Performance of Ku-band satellite signals during rainy condition in Akure, Southwestern Nigeria

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Abstract

Propagation impairment such as signal fluctuation caused by attenuation due to rain on satellite communication links operating in the Ku frequency bands in a tropical location such as Akure, Southwestern Nigeria, **7.3N, 5.3E,** must be carefully studied for the accurate determination of link budget. In this paper, we present the statistical analysis of the concurrently measured rainfall rates, signal strength and quality of a Ku-band satellite signal received during the occurrence of some rain events in Akure. The study used sample data from one year of Ku band, EUTELSAT, W4/W7 satellite beacon footprint at a frequency of 12.245GHz and elevation angle of **036E** over the region to determine the significance of rainfall intensity in the prediction of rain induced attenuation. The Ku-band signal level and noise threshold for clear and non-clear air conditions were measured and recorded using the SATLINK digital meter. Concurrently, rainfall intensities were measured at **one minute** integration time, using a Vantage Vue Integrated Sensors Suite, **ISS,** weather station. Comparison of the predicted rain-induced attenuation computed using the measured data was carried out with some selected rain attenuation models such as the **ITU R**, **Garcia** and **Moupfouma**, so as to determine which attenuation prediction model would be most suitable for Ku-band satellite communication in the region. The measured data were also used to investigate the correlation between rainfall pattern and the observed signal fluctuation in the location. The pattern of rainfall events and intensities modeled as a time series for the rainy months for the one year period gave an indication of the pattern of signal outage experienced in the region at different times of the day. The results also show that the **ITU R** rain attenuation prediction model underestimates rain attenuation in the region.

Keywords: Tropical region, Ku-band frequency, one minute rainfall intensity, Earth-Space propagation.