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Signal-In-Space Minimum Aviation System Performance Standards (MASPS) For Advanced VHF Digital Data Communications Including Compatibility with Digital Voice Techniques

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FOREWORD

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- Developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and
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EXECUTIVE SUMMARY

The purpose of this document is to define Minimum Aviation System Performance Standards (MASPS) for the signal-in-space characteristics for advanced Very High Frequency (VHF) digital data communications, including compatibility with digital voice techniques. The MASPS document is divided into three sections; an introduction, aviation user requirements, and technical characteristics.

The introductory section provides VHF communications system characteristics including aeronautical VHF communications frequencies utilized and its implications to spectrum congestion. Service rules as defined by the Federal Communications Commission (FCC) and the Federal Aviation Administration (FAA) are also provided. Principles of operation of the current VHF voice and data systems and the proposed future system are presented. General applications are divided into three categories; they are Air Traffic Services (ATS) communications, Aeronautical Operational Communications (AOC), and Aeronautical Administrative Communications (AAC). Current system interconnection, routing, integration considerations and deficiencies are highlighted.

The aviation user requirements section identifies the users of the systems and specific aircraft characteristics. The expected availability and integrity of the avionics are described. System interoperability and compatibility requirements are emphasized to assure coexistence with the present analog voice system.

The technical characteristics section describes the new system. Two modes of operation are defined: VDL Mode 2 and VDL Mode 3. VDL Mode 2 refers to the operation of the Carrier Sense Multiple Access (CSMA) Media Access Control (MAC) protocol to support data link compatibility. VDL Mode 3 refers to the functionally simultaneous voice and data link capability of the Time Division Multiple Access (TDMA) MAC protocol.

The signal-in-space may be used for either or both modes of operation provided implementation is in accordance with the VDL Mode 2 and VDL Mode 3 characteristics described herein and with other relevant industry standards. The definition, description, and specification of both modes are expected to continue to evolve as the industry, the service providers, and the users further develop future system concepts and capabilities.

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TABLE OF CONTENTS

1. INTRODUCTION 1

1.1 VHF Communications System Characteristics 1
1.1.1 Introduction **1**

1.1.2 Definitions of Terms 2
1.1.3 Aeronautical VHF Communications Frequencies 12
1.1.4 Spectrum Congestion 12
1.1.5 Service Rules 12
1.1.5.1 Federal Communications Commission (FCC) 12
1.1.5.2 Federal Aviation Administration (FAA) 13

1.2 VHF Voice and Data System Elements and Principles of Operation 13
1.2.1 Principles of Operation for VHF Packet Data System Elements 14
1.2.2 New VHF Integrated Voice and Data System Elements 14
1.2.3 Principles of Operation for New VHF Integrated Voice and Data System Elements 14

1.3 General Applications 15
1.3.1 Introduction 15
1.3.2 Data Services 15
1.3.2.1 Air Traffic Services (ATS) Communications 15
1.3.2.2 Aeronautical Operational Communications (AOC) 16
1.3.2.3 Aeronautical Administrative Communications (AAC) 16
1.3.3 Digital Voice 16
1.3.4 VDL Mode 3 Configuration Descriptions 17

1.4 System Interconnection and Routing 18
1.4.1 Data 18
1.4.2 Voice 19

1.5 System Integration Considerations 19

1.6 Present VHF System 19
1.6.1 Technical Description 23
1.6.2 Deficiencies 24

2. AVIATION USER REQUIREMENTS 25

2.1 System Users 25

2.2 Aircraft Characteristics 25

2.3 User Applications 26

2.4 Availability and Integrity 26
2.4.1 Availability 26
2.4.2 Integrity 26
2.4.3 Continuity of Function 27

2.5 System Interoperability and Compatibility Requirements 27
2.5.1 Provision of Digital Voice and Data Link 27
2.5.2 Coexistence with Analog Voice 28

2.6 Delay 28

2.6.1 VDL Mode 2 28
2.6.2 VDL Mode 3 28
2.6.2.1 Data 28
2.6.2.2 Voice 28

3. TECHNICAL CHARACTERISTICS 29

3.1 Modes of Operation 29

3.2 VDL Mode 2 29
3.2.1 Physical Layer Protocols and Services 29
3.2.1.1 Functions 29
3.2.1.1.1 Transceiver Frequency Control 29
3.2.1.1.2 Data Reception by the Transceiver or Receiver 30
3.2.1.1.3 Data Transmission by the Transceiver or Transmitter 30
3.2.1.1.4 Notification Services 30
3.2.1.2 Modulation Scheme 30
3.2.1.2.1 Data Encoding 31
3.2.1.2.2 Transmitted Signal Form 31
3.2.1.2.3 Modulation Rate 32
3.2.1.2.4 Emission Designator 32
3.2.1.2.5 Pulse Shaping Filters 32
3.2.1.3 Training Sequence 32
3.2.1.3.1 Transmitter Ramp-up and Power Stabilization 33
3.2.1.3.2 Transmitter Power Ramp-Down 34
3.2.1.3.3 Synchronization and Ambiguity Resolution 34
3.2.1.3.4 Reserved Symbol 34
3.2.1.3.5 Transmission Length 34
3.2.1.3.6 Header FEC 34
3.2.1.3.7 Bit Transmission Order 35
3.2.1.4 Error Correction Encoding Techniques 35
3.2.1.4.1 Error Correction Encoding of Data 35
3.2.1.4.2 Error Detection Encoding of Data 35
3.2.1.4.3 Forward Error Correction 35
3.2.1.4.3.1 FEC Calculation 35
3.2.1.4.3.2 Block Lengths 36
3.2.1.4.3.2.1 No Error Correction 36
3.2.1.4.3.2.2 Single-Byte Error Correction 36
3.2.1.4.3.2.3 Two-Byte Error Correction 36
3.2.1.4.3.2.4 Three-Byte Error Correction 36
3.2.1.5 Interleaving 36
3.2.1.6 Bit Scrambling 37
3.2.1.7 Channel Sensing 38
3.2.1.7.1 Channel Busy to Idle Detection 38
3.2.1.7.2 Channel Idle to Busy Detection 38
3.2.1.8 Physical Layer System Parameter 39
3.2.1.9 Receiver/Transmitter Interactions 39
3.2.1.9.1 Receive to Transmit Turnaround Time 39
3.2.1.9.2 Transmit to Receive Turnaround Time 39
3.2.1.10 Transmission Characteristics 40
3.2.1.10.1 Carrier Frequencies 40
3.2.1.10.2 Spurious Emissions 40
3.2.1.10.3 Adjacent Channel Emissions 41

