

Contents

Acronyms	1
1 Introduction	5
1.1 State-of-the-Art of MIMO Signal Processing in DTT Systems	11
1.2 Motivation and Problem Statement	14
1.3 Objectives and Thesis Scope	16
1.4 Research Approach and Methodology	17
1.5 Thesis Outline	19
1.6 Research Contributions	20
1.7 List of Publications	23
2 Preliminaries	27
2.1 System Model Overview	28
2.2 MIMO Channel: Signal model, Gains and Capacity	30
2.2.1 AWGN channel	30
2.2.2 Fading	30
2.2.3 Multiple Antenna Channel	31
2.2.4 MIMO Channel Capacity	34
2.3 A Fundamental Trade-Off and Transmission Approaches	37
2.3.1 Multiplexing-Diversity Trade-Off	37
2.3.2 Space-Frequency Block codes	38
2.3.3 Spatial Multiplexing Techniques	40
2.4 MIMO-BICM: Components and Mutual Information	44
2.4.1 Forward Error Correction	44
2.4.2 Bit-Interleaver	45
2.4.3 Mapping from Bits to Constellation Symbols	46
2.4.4 MIMO Demodulation and Iterative Decoding	48
2.4.5 Mutual Information of MIMO-BICM systems	53
2.5 Quantization	55

CONTENTS

3	MIMO Precoding for Terrestrial Broadcast Systems	59
3.1	Introduction and Scope	60
3.2	Precoding Based on Rotation Matrices	62
3.2.1	BICM Capacity Analysis	64
3.2.2	System Performance	75
3.2.3	MIMO Precoding in DVB-NGH and ATSC 3.0	87
3.3	Precoding Based on Maximum Ergodic Capacity	92
3.3.1	Design of MIMO-Channel-Precoders	97
3.3.2	Capacity Analysis	99
3.3.3	System Performance	104
3.4	Summary and Conclusions	113
4	Receiver Memory and Performance Trade-Off of Soft-Quantized Information	115
4.1	Quantized receiver Architectures	116
4.2	Quantization Algorithms	120
4.2.1	Quantization of I&Q Signal Components	120
4.2.2	Quantization of Log-likelihood Ratios	121
4.3	Performance Evaluation of Quantized Architectures	126
4.4	Memory vs. Performance Trade-Off	134
4.5	Summary and Conclusions	137
5	Conclusions and Outlook	139
5.1	Conclusions	141
5.2	Outlook	145
A	MIMO Channels in Terrestrial Broadcasting: Models and Capacity	149
A.1	Channel Models	150
A.1.1	Basic Models	150
A.1.2	Modified Guilford Rooftop Model	152
A.1.3	Next Generation Handheld Models	154
A.1.4	Extension to Four Transmit Antennas	157
A.2	Ergodic Capacity with Asymptotic SNR	158
A.3	Performance Evaluation	159
A.3.1	Performance evaluation in basic channels	159
A.3.2	Performance evaluation in Terrestrial broadcast channels	165
B	DVB-NGH and ATSC 3.0 MIMO Physical Layers	173
B.1	Generic Transmit MIMO DVB-NGH & ATSC 3.0 Physical layer	174
B.2	Overview of DVB-NGH and ATSC 3.0 Transmitting blocks	174
	References	181