Chapter 1

Introduction...1

1.1 Introduction....3
1.2 Over view of Antenna Research....4
1.3 Small mobile terminal antenna performance and effect of ground plane....6
1.4 State of the art technologies....7
1.5 Microstrip Antennas....9
1.6 Planar Inverted F Antennas....11
1.7 Metamaterial Antennas....12
1.8 Coplanar waveguide (CPW) and its application in antennas....14
  1.8.1 Types of Coplanar Waveguide....16
  1.8.2 Field distribution in CPW....16
  1.8.3 Applications of CPW....17
1.9 Motivation of present Research....19
1.10 Thesis Organization....24
1.11 References....26

Chapter 2

Review of Literature....31

2.1 Introduction....33
2.2 Antennas for mobile applications....33
2.3 Multi-band antenna design techniques....39
4.2 Three dimensional FDTD method...103
  4.2.1 Finite Difference Equations...104
  4.2.2 Stability criteria...106
  4.2.3 Numerical dispersion...106

4.3 Absorbing Boundary conditions...107
  4.3.1 Mur’s first order ABC...109
  4.3.2 Perfectly Matched Layer (PML)...110

4.4 PML for Finite Difference Time Domain technique...111

4.5 Lubbers feed model for fast FDTD convergence...123
  4.5.1 Resistive source model...124
  4.5.2 Staircase transition for microstrip line feed...126

4.6 Excitation functions...127
  4.6.1 Gaussian pulse...128
  4.6.2 Sine function...128

4.7 General Flow chart of FDTD algorithm...129

4.8 Return loss calculation...130

4.9 References...131

Chapter 5

Investigations on Coplanar Waveguides (CPW)...133

5.1 Introduction...135

5.2 Resonance and radiation from finite ground open circuit CPW...136
  5.2.1 Return loss characteristics...137
  5.2.2 Far field radiation...138
  5.2.3 3D radiation pattern...139
  5.2.4 Gain and Efficiency...140
  5.2.5 Conclusions...141

5.3 Resonance and radiation from offset fed open circuit CPW...142
5.3.1  FDTD analysis of offset fed open circuit CPW.....143

5.3.1.1 Description of the problem and excitation schemes....143
5.3.1.2 FDTD flow chart.....146
5.3.1.3 Input Gaussian pulse.....148
5.3.1.4 PMT coefficients.....149
5.3.1.5 Computed time domain characteristics at feed point.....152
5.3.1.6 Return loss characteristics and input impedance.....154
5.3.1.7 Computed fringing electric field values at the gaps.....156
5.3.1.8 Conclusion.....162

5.4 Parametric analysis.....163

5.4.1 Effect of CPW length on resonance and radiation efficiency.....163
5.4.2 Effect ground strip width resonance and radiation efficiency.....164
5.4.3 Effect of centre strip width on resonance and radiation efficiency.....165
5.4.4 Effect of substrate εr & thickness on resonance.....166

5.5 Far field radiation and polarization.....168

5.6 Current distribution.....170

5.7 Radiation pattern and gain.....172

5.8 Equivalent circuit representation and radiation mechanism.....173

5.9 Conclusions.....178

Chapter 6

Development and analysis of a Compact

Microstrip-fed Dual-band Coplanar Antenna.....181

6.1 Introduction.....183

6.2 Offset fed coplanar geometry with wide centre strip width.....184

6.3 Dual-band coplanar antenna configuration.....194

6.3.1 Microstrip line feed.....195
6.3.2 Ground plane and its importance in the present design.....196
6.3.3 Conducting pins or vias.....199
6.3.4 Antenna configuration.....200

6.4 FDTD analysis of coplanar antenna.....202
Appendix A
Compact planar Multi-band Antenna for GPS, DCS, 2.4/5.8 GHz WLAN applications.....265

A.1 Introduction.....267
A.2 Antenna Design.....267
A.3 Results and discussions.....269
A.4 References.....273

Appendix B
Compact Amplifier Integrated Microstrip Antenna.....275

B.1 Introduction.....277
B.2 Active Antenna Design.....278
B.3 Results and discussions.....280
B.4 References.....282

List of publications of the author.....283
Resume of the author.....287
Index.....291