3.2.2 Link Layer Protocols and Services 41
3.2.2.1 Structure 41
3.2.2.2 Service 41
3.2.2.2.1 Connection-Oriented 41
3.2.2.2.2 Connection-Less 41
3.2.2.3 MAC Sublayer 42
3.2.2.3.1 MAC Services 42
3.2.2.3.1.1 Multiple Access 42
3.2.2.3.1.2 Channel Occupancy 42
3.2.2.3.1.3 Channel Congestion 42
3.2.2.3.2 MAC Service System Parameters 42
3.2.2.3.2.1 Timer TM1 (Inter-access Delay Timer) 42
3.2.2.3.2.2 Timer TM2 (Channel Busy Timer) 43
3.2.2.3.2.3 Parameter p (Persistence) 43
3.2.2.3.2.4 Counter M1 (Maximum Number of Access Attempts) 43
3.2.2.3.3 Description of Procedures 43
3.2.2.3.3.1 Channel Sensing 43
3.2.2.3.3.2 Access Attempt 43
3.2.2.4 Data Link Service Sublayer 43
3.2.2.4.1 Services 44
3.2.2.4.1.1 Frame Sequencing 44
3.2.2.4.1.2 Error Detection 44
3.2.2.4.1.3 Station Identification 44
3.2.2.4.1.4 Broadcast Addressing 44
3.2.2.4.1.5 Data Transfer 44
3.2.2.4.2 AVLC Data Link Service Protocol Specification 44
3.2.2.4.2.1 Frame Format 44
3.2.2.4.2.2 Address Structure 45
3.2.2.4.2.3 Address Fields 45
3.2.2.4.2.3.1 Air/Ground Status Bit 46
3.2.2.4.2.3.2 Command/Response Status Bit 46
3.2.2.4.2.3.3 Data Link Service Addresses 46
3.2.2.4.2.3.4 Address Type 46
3.2.2.4.2.3.5 Aircraft Specific Addresses 46
3.2.2.4.2.3.6 ICAO-Administered Ground Station Specific Addresses 47
3.2.2.4.2.3.7 ICAO-Delegated Ground Station Specific Addresses 47
3.2.2.4.2.4 Broadcast Address 47
3.2.2.4.2.4.1 Encoding 47
3.2.2.4.2.4.2 Erroneous Transmission 47
3.2.2.4.2.4.3 Erroneous Reception 48
3.2.2.4.2.5 Link Control Field 48
3.2.2.4.2.6 Information Field 48
3.2.2.4.3 Data Link Service System Parameters 48
3.2.2.4.3.1 Timer T1 (Delay Before Retransmission) 49
3.2.2.4.3.2 Parameter T2 (Delay Before Acknowledgment) 50
3.2.2.4.3.3 Timer T3 (Link Initialization Time) 50
3.2.2.4.3.4 Timer T4 (Maximum Delay Between Transmissions) 51
3.2.2.4.3.5 Parameter N1 (Maximum Number of Bits of any Frame) 51
3.2.2.4.3.6 Counter N2 (Maximum Number of Transmissions) 51
3.2.2.4.3.7 Parameter k (Window Size) 52
3.2.2.4.4 Description of Procedures 52
3.2.2.4.5 Modes of Operation 52
3.2.2.4.5.1 Operational Mode 52
3.2.2.4.5.2 Non-operational Mode 52

3.2.2.4.5.2.1 DISC Frame 52
3.2.2.4.5.2.2 DM Frame 53
3.2.2.4.5.2.3 Frame Reject Mode 53
3.2.2.4.5.2.4 Sent Selective Reject Mode 53
3.2.2.4.6 Use of the P/F Bit 53
3.2.2.4.6.1 General 53
3.2.2.4.6.2 INFO Frames 53
3.2.2.4.6.3 Unnumbered Frames 54
3.2.2.4.7 Unnumbered Command Frame Collisions 54
3.2.2.4.7.1 DLE Procedures 54
3.2.2.4.7.2 LME Procedures 54
3.2.2.4.8 XID Frame 54
3.2.2.4.9 Broadcast 55
3.2.2.4.10 Information Transfer 55
3.2.2.4.10.1 Transmission Queue Management 55
3.2.2.4.10.1.1 Eliminate Redundant Frames 55
3.2.2.4.10.1.2 Procedures for Transmission 56
3.2.2.4.10.2 SREJ Frame 56
3.2.2.4.10.3 FRMR Frame 56
3.2.2.4.10.4 UA Frame 57
3.2.2.4.10.5 UI Frame 57
3.2.2.4.10.6 TEST Frame 57
3.2.2.5 VDL Management Entity 57
3.2.2.5.1 Services 57
3.2.2.5.1.1 Link Provision 57
3.2.2.5.1.2 Link Change Notifications 57
3.2.2.5.2 Exchange Identity (XID) Parameter Formats 58
3.2.2.5.2.1 Encoding 58
3.2.2.5.2.2 Public Parameters 58
3.2.2.5.2.2.1 HDLC Public Parameter Set Identifier 58
3.2.2.5.2.2.2 Timer T1 59
3.2.2.5.2.3 VDL Private Parameters 59
3.2.2.5.2.4 General Purpose Information Private Parameters 60
3.2.2.5.2.4.1 VDL Private Parameter Set Identifier 60
3.2.2.5.2.4.2 Connection Management Parameter 60
3.2.2.5.2.4.3 Signal Quality Parameter (SQP) 61
3.2.2.5.2.4.4 XID Sequencing Parameter 62
3.2.2.5.2.4.5 AVLC Specific Options Parameter 62
3.2.2.5.2.4.6 Expedited Subnetwork Connection Parameter 64
3.2.2.5.2.4.7 LCR Cause Parameter 64
3.2.2.5.2.5 Aircraft-Initiated Information Private Parameters 66
3.2.2.5.2.5.1 Modulation Support Parameter 67
3.2.2.5.2.5.2 Acceptable Alternate Ground Station Parameter 67
3.2.2.5.2.5.3 Destination Airport Parameter 67
3.2.2.5.2.5.4 Aircraft Location Parameter 68
3.2.2.5.2.6 Ground-Initiated Modification Private Parameters 69
3.2.2.5.2.6.1 Autotune Frequency Parameter 69
3.2.2.5.2.6.2 Replacement Ground Station List 69
3.2.2.5.2.6.3 Timer T4 Parameter 70
3.2.2.5.2.6.4 MAC Persistence Parameter 70
3.2.2.5.2.6.5 Counter M1 Parameter 70
3.2.2.5.2.6.6 Timer TM2 Parameter 70
3.2.2.5.2.6.7 Timer TG5 Parameter 71
3.2.2.5.2.6.8 T3min Parameter 71
3.2.2.5.2.6.9 Ground Station Address Filter Parameter 71
3.2.2.5.2.6.10 Broadcast Connection Parameter 72
3.2.2.5.2.7 Ground-Initiated Information Private Parameters 73

