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IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Advance Higher Throughput Communications and Networks for GEO and LEO satellites (3)

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FUNDAMENTAL STUDY ON L/KA DUAL-BAND PLANAR ANTENNAS FOR NON-TERRESTRIAL NETWORKS

Abstract

In recent years, with the development of non-terrestrial networks (NTN), the demand for small, lightweight, high-gain antennas suitable for aircraft, self-driving cars, drones, etc. has been increasing. In addition, antennas must be able to use multiple frequency bands to keep up with changes in the communication environment and communication demands. One example is the combined use of the Ka band and the L band. Although the Ka band is capable of high-speed, large-capacity communication, it is susceptible to rainfall and other factors and may lack stability. On the other hand, the L band is stable but not suitable for high-speed, large-capacity communication. If these bands can be used together, the communication environment provided to a mobility can be made more stable. However, since the installation space for antennas in a mobility is limited, if antennas are independent for each frequency band, it is necessary to reduce the area of the antenna by the number of corresponding frequency bands. And it is difficult to cover very distant frequency bands such as the Ka band and the L band with a wide-band antenna. In order to solve this problem, this research proposes a design that integrates Ka-band and L-band antennas into a multi-layer substrate structure. It is possible to change the antenna configuration for both Ka-band and L-band antennas in a scalable without re-design to construct array antenna. As for the structure of proposed antenna, the Ka-band antenna is a 256 element array using a circularly polarized patch antenna, and the L-band antenna is a single-element patch antenna. By applying a sequential array antenna system to the Ka-band antenna, a broadband axial ratio characteristic is ensured. In addition, by making the Ka-band antenna function as a parasitic element of the L-band antenna, the gain of the L-band antenna is improved. The performance of the fabricated proposed antenna is evaluated in an anechoic chamber. The Ka-band antenna has an operating band of 29.5 to 30.0 GHz and an in-band radiation gain of more than 20.0 dBic. The L-band antenna has an operating band of 1.62 to 1.66 GHz and an in-band radiation gain of more than 5.0 dBi. With the results of this research, we have been able to present a new solution to the problems of miniaturization and structure optimization for conventional dual-band antennas, and to provide design guidelines for practical dual-band antennas in NTN.