

Algorithm for Forming Structure and Stages of Message Transfer in Unidirectional Radio Systems

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Abstract—The paper presents the substantiation of algorithm for forming the structure and technique for message transmission in unidirectional radio communication systems. The proposed algorithm is intended for use before the beginning of signal transmission for implementing the single-use reliable transmission technique with delayed acknowledgement, but with the possibility of forecasting the interference conditions at the receiving point. The algorithm stages are also discussed and analyzed. The first stage involves the search of the threshold quantity of correctly received symbols of message, the quantity of its blocks and the length of code sequences, which ensure the attaining of required probability of erroneous reception (malfunctioning). The first stage of the algorithm is proposed implying the need to follow a specific order of operations that include gradual increase of the threshold, gradual rise of the quantity of message blocks, and gradual increase of the length of code sequences. The second stage involves the calculation of the structure of discrete messages and algorithm of their transmission that ensure the required probability of correct reception. It is proposed to execute this stage in a specific order that includes gradual increase of the repetition multiplicity of message transmission, gradual rise of the quantity of frequencies for parallel transmission of message, and gradual increase of the length of code sequences. It has been proved that precisely such order of algorithm execution ensures the best indicators regarding the required time and the optimization of the computational complexity (in terms of the number of iterations) in providing the required transmission validity in unidirectional transmission radio systems.

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TOPICALITY

Nowadays, the systems of radio control, telemetry, monitoring of remote objects, warning systems, and others are in widespread use.

For improving the electromagnetic compatibility of different facilities, reducing the energy consumption, weight-and-size indicators, reducing the cost of equipment deployment and maintenance, and for the sake of hiding the location of a correspondent, the unidirectional radio systems (URS) occupy a particular place in the specified systems of both domestic and foreign production. They are applied for the transfer of data about the object state in surveillance-alarm and security systems, transmission of control commands and warning signals to submarines, surface fleet, individual combat tactical groups, and special operation forces. For example, ACP-142(A) Protocol that anticipates the operation in radio broadcasting mode EMCON (Emission Control or Radio Silence) [1].

The communications between the ship and shore in Naval Forces of NATO countries are performed using the BRASS technology (Broadcast and Ship to Shore). The basic aim of this technology is to ensure a reliable transmission of messages to ships that operate in the EMCON mode. In this case, the message transmission involves the use of ACP-142(A) Protocol [2].

Disadvantages of URS systems include their operation under conditions when the fact of sending a useful signal is a priori unknown, and the possibility of adapting to the signal and interference conditions is not available. The selection of optimal modulation methods and signal receiving and processing techniques, and also the antinoise coding is limited that is stipulated by the limited resource in terms of frequency, time, and power, and by the need of operating in conditions of exposure to deliberate interferences. Data transmission

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ADDITIONAL INFORMATION

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