Development of an algorithm for a radio monitoring system for horn and log-periodic antennas

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Abstract. In the world, research is being carried out on the study of radio communications for the spectral conversion of radio signals,
coordination of electronic and high-frequency devices, and signal detection. Including radio signals: telecommunications, navigation, telemetry, wireless technology signals, electronic signals, etc. Digital algorithms are also being developed, the introduction of new systems for monitoring and identifying signals and improving detection systems is one of the most important tasks. In this article, special attention is paid to the development of informatization, ensuring high-quality reception of digital television signals, as well as improving mobile communication systems. In this direction, in particular, scientific research was conducted on the analytical presentation of the processing of television signals to provide the consumer with a wide variety of television programs and significant results were obtained.
Keywords: radio, system, antennas

Studies in algorithms and devices for the development of methods for monitoring radio signals, radio control, location, telecommunications, navigation, telemetry, wireless technologies, digital television, in recent years, to adapt the radio signal flow to existing wireless communications, have obtained sufficient theoretical and practical results. Among foreign scientists - Professor D.N. Kiselev, Ph.D. Professor Siforov V.I., Ph.D. Professor S.V. Porshnev, and others. In addition, S.L. Findholt, E.C. Bely, R. Gonzalez, R. Woods (USA), C. Blatter (Germany), M. Hut (Japan) and others.

In Uzbekistan T.D. Rajabov, D.A. Abdullaev Yu.S. Sagdullaev T.G. Rakhimov and their students are familiar with the study of radio monitoring spectra of mathematical models, algorithms and devices for determination.

Currently, scientific studies on monitoring, detection and processing of radio signals in real time in vertical and horizontal polarization of radiation in the allowed frequency bands, as well as the development of processing methods and devices based on industrial radar identification, have not been sufficiently studied.

Since the aim of the study was to determine the direction and location of the source of radio emission, the antennas operating in two different frequency bands were chosen as radio antennas and high-frequency devices. Work has been done on their processing processes.

Log-periodic antenna type LPA-2-01M for measuring frequencies in the range from 80 MHz to 1000 MHz (signals for reception) and horn type P6-23A for measuring in the range from 1 GHz to 12 GHz (signals for receiving) antennas.

The signals received from the antennas are combined in a collection unit and transmitted to the connecting unit. In this block, signals from both antennas are sent to the control unit for the decision block in the case of 80 MHz to 12000 MHz.

Using the D-38T 41 V, 27 V, 3.5 A engine in this block, the radio operator can automatically install the antennas horizontally or vertically through a computer network without using mechanical power and time, and also as an auxiliary designer for switching antennas to vertical or horizontal polarization. decision is made. Another goal of the solution was to use the DKV-3 SS-405 engine to control the antenna directivity angle at a width of ph = 3600 (Fig. 1).

Therefore, the vertical or horizontal polarization of the antennas of the decision-making device, as well as the angle of the antenna at a width of 3600 degrees, are determined by the control unit when determining the direction and location of the radiation source of electronic devices or high-frequency devices.

The control unit consists of a special device No. TJ 2 287 002 MIN No. 1226, which is controlled by the duty radio operator.

The figure shows a diagram of the performance algorithm of the control unit. To determine the radiation pattern of the signal, both antenna devices are detected simultaneously by vertical or horizontal polarization

