



TREVOR MANNING

MICROWAVE RADIO TRANSMISSION DESIGN GUIDE

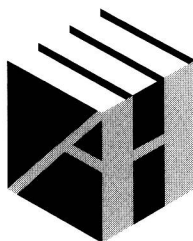
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Microwave Radio Transmission Design Guide

Second Edition

Trevor Manning



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Foreword

Digital microwave radio systems have for many years provided operators with flexible, high-quality, and cost-effective telecommunications network connectivity. Over the years these digital radio systems have evolved in terms of capacity and functionality to such an extent that they can now support all fixed and mobile data and voice applications along with associated transport protocols. Within the mobile backhaul arena, the majority of cell sites around the globe are connected within the access domain by point-to-point digital microwave radio systems. As advanced mobile broadband and VoIP technologies are deployed, there is no reason why microwave radio systems cannot continue to provide this vital connectivity into the operators transport backbone.

This second edition of Trevor's *Microwave Radio Transmission Design Guide* provides all the theoretical and practical advice required for students or practicing engineers to gain the necessary knowledge to start planning and deploying modern digital microwave radio systems.

*Andy Sutton
Principal Design Consultant
Transport Network Design
Orange/France Telecom
July 2009*

Preface

In the preface to the first edition, I mentioned that there was very little practical advice on how to tackle the challenge of upgrading analog radio links to digital. Ten years later, the challenge in the industry is now how to upgrade radio networks to incorporate packet-based traffic, and the majority of the new material addresses this aspect. It is interesting to observe that the backhaul bottleneck is a major strategic issue for operators, and yet despite 70% to 80% of the backhaul in the access network being carried over microwave, little attention is given to the solutions available with this technology. In this second edition, I have also updated the various reference standards and added further real-world examples and formulas so that this book can still be used as a handy reference guide for people designing and maintaining microwave radio systems from UHF up to the millimeter bands. It is my view that the problems in the industry result from a paradoxical mix of attitudes, in which one group feels microwave radio design is so well established as to be trivial, yet often is using outdated analog-based design methods, and another group believes that digital microwave systems are binary in nature and forgets that the RF carrier is still analog and therefore subject to all the adverse affects of a complex analog radio signal traveling in a constantly varying atmosphere and thus having to overcome all the adverse weather effects. A key purpose of this book is to provide a thorough and accurate treatment of the fundamental principles of microwave transmission, which have been forgotten over the years, together with a fully updated approach to what happens in the real world in modern digital radio systems using the latest radio equipment.

I am grateful to the various microwave manufacturers who have provided white papers that have technically supported the new material that I have written. Included in this list are Harris Stratex Inc., Ceragon Networks, Alcatel Lucent,

Dragonwave, RAD, and Cisco. I would also like to thank Eskom, Andrew Antennas, Alcatel, and Microflex for the material that is still relevant from the first edition. Once again I thank the ITU for the documents that form the basis of the design standards I have referenced, together with the Metro Ethernet Forum (MEF) standards for packet-based networks. I thank Andy Sutton from France Telecom, Orange group, for various useful discussions and for writing the foreword of the book. Lastly, I thank my son Sean for the excellent new diagrams he has produced for this new edition of the book.

Microwave Radio Transmission Design Guide

Second Edition

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Contents

	Foreword	<i>xiii</i>
	Preface	<i>xv</i>
1	Introduction	1
1.1	History of Wireless Telecommunications	2
1.2	What Is Microwave Radio?	3
1.2.1	Microwave Fundamentals	3
1.2.2	RF Spectrum	4
1.2.3	Safety of Microwaves	5
1.2.4	Allocation of Spectrum	6
1.2.5	Electromagnetic Wave Fundamentals	7
1.3	Why Radio?	10
1.3.1	Benefits and Advantages of Microwave	10
1.3.2	Transmission Alternatives	11
1.4	Microwave Applications	12
1.4.1	Fixed-Link Operator	13
1.4.2	Utility Private Network	13
1.4.3	TV Distribution Network	15
1.4.4	Mobile Backhaul Network	16
1.4.5	Ethernet Enterprise Application	18

1.5	Planning Process	19
	Reference	20
2	Link Planning	21
2.1	Establish the Planning Brief	21
2.2	Initial Planning	23
2.2.1	Site Location	23
2.2.2	Network Diagram	24
2.2.3	Initial Mapwork	25
2.2.4	Existing Infrastructure and Repeater Sites	26
2.2.5	Route Map	27
2.3	Path Profiles	27
2.4	Radio Repeaters	31
2.4.1	Passive Repeaters	32
2.4.2	Active Repeaters	38
2.5	Radio Surveys	41
2.5.1	Path Survey	41
2.5.2	Site Surveys	42
2.6	Frequency Considerations	44
	References	45
3	Reliability Standards	47
3.1	Introduction	47
3.2	What Do I Aim For?	48
3.3	Hypothetical Reference Path	48
3.4	Unavailability Standards	50
3.4.1	Causes of Unavailability	51
3.4.2	Unavailability Objectives	54
3.4.3	Apportionment of Objectives	55
3.4.4	Practical Advice	56
3.5	Performance Standards	56
3.5.1	Causes of Outage	57
3.5.2	Performance Objectives	57

