

Contents

List of Figures	xi
List of Tables	xv
List of Symbols	xvii
List of Abbreviations	xix
Preface	xxi
1 Introduction	1
1.1 Motivation of the Research Work	6
1.2 Scope of Work	8
1.3 Objectives	8
1.4 Design Methodology	9
1.5 Organization of the Thesis	11
2 Analysis of Substrate Integrated Waveguide (SIW) Antennas and Systems	15
2.1 Substrate Integrated Waveguide (SIW)	16
2.1.1 Operation Mechanism and modes in SIW	18
2.1.2 SIW Transition	20
2.1.3 Loss Mechanism in SIW	22
2.1.4 Bandgap Effect	23
2.1.5 SIW design rules	24
2.1.6 Design of SIW Rectangular Cavity	26
2.2 Review of SIW Cavity-Backed Wideband Slot Antennas (SIW CBWSA)	28
2.3 Review of SIW based Multiplexers	31
2.3.1 SIW based Self-diplexing Antennas (SDAs)	32
2.3.2 SIW based Self-triplexing Antennas (STAs)	34

2.4	Review of SIW based MIMO ANTENNAS	36
3	Substrate Integrated Waveguide Cavity Backed Wideband Slot Antenna for 5G Applications	43
3.1	Introduction	43
3.2	Design of the Proposed Antenna	44
3.2.1	Antenna Configuration	44
3.3	Equivalent Circuit Analysis	50
3.4	Parametric Analysis	52
3.4.1	Influence of cavity width W_{SIW}	54
3.4.2	Influence of arm lengths of U slot	54
3.5	Results and Discussion	55
3.5.1	Matching Characteristics	55
3.5.2	Radiation Characteristics	57
4	SIW based Self-Multiplexed Antennas	63
4.1	A Dual-band Dual-Sense Circularly Polarized Self-Diplexing SIW Cavity-Backed Antenna with Elliptical Slot for Millimeter-Wave 5G Applications	64
4.1.1	Antenna Design	64
4.1.2	Equivalent Circuit Model	70
4.1.3	Parametric Study	72
4.1.4	Experimental Results and Discussion	75
4.1.5	Comparison Analysis	81
4.2	On the behaviour of Self-Triplexing SIW Cavity Backed Antenna with Non-Linear Replicated Hybrid Slot for C and X-band Applications . . .	83
4.2.1	Proposed Antenna Design and Analysis	84
4.2.2	Experimental Validation	95
5	Multiple-Input Multiple-Output Dual-band Dual-Circularly Polarized SIW Cavity-Backed Slot Antenna for Satellite and 5G Systems	105
5.1	Introduction	105
5.2	Antenna Configuration and Design	107
5.3	Equivalent Circuit Analysis	109
5.4	Design Steps and Parametric Study	111
5.4.1	Matching characteristics	112
5.5	Results and discussion	112
5.5.1	Radiation characteristics	115

5.5.2 Diversity performance	115
5.6 State-of-the-art Comparison	121
6 Conclusion and Future Work	123
References	128
List of Publications	148