3.2.2.5.2.7.1 Frequency Support List (FSL) 73
3.2.2.5.2.7.2 Airport Coverage Indication Parameter 74
3.2.2.5.2.7.3 Nearest Airport Parameter 74
3.2.2.5.2.7.4 ATN Router NETs Parameter 75
3.2.2.5.2.7.4.1 Recommendation 75
3.2.2.5.2.7.5 Station Operator Mask Parameter 76
3.2.2.5.2.7.6 Timer TG3 Parameter 76
3.2.2.5.2.7.7 Timer TG4 Parameter 76
3.2.2.5.2.7.8 Ground Station Location Parameter 77
3.2.2.5.3 VME Service System Parameters 77
3.2.2.5.3.1 Timer TG1 (Frequency Dwell Time) 78
3.2.2.5.3.2 Timer TG2 (Maximum Idle Activity Time) 78
3.2.2.5.3.3 Timer TG3 (Maximum Time Between Transmissions) 78
3.2.2.5.3.4 Timer TG4 (Maximum Time Between GSIFs) 79
3.2.2.5.3.5 Timer TG5 (Maximum Link Overlap Time) 79
3.2.2.5.4 Description of LME Procedures 79
3.2.2.5.4.1 Frequency Management Procedures 79
3.2.2.5.4.1.1 Frequency Search 79
3.2.2.5.4.1.2 Frequency Recovery 80
3.2.2.5.4.2 Link Maintenance Procedures 80
3.2.2.5.4.3 Ground Station Identification 80
3.2.2.5.4.4 Link Establishment 85
3.2.2.5.4.4.1 Aircraft Initiation 85
3.2.2.5.4.4.2 General Ground Response 85
3.2.2.5.4.4.3 Exceptional Cases 85
3.2.2.5.4.5 Link Parameter Modification (LPM) 86
3.2.2.5.4.5.1 Ground Initiation 86
3.2.2.5.4.5.2 General Aircraft Response 86
3.2.2.5.4.6 Aircraft-Initiated Handoff 86
3.2.2.5.4.6.1 Aircraft Handoff 86
3.2.2.5.4.6.2 Site Selection Preference 87
3.2.2.5.4.6.3 Interaction of LMEs 87
3.2.2.5.4.6.4 General Ground Response 87
3.2.2.5.4.6.5 Disconnecting Old Link 87
3.2.2.5.4.6.5.1 Disconnecting Old Link (Autotune Parameter Not Used) 87
3.2.2.5.4.6.5.2 Disconnecting Old Link (Autotune Parameter Used) 88
3.2.2.5.4.6.6 Exceptional Cases 88
3.2.2.5.4.7 RESERVED 88
3.2.2.5.4.8 Ground-Initiated Handoff 88
3.2.2.5.4.8.1 Ground Action 88
3.2.2.5.4.8.2 General Aircraft Response 88
3.2.2.5.4.8.3 Disconnecting Old Link 89
3.2.2.5.4.8.4 Exceptional Cases 89
3.2.2.5.4.9 Ground-Requested Aircraft-Initiated Handoff 89
3.2.2.5.4.9.1 Ground Action 89
3.2.2.5.4.9.2 General Aircraft Response 89
3.2.2.5.4.9.3 Exceptional Cases 89
3.2.2.5.4.10 Ground-Requested Broadcast Handoff 90
3.2.2.5.4.10.1 Ground Action 90
3.2.2.5.4.10.2 Aircraft Response 90
3.2.2.5.4.10.3 Exceptional Cases 91
3.2.2.5.4.11 Ground-Requested Autotune 91
3.2.2.5.4.11.1 Ground Action 91
3.2.2.5.4.11.2 General Response 92
3.2.2.5.4.11.2.1 Aircraft Response 92
3.2.2.5.4.11.2.2 Ground Response 92
3.2.2.5.4.11.3 Exceptional Cases 92

3.2.2.5.4.12 Frequency Support List-assisted Frequency Management 93
3.2.2.5.4.12.1 Frequency Support List for Aircraft in the Air 93
3.2.2.5.4.12.2 Frequency Support List for Aircraft on the Ground 93
3.2.2.5.4.13 Expedited Subnetwork Connection Management 94
3.2.2.5.4.13.1 Initiating Station of Subnetwork Connection Management 94
3.2.2.5.4.13.2 General Responder Action 94
3.2.2.5.4.13.3 Exceptional Cases 95
3.2.2.5.4.14 Ground Base Recovery When N2 Uplink Occurs 95
3.2.3 Subnetwork Layer Protocols and Services 96
3.2.3.1 Architecture 96
3.2.3.1.1 Access Points 96
3.2.3.1.2 ACARS Over AVLC (AOA) 96
3.2.3.1.3 Flight Information Services-Broadcast (FIS-B) 97
3.2.3.2 Services 98
3.2.3.2.1 Subnetwork Connection Management 99
3.2.3.2.2 Packet Fragmentation and Reassembly 99
3.2.3.2.3 Error Recovery 99
3.2.3.2.4 Connection Flow Control 99
3.2.3.2.4.1 Flow Control Window Closure 99
3.2.3.3 Packet Format 100
3.2.3.3.1 General Format Identifier 100
3.2.3.3.2 Calling and Called DTE Addresses 100
3.2.3.3.2.1 Encoding 100
3.2.3.3.2.2 Address Field 101
3.2.3.3.2.2.1 Aircraft DTE Address 101
3.2.3.3.2.2.2 Ground VDL Specific DTE Addressing (VSDA) 101
3.2.3.3.2.2.2.1 Ground DTE Address 101
3.2.3.3.2.2.2.2 Ground Network DTE Addresses 101
3.2.3.3.3 Call User Data Field 102
3.2.3.3.4 Packet Types 102
3.2.3.4 Subnetwork Layer Service System Parameters 102
3.2.3.4.1 Packet Size 102
3.2.3.4.2 Parameter W (Transmit Window Size) 102
3.2.3.4.3 Parameter A (Acknowledgment Window Size) 103
3.2.3.5 Effects of Layers 1 and 2 on the Subnetwork Layer 103
3.2.3.6 Description of Procedures 103
3.2.3.6.1 Supported Facilities 103
3.2.3.6.2 Unsupported Facilities 104
3.2.3.6.3 Subnetwork Establishment and Connection Management 104
3.2.3.6.3.1 Subnetwork Entity Initialization 105
3.2.3.6.3.2 Subnetwork Connection Establishment 105
3.2.3.6.3.2.1 Explicit Subnetwork Connection Establishment 105
3.2.3.6.3.2.2 Expedited Network Connection Establishment 106
3.2.3.6.3.3 Subnetwork Connection Maintenance 106
3.2.3.6.3.3.1 Explicit Subnetwork Connection Maintenance 106
3.2.3.6.3.3.2 Expedited Subnetwork Connection Maintenance 107
3.2.3.6.3.3.3 Broadcast Subnetwork Connection Maintenance 107
3.2.3.6.3.4 Call Redirection for X.121-based Networks 107
3.2.3.6.4 Error Handling 108
3.2.3.6.5 Acknowledgments 108
3.2.4 VDL MOBILE SNDCF 108
3.2.4.1 Introduction 108
3.2.4.2 RESERVED 108
3.2.4.3 Call User Data Encoding 108
3.2.4.3.1 ISH PDU 108

