ABSTRACT

Information and communication technology has become essential in recent years, with broadband, fiber optics, and satellites playing key roles in global connectivity. Non-geostationary (non-GSO) satellites are increasingly favoured for their high throughput and low latency, especially in rural or remote areas. However, their rapid deployment introduces challenges, particularly the risk of interference with Geostationary Satellite Orbit (GSO) networks. To address this, the International Telecommunication Union (ITU) regulates interference through Equivalent Power Flux Density (EPFD) limits, as outlined in ITU-R Article 22.

To ensure compliance, ITU developed Recommendation ITU-R S.1503, which provides guidance for validating EPFD levels. The Worst Case Geometry (WCG) algorithm is used to identify the geometry combination that causes the highest interference. ITU also offers a validation tool called ITU-BR GIBC. However, studies suggest that the WCG algorithm may fail to find the true worst-case scenario, potentially due to manipulation of the Power Flux Density (PFD) masks used as input, which compromises the algorithm's accuracy.

To address this issue, this study analyses the WCG algorithm and its main input, the PFD mask, to understand their roles and identify potential manipulation. The analysis reveals that the WCG follows a structured process, validating interference levels across geometry combinations based on non-GSO satellite data. It was found that the PFD value increases at latitude 0°, which is inconsistent with expectations for high-inclination non-GSO satellites, where received power should be lower when crossing the GSO earth station's main beam at equator. EPFD validation using GIBC confirmed that artificially increasing the PFD at latitude 0° affects the WCG algorithm's selection of the worst-case geometry.

Keyword: Satellite Technology, NonGSO, Interference, EPFD, WCG, GIBC, Geometry Combination.