ABSTRACT

Satellite communications offer high-quality services with wide coverage and minimal infrastructure. Satellites are divided into Geostationary (GSO) and Non-Geostationary (non-GSO), which differ in their orbital shell altitude and movement. Joint operation of both on the same frequency band can trigger interference, which is evaluated using the Equivalent Power Flux Density (EPFD) parameter.

Equivalent Power Flux Density (EPFD) quantifies the aggregate emissions from non-GSO satellites directed towards GSO earth stations, taking into account the directivity of GSO antennas. The EPFD calculation in the study concentrates on the downlink direction and must adhere to the EPFD value limits stipulated in Article 22 of the Radio Regulations. The investigation utilised GIBC software, created according to the ITU-R S.1503-2 methodology, employing the worst case geometry technique to identify the most unfavourable site for the EPFD value.

This study used GIBC software with two simulation methods on various orbital shell: aggregate and separate. The results showed that the aggregate simulation produced EPFD values following the limits set in Article 22. In contrast, separate simulations showed that several orbital shell with heights 340, 345, 360, 525, 530, and 535 exceeded the EPFD limits. Analysis was also carried out on the long terms and short terms values in all simulation to evaluate the maximum and minimum margins. In addition, graphs were used to identify the worst case positions of the GSO satellites based on their longitude values. The results showed inconsistencies between the entire orbital shell simulation and the individual simulation of each orbital shell. Theoretically, the entire orbital shell simulation should cover all individual simulation of each orbital shell. The inconsistency of the results between the two simulation methods with the worst case geometry approach indicates the need for a more in-depth study of the definition of worst case geometry in the Recommendation ITU-R S.1503-2 implemented by GIBC software.

Keyword : EPFD Downlink, non-GSO, Interference, Frequency Ku Band, Worst case geometry, GIBC, Orbital Shell.