# Millimeter-Wave Wideband L-probed Magneto-Electric Dipole Antenna

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# Millimeter-Wave 광대역 L-probed Magneto-Electric 다이폴 안테나

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## Abstract

A millimeter-wave wideband L-probed magneto-electric (ME) dipole antenna for the 60 GHz unlicensed band is proposed in this work. Because of its complementary nature, the proposed antenna emits a wide bandwidth and unidirectional radiation pattern. The simulated S11 of the proposed ME dipole antenna was less than -10 dB with a bandwidth of 24%, spanning from 54.82 GHz to 69.78 GHz. Its peak gain was 11.93 dBi, with a 3-dB gain bandwidth of 33.3%, spanning from 53.54 GHz to 75 GHz.

## Ⅰ. Introduction

The millimeter-wave frequency band has created many opportunities for cutting-edge wireless technologies in recent years. However, in order to support the large range of unlicensed frequency bands from 57GHz to 71GHz that are currently available, new millimeter-wave antennas are required [1]. Due to the enormous bandwidth of the 60-GHz unlicensed band, research is being done on the range of this frequency because it allows for the realization of communication links that can reach speeds of nearly many tens of gigabits per second [2]. Before millimeter-wave antennas were developed, the Limited bandwidth problem of micro strip antennas is being solved by using various techniques including E-shaped [3], and U-slot [4] and more advancement is required in mm-wave for wideband antennas. Magneto-electric (ME) dipole antennas are a novel type of complementary antenna that was first presented by Wong and Luk in 2006 [5]. In this paper, a millimeter-wave wideband Magneto-electric (ME) dipole antenna is proposed feeding by an L-shaped probe.

## Ⅱ. Antenna Geometry

Figure 1 shows the antenna geometry. A ME dipole antenna with a wide bandwidth and low cross-polarization has been proposed. Ansoft HFSS, a 3-D full-wave simulator, is used to simulate the proposed antenna. The parameter dimensions in millimeters are Wp=0.75, Lp=0.75, Hg=0.06, Hi=0.015, Ht=0.46, Lpr=0.9, Sp=0.15, Gap=0.2, Dp=0.4. It is visible that the feeding is done with an L-probed, which is positioned at same layer as the dipole to provide low cross-polarization and maximum radiation efficiency. The 2x2 array's antenna dimensions are 5.3x6.2x0.46mm$^3$, or 1.06x1.24x0.092 $\lambda_0^3$. Seven layers of FR-4 board with a dielectric constant of 3.42 make up the antenna design.

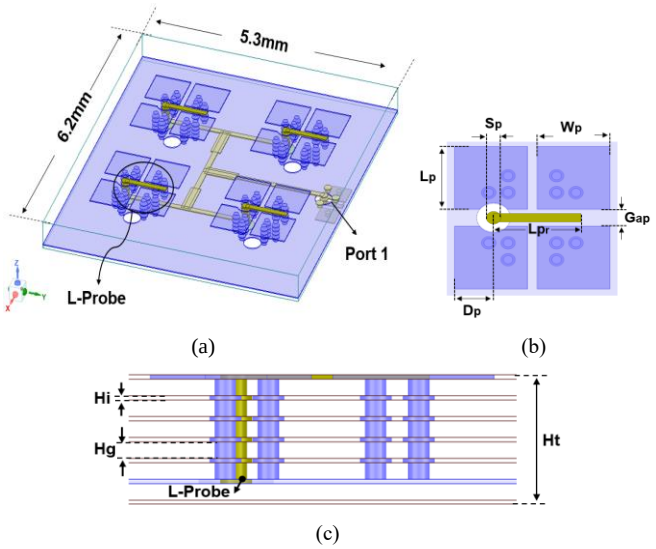


Fig. 1. Geometry of proposed ME dipole antenna. (a) side view of the 2x2 array. (b) top view of the single antenna. (c) Layer view

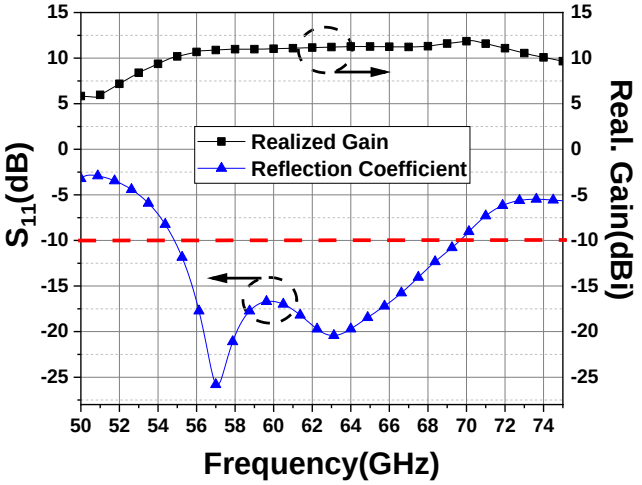


Fig. 2. S11 and realized gain of proposed 2x2 antenna array.

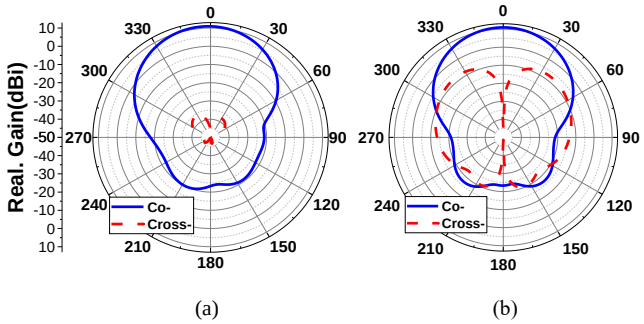


Fig. 3 Radiation pattern of proposed 2x2 antenna array (a) E-plane and (b) H-plane at 57.8GHz

## Ⅲ. Simulation Results

In Fig. 2. the S11 and realized gain of proposed 2x2 antenna array is shown. The S11 is less than -10 dB with 24% of 54.82GHz to 69.78GHz frequency band. Moreover, the realized gain of the proposed antenna is maximum at 70.3GHz with 11.93dBi value and the 3dB bandwidth is 33.3% covering 53.54GHz to 75GHz of frequency band.

In Fig. 3. the radiation pattern of proposed antenna array can be seen at (a) E-plane and (b) H-plane at 57GHz. It can be seen that at the broadside direction (Θ=0°, ϕ=0°) the cross polarization is least higher in with 49.56 dB at 57.8GHz.

## IV. Conclusion

This work introduces a wideband millimeter-wave L-probed magneto-electric (ME) dipole antenna for the 60-GHz unlicensed band, with a single L-shaped probe feeding. Wide bandwidth, enhanced 3dB gain bandwidth, and high gain are the objectives of the antenna under discussion. The proposed antenna has a peak realized gain of 11.93 dBi and an S11 value of less than -10 dB, covering a wide bandwidth of 24% from 54.82 GHz to 69.78 GHz. It also has a 3-dB gain bandwidth of 33.3%-from 53.54 GHz to 75 GHz.

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