

修士論文題目 A Study on Channel Capacity Enhancement Based on Beam
Pattern with Polarization Diversity
(ビームパターン及び偏波ダイバーシティによるチャネル容量の改善に関する研究)
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There is an increasing demand in communication system today as to provide a wireless mobile data services that has the capability of empowering higher voice and data rates but at the same times managed to accommodate higher capacity users. As mobile voice service is already part of our lives by most, mobile voice with data and video services are fast becoming an important and necessity part as well. Most of the mobile data traffic is being generated indoors. However, indoor performance is significantly poorer compared to outdoor performance due to propagation problems such as signals distortion, attenuation and redirection by floors, ceilings, walls, and etc. Thus the advanced cellular architecture such as LTE is very suitable in designing a system for small indoor base station as it can provide satisfactory end-user experiences while the current cellular architecture won't be able to meet the anticipated growth in mobile data traffic. However, the advance environment itself is not enough to cope with the growing demand. An antenna with channel capacity enhancement capability operating in LTE environment is one of the solutions to this challenge. A large number of low costs, small base station installed to cover a large area is expected can increase the channel capacity significantly and expend the coverage. Thus, it is almost required to not just design an antenna, but with channel capacity enhancement especially for indoor communication system where access is expected.

In multi antenna environment, optimizing the radiation pattern and polarization are very effective especially for enhancing the channel capacity. Thus, it is important to encompass these factors into antenna design so that we can produce an antenna with good radiation pattern and polarization that will help improving the channel capacity as a whole. This thesis discusses technology behind the LTE and MIMO especially and the focusing is put on channel capacity specifically.

MIMO system performance in general is evaluated in the means of channel capacity where various simulations were done in various conditions and arrangements with comparison between common pattern and beam pattern with the target that the channel capacity can be improved using beam pattern utilizing the polarization diversity. On the other hands, two antennas which can produce directional and dual polarization patterns are proposed with the target to improve channel capacity for small base station in LTE environment utilizing 4 x 4 MIMO systems. These antennas were designed with an emphasis on radiation pattern where our priority was to produce a more directive pattern in both vertical and horizontal polarization plane. In addition, channel capacity calculations are presented using the beam-patterns produced by the proposed antenna respectively. The simulation environment for channel capacity calculation was similar as in previous, but the position of each transmit antenna was adjusted according to the actual configuration as described in their respective designs. The results confirmed that directional beam pattern with polarization diversity antenna enhanced the overall channel capacity in a small base station as compared with dipole antenna.