/Q analysis) including modulation mean error estimation (MER and EVM), plotting MER/frequency graphs, modulation
For DVB-T2 signals:
- Automatic determination of number of DVB-T2 digital TV signal carriers for 1K, 4K, 6K, 16K, 32K modes
- Automatic determination of availability of extended set of carriers for 8K, 16K, 32K modes
- Automatic determination of relative duration of protection interval (1/128, 1/32, 1/16, 19/256, 1/8, 19/128, 1/4) of DVB-T2 digital TV signal
- Automatic determination of distribution scheme of dispersed pilot signals (PP1; PP2; PP3; PP4; PP5; PP6; PP7) of DVB-T2 digital TV signal
- Determination of modulation type (QPSK; 16-QAM; 64-QAM; 256-QAM) of PLP single stream in single stream mode A or PLP selected stream in multistream mode B
- Determination of relative rate of code with low density of parity checks (LDPC) for PLP single stream in single stream mode A or selected PLP stream in multistream mode B. Relative code rate should correspond to series of allowable values: 1/4; 1/2; 3/4; 5/6.
- Determination of frame length (16K; 64K) with noiseless coding (FECFRAME)
- Imaging signal constellation for:
  - Single PLP stream in single stream mode A;
  - Selected PLP stream in multistream mode B;
  - P1 preamble symbols;
  - LI signaling.
- Determination of spatial separation mode for transmitting set antennas (SISO; MISO)
- Determination of per bit error rate before Bose-Chaudhuri-Hocquenghem code (hereinafter, BCH code) decoder
- Limits of allowable relative error of measurement of bit error rate before Bose-Chaudhuri-Hocquenghem code decoder ±(0.1 M + 0.1), where M is measured value of bit error rate.
- Determination of relative amount of erroneous streaming frames (BBFRAME)
- Determination of relative amount of erroneous packages of transport stream.
- Determination of modulation error ratio for single PLP stream in single stream mode A or selected PLP stream in multistream mode B
- Measurement of amount of received PLP streams in multistream mode B within the range from 0 to 255
- Analysis of transport stream structure and relevant service information tables (SIP/SI)
- Measurement of full transport stream rate, actual rate of each transport stream program and each package type having data package identifier (PID), separately.

For DVB-T/H signals:
- Hierarchy parameter detection
- Measurement of power including estimation of the average signal power, OFDM signal amplitude-phase distribution and OFDM signal CCD, estimation of signal peak factor and crest factor
- Measurement of bit error rate before the Viterbi decoder, bit error rate before the Reed-Solomon decoder, visualization of channel’s burst response, channel’s frequency response (range, phase, delay).

Features:
- Should be used with ARC-RP3M Manual Direction Finder.
- Takes emitter bearings based on the signal level maximum and tone
- In the probability spectrum, emitters bearings can be taken on the background of other signals found at the same frequency.

The Software Package Provides for the Following Functions:
- Displaying of the maximum and current signal levels to determine the way to the emitter
- Generation of sound with the frequency in proportion to the signal level
- Spectrum analysis and displaying of simultaneous or probability spectrum
- Frequency tuning at the given interval and pitch
- Detection of fast, single and periodic signals
- Fast tuning to the signals from the list entered in the program before
- Saving radio signals and sound at the current frequency to files
- Listening to the signal at a fixed frequency
- Search for signals as per fixed frequency sets and ranges
- Saving detected signals parameters to the database
- Wi-Fi access points monitoring.

SMO-ANOMEDA
Software Package for Manual Direction Finding and Radio Monitoring for Android OS Tablets and Smartphones

Purpose:
- Software package is designed for panoramic (spectrum) analysis and radio signal analysis, detection, direction finding and parameters measurement with the equipment: ARGAMAK-M, ARC-RP3M with optional ARC-KNV3, ARC-KNV4 Down-Converters.

Features:
- Operation with Android OS Tablets and Smartphones of version 2.2 and later
- Supports interaction of all units in panoramic analysis mode within 9 kHz - 18 GHz in real-time and postprocessing modes options
- Control of the equipment via Bluetooth wireless interface
- Complex navigation and cartography based on satellite and magnetic facilities of control device
- Work with OpenStreetMap.

