A Ku-Band Omnidirectional Circularly Polarized Antenna for Telemetry Applications in Satellite Communication

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Ku-band is a frequently used frequency band especially satellite communication application. Telemetry systems collecting measurement or other kind of data are important part especially in the space segment of satellite communication. The antennas in telemetry systems are usually desired to have omnidirectional characteristics in one (usually azimuth) direction. The necessity is much more essential in satellites such that the received/transmitted signal level of satellite should not decrease significantly as the satellite rotates around its rotation axis. Besides, the antennas in satellites are required to have circular polarization to get from incoming linearly polarized wave in any orientation angle without any significant power fluctuations.

This study describes about a Ku-band antenna with almost circular polarization in omnidirectional azimuth direction. The antenna structure contains two sections of inclined slotted array in a circular waveguide. The waveguide is terminated with short circuit and two sections are spaced by $\lambda_g/4$ to provide 90° phase shift between the sections. The inclined slots are cut in a slanted way (+45° and -45° for the first and second sections) to satisfy orthogonal linear polarizations between the sections. The slots in each section are oriented to have circular symmetry and they are radiated into the radial waveguides to provide as omnidirectional characteristics in azimuth plane as possible. The structure is fed a rectangular waveguide and a rectangular-to-circular waveguide transition. Here, the dominant TE_{10} mode of rectangular waveguide is converted to nondominant and symmetric TM_{01} mode of the circular waveguide by suppressing the effect of the dominant TE_{11} mode of the circular waveguide as possible.

The presentation at the meeting will cover much more details about the information and explanation of the designed antenna structure, and its corresponding results. However, the important ones of these results, which are obtained by the simulations carried out in CST Microwave Studio at Ku-band, can be briefly stated here such that 10 dB return loss bandwidth of the antenna structure is about 4-5 percent, which is usually sufficient for the most of the satellite communication applications in Ku-band. Besides, the axial ratio performance of the antenna is also good that it is approximately at most 4 dB within the most part of the frequency bandwidth. The gain of the antenna is about 4 dBi on the average, and the azimuth plane radiation patterns are found to be omnidirectional with low ripple values in the full coverage of 0° to 360°. Therefore, the proposed antenna structure can be considered as a suitable alternative for the telemetry systems in satellite communication applications.