

## Design of Yagi-Uda Antenna in 900 MHz Band for Multi-Band Base Station Antenna

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### 1. INTRODUCTION

In recent years, cellular communications have been widely used and more and more services have been started which use different frequency bands. On the other hand, installation space of antennas in base station is limited and it is difficult to install as many antennas as the number of frequency bands in the base station. To overcome this problem, various multiband antennas have been proposed [1]. In this study, we attempt to design a multi-band base station antenna which operates in four frequency bands: 900 MHz, 1.5 GHz, 1.7 GHz and 2GHz, by using Yagi-Uda antenna and Tapered slot antenna (TSA) [2]. Yagi-Uda antenna covers 900 MHz band while TSA covers other three bands.

In this report, Yagi-Uda antenna is designed to achieve desired performances such as beamwidth and front to back ratio in 900 MHz band. It is shown that the designed Yagi-Uda antenna achieves desired performances in 900 MHz band.

### 2. DESIGN OF YAGI-UDA ANTENNA

The structure of Yagi-Uda antenna for 900 MHz band is illustrated in Fig. 1. The director and the planar reflector are located to realize narrow beamwidth. The reflector is composed of two parts, main and sub reflectors, so as to obtain high gain with smaller aperture. In order to obtain high front to back ratio, it is desirable that the spacing between dipole and main reflector ( $d_r$ ) is approximately  $d_r = 0.25\lambda_{900}$ , where  $\lambda_{900}$  is the wavelength at 900 MHz. However, due to the limitation of the radome size,  $d_r = 0.165\lambda_{900}$  is chosen. The desired performance of Yagi-Uda antenna is shown in Table 1.

The simulated actual gain of Yagi-Uda antenna is shown in Fig. 2. The simulation was performed using the method of moments. The beamwidths at 900 and 960 MHz are 68.4° and 65.9°, respectively, and the front to back ratios at 900 and 960 MHz are 20.7 dB and 22.2 dB, respectively. It is found that desired beamwidths and front to back ratios are realized by using the Yagi-Uda antenna.

### 3. CONCLUSIONS

A Yagi-Uda antenna was designed for the multi-band base station antenna to realize desired performance in 900 MHz band. As a result of numerical simulation, desired beamwidth and front to back ratio were achieved.

### REFERENCES

- [1] K. Cho, et. al., IEICE Trans. Commun. (Japanese Edition), Vol. J91-B, No. 9, pp. 886 - 900, Sep. 2008.  
[2] K. Itoh, et. al., Proc. IEICE Gen. Conf. 2013, B-1-100, Mar. 2013.

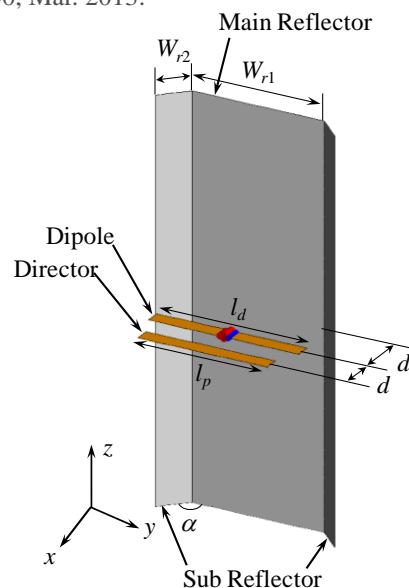


Fig. 1. Structure of Yagi-Uda antenna for base station

Table 1. Desired performance of Yagi-Uda antenna

| Frequency Range     | 900 - 960 MHz |
|---------------------|---------------|
| Return Loss         | $\geq 10$ dB  |
| Number of Sectors   | 6             |
| Beamwidth           | 60 - 70 deg.  |
| Front to Back Ratio | $\geq 20$ dB  |

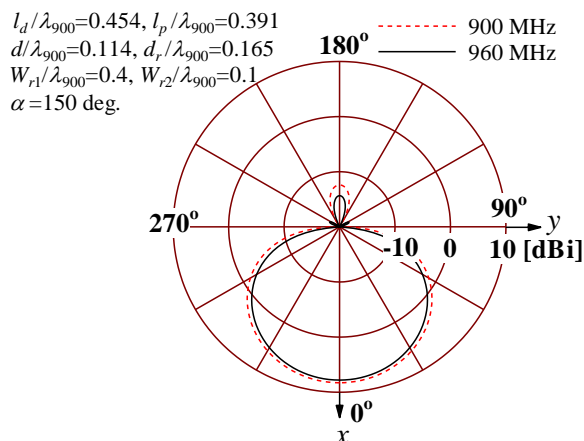


Fig. 2. Actual gain of Yagi-Uda antenna