Proceedings of International Scientific-Practical Conference «Sustainable Development Goals: Youth Policy and Innovative Technologies», February 15-16, 2023, Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan

ANALYSIS OF ELECTROMAGNETIC COMPATIBILITY GEOSTATIONARY COMMUNICATIONS SATELLITES TURKMENALEM 52.E AND BELINTERSAT-1

Chary Seyitnepesov[1], Guvanch Allamuradov[2*]

[1]Institute of Telecommunications and Informatics of Turkmenistan, Ashgabat, Turkmenistan.
[2]Space Administration of "Turkmenaragatnashyk" Agency, Ashgabat, Turkmenistan.

[*]Corresponding author

DoI: https://doi.org/10.5281/zenodo.7776869

The satellite orbit (GSO) is unique in that a satellite located on it will appear fixed with respect to the rotating Earth. At this altitude a single satellite is able to provide communication services over a very wide area, with approximately 40% of the Earth's surface visible. The line of this orbit in the sky is called the GSO arc, and positions or slots, defined by the longitude of the GSO satellite, are in great demand. If satellites are located too close together, they can cause harmful interference. For this reason the GSO arc is considered a limited resource, and there are specific requirements in international regulations to ensure it is used in an efficient and equitable manner. A GSO system comprises two paths, an uplink and a downlink [1]. Where there are two GSO systems, there can be four potential interference paths as identified in Figure 1.

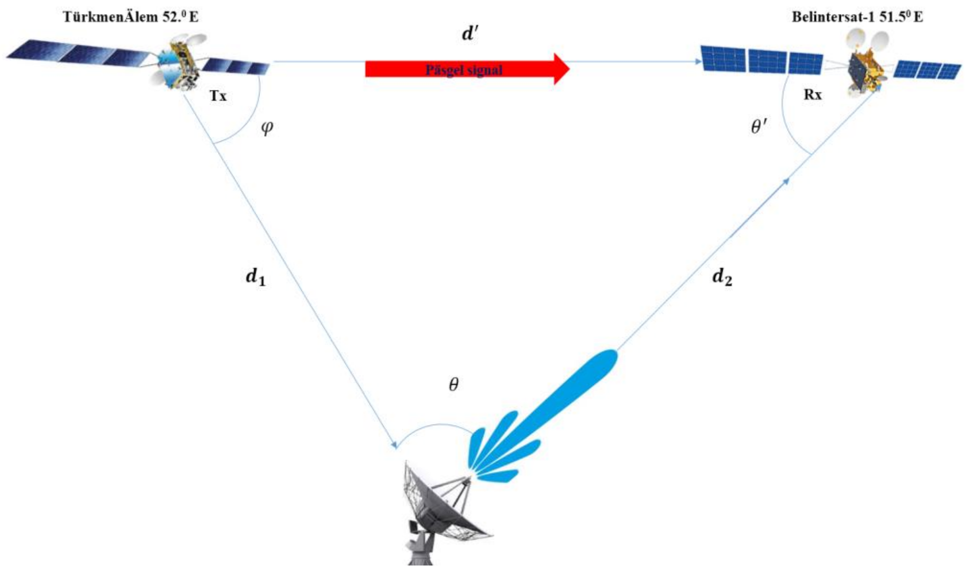

Figure 1. Potential interference paths to consider between GSO satellite systems

The standard GSO satellite coordination process involves the first of these cases and has two stages: 1. The coordination trigger, by which it is identified where further analysis is required, involves checking if there is frequency overlap (hence non-co-frequency analysis is typically not required) and one of: a. Difference in GSO longitude between two systems is less than the coordination arc defined for the bands involved. b. T(DT/T) > 6%. 2. Detailed coordination.

The coordination arc is defined in the RR Appendix 5 and varies between ±70 and ±160 depending upon frequency band. In some bands the coordination arc is the default method unless an administration requests it be included in the coordination process based upon a DT/T calculation [2].

In the work, the electromagnetic compatibility analysis of "TurkmenElem 520 E" and "Belintersat-1" geostationary communication satellites located at 52 and 51.50 degrees, as well as communication satellites operating in the same Ku radio frequency band in different directions, was conducted. TurkmenElem 52 E uses the radio frequency for transmission (TX) and Belintersat-1 uses the same radio frequency for reception (RX). The power of the interfering signal of the "TurkmenElem 52 E" satellite to the "Belintersat-1" satellite is determined based on the following expression, dBWt,

$$I' = P'_{st} + G'(\phi)_{st} + G(\theta')_{sr} - L'_t$$

As a criterion of the permissible interference signal, the ratio of the signal of the receiving radio system to the power of the interference signal at the input is taken, dB. The loss signal power N can be written as dBWt.

$$N = k + 10(lgT_s + lgB_{wup})$$

During the study, an analysis of the electromagnetic compatibility of communication satellites “TurkmenAlem 52 E” and “Belintersat-1” operating in different directions in the same radio frequency range Ku was carried out. According to the results of the study, the level of interference caused by the Turkmenel 52 E satellite to the Belintersat-1 satellite is “71.5 %”. This shows that the electromagnetic compatibility between the systems exceeds the “6%” standard of the limit values set by the International Telecommunication Organization [3]. The results convincingly indicate the need for technical measures to ensure the electromagnetic compatibility of communication satellites. An increase in the ratio of interference signals to noise signals leads to a deterioration in the behavior of the useful signal in the receiver. This can lead to increased errors, reduced image quality or distortion of audio data, and in some cases communication may be completely lost [4].

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ISSN (Print):2663-2381, ISSN(Online):2663-4007
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