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THE ARCHITECTURE PAYLOAD "S-AIS" FOR SERIES OF EXPERIMENTS

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Abstract: The paper considers a technology of design and architecture of the onboard communication system "S-AIS" for a series of experiments on processing signals received from navigational equipment of ships.

Keywords: smal spacecraft, nanosatellite, picosatellite, platform, cubesat, onboard communication system, ais

In order to examine the message collision preventing method, based on Doppler filtering [2], in space-based AIS system, a series of space experiments is planned to be conducted on Cubesat-3U format satellite developed in the laboratory “Space communication technologies” of Peter the Great St. Petersburg Polytechnic University.

The equipment, needed for the experiments, contains the following components: spacecraft in Cubesat 3U form; on-board AIS

receiver; ground station, consisting of rotating antenna system and retransmission point, for controlling spacecraft and receiving AIS information.

For controlling the satellite and receiving targeted information, a radio-technical complex, which consists of an ISM-band command-telemeter station and high-speed reception station working in L-K bands, has been developed. Controlling center is located in SPBPU. The complex has the following characteristics:

- Command radio link: 145/435 MHz
- Information transmission speed: 9.6 kbit/s
- Package protocol for data transmission: AX.25
- Modulation method: AFSK.

By examining the hardware realized methods, which allow us to implement Doppler filtering AIS signal, it is shown that the implementation by direct methods is impossible because there is no practicable bandpass filters with the required bandwidth (4.8 kHz) and central carrier frequency (161.975 MHz). Therefore, one possibility is offsetting the central frequency to the lower frequency and recovering it later.

A scheme (fig. 1) is suggested to carry out the experiment, which provides the data in two conditions: using filter and not using.

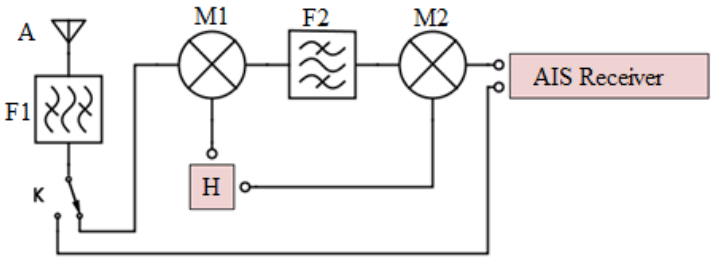

Fig. 1. Structure scheme of targeted equipment.

The signal received by the antenna A passes the primary filtering process (F1). An electromechanical switch is needed to consecutively realize the AIS signal reception in the conditions of using Doppler filtering and not using (when the signal is get on the AIS receiver directly after primary filtering). In the case of using

Doppler filtering, after primary filtering, the signal gets on the mixer 1, in which the frequency offsetting takes place by using the heterodyne H with a fixed frequency. Then, the signal passes the bandpass filter F2, which is configured on shifted central frequency and has fixed bandwidth, and gets recovered in mixer M2. The model BRTK "Polimorf", made by OOO "Laboratory Astronomikon", is used as an AIS receiver. The structural scheme of receiver is shown in Fig. 2.

The content of space experiment is carrying out the sessions of AIS message reception from zones with the same intensity of ships in 2 conditions: using Doppler filtering and not using. Then, the number of detected ships in these cases is compared. In this way, the experiment program provides the information about zones of view, the order of switching the onboard AIS equipment with and without the Doppler filtering, and the procedure of processing the information obtained by considering the data.

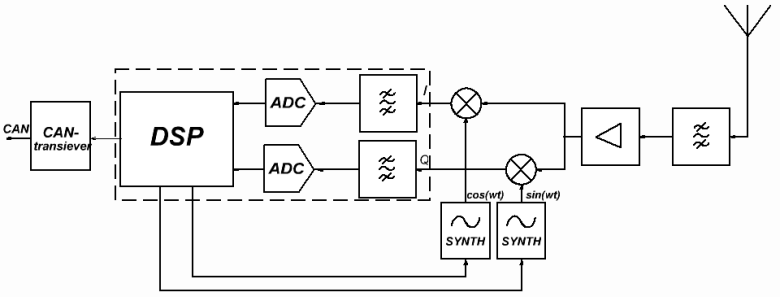

Fig. 2. The structural scheme of the AIS receiver.

Based on the analysis of the available information about the density of shipping traffic, it was found that a part of the Atlantic Ocean, which is enclosed by the northwestern shore of Africa and the eastern shore of the North America, is a potential zone to conduct the experiment. The potential area allows us to realize collecting information about positions of ships in two rounds. In one round, the switch K is turned on and activates the Doppler filtering process.

The process is continued by counting the number of ships, detected in the first and the second rounds, in the crossing area of the field of view of spacecraft. If the number of detected ships in crossing area with Doppler filtering is 3-4 times higher than without filtering,

the experiment will be considered successful and the novel method against collision could be recommended to be used in domestic space-based AIS systems.

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POLARIMETRY OF ATMOSPHERE: EVIDENCE FROM CONDENSED MEDIUM

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Abstract: Optoelectronic system for polarization measurements is presented. The system consists of channel of analysis that is based on the method of polarization visualization and of analysis of spatial distributions of polarized light back scattered by the turbid medium. The results which were obtained and developed methods can be used in lidar applications.

Keywords: polarized light, back scattering, air pollution, biotissue.

Introduction

Nowadays one of the most socially important problem is the problem of air pollution. The analysis of nature of the pollution can be carried out rather efficiently by laser optoelectronic methods. There were developed the technologies on the basis of lidar probing that allowed to determine remotely the spatial contamination level.

There such is a wide variety of lidar systems, all of them are differ in the number of used lasers and the methods of detecting aerosol particles. They feature systems, based upon polarized measurements by which it is possible to define the type of aerosol