3.2.4.3.2 Maintained/Initialized Status Bit 108
3.3 VDL Mode 3 109
3.3.1 Physical Layer 109
3.3.1.1 Functions 109
3.3.1.1.1 Transceiver Frequency Control 109
3.3.1.1.2 Data Reception by the Transceiver or Receiver 109
3.3.1.1.3 Data Transmission by the Transceiver or Transmitter 109
3.3.1.1.4 Notification Services 109
3.3.1.2 Modulation Scheme 110
3.3.1.2.1 Data Encoding 110
3.3.1.2.2 Transmitted Signal Form 110
3.3.1.2.3 Modulation Rate 110
3.3.1.2.4 Emission Designator 110
3.3.1.2.5 Pulse Shaping Filters 110
3.3.1.3 Time Division Multiple Access (TDMA) Time Slot Bursts 110
3.3.1.3.1 Management (M) Burst and Handoff Check Message (H) Uplink 110
3.3.1.3.1.1 Training Sequence 111
3.3.1.3.1.1.1 Transmitter Ramp-Up and Power Stabilization 111
3.3.1.3.1.1.2 Synchronization and Ambiguity Resolution 111
3.3.1.3.1.2 System Data and Handoff Check Message 111
3.3.1.3.1.3 Transmitter Ramp-Down 112
3.3.1.3.2 Management (M) Burst Downlink 112
3.3.1.3.2.1 Training Sequence 112
3.3.1.3.2.1.1 Transmitter Ramp-Up and Power Stabilization 112
3.3.1.3.2.1.2 Synchronization and Ambiguity Resolution 112
3.3.1.3.2.2 System Data 113
3.3.1.3.2.3 Transmitter Ramp-Down 113
3.3.1.3.3 Voice or Data (V/D) Burst 113
3.3.1.3.3.1 Training Sequence 113
3.3.1.3.3.1.1 Transmitter Ramp-Up and Power Stabilization 113
3.3.1.3.3.1.2 Synchronization and Ambiguity Resolution 113
3.3.1.3.3.2 Header 113
3.3.1.3.3.3 User Information 114
3.3.1.3.3.4 Transmitter Ramp-Down 114
3.3.1.4 Interleaving 114
3.3.1.5 Bit Scrambling 114
3.3.1.6 Transmit/Receive Turnaround Times 114
3.3.1.6.1 Receive to Transmit Turnaround Time 115
3.3.1.6.2 Transmit to Receive Turnaround Time 115
3.3.1.7 Transmission Characteristics 115
3.3.1.7.1 Carrier Frequencies 115
3.3.1.7.2 Spurious Emissions 115
3.3.1.7.3 Adjacent Channel Emissions 115
3.3.1.8 Fringe Coverage 115
3.3.1.8.1 Recommendation 115
3.3.2 Data Link Layer 116
3.3.2.1 MAC Sublayer (VDL Mode 3) 116
3.3.2.1.1 MAC Services 116
3.3.2.1.1.1 Multiple Access 116
3.3.2.1.1.1.1 Recommendation 116
3.3.2.1.1.2 Channel Occupancy 116
3.3.2.1.2 MAC Protocol Framework 117
3.3.2.1.2.1 Timing Structure 117

3.3.2.1.2.1.1 TDMA Frame 117
3.3.2.1.2.1.2 Time Slot 117
3.3.2.1.2.1.2.1 Timing Accuracy (Timing State 1) 117
3.3.2.1.2.1.2.2 Timing Accuracy (Timing State 2 or 3) 117
3.3.2.1.2.1.3 Bursts 118
3.3.2.1.2.1.4 Epoch 120
3.3.2.1.2.1.5 External Time Reference Interface 120
3.3.2.1.2.2 System Data and Header Field Formats 121
3.3.2.1.2.3 User Groups 121
3.3.2.1.2.4 System Configurations 121
3.3.2.1.2.5 Media Access Control Cycle 123
3.3.2.1.2.5.1 Logical Burst Access Channels (LBACs) 123
3.3.2.1.2.5.2 Burst Access Timing 124
3.3.2.1.2.5.3 Access Rules for M Downlink 124
3.3.2.1.3 Aircraft MAC Service System Parameters 125
3.3.2.1.3.1 Parameter t (Truncation) 128
3.3.2.1.3.1.1 Validity Window 131
3.3.2.1.3.1.2 Receipt of Beacon Information 132
3.3.2.1.3.2 Parameter f (Free Running) 132
3.3.2.1.3.3 Parameter NM1 (Maximum Retry) 132
3.3.2.1.3.4 Parameter RR (Reservation Request Randomizer) 132
3.3.2.1.3.5 Parameter RE (Net Entry Request Randomizer) 132
3.3.2.1.3.6 Parameter RL (Leaving Net Randomizer) 132
3.3.2.1.3.7 Parameter WR (Reservation Request Retransmission Delay) 132
3.3.2.1.4 Description of Procedures 133
3.3.2.1.4.1 Timing Acquisition and Maintenance 133
3.3.2.1.4.1.1 Primary Timing Reference 133
3.3.2.1.4.1.2 Alternate Timing Reference 133
3.3.2.1.4.1.3 Coast Timing Counters 134
3.3.2.1.4.1.4 Timing States 134
3.3.2.1.4.1.4.1 Recommendation 135
3.3.2.1.4.1.5 Timing State Transitions 135
3.3.2.1.4.1.5.1 Tuning to Invalid Channel – TS1 136
3.3.2.1.4.1.5.2 Tuning to Invalid Channel – TS2/TS3 136
3.3.2.1.4.1.6 Dummy Poll Responses 136
3.3.2.1.4.2 Voice Operation Support 137
3.3.2.1.4.2.1 Voice Access Channel Contention 138
3.3.2.1.4.2.3 Free Running Voice Operation 139
3.3.2.1.4.3 Link Management Support 139
3.3.2.1.4.3.1 Polling 139
3.3.2.1.4.3.2 Net Entry Request Message 140
3.3.2.1.4.3.3 Next Net Message 140
3.3.2.1.4.3.4 Leaving Net Message 140
3.3.2.1.4.3.4.1 Tuning to Next Net 141
3.3.2.1.4.3.4.2 Maximum Leaving Net Delay 141
3.3.2.1.4.3.5 Terminate Net Message 141
3.3.2.1.4.3.6 Supported Options Message 141
3.3.2.1.4.3.7 RESERVED 141
3.3.2.1.4.4 Data Operation Support 141
3.3.2.1.4.4.1 Segmentation Function 141
3.3.2.1.4.4.2 Uplink Data Transfer 142
3.3.2.1.4.4.2.1 Acknowledgement Protocol 142
3.3.2.1.4.4.3 Downlink Data Transfer 143
3.3.2.1.4.4.3.1 Data Transfer 143
3.3.2.1.4.4.3.2 Assemble Message for MAC Data Transfer 143
3.3.2.1.4.4.3.3 Request a Reservation 143

