Study on Leaky-wave Antennas Using Water-slab

Lin Zhang[1], Hiroyasu Sato[2] and Qiang Chen[3]

[123]Department of Communications Engineering, Graduate School of Engineering, Tohoku University

1. Abstract

In this report, the LWA structure with lossy water as a dielectric slab, named as the Water Leaky-wave antenna (WLWA) is proposed.

Four frequency band WLWAs are evaluated respectively to explore the effect of water loss on leaky-wave antenna gain.

2. Structure of WLWA

The structure of WLWA is shown in Figure 1. Leaky wave antenna (LWA) with high relative permittivity slabs was reported [1]. There was a method involving the addition of a slab to significantly improve gain was proposed [2]. By choosing the thicknesses h and the height d appropriately by

$$d = \frac{m\lambda_0}{2} \qquad (1)$$

$$h = \frac{(2n-1)\lambda_0}{4\sqrt{\varepsilon_r}} \qquad (2)$$

where m, n are positive integers. Water is placed at a distance d from the ground plane and is used as a slab. A patch with a length L_p is placed at a distance g_2 from the ground plane. An acryl case is used as a container for carrying the water.

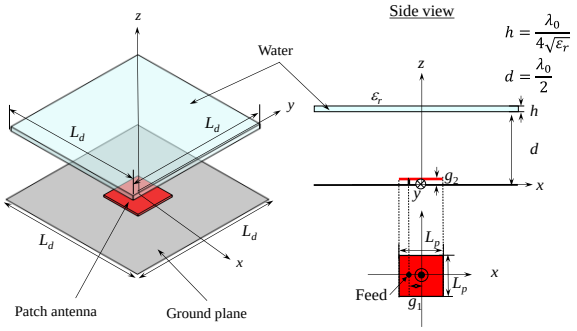

Fig.1. Structure of WLWA

3. Results of experiment

Gain increases in presence of water slab. Antenna 2 GHz will reach the maximum gain 17.1 dBi at 2.06 GHz. 7dB increased compared with the case of patch only at 2 GHz. Gain decreases sharply at 2.5GHz because loss of water is large in high frequency. Therefore, the WLWA can be applied at 2 GHz and L_d/λ_0 is 3 on some occasions with high gain requirements.

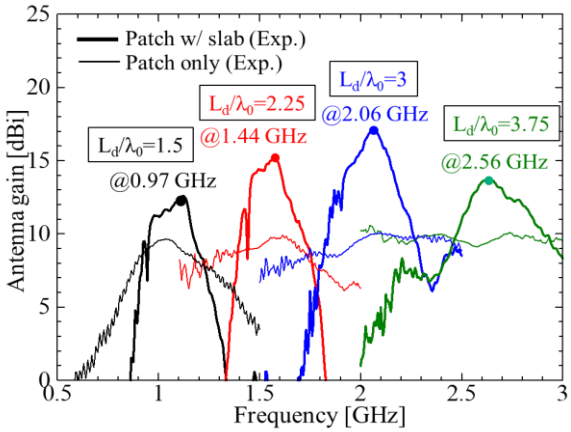

Fig.2. Experimental results

4. Conclusion

In this report, an LWA using water as a slab was evaluated. It was confirmed that WLWA has a maximum gain around 2 GHz considering loss of water. 7 dB increase of antenna gain at 2.06 GHz was obtained even if water loss is included.

Acknowledgment

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References

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