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THE PREDICTION OF AREA WHERE SHOULD BE LOOKED ASIDE FOR MITIGATION OF INTERFERENCE FROM NGSO CONSTELLATION

Abstract

With the deployment and application of mega Non-Geostationary Satellite Orbit (NGSO) systems around the world, there is a risk of mutual interference between different NGSO systems. At the time of writing this abstract, OneWeb has already launched 394 satellites completing almost 80% of its low Earth orbit (LEO) network. SpaceX has launched more than 3,500 Starlink satellites to date. Given the expected traffic in Ku and Ka band, it is legitimate to wonder whether there is rest room or development resource for successors to build up a co-frequency communication system in LEO with the existing constellations. In view of the interference problem of NGSO system to GSO system, the International Telecommunications Union (ITU) recommendation lists several possible techniques to avoid interference. The techniques are limited to the degrees of freedom which can be used to avoid interference, such as power control, satellite diversity, satellite selection and so on. Different from the relatively static characteristics of the GSO system, the NGSO system has the characteristics of dynamic position and complex link behavior. There is greater underlying risk of mutual interference between different NGSO systems. The common method to realize mitigation of frequency interference between NGSO systems is called *look aside* technique, which manipulates the active beam aside from the high-risk area. However, there is still no practical method to predict the area where should be looked aside. The scope of this paper is to introduce an algorithm to predict high-risk area in the field of view (FOV) of earth terminal for large-scale constellation with different configurations. A universal analytical expression of satellite constellation probability distribution was proposed and derived in detail. The effect of *look aside* technique applying on different scale of constellations is demonstrated. In this paper, a first NGSO constellation able to dynamically reconfigure beams via active antenna technologies but considered non collaborative is called interfering constellation. A second NGSO constellation, which is assumed to use *look aside* technique and will be treated as the competing system accessing the same spectrum resource, is called interfered constellation. The interference from interfering constellation towards the interfered system is estimated with or without the *look aside* technique. Several typical system configurations will be considered. The effects of mitigation techniques are analyzed in regard of the prediction and grading of high-risk area. Finally, the outlook of the proposed mitigation technique will be discussed in detail.