3.3.2.1.4.4.3.4 Reservation Request Retransmission 145
3.3.2.1.4.4.3.5 Reservation Confirmation Indication 145
3.3.2.1.4.4.3.6 Acknowledgment Protocol 145
3.3.2.1.4.5 MAC Data Frame Transmission/Retransmission 145
3.3.2.1.4.6 Automated Handoff for 3T Configuration 146
3.3.2.2 Data Link Services (DLS) (VDL Mode 3) 147
3.3.2.2.1 Services 147
3.3.2.2.1.1 Error Detection 147
3.3.2.2.1.2 Address Identification 148
3.3.2.2.1.2.1 Address Uniqueness 148
3.3.2.2.1.2.2 Broadcast Addressing 148
3.3.2.2.1.3 Data Transfer 148
3.3.2.2.2 VDL Mode 3 Data Link Service Protocol Specification 148
3.3.2.2.2.1 Frame Format 148
3.3.2.2.2.2 FCS/Aircraft Address Field 148
3.3.2.2.2.2.1 FCS/Aircraft Station Address 149
3.3.2.2.2.2.2 Address Type 149
3.3.2.2.2.3 Link Control Field 149
3.3.2.2.2.3.1 Frame Type 150
3.3.2.2.2.3.2 Priority 150
3.3.2.2.2.3.3 More Frame 151
3.3.2.2.2.4 Data Control Field 151
3.3.2.2.2.4.1 Ground Subnetwork Address Subfield 151
3.3.2.2.2.4.2 Data Length Subfield 152
3.3.2.2.2.5 Information Field 152
3.3.2.2.3 Data Link Service System Parameters 152
3.3.2.2.3.1 Timer T3 (Link Initialization Time) 152
3.3.2.2.3.2 Parameter N1 (Maximum Frame Group Size) 152
3.3.2.2.4 Description of Procedures 152
3.3.2.2.4.1 Modes of Operation 152
3.3.2.2.4.1.1 Operational Mode 152
3.3.2.2.4.2 Broadcast 153
3.3.2.2.4.3 Information Transfer 153
3.3.2.2.4.3.1 Transmission Queue Management 153
3.3.2.2.4.3.1.1 Priority Processing 153
3.3.2.2.4.3.1.2 Recommendation for Frame Grouping 153
3.3.2.2.4.3.2 Reception Acknowledgement 154
3.3.2.2.4.3.2.1 Acknowledged Frames 154
3.3.2.2.4.3.2.2 Unacknowledged Frames 154
3.3.2.2.4.3.3 Transmission Acknowledgement/Retransmission 154
3.3.2.2.4.4 Control Frame 154
3.3.2.2.4.4.1 Control Command Frame 155
3.3.2.2.4.4.2 Control Response Frame 155
3.3.2.2.5 MAC-DLS Processing Delays 155
3.3.2.2.5.1 Aircraft DLS-MAC Processing Delay 155
3.3.2.2.5.2 Downlink ACK Transmission Delay 155
3.3.2.2.5.3 Uplink ACK Transmission Delay 155
3.3.2.2.5.4 Downlink Data Transmission Delay 156
3.3.2.3 Link Management Entity (LME) Sublayer (VDL Mode 3) 156
3.3.2.3.1 Services 156
3.3.2.3.2 Operation Procedures 156
3.3.2.3.2.1 Link Establishment 156
3.3.2.3.2.1.1 Net Initialization 157
3.3.2.3.2.1.2 NetEntry 157

3.3.2.3.2.1.2.1 Supported Options 160
3.3.2.3.2.1.3 Initial Link Negotiation 160
3.3.2.3.2.1.3.1 Air Initiation 160
3.3.2.3.2.1.3.2 General Ground Response 160
3.3.2.3.2.1.3.3 Air Response 161
3.3.2.3.2.1.3.4 Exceptional Cases 161
3.3.2.3.2.1.3.5 Parameter Longevity 161
3.3.2.3.2.2 Slot Selection (Configurations 3S and 2S1X) 162
3.3.2.3.2.3 Link Modification 164
3.3.2.3.2.3.1 Description of LME Procedures 164
3.3.2.3.2.3.2 Link Maintenance Procedures 164
3.3.2.3.2.3.2.1 Addressed Link Parameter Modification 164
3.3.2.3.2.3.2.2 Broadcast Link Parameter Modification 165
3.3.2.3.2.3.2.3 Parameter Longevity 165
3.3.2.3.2.4 Link Maintenance 165
3.3.2.3.2.5 Recovery 166
3.3.2.3.2.5.1 Polling System Configurations 168
3.3.2.3.2.5.2 Data-Capable System Configurations 169
3.3.2.3.2.5.3 Missed Poll 169
3.3.2.3.2.5.4 Retransmission 169
3.3.2.3.2.5.5 Verification 169
3.3.2.3.2.6 Link Release 170
3.3.2.3.2.6.1 Explicit Link Release 170
3.3.2.3.2.6.2 Implicit Link Release 170
3.3.2.3.2.7 Handoff 171
3.3.2.3.2.7.1 Air-initiated Link Handoff 171
3.3.2.3.2.7.2 Ground-initiated Link Handoff 171
3.3.2.3.2.7.3 Same GNI 171
3.3.2.3.2.7.4 Different GNI 171
3.3.2.3.2.8 Authentication 171
3.3.2.3.2.8.1 Signature Verification 171
3.3.2.3.2.8.2 Unknown Authentication Type 171
3.3.2.3.2.8.3 Authentication Type Mismatch 172
3.3.2.3.2.8.4 Invalid Signature 172
3.3.2.3.3 Link Management Frames 172
3.3.2.3.3.1 M Burst Message Format 172
3.3.2.3.3.2 LME Service System Parameters 172
3.3.2.3.3.2.1 RESERVED 173
3.3.2.3.3.2.2 Counter NL2 (Polling Reply Counter) 173
3.3.2.3.3.2.3 Timer TL3 (Disconnect Delay Timer) 173
3.3.2.3.3.2.4 Timer TL4 (Polling Interval) 173
3.3.2.3.3.2.5 Parameter WE (Net Entry Retransmission Delay) 174
3.3.2.3.3.2.6 Parameter NL5 (Multiple Radio Local Identifier Buffer) 174
3.3.2.3.3.2.7 Parameter NL6 (Free Address Recovery) 174
3.3.2.3.3.3 Exchange Identity (XID) Parameter Format 174
3.3.2.3.3.3.1 Public Parameters 174
3.3.2.3.3.3.1.1 General Public Parameters 174
3.3.2.3.3.3.1.2 VDL Mode 3 Public Parameters 175
3.3.2.3.3.3.2 Private Parameters 176
3.3.2.3.3.3.3 General Private Parameters 176
3.3.2.3.3.3.3.1 General Purpose Information Private Parameters 176
3.3.2.3.3.3.3.2 Aircraft-Initiated Information Private Parameters 176
3.3.2.3.3.3.4 VDL Mode 3 Private Parameters 176
3.3.2.3.3.3.4.1 General Purpose Information Private Parameters 176
3.3.2.3.3.3.4.1.8 Assigned Altitude Parameter 180
3.3.2.3.3.3.4.2 Air-initiated Information Private Parameters 180
3.3.2.3.3.3.4.3 Ground-initiated Modification Private Parameters 182

