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Extended Abstract

Outdoor Measurement of Millimeter-Wave Propagating Through Vegetation at 28GHz Band

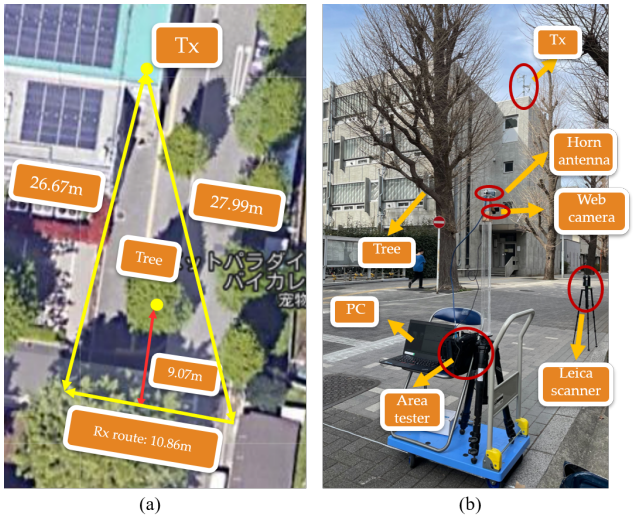
C. Weiqi*, N. Keerativoranan* and J. Takada*

* Department of Transdisciplinary Science and Engineering
School of Environment and Society,
Tokyo Institute of Technology
email: weiqi.c.aa@m.titech.ac.jp

I. Introduction

With the increasing demand for higher communication data rates, new communication technology with higher data bandwidth has been a hot topic in the field. Due to the congestion in sub-6 GHz, the 5G wireless technology, also called new radio (NR), at millimeter wave (mm-Wave) band has been intensively researched. While NR promises communication of high data rate, the mm-Wave is easily blocked by obstacles than signals in sub-6 GHz bands due to small wavelength. This includes vegetations that causes significant attenuation to the communication link in both urban and suburban areas. Although foliage attenuation is one of the anticipated challenges facing mm-Wave cellular or fixed wireless access networks [1], there has been a limited number of measurements to investigate its effects at mm-Wave band. Hence, this work investigates the attenuation to the reference signal received power (RSRP) caused by the trunk and branches of a ginkgo tree in its leaf-off period.

II. Measurement Setup



(a) (b)

Figure 1: Measurement setting, (a) bird-eye view (b) detailed setting

In this campaign, the changing level of SS (Synchronization Signal)-RSRP along the moving route in the back of the tree is expected to indicate the influence of the tree shadowing. A 5G base station, built by Rakuten Mobile, Inc, mounted on top of the administration bureau buildings, Tokyo Institute of Technology sends reference signals at 27.15 GHz with a bandwidth of 400MHz. In front of the building, a ginkgo tree was considered the obstacle. A 20 dB gain horn antenna connected to the Anritsu ML8780A area tester and were moved in a constant speed along the trajectory behind the tree. The line-of-sight (LOS) and non-line-of-sight (NLOS) situation were clarified by Rx-attached web camera. The bird-eye view of measurement scenario and detailed settings are depicted in Fig.1 a.

III. Result and Discussion

The result of this measurement is shown in Fig.2. There were LOS and NLOS regions which was determined by the video footage. The difference in signal level on each side of the tree was caused by different path loss distance. A method of window filtering with a window size of 4 samples, was used to eliminate the small scale fading. Approximately 15-dB path loss caused by the branches and tree trunk was observed. The strongest attenuation accrued when the Rx reached the shadowing area of the trunk. In the first LOS region, the ascending trend of RSRP indicated that Rx was moving closer to the Tx. In the second LOS region, RSRP dropped as distance increased.

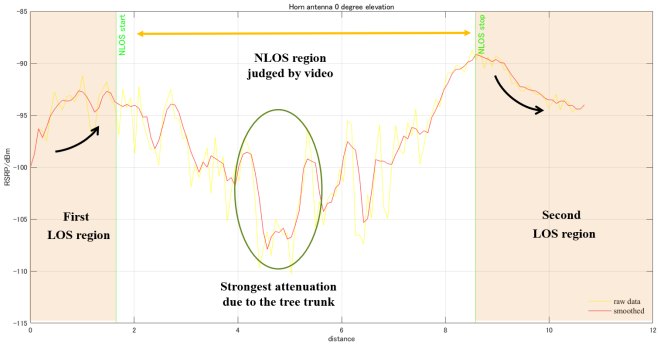


Figure 2: measurement result

References

[1] C. U. Bas, R. Wang, S. Sangodoyin, S. Hur, K. Whang, J. Park, J. Zhang, and A. F. Molisch, "28 ghz foliage propagation channel measurements," in *2018 IEEE Global Communications Conference (GLOBECOM)*. IEEE, 2018, pp. 1–6.