

LIST OF FIGURES

2.1	Top view of antenna (a) , Bottom view of antenna (b)	7
2.2	Multilayer FSS System Design	9
3.1	Antenna Design Flowchart	10
3.2	Circular Patch Antenna	11
3.3	Planar monopole antenna with circular patch	14
3.4	FSS Design concept on top and side view	14
3.5	FSS Design Flowchart	15
3.6	Antenna initial on top and bottom view	16
3.7	VSWR simulation result in initial antenna	17
3.8	The Picture of Antenna in Iteration 1	18
3.9	VSWR Simulation Result in Iteration 1	19
3.10	Antenna in Iteration 2	19
3.11	VSWR simulation result in iteration 2	20
3.12	Antenna in Iteration 3 on top and bottom view	21
3.13	VSWR Simulation Result in Iteration 3	22
3.14	Gain Simulation Result in Iteration 3	22
3.15	Unit Cell of FSS First and Second Layers	23
3.16	Antenna with FSS Initial Design	23
3.17	VSWR Simulation Result of Antenna and initial FSS Design	24
3.18	Gain Simulation Result of Antenna and initial FSS Design	25
3.19	Antenna with FSS in Iteration 1	25
3.20	VSWR Simulation Result of FSS Iteration 1	26
3.21	Gain comparison result in antenna initial and Iteration 1	27
3.22	Unit Cell of First and Second Layers in Iteration 2	27
3.23	Antenna with FSS in Iteration 2	28
3.24	VSWR Simulation Result in Iteration 2	29
3.25	Gain Comparison Result in Iteration 1 and Iteration 2	29
3.26	Unit Cell of First and Second Layers in Iteration 3	30
3.27	Antenna with FSS in Iteration 3	30
3.28	VSWR Simulation Result in Iteration 3	31
3.29	Gain Comparison Result in Iteration 1 and Iteration 3	31
3.30	Unit Cell of First and Second Layers in Iteration 4	32

3.31	Antenna with FSS in Iteration 4	32
3.32	VSWR Simulation Result in Iteration 4	33
3.33	Gain Comparison Result in Iteration 1 and Iteration 4	34
3.34	Printed antenna on top (a) and bottom (b) view	34
3.35	Printed FSS first layer (a) and second layer (b)	35
3.36	Printed Antenna with FSS	35
4.1	VSWR measurement scheme	36
4.2	VSWR measurement result of fabricated antenna	37
4.3	VSWR measurement result of fabricated antenna with FSS	38
4.4	VSWR measurement result antenna alone	39
4.5	VSWR measurement result antenna with FSS	39
4.6	Gain measurement scheme	40
4.7	Radiation Pattern Measurement at Frequency 3.1Ghz	42
4.8	Radiation Pattern Measurement at Frequency 5.8Ghz	42
4.9	Radiation Pattern Measurement at Frequency 8Ghz	43
4.10	Radiation Pattern Measurement at Frequency 10.6Ghz	43
4.11	Simulated and measured VSWR result of antenna with and without FSS	44
4.12	Simulated and measured Gain result of antenna with and without FSS	44
4.13	VSWR variation for different gap distance between the first and second layers	45
4.14	VSWR variation for different gap distance between the first and second layers	45
4.15	VSWR variation for different gap distance between the first layer FSS and antenna	46
4.16	Gain variation for different gap distance between the first layer FSS and antenna	46
4.17	Radiation Pattern at 3.6Ghz azimuth angle (a), elevation angle (b)	47
4.18	Radiation Pattern at 5.8Ghz azimuth angle (a), elevation angle (b)	47
4.19	Radiation Pattern at 8Ghz azimuth angle (a), elevation angle (b)	48
4.20	Radiation Pattern at 10.6Ghz azimuth angle (a), elevation angle (b)	48