

# Extra Compact Two Element Sub 6 GHz MIMO Antenna for Future 5G Wireless Applications

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**Abstract**—In this paper, a single band two element MIMO antenna for future 5G wireless applications at 5 GHz is presented. The antenna consists of T over T shaped meander microstrip lines printed on the front side and defected ground structure on the back side of an RT Rogers 5880 substrate, which are able to excite a resonance mode. The antenna operates at 4900 to 5060 MHz ( $|S_{11}| < -10$  dB) covering the 5G NR band n79. The antennas are to be placed symmetrically along the edges at the corners of the Smartphone panel. The isolation in the case of two elements MIMO antenna is enhanced by an I-shaped ground slot. The mutual coupling reduction is facilitated by 10 mm neutralization line (NL) at both hands. The prototype is fabricated to validate the proposed model. The measured results show good accordance with simulated results. The main performance results wherever possible of the proposed design are calculated, compared, and analyzed with the measured results.

## 1. INTRODUCTION

The enhancement of the transmitting and receiving efficiencies of a wireless mobile communication network remains the biggest worry as the demand of intelligent services and high data rate increase day by day. In order to address the concern, various techniques have been introduced like implementation of multiple input multiple output (MIMO) antenna transmission technique. MIMO antenna effectively improves the spectral efficiency and channel capacity resulting in significant increase in LTE applications and will be one of the vital technologies in 5G communication [1]. The various constraints that need to be considered while designing an antenna like size, high isolation, ease of fabrication, ease of integration, and low profile must be overcome in order to qualify the design for MIMO antenna system for smartphones [2]. The 5G new radio (NR) frequency band is further divided into two sub frequency band, frequency range one (FR1) working in sub 6 GHz (or  $> 6$  GHz band) and frequency range two (FR2) working in millimeter range (mm-Wave band) as per Technical Specification (TS) 38.101 of 3rd Generation Partnership project (3GPP) [3]. Various techniques and methods have been reported in recent times for 5G MIMO antenna arrays for smartphone handsets operating in sub-6 GHz band [4–9]. These MIMO antenna designs resonate at single frequency band at sub-6 GHz bands like 2.55–2.65 GHz, 3.3–3.6 GHz and are fit for mobile phones without metal frame, and some are suitable for mobile phone with metal frames [10–13].

The design of a MIMO system for 5G mobile terminals is a challenging task since the positioning of the antenna elements in a small space results in poor isolation, in turn altering the system performance characteristics. Various efficient methods have been proposed to reduce mutual coupling and enhance isolation such as defected ground structures (DGSs), lumped elements, neutralization line, and electromagnetic band gap structures. Reportedly, several studies and antenna element structures

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