3.6	Real-World Conclusions	65
	References	66
4	Transport Technologies	69
4.1	Introduction	69
4.2	The Backhaul Transmission System	70
4.2.1	The Backhaul Network	70
4.2.2	OSI ISO Model	71
4.3	Transport Technology Options	72
4.3.1	Plesiochronous Digital Hierarchy (PDH)	72
4.3.2	Synchronous Networks (SDH/SONET)	74
4.3.3	ATM	82
4.3.4	Ethernet	84
4.4	Network Synchronization	88
4.4.1	PDH Synchronization	88
4.4.2	SDH Synchronization	89
4.4.3	ATM Synchronization	90
4.4.4	Ethernet Synchronization	90
	References	93
5	Radio Equipment Characteristics	95
5.1	Introduction	95
5.2	Basic Radio System Block Diagram	95
5.2.1	All Indoor	97
5.2.2	Split Unit (RF Outdoors)	97
5.2.3	All Outdoors	97
5.2.4	TDM/Ethernet Options	97
5.3	Primary Multiplex	101
5.3.1	Sampling	101
5.3.2	Quantizing	101
5.3.3	Companding	103
5.3.4	Coding	104
5.3.5	Time Multiplexing	104
5.3.6	Primary Multiplexing Equipment	105

5.4	Muldem (Secondary Multiplexing and Services)	105
5.4.1	Multiplexing and Demultiplexing	105
5.4.2	Overhead Channels	106
5.4.3	Baseband Filtering	107
5.4.4	Basic Muldem Block Diagram	108
5.5	Modem	110
5.5.1	Modulators	110
5.5.2	Demodulators	112
5.5.3	Basic Modem Block Diagram	116
5.6	Transceivers	116
5.6.1	Transmitters	116
5.6.2	Receivers	118
5.6.3	Basic Transceiver Block Diagram	118
5.7	Branching	118
5.7.1	Duplexer	118
5.7.2	Hot Standby Branching	120
5.7.3	Frequency Diversity Branching	120
5.7.4	Space Diversity Branching	120
5.7.5	Hybrid Diversity Branching	121
5.8	Equipment Characteristics	123
5.8.1	RF Details	123
5.8.2	Transmitter Characteristics	124
5.8.3	Receiver Characteristics	125
5.8.4	C/I Ratio	125
5.8.5	Digital Interfaces	125
5.8.6	Management and Alarm Interfaces	126
5.9	Power Details	126
5.9.1	Input Voltage Range	126
5.9.2	Power Consumption	127
5.10	Environmental Considerations	127
5.11	Equipment Type Approvals	127
	References	127
6	Microwave Propagation	129
6.1	Atmospheric Effects on Propagation	129
6.1.1	Refractive Index	130

6.1.2	Radio Refractivity	130
6.1.3	Refractivity Gradient	131
6.1.4	Effective Earth Radius	134
6.1.5	Anomalous Propagation	135
6.1.6	Physical Atmospheric Conditions	145
6.1.7	Modified Refractivity	148
6.2	Free-Space Propagation	150
6.3	Power Budget	153
6.3.1	Receiver Threshold	154
6.3.2	Nominal Receive Level	154
6.3.3	Fade Margin	155
6.4	Fading of Microwave Links	155
6.4.1	Atmospheric Absorption, Including Rain	156
6.4.2	Diffraction Fading	157
6.4.3	Refractive Fading	169
	References	172
7	Antenna Considerations	175
7.1	Antenna Fundamentals	175
7.2	Antenna Characteristics	176
7.2.1	Gain	176
7.2.2	Sidelobes	177
7.2.3	Front-to-Back Ratio	178
7.2.4	Beamwidth	179
7.2.5	Polarization	180
7.2.6	Radiation Pattern	180
7.2.7	VSWR	181
7.2.8	Near Field, Far Field	182
7.3	Types of Antenna	184
7.3.1	Nonparabolic Antennas	184
7.3.2	Parabolic Antennas	185
7.3.3	Radomes	188
7.4	Feeder Characteristics	188
7.4.1	Coaxial Cable	188
7.4.2	Waveguide	190

7.5	Antenna System Accessories	193
7.5.1	Pressurizers	193
7.5.2	Plumbing	194
7.5.3	Earth Kits	194
7.5.4	Cable Clamps	194
7.6	Installation Practices	194
	Reference	196
8	Frequency Planning	197
8.1	Frequency Regulation	198
8.1.1	ITU-R Frequency Coordination	198
8.1.2	FCC Frequency Coordination	199
8.1.3	Ofcom Frequency Coordination	199
8.1.4	Microwave Radio Link Bands	200
8.2	What Is Interference?	201
8.2.1	Causes of Interference	201
8.2.2	Types of Interference	201
8.2.3	Effects of Interference	202
8.2.4	Intersystem Interference	206
8.3	Frequency Channel Planning	208
8.3.1	Basic ITU Arrangements	208
8.3.2	A and B Sites (High/Low Arrangements)	209
8.3.3	Alternate Polarization	211
8.3.4	Frequency Diversity Allocations	212
8.3.5	Interleaving of Channels	213
8.3.6	Spectral Efficiency	214
8.4	Frequency Reuse	215
8.4.1	Two-Frequency (One-Pair) Plan	215
8.4.2	Four-Frequency (Two-Pair) Plan	217
8.4.3	Six-Frequency (Three-Pair) Plan	218
8.5	Antenna Considerations	219
8.6	Intermodulation Products	219
	References	220