3.3.2.3.3.3.4.3.11 Operative_ GNIp Parameter 184
3.3.2.3.3.3.4.3.12 Aircraft_TMbB Parameter 184
3.3.2.3.3.3.4.3.13 MbB_Operations_Permitted 184
3.3.2.3.3.3.4.4 Ground-initiated Information Private Parameters 185
3.3.2.3.3.3.4.4.1 Counter NL2 (Polling Reply) Parameter 185
3.3.2.3.3.3.4.4.2 NL5 (Multiple Radio Local Identifier Buffer) Parameter 185
3.3.2.3.3.3.4.4.3 NL6 (Free Address Recovery) Parameter 185
3.3.3 Subnetwork Layer Protocols and Services (VDL Mode 3) 185
3.3.3.1 Payload Identification 185
3.3.3.2 Compression Signaling 186
3.3.3.2.1 ISO 8208 Compression 186
3.3.3.2.2 CLNP Compression 186
3.3.3.2.3 Raw Payload Type 186
3.3.3.2.4 ATN Frame Mode Payload Type 187
3.3.3.3 Make-before-Break (MbB) Operation 187
3.3.3.3.1 General Requirements 187
3.3.3.3.1.1 GNIp-Group Addressing 187
3.3.3.3.1.2 GNIp-Group Parameter Set 187
3.3.3.3.2 MbB Avionics Requirements 188
3.3.3.3.2.1 Initialization 188
3.3.3.3.2.2 Determining MbB Applicability in the Aircraft 188
3.3.3.3.2.3 Aircraft MbB-Operation 189
3.3.3.3.3 GNIp Requirements 189
3.3.3.3.3.1 Determining MbB Applicability on the Ground 189
3.3.3.3.3.2 Compatibility with Aircraft not Requesting MbB Capability 190
3.3.3.3.3.3 Operative_GNIp Requirements 190
3.3.3.3.3.4 Former_GNIp Requirements 191
3.3.3.3.4 Recommended MbB Parameter Values 192
3.3.3.4 Router Interface Recommendation 193
3.3.3.5 Subnetwork Interface Support 193
3.3.3.5.1 Aircraft Subnetwork Interface Support 193
3.3.3.5.2 Ground Station Subnetwork Interface Support 193
3.3.3.6 Raw Subnetwork Interface Operation 193
3.3.3.6.1 Protocol Identifier 193
3.3.3.6.2 Supported Protocols 193
3.3.3.6.2.1 ACARS over VDL3 194
3.3.3.6.2.2 Flight Information Service - Broadcast 194
3.3.3.6.2.3 Reserved for Testing 194
3.3.4 VDL Mode 3 SNDCF Introduction 194
3.3.4.1 The ISO 8208 SNDCF Interface 194
3.3.4.2 The Frame-Based SNDCF Interface 194
3.3.4.2.1 Frame-Based SNDCF Support for Broadcast & Unicast Network Packets 194
3.3.4.2.2 ATN Router Support 195
3.3.4.2.2.1 Join/Leave Events 195
3.3.4.2.2.2 Payload Identification 195
3.3.4.2.2.3 Disposition of CLNP and ISH Packets 195
3.3.4.2.2.4 ISH Packets 195
3.3.4.2.2.5 CLNP Compression 195
3.3.4.3 The ATN Frame Mode SNDCF 195
3.3.5 Voice Unit 195
3.3.5.1 Services 195
3.3.5.1.1 Priority Access 196
3.3.5.1.2 Message Source Identification 196

3.3.5.1.3 Coded Squelch 196
3.3.5.1.4 Urgent Downlink Request (UDR) Signaling 196
3.3.5.2 Speech Encoding 196
3.3.5.2.1 Speech Encoding Algorithm 196
3.3.5.2.2 Voice Burst Framing 197
3.3.5.2.3 Vocoder Frame Bit Ordering 197
3.3.5.3 Parameters 197
3.3.5.3.1 Group ID 197
3.3.5.3.2 Squelch Window 197
3.3.5.3.3 Algorithm Version Number 198
3.3.5.4 Description of Procedures 198
3.3.5.4.1 Link Establishment 198
3.3.5.4.1.1 Link Initialization 198
3.3.5.4.1.2 Net Entry 198
3.3.5.4.2 Timing 198
3.3.5.4.2.1 Transmit Delay 198
3.3.5.4.2.2 Receive Delay 198
3.3.5.4.3 Voice Transmit Function 199
3.3.5.4.3.1 Demand-Assigned Circuits 199
3.3.5.4.3.2 Vocoder Processing 199
3.3.5.4.3.2.1 Truncated Mode Encoding 199
3.3.5.4.3.2.2 Truncated Mode Decoding 199
3.3.5.4.3.2.3 Truncated Mode Formatting 200
3.3.5.4.3.3 Access Pre-emption 200
3.3.5.4.3.4 Urgent Downlink Request (UDR) 200
3.3.5.4.3.4.1 Urgent Downlink Request Not Supported 201
3.3.5.4.3.5 Anti-blocking 201
3.3.5.4.4 Voice Receive Function 201
3.3.5.4.4.1 Pre-processing 201
3.3.5.4.4.1.1 Source Filtering 201
3.3.5.4.4.1.2 Vocoder Processing 202
3.3.5.4.4.1.3 Source Identification 203
3.3.5.4.4.2 Voice Synthesis 203
3.3.5.4.5 Handoff Recommendation 203

3.4 Ground Transmitter 203
3.4.1 Ground Transmitter Power 203
3.4.2 Transmitter Duty Cycle 204

3.5 Uplink 204
3.5.1 Uplink Channel Characteristics 204
3.5.1.1 Doppler Characteristics 204
3.5.1.1.1 Doppler Shift 204
3.5.1.1.2 Doppler Rate 204
3.5.1.1.3 Delay and Doppler Spread 205
3.5.1.2 Signal Fading 205
3.5.1.2.1 Fast Fading with Rotary Wing Aircraft 205
3.5.1.3 Aircraft Noise Environment 205
3.5.1.4 Cochannel Interference 205
3.5.1.4.1 VDL Mode 2 205
3.5.1.4.2 VDL Mode 3 205
3.5.2 Typical Uplink Power Budget 205

3.6 Aircraft Receiver 208
3.6.1 Minimum Detectable Signal (Uplink) 208

3.7 Combined Aircraft Receive/Transmit Characteristics 209

3.7.1 Frequency Stability 209
3.7.2 Tuning Time 209
3.7.3 Aircraft Antenna Characteristics 210
3.7.4 Link Availability 210

