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RESULTS OF THE CONTINUOUS MONITORING OF THE POSITION OF A GEOSTATIONARY TELECOMMUNICATION SATELLITE BY THE METHOD OF SPATIALLY SEPARATED RECEIVING SIGNALS OF DIGITAL SATELLITE TELEVISION

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The report presents results of the continuous monitoring of the position of the geostationary telecommunication satellite «Eutelsat-13B» (13° East). The results were obtained during March and April 2015 using a simple radio interferometer which has been developed in the Research Institute "Mykolayiv astronomical observatory".

The radio interferometer is a radio engineering complex (RC) of four stations receiving digital satellite television and a data processing center. The stations are located in Kyiv, Mukachevo, Kharkiv and Mykolayiv. The maximum distances between the stations in longitude and latitude are equal to 1000 km and 400 km, respectively. Each station has identical equipment. The equipment allows making synchronous recording of fragments of the DVB-S signal (11245 MHz, V, 22000 kS/s) from the quadrature detector output a satellite television receiver. The fragments are recorded every second. Their length equals 200 microsecond or 10240 samples per each quadrature channel. Synchronization of the stations is performed using GPS receivers "ThunderBolt-E". The USB-oscilloscope "DSO5200A" is used as an analog-to-digital converter, and PCI-cards "SkyStar1" and "SkyStar2" are used to receive DVB-S signals. The cards were modified to output the signals of their quadrature detectors. Samples of the complex signal obtained in this way are archived and are sent to the data processing center over the Internet. Here three linearly independent slant range differences (Δr) for pairs of the stations are determined as a

result of correlation processing of received signals. For every second measured values of Δr are used to calculate Cartesian coordinates (XYZ) of the satellite in the coordinate system WGS84 by multilateration method.

The time series of Δr, X, Y and Z obtained during the whole period of continuous observations are presented in the report. Estimations of single-measurement errors of Δr, X, Y and Z are also given. These errors are equal to 2.6 m, 3200 m, 600 m and 400 m, respectively. The complex is compared with known analogues. Ways of reducing measurement errors of satellite coordinates are considered. It is expected that an increase of the maximum distance between the stations along latitude up to 1000 km will reduce measurement error of X-coordinate to a kilometer and less. The maximum error of the coordinates' determination could be of the order of 300 m if stations of the RC are optimum placed around the whole satellite footprint that usually is 2000-3000 km long.

The results presented in the report show that radio engineering complex developed, by the RI MAO, could be considered as a prototype of a system of independent continuous monitoring the position of geostationary telecommunication satellites.

Key words: radio interferometer, coordinates of geostationary satellites, DVB-S.