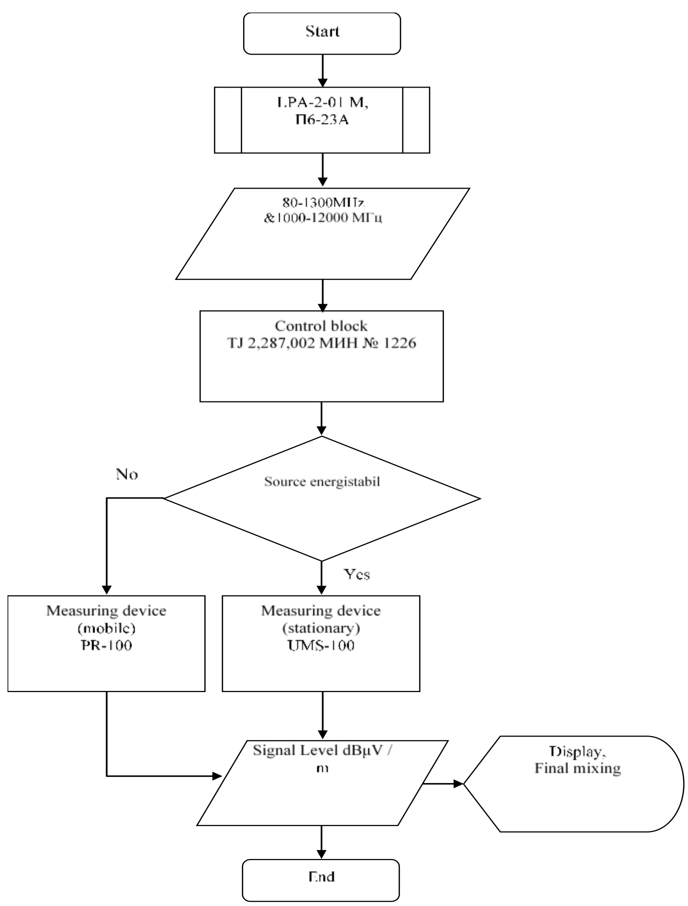
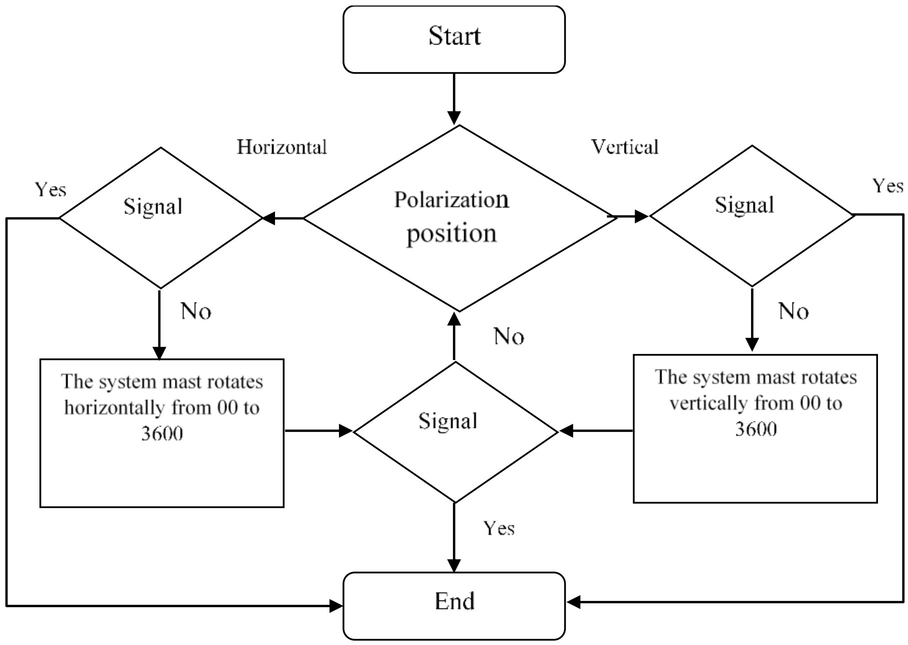


Figure 1. The algorithm of the device

For this, the decision algorithm selects the desired polarization (vertical or horizontal). If the signal is not detected at the selected polarity, the antennas rotate to the right or left until the desired signal is detected using a mechanism that rotates the mast of the system from 0 to 3600. If the signal is not detected on both antennas until the mast of the system will not rotate from 0 to 3600 using the DKV-3 SS-405 engine, the decision algorithm informs the starting point and indicates a change in polarity. In this case, the polarization position (vertical or horizontal) is changed using the D-38T motor.



