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Mitigation technique for rain fade using frequency diversity method

(Conference Paper)

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Abstract

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The radio waves propagating through the earth atmosphere is attenuated due to the presence of atmosphere particles, such as water vapor, water drops and the ice particles. The atmospheric gases and rain both absorb and scatter the radio waves, and consequently degrade the performance of the microwave link. Millimeter wave (mmWave) is today's breakthrough frontier for emerging wireless mobile cellular networks, wireless local area networks, personal area networks, and vehicular communications. In the near future, mmWave products, systems, theories, and devices will come together to deliver mobile data rates thousands of times faster than today's existing cellular and WiFi networks for an example from the era of 3 G towards 5 G mobile communication near future. However for Tropical countries the data link realibility is effected during rain. Rain is a major source of attenuation for microwave propagation above 7 GHz [1], In tropical and equatorial regions, the rain intensity is higher and designing terrestrial and earth-to-satellite microwave links are very critical and challenging for high frequencies. This paper presents the summary of rain effects studies for lower operating frequency such as C band compare to higher operating frequency such as Ka band in tropical environment The main objective is to justify the literature findings on the effect of rain at lower and higher operating frequency in microwave link and solution to overcome it by implementing Switching Circuit as Fade Mitigation Technique (FMT). An experimental test bed has been set up for 5.8 GHz and 26 GHz terrestrial point to point data communication link. The received signal strength (RSS) data and rain fall intensity data were recorded for 24 hours daily over period of 12 months (Jan 2013-Dec 2013) at 1 minute interval. The collected rain rate data has been analyzed with some prediction models. The main outcome of the research shows that there is negligible effect of rain for 5.8 GHz link whereas it very strong on the 26 GHz link. It was observed 15 dB to 35 dB attenuation during measurement period. The FMT used in this research for dual frequency by shifting the operating frequency to lower band (5.8 GHz) while heavy rain and shifting back to normal position at higher operating frequency (26 GHz) using the threshold level as reference seems to be one of the solution in future. This findings will be useful resources of information for researchers or telecommunication engineers. © 2015 IEEE.

Author keywords

Fade Mitigation Technique Rain attenuation Received Signal Strength

Indexed keywords

Engineering controlled terms: Cellular telephone systems Earth atmosphere Microwave links Microwaves Millimeter waves Mobile telecommunication systems Personal communication systems Radio waves Rain Satellite links Tropics Wi-Fi Wireless local area networks (WLAN)

Compendex keywords: Fade mitigation techniques; Microwave propagation; Millimeter waves (mmwave); Mobile cellular networks; Rain attenuation; Received signal strength; Telecommunication Engineers; Vehicular communications

Engineering main heading: 3G mobile communication systems

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