3.8 Aircraft Transmitter 211
3.8.1 Transmitter Power 211

3.9 Downlink 211
3.9.1 Downlink Channel Characteristics 211
3.9.1.1 Ground Noise Environment 211
3.9.2 Typical Downlink Power Budget 211

3.10 Ground Receiver 213
3.10.1 Minimum Detectable Signal (Downlink) 213

3.11 Combined Ground Receive/Transmit Characteristics 214
3.11.1 Frequency Stability 214
3.11.2 Ground Antenna Characteristics 215

4. MEMBERSHIP……...217

APPENDIX A TUTORIAL ON ASPECTS OF VHF COMMUNICATIONS SYSTEM DESIGN……...A-1

APPENDIX B ACRONYMS……...B-1

APPENDIX C SYSTEM LINK MARGIN COMPARISON OF D8PSK AND DSB-AM…….C-1

APPENDIX D VDL MODE 2 GENERATOR POLYNOMIAL G(X)……D-1

APPENDIX E SAMPLE VDL MODE 2 AND VDL MODE 3 TRANSMISSION EXAMPLES.E-1

APPENDIX F FORMAT AND USAGE OF THE SYSTEM DATA AND HEADER SEGMENTS FOR VDL MODE 3 OPERATION……F-1

APPENDIX G RANDOM NUMBER GENERATION ALGORITHM……..G-1

APPENDIX H RANDOM ACCESS DOWNLINK M BURST SELECTION ALGORITHMS FOR AIRCRAFT RADIOS…….H-1

APPENDIX I ISO 8208 COMPRESSION DEFINITION……I-1

APPENDIX J CLNP COMPRESSION DEFINITION…… J-1

APPENDIX K PREPARATION OF LINK BUDGETS FOR VHF DATA LINK……K-1

APPENDIX L VHF CHANNEL LABELS……L-1

APPENDIX M MASPS TO SARPS MAT…….M-1

TABLE OF FIGURES

Figure 1-1: End-to-End ATN Compatible Data System Structure 21
Figure 1-2: VDL Mode 3 End-to-End Voice Services System Structure 22
Figure 1-3: Establishing Reuse Distance in the ATC Environment 24
Figure 3-1: Transmitter Power Stabilization 33
Figure 3-2: PN Generator for BIT Scrambling Sequence 37
Figure 3-3: Turnaround Time 40
Figure 3-4: Link Layer Frame Format 45
Figure 3-5: Management (M) and V/D Bursts and Slot Components 118
Figure 3-6: Four Management (M) Bursts and Slot Components (Downlink Slot A of 3T) 119
Figure 3-7: Bursts and Slot Components for Management (M) and Handoff Check Message (H) Bursts (Uplink Slot A of 3T) 119
120
Figure 3-8: Frame Structure for Normal Range Non-3T Configurations (Section 3.3.2.1.2.3) 120
Figure 3-9: Frame structure for Normal Range 3T Configurations (Section 3.3.2.1.2.3) 120
Figure 3-10: Frame Structure for Long Range Configurations (Section 3.3.2.1.2.3) 121
Figure 3-11: M Burst ACK Timing 142
Figure 3-12: DLS Sublayer Frame Format 148
Figure 3-13: VDL Mode 3 Link Control Field 150
Figure 3-14: Payload octet 186
Figure E-1: FEC Computation E-6
Figure E-2: Absolute Phase Encoding (Gray code) E-8
Figure E-3: Power Stabilization Sequence E-11
Figure E-4: Synchronization Sequence E-12
Figure E-5: Golay Coded Header Sequence E-12
Figure E-6: Reed-Solomon Coded Data Sequence E-16
Figure E-7: Bit Scrambler Sequence E-17
Figure E-8: Payload Sequence E-17
Figure E-9: Scrambled Payload E-18
Figure E-10: Phase Change Sequence E-20
Figure E-11: Final Phase Sequence E-21
Figure F-1: Non-3T Configuration Generic M Uplink System Data Segment F-1
Figure F-2: M Uplink (Normal Message) F-5
Figure F-3: M Uplink (Net Entry Response Message) F-7
Figure F-4: M Uplink (Next Net Command Message) F-8
Figure F-5: M Uplink (Recovery Message) F-8
Figure F-6: M Uplink (Handoff Check Message) F-9
Figure F-7: 3T Configuration Generic M Uplink System Data Segment F-11
Figure F-8: M Downlink (Net Entry Request Message) F-11
Figure F-9: Poll Response and M Downlink (Reservation Request Message) F-12
Figure F-10: M Downlink (Acknowledgement Message) F-13
Figure F-11: M Downlink (Leaving Net Message) F-13
Figure F-12: M Downlink (Next Net ACK Message) F-13
Figure F-12a: M Uplink (Terminate Net Message) F-14
Figure F-12b: M Uplink (Supported Options Message) F-15
Figure F-13: V/D (Voice) Burst Header Segment F-16
Figure F-14: V/D (Data) Burst Header Segment F-17
Figure I-1: ISO 8208 Compressor Architecture I-2
Figure J-1: ATN CLNP Packet J-1
Figure J-2: Compressed CLNP Header Format J-2
Figure J-3: Compression Field (Type-Specific Information Field) Definition for ISO8473 (Payload Field Value of 0001 Binary) J-3
Figure J-4: Bit Field Definitions J-4

Figure J-5: CLNP Compression System Parameters J-8

TABLE OF TABLES

Table 3-1: Data Encoding 31
Table 3-2: Scrambler Functions 37
Table 3-3: MAC Service System Parameters 42
Table 3-4: Address Type Field Encoding 46
Table 3-5: Broadcast Address Encoding 47
Table 3-6: AVLC Commands and Responses 48
Table 3-7: Data Link Service System Parameters 48
Table 3-8: HDLC Public Parameter Set Identifier 58
Table 3-9: Timer T1 Parameter 59
Table 3-10: VDL Private Parameter Identification 59
Table 3-11: Private Parameter Set Identification 60
Table 3-12: Connection Management Parameter 60
Table 3-13: Connection Management Parameter Values 60
Table 3-14: Abbreviated XID Names 61
Table 3-15: Signal Quality Parameter 62
Table 3-16: XID Sequence Parameter 62
Table 3-17: AVLC Specific Options Parameter Format 62
Table 3-18: AVLC Specific Options Parameter Values 63
Table 3-19: Expedited Subnetwork Connection 64
Table 3-20: LCR Cause Parameter 65
Table 3-21: Cause Code Table 65
Table 3-22: Modulation Support 67
Table 3-23: Modulation Scheme and Bit Rate 67
Table 3-24: Acceptable Alternative Ground Station Parameter 67
Table 3-25: Destination Airport 68
Table 3-26: Aircraft Location 68
Table 3-27: Aircraft Location Subfield Description 68
Table 3-28: Autotune Frequency Parameter 69
Table 3-29: Replacement Ground Station List 69
Table 3-30: Timer T4 Parameter 70
Table 3-31: MAC Persistence Parameter 70
Table 3-32: Counter M1 Parameter 70
Table 3-33: Timer TM2 Parameter 71
Table 3-34: Timer TG5 Parameter 71
Table 3-35: T3min Parameter 71
Table 3-36: Ground Station Address Filter Parameter 72
Table 3-37: Broadcast Connection (Link Only) Parameter 72
Table 3-38: Broadcast Connection (Link and Subnetwork) Parameter 73
Table 3-39: Frequency Support List 74
Table 3-40: Airport Coverage Indication Parameter 74
Table 3-41: Nearest Airport Parameter 75
Table 3-42: ATN Router NETs Parameter 75
Table 3-43: Station Operator Mask Parameter 76
Table 3-44: Timer TG3 Parameter 76
Table 3-45: Timer TG4 Parameter 77
Table 3-46: Ground Station Location Parameter 77
Table 3-47: VDL Management Entity System Parameters 77
Table 3-48a: XID Parameters 81
Table 3-48b: XID Parameters 82
Table 3-48c: XID Parameters 83
Table 3-49: AOA Message Format within the AVLC frame 97
Table 3-50: FIS-B Message Format 98
Table 3-51: Subnetwork Layer Service System Parameter 102