When the control unit completes its operation, a signal is sent to the meter. As soon as a signal is detected, the signal level and voltage field are measured by the PR-100 mobile measuring devices from the UMS-100 stationary measuring device, if the power supply is stable, if the power supply is turned off or the backup power supply also does not work.

Measurements are taken at a signal level of dBμV / m in the frequency range from 80 MHz to 12 GHz, obtained using a stationary measuring device UMS-100 or a mobile measuring device PR-100.

In practice, when using a complex measuring (horn and log-periodic) antenna for measuring the field strength level, a significant difference in the parameters was found. Basically it is FM-radio, digital television when measuring mobile spectrograms shows that their differences are clearly and vividly described.

When measuring field strength parameters using the developed integrated measuring (horn and log-periodic) antennas, it was found in practice that there are some differences in the range with stationary antennas.

Table 1: Electric field strength measurement results

№	Frequency, MHz (type of system)	Field strength values measured using the developed antenna system (dBμV / m)	Field strength values measured using the developed antenna system (dBμV / m)...	Difference in %
		Vertical / horizontal	Vertical / horizontal	

1	100.5 (radio station FM)	87,0	80,0	8.8
2	101.0 (radio station FM)	95,2	84,1	13.1
3	554 (broadcasting standard DVB, 31TVK)	78,4	70,0	12.0
4	569 (broadcasting standard DVB, 33TVK)	79,1/74,0	74,0/68,3	6.8/8.3
5	465,850 (CDMA450 mobile communication)	95,5	90,5	5.5
6	872,500 (mobile communication standard LTE800)	99,8	85,4	6.9
7	886.5 (mobile communication standard GSM900)	103,7	91,7	11.6
8	946 (mobile communication standard GSM900)	101,7	88,4	10.3

Table 1. Shows the measurement results obtained using the developed antenna system and status antennas included in the UMS-100 measuring device.

Analysis of the measurement results shows that the difference between the analyzes obtained using the developed antenna system and antennas is from 5 dBμV / m to 26 dBμV / m or from 8.8% to 35.1%.

For instance:

- the difference in the frequency of -100.5 MHz is 7 dBμV / m or 8.8%;
- the difference in the frequency of -465.850 MHz is 5 dBμV / m or 3.7%;
- the difference in the frequency of -569 MHz is 5.1 dBμV / m in the horizontal position or 6.8% in the vertical position, while the difference is 5.7 dBμV / m or 8.3%;
- the difference in the frequency of -886.500 MHz is 12.0 dBμV / m or 11.6%;
- the difference in the frequency of -1877.4 MHz is 26.3 dBμV / m or 35.1%.
- measurement results are clearly visible on the spectrogram.

At the operating frequency in the range 460–470 MHz, when measuring distribution signals through the coded separation of digital cellular channels of SDMA 450 standard, the measurements were performed at the UMS 100 receiver. The difference in the range was 8.3 dBμV / m.

Uzbek mobile and PerfectumMobile companies operate throughout the country, including in the Samarkand region, at this standard frequency. Compared to GSM mobile companies, the base station signals of the SDMA 450 standard digital mobile company cover an area of 80-100 km on a plain without mountains. This, of course, is very suitable for large regions.

GSM mobile companies cover a distance of 10-15 km in terms of the number of subscribers and channels. If the number of channels in this base station is not enough, the coverage area may not be able to cover a very small distance, even the closest distance from the base station, unless the company calculates the bill based on population.

The above database clearly shows that in the development and application of the developed antenna algorithms it was possible to achieve a slight improvement in the quality of communication.

Figure 3 shows a generalized diagram of the antenna system. Both antennas are mounted on a common traverse, which, in turn, is mounted on a vertical mast. The system has the ability to change the direction of monitoring in the meridional (horizontal) plane, as well as change the polarization of the antennas.

The horizontal spacing between the antennas is 1.5 meters, which allows us to solve the problem of the mutual influence of the antennas on each other.

