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Two-year rain fade empirical measurements and statistics of earth-space link at Ka-band in Malaysia
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Abstract

Satellite communication links at a frequency above 10GHz experience severe attenuations due to rain, particularly in tropical regions. Reliable long-term rain fade empirical data for Ka-band satellite links in Malaysia and in other tropical areas are indeed limited. The main objective of this paper is to provide and present the findings of an empirically measured rain fade at the Ka-band of 20.1998GHz and the cumulative distribution analysis. An 8.1m dual Gregorian dish antenna with 21dB/K G/T and a meteorological standard dual type tipping bucket were used to measure the Ka-band beacon signal emanating from the MEASAT-5 satellite and the rainfall intensity, respectively, for a period of two years. Cumulative distribution of rain fades for monthly, annual and monsoon seasons were compiled to reflect accurate changes in the Malaysian weather. The measured rain fades were at 10dB and 29dB for the exceeded percentages of 0.3% and 0.1%, respectively. At rain fade of 33dB, the receiver began to saturate, resulting in a QoS of 99.9% for the Ka-band. These findings provided insights into the actual rain fade experience for the practical implementation of the Ka-band satellite link and for future studies of rain fade models in tropical regions. © Academy of Sciences Malaysia 2019.

Author Keywords

Ka-band; Rain attenuation; Satellite link; Tropical region

References

- Adhikari, A.
Improving rain attenuation estimation: Modelling of effective path length using Ku-Band measurements at a tropical location
(2011) *Progress In Electromagnetics Research B*, 34, pp. 173-186.
- Cuervo, F.
Ka-band propagation campaign in Malaysia-First months of operation and site diversity analysis
(2016) in *2016 10th European Conference on Antennas and Propagation, EuCAP*,
- Cuervo, F.
The JOANNEUM RESEARCH SatCom Ka and Q band campaigns in Europe and Malaysia
(2017) in *2017 11th European Conference on Antennas and Propagation, EUCAP*, pp. 1476-1480.
- Eng, K.H.
Malaysia's Drive for High Speed Broadband
(2009) *Malaysian Communications and Multimedia Commission*, 3 (1), pp. 16-19.
- Hassan, Z.
Spatial Interpolation of Historical Seasonal Rainfall Indices over Peninsular Malaysia
(2018) in *E3S Web of Conferences*,
- Huffman, G.J.
The TRMM Multisatellite Precipitation Analysis (TMPA): Quasi-Global, Multiyear, Combined-Sensor Precipitation Estimates at Fine Scales
(2007) *Journal of Hydrometeorology*, 8 (1), pp. 38-55.
- Ismail, A.F.

Determination of Ku-band specific attenuation parameters based on measurements in the tropics

(2013) in *IEEE Antennas and Propagation Society, AP-S International Symposium (Digest)*, pp. 2008-2009.

- Ismail, A.F., Zhiger, S., Hasan, M.K.
An Intuitive Link Budget Tool for Military Satellite Communication
 (2017), 11 (2), pp. 97-106.
- **Propagation data and prediction methods required for the design of Earth-space telecommunication systems**
 (2015) *Recommendation ITU-R P. 618-8*, 12, pp. 1-24.
- **Characteristics of precipitation for propagation modelling P Series Radiowave propagation**
 (2012) *Radiowave Propagation*, p. 6.
- Kestwal, M.C., Joshi, S., Garia, L.S.
Prediction of rain attenuation and impact of rain in wave propagation at microwave frequency for tropical region (Uttarakhand, India)
 (2014) *International Journal of Microwave Science and Technology 2014*,
- Lam, H.Y.
'Assessment of seasonal Asia monsoon rain impact on the Earth-space propagation in equatorial Kuala Lumpur'
 (2012) In *IEEE Antennas and Propagation Society, AP-S International Symposium (Digest)*, pp. 1461-1464.
- Mignolo, D., Ginesi, A., Michael, H.
 (2013) *Approaching Terabit/s satellite: A system analysis*, Earth
- Mohd Zad, N.S., Zulkafli, Z., Muharram, M.F.
Satellite Rainfall (TRMM 3B42-V7) Performance Assessment and Adjustment over Pahang River Basin
 (2018) *Remote Sensing*, 10 (3).
- Nebuloni, R.
Assessment of Rain Fade Mitigation Techniques for High Throughput Satellites by a Time Series Synthesizer,
- Ostrometzky, J.
Calibration of the attenuation-rain rate power-law parameters using measurements from commercial microwave networks
 (2016) in *2016 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, pp. 3736-3740.
- Rapaka, P., Ramana, T.V.
Tropospheric scintillation of ku and ka-band satellite signals in south indian region
 (2017) in *Proceedings-7th IEEE International Advanced Computing Conference, IACC 2017*, pp. 188-192.
- Shayea, I.
Real Measurement Study for Rain Rate and Rain Attenuation Conducted Over 26 GHz Microwave 5G Link System in Malaysia
 (2018) *IEEE Access*, 3536 (c), pp. 1-1.

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