An Extension of Microstrip Grid Array Antenna to Microstrip Mesh Array Antenna for 94-GHz Applications

Chen Zihao, Zhang Yue Ping
School of Electrical and Electronic Engineering
Nanyang Technological University
50 Nanyang Avenue, 639798, Singapore

The 94-GHz band has received considerable attention in recent years, due to its short wavelength and low atmospheric loss. The Federal Communication Commission (FCC) has allocated the 94-GHz band from 92 GHz to 95 GHz for applications of imaging to display hidden contraband, weapons and nonmetal objects but also for point-to-point communications and point-to-multipoint communications. All these applications require high-gain, compact, and easily fabricated antennas which constitute one of the most important parts of such systems.

Most reported 94-GHz antennas suffer from low radiation efficiency and bulky volume due to complicated feeding networks and sophisticated realization. To avoid such disadvantages, in this paper, we first report a 94-GHz single linearly-polarized microstrip grid array antenna in LTCC and then we extend it into a 94-GHz dual linearly-polarized microstrip mesh array antenna. We show that the design of the dual linearly-polarized microstrip mesh array antenna is more involved as it requires the impedance-matching technique using the stubs. We highlight that the dual linearly-polarized microstrip mesh array antenna not only has the usual advantages of the single linearly-polarized microstrip grid array antenna such as high gain, light weight and simple probe feeding but also provides more advantages for its capabilities to support the simultaneous reception of two orthogonal polarizations or transmission in either of these polarizations.

The microstrip grid array antenna achieved a simulated maximum realized gain of 17.2 dBi at 94 GHz, a 10-dB impedance bandwidth of 7.35% and 3-dB gain bandwidth of 6.74% at 94 GHz. The dual linearly-polarized microstrip mesh array antenna achieved a simulated maximum realized gain of 13.5 dBi at 93.2 GHz, a 10-dB impedance bandwidth of 6.91% and 3-dB gain bandwidth of 3.19% at 94 GHz as a two-port antenna and a simulated maximum realized gain of 14.4 dBi at 93 GHz, a 10-dB impedance bandwidth of 6.91% and 3-dB gain bandwidth of 2.18% at 94 GHz as a one-port antenna.