5G mmWave Antenna Implementation for a Commercial Tablet

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The 5th generation (5G) mobile communication systems has been discussed to meet the demand for exponentially increasing traffic and faster network speed. As one of the candidate frequency, recent studies demonstrate the feasibility of 28 GHz frequency band for 5G cellular applications. Also lots of companies have kicked off large-scale research and development to launch mmWave 5G wireless broadband technology. Especially, Samsung Electronics has developed world first 5G tablet to give a demonstration in winter Olympic Games which will be held in South Korea. For the first time, this paper demonstrates novel 28 GHz phased array antenna suitable for future 5G cellular tablet devices.

The omnidirectional patterns of 3/4G cellular phone antennas today are advantageous, likewise, at mmWave frequencies the incoming waves on the antenna are predicted to be distributed across the entire sphere. To receive these signals, four end-fire array antenna has to be located in the each corner of the tablet. Although power consumption and cost are huge to implement this configuration, it can reduce hand effects and maximize gain coverage.

Due to the high signal attenuation at 28 GHz, the antenna must be placed in very close proximity to the 28 GHz RFIC and the front-end module. Implementing the antenna array directly on the printed circuit board (PCB) of the 5G cellular device will therefore keep the insertion loss between the antenna and RFIC to a minimum. Taking these into consideration, a minimum set of two 28 GHz antenna arrays is proposed for mmWave 5G cellular applications. For polarization-multiplexing-based multiple-input multiple-output (MIMO) systems, vertical and horizontal antenna arrays are realized simultaneously. As the thickness of cellular phone PCBs are thinner than 1 mm and the free-space half wavelength is larger than 5 mm, it is difficult to implement dual polarized antenna embedded in the PCB.

In this paper, 4 x 1 vertical and horizontal polarized antenna array structures are presented. A proposed structure of antenna feeding network is realized in the multi-layered PCB substrate. Using the novel structure, the radiators of vertical and horizontal polarization antenna are implemented. The design procedures, the simulation results, and the measured results will be discussed in the presentation.