LIST OF FIGURES

Figure 1.1:	Signal combining on receiving uncorrelated fading branches [Vaughan and Andersen (2003)].	5
Figure 1.2:	*M* x *N* MIMO antenna system.	6
Figure 1.3:	Schematic of a repeater system.	10
Figure 2.1:	Top view of the unit cell of the proposed absorber structure.	29
Figure 2.2:	Reflection coefficient and absorption characteristics of the proposed structure.	31
Figure 2.3:	Normalized input impedance of the proposed structure.	32
Figure 2.4:	Effect of varying (a) 'p' (b) 'l_p' (c) 'g_1' (d) 'w_d' (e) 'w_c' on the reflection characteristics.	34
Figure 2.5:	Dielectric power loss density and surface power loss density for the (a) first absorption band and (b) second absorption band.	35
Figure 2.6:	Effect of varying substrate thickness 't' on the (a) reflection characteristics (see inset for the zoomed view of response at second absorption frequency) and (b) $Re(Z)$ of the structure.	37
Figure 2.7:	Effect of varying dielectric loss tangent '$tan\delta$' by keeping ε_r constant (ε_r = 4.4) on the (a) reflection characteristics, and (b) $Re(Z)$ of the structure.	37
Figure 2.8:	*E*-field distributions at the peak absorption frequencies.	39
Figure 2.9:	Surface current distributions on the top and bottom layers of the proposed absorber at the peak absorption frequencies.	39
Figure 2.10:	Simulated reflection response under the variation of polarization angle 'ϕ'.	40
Figure 2.11:	Extracted constitutive parameters of the proposed structure, (a) real part of ε_{eff} and μ_{eff}, and (b) imaginary part of ε_{eff} and μ_{eff}.	42

Figure 2.12:	Experimental setup.	43
Figure 2.13:	Measured and simulated reflection response for normally incident wave.	44
Figure 2.14:	Measured and simulated reflection response for oblique incidence of (a) 15^0 (b) 30^0 (c) 45^0 (d) 60^0.	46
Figure 3.1:	Side view of the MTM absorber and its transmission line equivalent model.	52
Figure 3.2:	Decomposition of the proposed FSS into simpler structures (t = 0.8 mm and l = 11.6 mm).	52
Figure 3.3:	Surface current directions in the periodic square-shaped CRR structure.	57
Figure 3.4:	(a) Even and (b) odd mode coupling capacitance, (c) equivalent circuit of the FSS1.	57
Figure 3.5:	Microstrip bend and its equivalent T-network.	58
Figure 3.6:	Reflection response of the absorber1.	58
Figure 3.7:	Equivalent circuit of the FSS2.	60
Figure 3.8:	Reflection response of the absorber2.	60
Figure 3.9:	Surface current direction on the absorber top layer at 7 GHz (nodes 1-2: for FSS1, nodes 3-4: for FSS2, nodes 5-6: for proposed FSS).	62
Figure 3.10:	Proposed equivalent circuit model of the FSS used in dual-band absorber structure.	62
Figure 3.11:	Simulated and calculated reflection response of the proposed absorber structure.	63
Figure 4.1:	Electric resonator of the proposed absorber unit cell.	67
Figure 4.2:	Simulated absorption response of the proposed absorber.	68
Figure 4.3:	Normalized input impedance of the proposed absorber.	69
Figure 4.4:	Effect of varying (a) 'l_s', (b) 'lp', (c) 'w_d' on the reflection	71

characteristics.

Figure 4.5: Maximum values of dielectric and ohmic losses at the peak absorption frequencies. 72

Figure 4.6: Electric field distribution on the proposed structure at the peak absorption frequencies. 73

Figure 4.7: Surface current distribution at the resonator and backplane of the proposed structure. 74

Figure 4.8: Reflection response of the proposed absorber under the variation of polarization angle (ϕ). 74

Figure 4.9: Simulated reflection response of the proposed absorber with the variation of incident angle (θ) for (a) TE polarization and (b) TM polarization. 75

Figure 4.10: Measurement setup and fabricated sample. 77

Figure 4.11: Comparison of simulated and measured reflection responses. 77

Figure 5.1: (a) Schematic of the proposed MIMO antenna array, (b) enlarged view of single antenna element. 83

Figure 5.2: *S*-parameters of the proposed MIMO antenna array. 83

Figure 5.3: Design of the proposed metasurface unit cell. 86

Figure 5.4: Reflection and absorption characteristics of the proposed metasurface for normally incident (a) TM polarized wave and (b) TE polarized wave. 87

Figure 5.5: Co-polar and cross-polar reflection coefficient under the variation of the angle of incidence for (a) TM polarized and (b) TE polarized incident wave. 89

Figure 5.6: Proposed MIMO antenna array with isolator. 89

Figure 5.7: (a) Simulated reflection coefficients of the proposed antenna conf. 2, comparison of transmission coefficients of the conf. 1 and 2 (b) S_{21}, (c) S_{31}, and (d) S_{41}. 90

Figure 5.8: Surface current distribution in the proposed antenna system 92

by keeping antenna 1 excited and all other antennas matched terminated at (a) 5.25 GHz, and (b) 5.78 GHz.

Figure 5.9: Radiation patterns of the proposed MIMO antenna array at 5.25 GHz for one antenna excited at a time keeping all other matched terminated. 94

Figure 5.10: (a) Radiation efficiency and (b) peak realized gain of the array configuration 1 and 2 for antenna 1 excited and all other antenna elements matched terminated. 94

Figure 5.11: Envelope correlation coefficient between various antenna pairs for the proposed MIMO antenna array. 96

Figure 5.12: Diversity gain between various antenna pairs of the proposed MIMO antenna array. 97

Figure 5.13: Fabricated prototype of the proposed MIMO antenna. 98

Figure 5.14: (a) Reflection and transmission coefficient characteristics (b) S_{21}, (c) S_{31}, (d) S_{41} of the proposed MIMO antenna. 98

Figure 5.15: Measured radiation pattern of the proposed MIMO antenna array (conf. 2) by exciting one antenna element and keeping all other matched terminated. 99