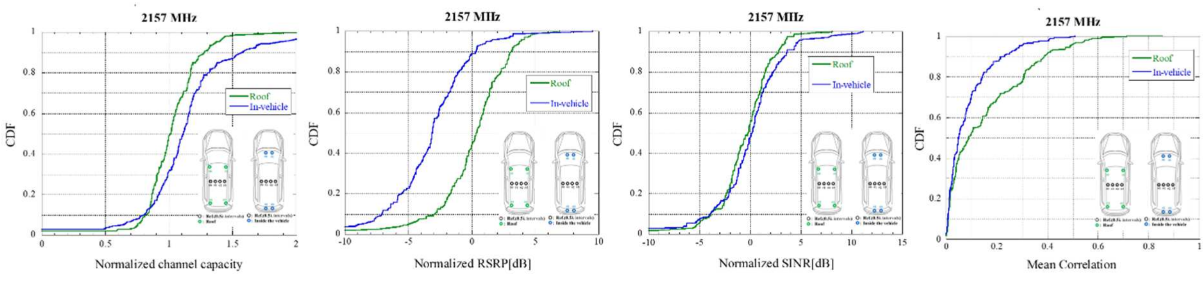
Vehicular multi-antenna characteristics on type of installation

Kazuma Tomimoto* [(1)], and Ryo Yamaguchi [(1)]
(1) Softbank Corp., Tokyo Portcity Takeshiba Office Tower, Tokyo, Japan; e-mail: kazuma.tomimoto@g.softbank.co.jp

To support autonomous driving, connected cars that can access mobile communication networks are being considered [1]. Currently offered 4th and 5th generation mobile communication services support up to 4 branches when MIMO is applied (for Sub-6 and below) [2], and it is necessary to clarify how to construct a 4-branch vehicular multi-antenna. Previous research realized a coherent base station scanner to enable a simple vehicular multi-antenna evaluation using base stations in operation [3]. In this abstract, two multi-antenna configurations in an urban environment are measured using the developed system. The results show that in urban areas, where SINR (Signal to Interference plus Noise power Ratio) does not depend on the RSRP (Received Signal Reference Signal) value, decreasing the antenna correlation is effective in improving channel capacity.

Two multi-antenna configurations are evaluation using the developed system in this study: a rooftop type and a in-vehicle type. The rooftop configuration sets one antenna at each of the four corners of the rooftop. The in-vehicle configuration sets two antennas at the front of the vehicle and two antennas at the rear. Both configurations use sleeve dipole antennas operating in the 2100 MHz band. The reference multi-antenna, a 4-element linear array antenna with antenna spacing of 0.5 λ (λ :wavelength) is measured simultaneously with the multi-antenna configurations. Channel capacity, RSRP of the desired cell, and SINR are plotted results which is normalized the multi-antenna under test by the reference multi-antenna. The average antenna correlations between each element is plotted. Measurements were made while driving in urban areas using downlink signals from FDD-LTE base stations in the 2100 MHz band.

Figure 1 shows the measurement results. From Figure 1 (a) and 1(b), it can be confirmed that the channel capacity of the in-vehicle configuration is higher despite the decrease in RSRP. The SINR characteristics of the two configurations, see Figure 1 (c), are not significantly different, confirming that they are not affected by the decline in RSRP. From these results, the measurement environment can be taken as one in which the RSRP of the desired and interfering waves was much greater than the received noise power. Therefore, the SINR of the in-vehicle configuration is considered to have changed little, since not only the RSRP of desired wave but also the RSRP of interfering wave has decreased. The antenna correlation in Figure 1 (d) shows the best values for the in-vehicle configuration. The results suggest that vehicle body and its structures act as scatterers. The reason why the in-vehicle configuration exhibited the highest channel capacity in an urban environment may be attributed to the propagation environment, where SINR does not vary significantly regardless of the installation location, and to the multi-antenna configuration with its low antenna correlation. However, this antenna configuration may result in a narrower communication area in weak field areas. In future work, similar studies will be conducted in rural environments.



(a) Channel capacity (b) RSRP of the desired cell (c) SINR (d) Antenna correlation

Figure 1 Measurement results with different antenna configurations.

References

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