
PREFACE

Stepping in the new generation of mobile communication, multiple antennas are gaining interests because of their dramatic increase in capacity and data transmissions without the need of additional power or spectrum in rich scattering environment. However, the issue of signal fading in rich scattering multipath environment still a major problem for mobile communication. By the use of multiple antenna systems inside mobile communication systems, multipath signal fading problem can overcome. In the multiple antenna system, number of antennas are placed at both transmitter and receiver side. Especially, in the case of mobile phone devices, space availability is very limited. However, the placement of multiple antennas with multi standard inside the mobile phone is one of the major challenges. The challenge may be in terms of size of antenna, isolation between multiple antennas, users' body losses, and performances degradation of multi antenna systems. The aims of this thesis are to design and development of the multiband diversity antenna with sufficient isolation for different wireless communication bands. The investigation of multiband MIMO antenna in actual scenario is also part of this thesis. The actual scenario is considered as actual mobile platform and presence of user proximity. All the investigations of MIMO/Diversity antenna system are given in different chapters.

The historical background of electromagnetic, wireless communication, and multiple antenna systems with fundamentals of MIMO wireless technology are introduced briefly in the first chapter. Some of the promising internal antenna structures which are considered for this thesis and elaborated with design concept and special features. In addition to this, various isolation enhancement techniques are also part of this chapter. In the last section of chapter one, brief literature review of relevant topics are given.

In the chapter two, various figure-of-merits of MIMO/Diversity antenna i.e. diversity performances and MIMO performances are discussed. In the presence of

users' body, parameters i.e. Specific Absorption Rate (SAR) and Total Radiated Power (TRP) are considered and discussed in this chapter.

The dual-band MIMO/Diversity antenna with high isolation is presented in the chapter three. To design the MIMO configuration, Planar Inverted-F Antenna (PIFA) structures are chosen. The proposed MIMO antenna is operated over WLAN frequency band with below -20dB isolation. The folded shorting strip is designed for isolation enhancement between multiple antennas. To make low profile, the proposed antenna structure uses 0.2mm thick copper sheet. All the diversity parameters of the proposed antennas are calculated in free space. Further, investigations are carried out in the presence of users' body and results make promising candidate for mobile handset applications

Further, chapter four tells about the compact highly isolated miniaturized triple-band MIMO/Diversity antenna. The isolation improvement is done by using folded shorting strip which is placed at the edge of the PIFA structure. The study of folded shorting strip is carried out in the user proximity to analyse the isolation variation. Some of the parametric investigations are carried out to optimize the antenna shape parameters to get the desired operating bands. All the performance parameters i.e. *S*-parameters, radiation performances, diversity performances, surface current distribution, SAR, and TRP are presented.

In the chapter five, quad-band PIFA implemented with MIMO configuration for next generation mobile handset applications is presented. The application platform of the quad-band MIMO antenna is GPS L1/ Bluetooth/ LTE2500/ WiMAX/ HiperLAN applications. Further, to check the robustness of the proposed antenna, three commonly used configurations namely, Talk mode, Data mode, and Read mode are considered by placing the antenna at top as well as bottom of the mobile circuit board. All the diversity parameters, SPLSR, and TRP are calculated in the user proximity.

Chapter six deals with planar monopole MIMO/Diversity antenna for LTE mobile handset applications. The desired operating bands of the proposed planar

monopole MIMO antenna are LTE700, GSM1700, GSM1800, UMTS, Wi-Fi, Bluetooth, LTE2300, and LTE2500. The proposed antenna is analysed in free space as well as in user proximity. User proximity is considered similar to chapter five and investigations are carried out.

Finally, chapter seven drawn major findings and summaries the entire investigations which also emphasize the future research of the relevant topic.