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Propagation Measurements during Daytime for RazakSAT S-band Space to Earth Satellite Signal Transmission

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Abstract

Adequate fade margins for all conditions are critical in ensuring reliable satellite operation. The required fade margin value for specific desired quality of service (QoS) can be established from the statistics of outage due to attenuation. In the case of clear sky attenuation, the value is much dependent on the atmospheric layer conditions and their compositions. For absolute Free Space, the signal loss is only dependent on distance and frequency. In this study, the effects of distance were analysed in the investigation of identifying the most appropriate clear sky attenuation values during daytime. The RazakSAT received signal levels were matched according to the distances between the satellite and the Ground station. Clear sky conditions were confirmed using S-band (Terminal Doppler Weather Radar) TDWR reflectivity information. With this value, the satellite operator can decide execution of power uplink and mitigation technique if necessary. The RazakSAT S-band (2.232 GHz) transmission signal data of were furnished by Malaysian National Space Agency (ANGKASA) and radar data were acquired from Malaysian Meteorology department (MMD). The findings offer awareness of required fade margin as distance varies during each flight path. The collected data will also be employed in the investigation of Free Space Path Loss (FSPL) formulation applicable for satellite link in tropical region.

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Keywords: *Atmospheric layer; FSPL; Reflectivity; TDWR*

1. Introduction

Satellite communication is one of the most significant and beneficial technologies that has been ever developed. Many commercial and private communication services can be instantly offered by satellite communication, for example the voice, data transfer and video services. This technology has great appeal to many business applications, since it can be easily deployed in the shortest possible time and in select instances, with minimal investment [1]. The two basic components of a satellite communications system are the space segment and the ground segment. The space segment typically consists of the spacecraft and the launch mechanism while the ground segment on the other hand, conventionally comprises of the Earth station with a network control centre for the entire satellite system operation [2]. Free Space Path Loss (FSPL) or any loss determination is an important aspect to consider before the launching of any satellite. This is due to the fact that once the satellite is in orbit, limited modification to the space segment hardware can be carried out and will definitely involve a very high cost. The ionosphere is a region

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