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Compact Ferrite Antenna for T-DMB Applications

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1. Introduction

The frequency of T-DMB (terrestrial-digital multimedia broadcasting) is assigned in the range of 174 MHz to 216 MHz. Therefore, the radiator length of monopole antenna must be 37.5 cm long to meet the T-DMB frequency. Second, an average antenna gain higher than -10 dB is needed to achieve the high quality TV signal at the T-DMB frequency. In this paper, we report a study on design of 1.2 cc volume Co_2Z type ferrite helical T-DMB antenna and antenna performance. This antenna shows a minimum average gain of -9.67 dB in T-DMB frequency range.

2. Experimental

We have fabricated two different types of helical antenna using a low loss Co_2Z hexaferrite [1-3] for radiation efficiency measurement. One is a helical 9-turn, 0.75 mm wide radiator and the other 1.6 mm wide radiator, while maintaining 40 × 10 × 3 mm^3 of the antenna volume. The antenna radiation efficiency was evaluated by using a Wheeler cap system [4] that is connected to a network analyzer. Experimental set-up is shown in Fig. 1.

3. Results and discussion

A grounded ferrite substrate for a T-DMB antenna was made from 83% pure Co_2Z type ferrite particles. The magnetization and coercivity of the Co_2Z ferrite substrate are 47.3 emu/g and 6.47 Oe, respectively. The Co_2Z type ferrite substrate shows 9.67 of the permeability and 0.016 of loss tan δ_μ at 195 MHz, which is the central frequency of T-DMB. The measured radiation efficiency and estimated average gain of the Co_2Z type ferrite antenna are shown in Fig. 2. The radiation efficiency at 195 MHz is 14.3 %, which gives - 8.45 dB of an average gain. A minimum average gain was found to be -9.67 in the T-DMB frequency range. As shown in Fig. 2, the radiation efficiency and average gain of 1.6 mm wide radiator is lower than those of 0.75 mm wide radiator in the T-DMB frequency range. It is noted that an increase in the width of radiator degrades the radiation efficiency, and consequently an average gain of the antenna is lowered. This is attributed to an increase in interference and electromagnetic coupling between helical lines.

4. Conclusion

We have fabricated Co_2Z ferrite IL helical antennas to characterize their performance in the T-DMB frequency range. The static and dynamic magnetic properties of the Co_2Z type ferrite substrate is found to be suitable for T-DMB antenna applications. Measured radiation efficiency and average gain of the Co_2Z ferrite antenna suggests that further miniaturization of T-DMB antenna is possible.

5. References

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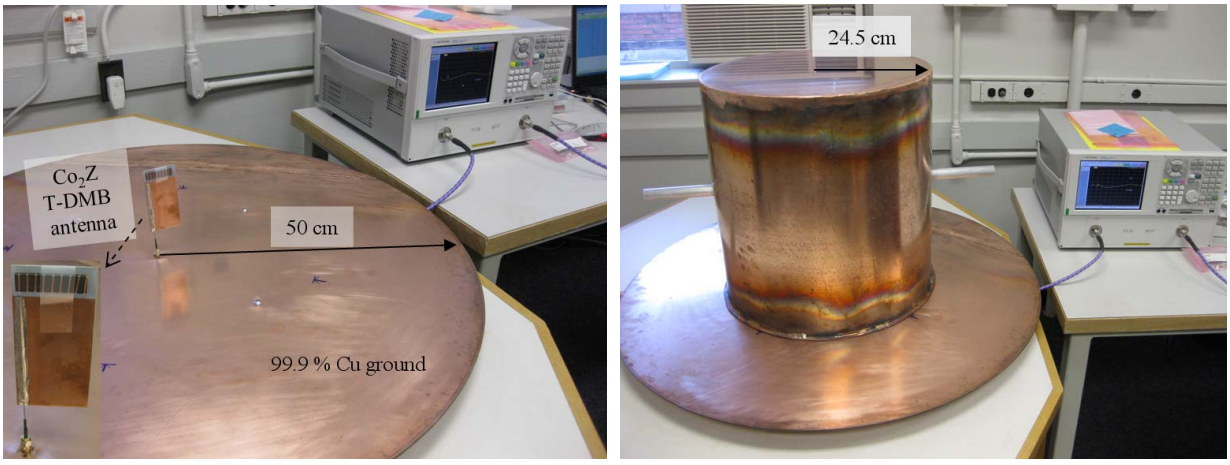

(a) (b)

Fig. 1. (a) Co_2Z ferrite antenna on a Cu ground having one meter in diameter and (b) a Wheeler cap system for radiation efficiency measurement and a Co_2Z type ferrite antenna is located inside the Wheeler cap.

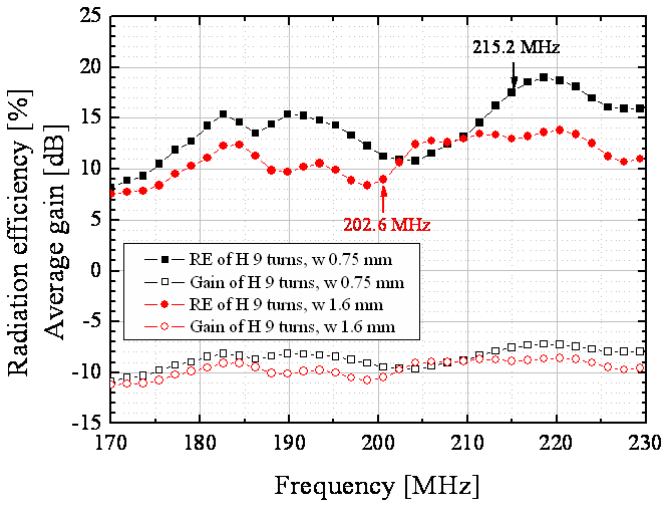

Fig. 2. Frequency dependency of radiation efficiency and average gain of Co_2Z ferrite helical antenna.