

Improvements of Signal Gain for MEASAT-2 and MEASAT-3 using Orbital Diversity under Rain Attenuation: A Simulation Approach.

ABSTRACT

The effect of rain attenuation becomes significant for satellites operating at 10 GHz and above. This has become a matter of concern, especially in tropical regions where relatively heavy rainfall occurs throughout the year. Orbital diversity (OD) is seen to be a viable method to mitigate rain attenuation. It employs multiple satellites transmitting identical signal streams toward a mutual ground station. Although OD has been studied with great interest in regions such as Europe, there is little information of OD research in tropical regions, particularly in Malaysia. Therefore, this paper proposed an analytical approach towards the study of OD in Malaysian climate using MEASAT satellites. The performance of OD is dependent upon the operating frequency and the satellite's elevation angle. From the simulation, the rain attenuation increases exponentially with the increasing frequency. Therefore, the signal gain decreases in inverse exponential manner. The simulation also shows that MEASAT-3, having an elevation angle of 77.695° , experiences higher signal attenuation than MEASAT-2 (elevation angle 34.324°). Using signal combination, an OD signal experiences signal boost of up to 2.3 times the individual signal gain. With this significant finding, the OD is proposed to mitigate rain attenuation in Malaysia.

Keyword: Orbital Diversity; Rain Attenuation; Maximal Ratio Combining; Signal Strength