

Contents

List of Figures	v
List of Tables	ix
Acronyms	xi
1 Introduction	1
1.1 Background	1
1.2 Hypotheses and objectives	3
1.3 Thesis outline	4
1.4 Related publications	5
2 Conference Networks	7
2.1 State of the art	7
2.1.1 Conference systems standardisation	7
2.1.2 Real-live deployment - Televic Conference use cases	11
2.2 Conference network essentials	13
2.2.1 Indoor environments description	13
2.2.2 Quantity, placement, and role of the devices	15
2.2.3 Latency in the network	16
2.2.4 Power consumption	17
2.3 Conferencing environments for measurements	21
2.3.1 Meeting room - DUR	22
2.3.2 Meeting room - UPV	23
2.3.3 Auditory, Large classroom, and seminary room - GUT	25
2.4 Summary	31
3 Introduction to mm-wave radio channel at 60 GHz	33
3.1 State of the art	33
3.1.1 Radio channel characterisation	33

CONTENTS

3.1.2	60 GHz frequency band	36
3.1.3	Standards for 60 GHz band	37
3.2	Multipath and directivity	41
3.2.1	Measurements at DUR	41
3.2.2	Measurements at GUT	42
3.3	RMS DS prediction model	46
3.4	Guard Interval prediction	52
3.5	Overhead in the IEEE 802.11	58
3.6	Summary	71
4	Other Millimeter Wave Bands	75
4.1	State of the art	75
4.1.1	Characteristics of mmW bands	76
4.1.2	Materials characteristics overview	77
4.1.3	27 GHz frequency band	78
4.2	Impact of the transmitting antenna	78
4.2.1	Measurements stand	78
4.2.2	Height dependence	81
4.2.3	Position dependence	87
4.2.4	Antenna type dependence	90
4.3	Impact of the propagation environment	93
4.3.1	Measurements stand	93
4.3.2	Maximum relative received power	96
4.3.3	Signal transmission duration dependence on environment's dimensions	98
4.3.4	Mean delay and RMS DS	99
4.3.5	Multipath Components	103
4.3.6	Spatial Correlation	105
4.3.7	Geometry impact	118
4.4	Material characteristics	119
4.4.1	Measurements stand	119
4.4.2	MUT selection	123
4.4.3	Methodology	123
4.4.4	Results and Discussion	124
4.4.5	Summary of material characteristics	131
4.5	Summary	132
5	Networks deployment	137
5.1	State of the art	137
5.1.1	RT simulations	137
5.2	Measurements and simulations comparison	138

CONTENTS

5.2.1	Parameters	139
5.2.2	Environment influence on RMS DS	139
5.2.3	Large environments calibration	146
5.3	RT simulations for the 60 GHz band	152
5.3.1	Comparison with the 27 GHz band	152
5.3.2	Antenna pattern influence	155
5.4	Final guidelines for conferences	157
5.4.1	Deployments	157
5.4.2	Materials	157
5.4.3	Network	158
6	Final Conclusions and Future Work	159
6.1	Concluding remarks	159
6.2	Future works	162
References		163