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ESTIMATION OF THE CO-FREQUENCY INTERFERENCE WITH THE CONSIDERATION OF THE BEAM BEHAVIOR CHARACTERISTICS OF NOVEL SPACEBORNE ANTENNA

Abstract

With the deployment and application of mega Non-Geostationary Orbit (NGSO) systems around the world, there is a risk of mutual interference between different NGSO systems. Probabilistic analysis of co-frequency interference between NGSO system with effective methods and reasonable specifications is the basis of the interference and countermeasure design. Conventionally, the classical antenna models or reference specifications are used to estimate the interference in the chosen worst case which figures out a co-site situation with relatively static behavior. However, with the application of novel spaceborne antenna, such as the phased array antenna or the waveguide slot array antenna, the time-varying behavior of antenna beams should be taken into consideration during the modelling of the interference scenario between different satellite systems. The probability of pointing distribution would highly impact on the interference analysis results. The analysis results, in turn, could guide future system design including the antenna optimization and access strategy decisions. In this work, the method of co-frequency interference estimation with the consideration of the beam behavior characteristics of novel spaceborne antenna will be illustrated. First, the analysis of the relationship between NGSO system configuration and satellite appearance probability distribution in the field of view is presented. Second, the relationship between the satellite selection strategy and the on-board beam pointing behavior is analyzed. Third, the probability distribution models are achieved for different types of satellite systems. Finally, based on the protection threshold of interference-noise ratio at the receiver of the ground station, the evaluation characteristics are established. Taking O3b system and SpaceX system as examples, the probability distribution characteristics of harmful interference occurring between different systems are analyzed. Aiming at the complicated features such as large number of satellites and the changing temporal and spatial beam pointing behaviors, the scheme of interference analysis is given.