

Fundamental Experiment on Position Estimation of Transmitting Antenna -Part 3-

Mitsuo Taguchi
(Graduate School of Engineering, Nagasaki University)

Mitsunaga Mori

(Graduate School of Engineering, Nagasaki University)

1 Introduction

The authors have proposed the estimation method of the position of a catheter within the pharynx composed of unbalanced fed ultra low profile inverted L (ULPIL) antenna [1]. The position of transmitter is estimated by using the received signals at three receiver antennas located around the transmitter[2-4].

In this paper, the receiver antennas are located at 60° intervals on the circumference of a circle with a radius of 40 mm. The amplitude and phase of received signals are calculated. In the case of the transmitter antenna is moved 40mm away from the center of the circle in the z-direction. In the numerical analysis, the electromagnetic simulator WIPL-D based on the Method of Moments is used [5].

2 Antenna Structure

Figure 1 shows a ULPIL antenna located very close to a rectangular conducting plane. The inverted L antenna is consisted of a semi-rigid coaxial cable. The radius of outer and inner conductors of the coaxial cable are 1.095 mm and 0.255 mm, respectively. L is the length of the horizontal element of the antenna, and $L1$ is the length from the bend to the feed point. The design frequency is 2.44 GHz. The parameters of antenna are $pxp = pxm = 15$ mm, $pyp = 50$ mm, $pym = 10$ mm, $h = 4$ mm, $L = 30.2$ mm, and $L1 = 24.0$ mm.

Figure 2 shows the cross-sectional view of antennas seen from y direction. "a1" is transmitter antenna. "a2", "a3" and "a4" are receiver antennas.

3 Calculation Results and Discussion

Figure 3 shows the calculated phase of received signals when the transmitting antenna is moved away in the z-direction. The phase of S21 is the reduced as the distance between the antennas is longer. Therefore the position of the transmitter antenna can be estimated from the phases of the S-parameter in addition to its amplitude.

4 Conclusion

The estimation method of the position of transmitter is proposed by using the amplitudes and phases at three receiver antennas located around the transmitter.

References

- [1] M. Taguchi, et al., Technical Report of IEICE, SANE2013-17, Jan. 2015.
- [2] M. Mori, et al., Technical Report of IEICE, AP2015-14, April 2015.

- [3] M. Mori, et al., Technical Report of IEICE, SANE2016-81, Jan 2016.
- [4] M. Mori, et al., Proc. on IEICE Gen. Conf B-1-206, March 2016.
- [5] WIPL-D Pro v11.1: <http://www.wipl-d.com>.

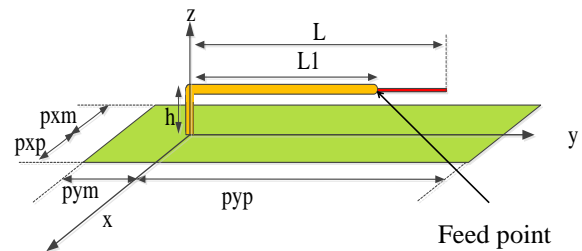


Fig. 1: Transmitter and receiver antennas.

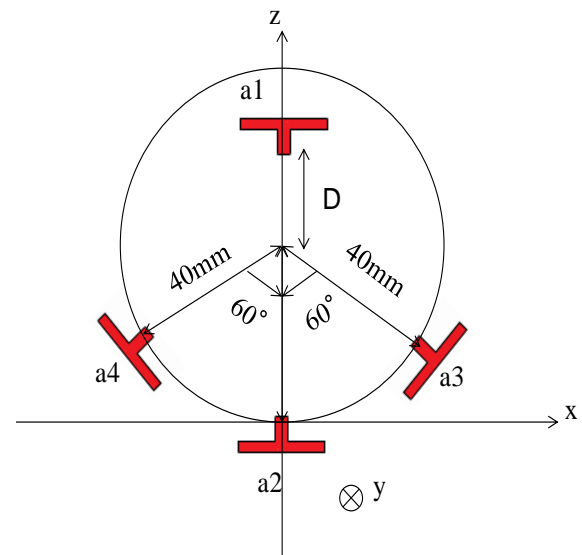


Fig. 2: Cross-sectional view of antennas seen from y direction

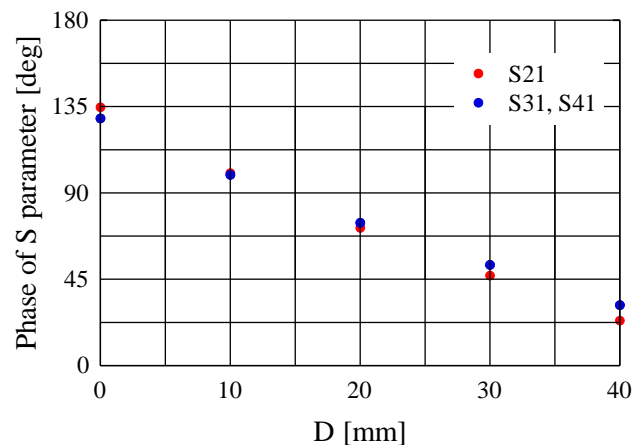


Fig. 3: Calculated phase of S parameters