TABLE I
MEASURED AND SIMULATED GAIN OF THE PROPOSED TILTED BOW-TIE ANTENNA AT VARIOUS FREQUENCIES

Freq. (GHz)	Simulated peak gain (dB)	Measured peak gain (dB)
58	11.9	11.5
60	12.4	12.0
62	12.5	12.0
64	12.1	11.7

of both antennas. The measured loss due to SIW and 1.85-mm end-launch connectors, shown in Fig. 21, is 2–2.5 dB over the frequency range of 57–64 GHz. This loss was taken into account in the gain measurement. It is important to mention that in the simulation, we have used wave ports on both ends of the SIW structure shown in Fig. 21, and the simulated antenna gain takes into account the SIW loss.

The measured peak gains of the proposed antenna are given in Table I. The discrepancy between simulation and measurement results is about 0.5 dB.

VIII. CONCLUSION

A modified bow-tie antenna structure is proposed for high-gain performance across 57–64 GHz. The antenna consists of a pair of tilted bow-tie radiators, where each radiator is etched on the opposite side of the common dielectric substrate and fed through SIW feed-line. The bow-tie radiators are arranged to cross each other symmetrically to enhance the antenna gain and to obtain the required radiation pattern. It is shown that the antenna gain can be significantly enhanced by loading the antenna with an array of ZIM unit-cells that are implemented laterally to the radiators. In addition, DGRs are employed to reduce the BLL of the antenna. The antenna exhibits a measured gain of 11.5–12 dBi over the frequency range of 57–64 GHz with reflection coefficient less than -11 dB. The proposed antenna is simple to design and inexpensive to fabricate. The characteristics of the antenna make it suitable for application in 60 GHz indoor wireless communication systems.

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A Compact Dual-Band Printed Yagi-Uda Antenna for GNSS and CMMB Applications

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***Abstract*—A printed Yagi-Uda antenna with a meandered driven dipole and a concave parabolic reflector is proposed for dual-band operations of L1-band Global Navigation Satellite System (GNSS) and S-band China Mobile Multimedia Broadcasting (CMMB). The antenna is designed and fabricated on a thin dielectric substrate, and measured at 1580 MHz in the low band (L1-band) and 2645 MHz in the high band (S-band), respectively, with directivities of 6.7 and 4.9 dBi, front-to-back ratios of 13.1 and 10.3 dB, cross-polarization levels of −23.8 and −21.9 dB, bandwidths of 4.0% and 6.5%, and antenna efficiencies of −0.40 dB (91.2%) and −0.96 dB (80.2%), which are better than −1 dBi in terms of the three-dimensional (3-D) average gain. The occupied area of this dual-band antenna is the same as that of the previously proposed single-band one. With these properties, the proposed antenna is promising for combo applications of L1-band GNSS and S-band CMMB.**

***Index Terms*—Endfire antennas, microstrip antennas, multifrequency antennas, Yagi-Uda antenna.**

I. INTRODUCTION

Because of the increasing demand on the L1-band Global Navigation Satellite System (GNSS) functions [1]–[5] and the emerging and promising digital TV broadcasting services of the S-band China Mobile Multimedia Broadcasting (CMMB) in China [6]–[14], portable devices, such as smart phones, tablets, notebooks, and navigators, are needed to have embedded antennas to operate at both

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