Fig. 4. The complete structural diagram of the system is presented, which consists of the developed antenna system, switching system, stationary radio monitoring system Rohde & Schwarz UMS100, with the ability to connect a portable Rohde & SchwarzPR100 receiver, antenna control unit, computer terminal.

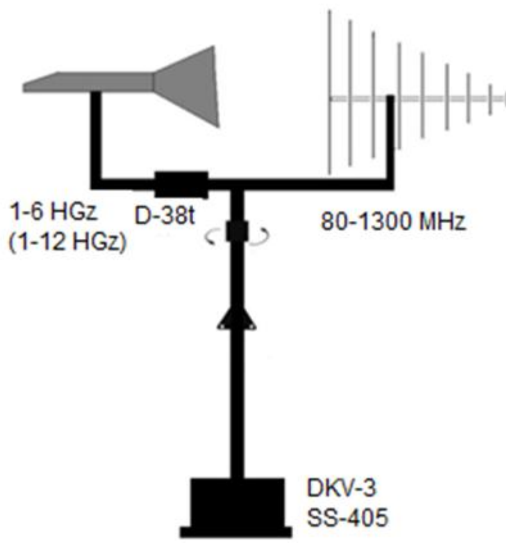


Fig. 3. General diagram of the antenna system

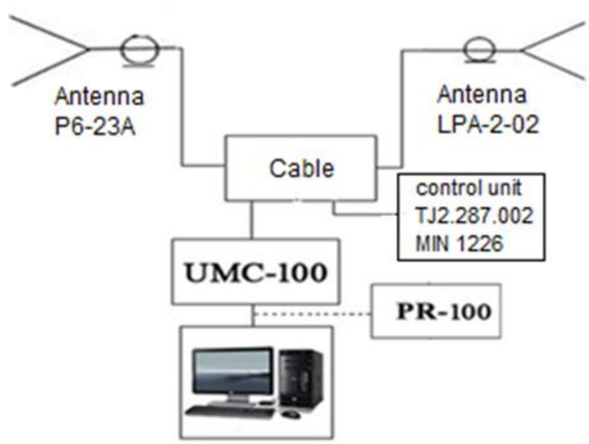


Fig. 4. Block diagram of the antenna system

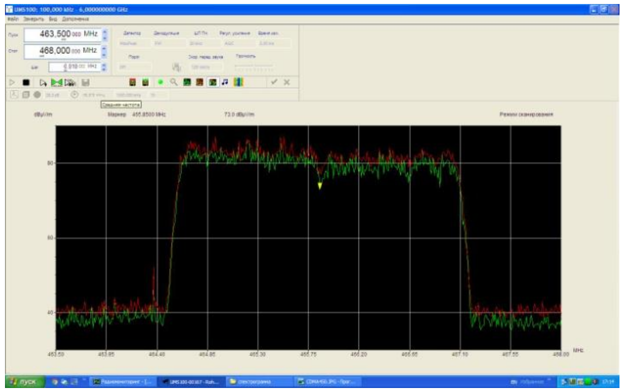


Fig. 5 Spectrogram on a standard antenna

In the range of 460-470 MHz of operating frequencies allocated for a digital cellular communication system with code division of channels of the CDMA 450 standard. The measurements were carried out using a UMS 100 measuring receiver. The difference is 8.3 dBcV / m.

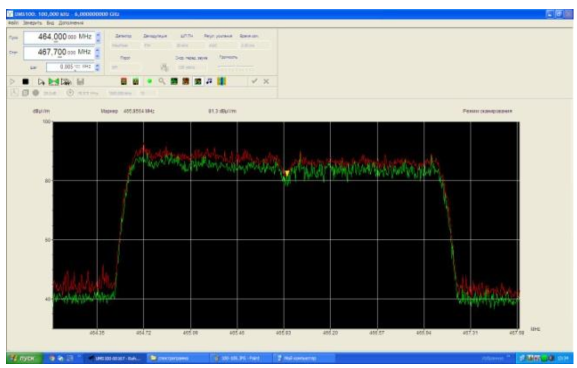


Fig. 6 Spectrogram antenna complex

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