The Software Package Provides for the Following Functions:
- Spectrum mode enables:
  - Real-time displaying results of fast panoramic spectrum analysis and readings of signal level linear indicator
  - Demodulated radio signal listening
  - Automatic search for active radio channels, saving of the detected frequencies in the database
  - Background monitoring of the detected radio channels.
  - Generating of reports with active channel search results.

SMO-RP
Software Package for Manual Direction Finding

Purpose:
- Search for signals, spectrum analysis and direction finding
- Detection of fast, single and periodic signals.
**SMO-RD8 Multi-Channel Radio Monitoring Software Package**

**Purpose:**
- Designed for automated multi-channel radio signal detection, recording demodulated voice communications to the hard drive and their reproduction via a sound card.

**Features:**
- Can be operated in local and network application
- The design package enables simultaneous operation of 8 receivers with the option to listen to one of them at operator’s discretion.

**The Software Package Provides for the Following Functions:**
- Display of spectra in the real time mode at the current frequency
- Setting frequencies to the listening mode manually and their recording as well as showing simultaneous, accumulated or averaged spectrum
- Receiver tuning during listening or recording
- Automatic search of signals as per the frequency list and saving sound to the PC hard drive when a signal is detected
- Search of signals by means of step-by-step viewing of frequency ranges table and saving detected signals in the scanning table
- Automatic search of signals as per the frequency range, saving sound to the PC hard drive when a signal is detected and simultaneous scanning as per dynamically generated scanning table
- Prompt task correction during scanning
- Fast accumulation of spectrum panorama for the given ranges and compact displaying of results
- Displaying of all controlled radio signals on the panorama during the current session, saving it to the hard drive and loading from files
- Displaying all radio signals in the current session
- Saving demodulated transmissions to the PC hard drive as standard WAV-files
- Playing of audio records via computer sound card; standalone operation during playing
- Tape scripting support and saving texts to the database
- Generation of reports with radio monitoring results and their export to external media
- Accumulation of radio signals in the database and their classification per sections and types
- Operation as a part of a distributed system, receipt of network commands about radio signals scanning.

**Map mode enables:**
- Display of location and orientation of the unit based on cardinal directions
- Displaying measurement results in the map
- Displaying and saving movement track in the memory
- Plotting current bearings on a map
- Azimuth-Amplitude circular indicator and color signal level indication on the movement track facilitating direction finding in difficult city conditions
- Automated localization of emitting source
- Default work with OpenStreetMap
- Operative loading of Google Maps with detailed satellite images.
**SMO-SEKTOR**
Software Package for Detection of Radio Emission Sources Indoors

**Purpose:**
- Designed for detection and localization of emitters indoors.

**Features:**
- Can be operated in local and network application
- Software package works in touch with equipment ARC-IG
- Software package works together with SMO-PPK.

**The Software Package Provides for the Following Functions:**
- Search of emitters indoors based on direction finding and evaluation of signal amplitude.
- Import data from SMO-PPK and saving multi-channel direction finding results
- Display spectrum panorama, frequency lists, bearings and direction finding data
- Save images of the controlled object obtained from video camera
- Merge several digital photos of the object into a common panoramic image
- Form and save sessions with object frames
- Setting angular limits of the object on its image to determine the emitter search area
- Form a list of suspicious frequencies that can pertain to the emitter inside the object
- Transmit single-channel bearing results from SMO-PPK to the object image based on angular coordinates
- Export frequency list to SMO-PPK Software Package for detailed analysis

**SMO-PVP**
Cross Talk Detection Software Package

**Purpose:**
- Detection of the sources of intermodulation interferences caused by nonlinear properties of radio receiving and transmitting equipment and wave distribution media.

**Features:**
- Can be operated in local and network application
- The search is performed in a real-time mode based on analysis of cross-correlation functions of the signal affected by interferences and the signals that could cause those interferences.