

Design and Analysis of Mobile Phone Antenna System with Integration of LTE 4G, Sub-6G and Millimeter Wave 5G Technologies

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Abstract - In this paper, a mobile phone MIMO antenna system with combinations of LTE, sub-6G and millimeter wave 5G is proposed and analyzed. With advanced tunable, decoupling and beam-steering technologies, the results showed that it is possible to design 4x4 LTE, 8x8 sub-6G and 4x4 millimeter wave 5G antenna systems with desired performance for future's 5G mobile applications.

Keywords— LTE, MIMO, sub-6G, 5G, beam-steering;

INTRODUCTION

Ever since Qualcomm and Intel released their 5G modem and RF frond end chip and module, 5G is on the fast speed track to deploy for commercial applications. Sub-6G mobile phones are reported to launch in Chinese market and millimeter wave 5G adopted phones are tested in the regional network in San Francisco, USA in 2018. The reported results showed that 5G indeed has 10x more data rate transfer than LTE and it becomes very important for future high date application areas like VR, HD video, remote medical surgery and beyond.

One the other hand, because of limitation of the 5G millimeter with big loss for long distance communication, it is clear that the future mobile phone should have co-existed design with LTE, sub-6G and millimeter wave solutions, also, with the combination of MIMO and Carrier Aggregation (CA) to provide a comprehensive solution for all the communication circumstances to provide excellent signal quality and less response latency [1], this is means that more antenna and RF circuits are required design to fit in the very compacted volume in the today's mobile phone. The outstanding challenges are many, such as how to design multi-band LTE and sub-6G MIMO antennas with high isolation and compact size, dual-band dual-polarized beam-steering millimeter wave RF module with compact size, high gain, wide beamwidth coverage, and very importantly, the whole antenna system's

analysis and combability study to maximum performance for free space, hand-held and regulation requirements. [2-5]

In this paper, we proposed a mobile phone antenna system with combinations of LTE, sub-6G and millimeter wave 5G solutions for future applications. The LTE antennas include 2x2 full band MIMO (from 699 to 2700 MHz) and 4x4 high band MIMO (from 1710 to 2690 MHz) with advanced low loss tunable technologies, the Sub-6G antennas include 8x8 MIMO with tri-band support (Band 41/42/43) with advanced LCP (liquid crystal polymer) materials, the millimeter wave 5G antennas is 4x4 MIMO where each is an active antenna and RF module operating at 24.75 to 27.5 GHz with 10 dBi gain and beam scanning angle from -60° to 60° . Many studied were given to solve the system integration and interference issues to achieve good performance and implementation to meet the industrial requirements and standards. The final design and technical discussion will be reported in details at the conference.

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