

Contents

Special Report Notice Of Disclaimer	iii
List of Figures	vii
List of Tables	viii
Foreword	ix
1. Introduction	1-1
1.1 Purpose and Scope	1-1
1.2 Structure of This Document	1-2
2. Description of Broadband Fixed Wireless Access (BFWA)	2-1
2.1 Functional Architecture	2-2
2.1.1 Customer Premises Equipment (CPE)	2-2
2.1.2 Base Station	2-3
2.1.3 Backbone Network	2-4
2.2 Network Operations and Management	2-4
3. BFWA Systems	3-1
3.1 Network Architectures	3-1
3.1.1 Point-to-Point (P-P) Architecture	3-1
3.1.2 Point-to-Multipoint (PMP) Architecture	3-2
3.1.3 Consecutive Point (Ring) and Mesh Architecture	3-3
3.2 BFWA Frequency Bands	3-5
3.2.1 Industrial, Scientific, and Medical Band (ISM)	3-5
3.2.2 Unlicensed National Information Infrastructure (U-NII)	3-6
3.2.3 Multipoint Distribution System (MDS)	3-6
3.2.4 Local Multipoint Distribution System (LMDS)	3-8
3.2.5 Other Frequency Bands	3-8
3.3 BFWA Technical Characteristics	3-9
3.3.1 Propagation Model	3-9
3.3.2 Link Budget Analysis	3-10
3.3.3 BFWA Interferers	3-12
3.3.3.1 Radio Interference	3-12
3.3.3.2 Physical Interference	3-13
3.3.4 Coverage and Capacity	3-13
3.3.5 Availability, Quality, and Reliability	3-13
3.3.6 Additional Considerations	3-14
3.3.6.1 Duplexing Scheme	3-14
3.3.6.2 Modulation	3-15
3.3.6.3 Security	3-15
4. How Radio Spectrum for BFWA is Obtained	4-1
4.1 The Licensed Spectrum	4-1
4.2 Unlicensed Spectrum	4-5
5. Market-Based Considerations for BFWA	5-1
5.1 Market Drivers	5-1
5.1.1 Internet Access	5-1

5.1.2	Voice Over IP (VoIP)	5-2
5.1.3	IP Virtual Private Network (VPN)	5-3
5.2	Examples of BFWA Markets	5-4
5.2.1	Small and Medium-Size Markets	5-5
5.2.2	The Multi-Tenant Unit (MTU)	5-5
5.2.3	Industrial Parks	5-5
5.3	Opportunities for Various Service Providers	5-6
5.3.1	Incumbent Local Exchange Carriers (ILECs)	5-6
5.3.2	Competitive Local Exchange Carriers (CLECs)	5-8
5.3.3	Internet Service Providers (ISPs)	5-10
5.3.4	Cable Companies	5-11
5.4	Potential Market Winners	5-12
5.4.1	Service Providers	5-13
5.4.2	Equipment Suppliers	5-14
6.	RF Coverage Planning with the Wireless Network Planning Tool	6-1
6.1	Overview	6-1
6.2	Design Features of the Wireless Network Planning Tool	6-1
6.3	Modes of Analysis	6-4
7.	The Role of GIS Data in BFWA Networks	7-1
7.1	The Importance of GIS In a BFWA Network Design	7-1
7.2	Data Types Used in GIS	7-2
8.	Conclusion	8-1
8.1	Value Statement for BFWA	8-1
8.1.1	Time-to-Market	8-1
8.1.2	Quality of Service	8-2
8.1.3	Scalability	8-2
8.2	Outstanding Issues and Outlook for the Future	8-3
Appendix A:	Alternatives to BFWA for Broadband Access	A-1
A.1	The xDSL Family of Access Technologies	A-1
A.2	HFC Networks and Cable Modems	A-4
A.3	Fiber-Based Access Technologies	A-7
Appendix B:	Major Players in the BFWA Market	B-1
Appendix C:	Bibliography and References	C-1
C.1	Telcordia Documents	C-1
C.2	Other Documents	C-3
Appendix D:	Glossary	D-1

List of Figures

Figure 2-1	Generic BFWA Network Based on an Internet Protocol (IP) Backbone	2-1
Figure 2-2	End Terminal with Voice and Data Services	2-3
Figure 2-3	Network and Service Focuses of BFWA Network Elements	2-4
Figure 2-4	Summary of Functional Areas of Each BFWA Network Component	2-6
Figure 3-1	Point-to-Multipoint (PMP) Architecture	3-2
Figure 3-2	Consecutive Point (Ring) Architecture	3-3
Figure 3-3	Mesh Architecture	3-3
Figure 3-4	Spectrum Chart for MDS Bands	3-7
Figure 3-5	Illustration of Line Of Sight (LOS) and Obstructed Line Of Sight (OLOS)	3-10
Figure 4-1	Automated Auction System Login Window	4-3
Figure 4-2	An Example of an Automated Auction System Bidder's Screen	4-4
Figure 5-1	Consumer Internet Customer Base (Source: Morgan Stanley Dean Witter, 2000)	5-2
Figure 5-2	Worldwide VoIP Service Revenue (Source: Probe Research, 2000)	5-3
Figure 5-3	Illustration of a BFWA System in an ILEC Network	5-7
Figure 5-4	Illustration of a BFWA System in a CLEC Network	5-9
Figure 5-5	Illustration of a BFWA System in an ISP Network	5-11
Figure 5-6	U.S. Market Share for Internet Access Technologies for Businesses (Source: Morgan Stanley Dean Witter, 2000)	5-12
Figure 5-7	U.S. Market Share for Internet Access Technologies for Consumers (Source: Morgan Stanley Dean Witter, 2000)	5-13
Figure 6-1	Superimposed GIS Layers to Create the Map in the Design Environment	6-2
Figure 6-2	Sample of a Wireless Network Planning Tool Channel List	6-3
Figure 6-3	Transmitter Configuration Form in the Wireless Network Planning Tool	6-4
Figure 6-4	Sample of a Path Profile Analysis	6-5
Figure 6-5	Sample Result from an Area Of Interest (AOI) Analysis	6-5
Figure 6-6	Sample Analysis Results for a Subscriber	6-6
Figure 7-1	Overlaying Layers to Create the Map in a GIS System	7-1
Figure A-1	High-Level View of a Typical xDSL Architecture	A-2
Figure A-2	High-Level View of the xDSL Architecture with a Digital Loop Carrier (DLC)	A-3
Figure A-3	High-Level View of Hybrid Fiber-Coaxial Network	A-5
Figure A-4	High-Level View of a Fiber To The Curb (FTTC) Network	A-7
Figure A-5	High-Level View of a Fiber To The Home (FTTH) Network	A-8

List of Tables

Table 3-1	Coverage vs. Capacity for BFWA Frequency Bands	3-13
Table B-1	Operators in BFWA Unlicensed Bands	B-1
Table B-2	Operators in Multipoint Multichannel Distribution Service (MMDS) Bands	B-3
Table B-3	Operators in Local Multipoint Distribution Service (LMDS) Bands	B-4
Table B-4	BFWA Equipment Suppliers	B-6