Table 3-52: Facilities Supported By VDL Mode2 104
Table 3-53: Facilities Not Supported 104
Table 3-54: System Configurations and Addressing Schemes 122
Table 3-55: Logical Burst Access Channel (LBAC) Descriptions for Configurations 4V, 2V2D, 3V, 3V1D and 2V1D 123
Table 3-56: LBAC Timing Offset Values for Configurations 2V2D, 3V, 3V1D and 2V1D 124
Table 3-57: LBAC Description and Timing for 3T Configuration 125
Table 3-58: LBAC Description and Timing for 3S Configuration 126
Table 3-59: LBAC Description and Timing for 2S1X Portion of Configuration 126
Table 3-60: LBAC Description and Timing for 1V3D Configuration 126
Table 3-61: LBAC Description and Timing for 1V2D Configuration 127
Table 3-62: Relative Timing Relationship for TRPs of Different User Groups for All System Configurations 127
Table 3-63: Access Rules for M Downlink 128
Table 3-64: Aircraft MAC Service System Parameters 130
Table 3-65: Aircraft MAC Service System Parameters 131
Table 3-66: Rules for CTCs' Maintenance 134
Table 3-67: Timing States for Non-3T Configurations 134
Table 3-68: Timing States for 3T Configuration 135
Table 3-69: Conditions for Voice Media Access (AircraftRadio) 138
Table 3-70: MAC Data Frame Transmission System Parameters 146
Table 3-71: VDL Mode 3/ATN Priority Mapping 150
Table 3-72: DLS System Parameters 152
Table 3-73: XID Parameters 162
Table 3-74: XID Parameters 166
Table 3-75: LME System Parameters 172
Table 3-76: WE and TL4 Parameter Default Values 173
Table 3-77: VDL Mode 3 Public Parameter Set Identifier 175
Table 3-78: Timer T1 Parameter 175
Table 3-79: Timer T_ack Parameter 176
Table 3-80: Parameter Set Identification 177
Table 3-81: Algorithm Version Number Parameter 177
Table 3-82: Vocoder Algorithm Version Encoding 177
Table 3-83: Network Initialization 177
Table 3-84: Network Type Values 178
Table 3-85: Connection Check Parameter 179
Table 3-86: Version Parameter 179
Table 3-87: Version Values 179
Table 3-88: Authentication Parameter 179
Table 3-89: Authentication Type 180
Table 3-90: Subnetwork User Data Parameter 180
Table 3-91: Assigned Altitude Parameter 180
Table 3-92: Expedited Recovery Parameter 181
Table 3-93: t Parameter 181
Table 3-94: f Parameter 181
Table 3-95: Former_GNI_p Parameter 181
Table 3-96: NM1 Parameter 182
Table 3-97: RR Parameter 182
Table 3-98: WR Parameter 182
Table 3-99: RE Parameter 183
Table 3-100: RL Parameter 183
Table 3-101: Timer T3 Parameter 183
Table 3-102: Timer TL3 Parameter 183
Table 3-103: Timer TL4 Parameter 184
Table 3-104: WE Parameter 184
Table 3-105: Operative_GNIp Parameter 184
Table 3-106: Aircraft_TMbB Parameter 184
Table 3-107: MbB_Operations_Permitted Parameter 185
Table 3-108: Counter NL2 Parameter 185
Table 3-109: NL5 Parameter 185

Table 3-110: NL6 Parameter 185
Table 3-111: Recommended MbB Parameter Values 192
Table 3-112: IPI and EIPI Protocol Identifiers 193
Table 3-113: Source Filtering Squelch Window Matrix for 4-Slot Configurations 202
Table 3-114: Source Filtering Squelch Window Matrix for 3-Slot Configurations 202
Table 3-115: Uplink Power Budget for VHF Digital Radio 207
Table 3-116: Excess Path Loss 95% Prob 1 Hr. Avg 137 MHz(dB) 207
Table 3-117: Link Margin (Uplink) in Decibels 208
Table 3-118: Minimum Detectable (Uplink) Signal Calculations 209
Table 3-119: Downlink Power Budget for VHF Digital Radio 212
Table 3-120: Link Margin (Downlink) (dB) 213
Table 3-121: Minimum Detectable (Downlink) Signal Calculations 214
Table A-1: Signal Fading On VHF Air/Ground Path A-2
Table A-2: Terminal Domain Application Message Traffic Model A-9
Table A-3: VDL Mode 3 Data Link Message Delay Performance for Frame-based SNDCF A-10
Table C-1: Margin Comparison for D8PSK (Voice) and DSB-AM (Voice) C-2
Table E1: Data Encoding E-19
Table F-1: M Burst Messages F-2
Table F-2: System Configuration Codes F-3
Table F-3: Voice Signal Codes F-3
Table F-4: Aircraft ID Codes F-3
Table F-5: Beacon ID Codes F-4
Table F-6: Reserved Slot Subfield Encoding F-5
Table F-7: Next Net Subfield Encoding when Net Type field set to 0 (AM) F-7
Table F-8: Voice Request Field F-12
Table F-9: Options field F-15
Table F-10: Radio Identifier Field F-15
Table I-1: DCE Substate Hierarchy I-4
Table I-2: VDL Mode 3 Call Request Packet I-7
Table I-5: VDL Mode 3 CALL ACCEPT Packet I-12
Table I-7: VDL Mode 3 CLEAR REQUEST Packet I-15
Table I-8: VDL Mode 3 DATA Packet I-16
Table I-9: VDL Mode 3 RESET REQUEST Packet I-18
Table I-12: VDL Mode 3 CLEAR CONFIRMATION Packet I-21
Table I-15: DCE Actions at State Transition I-23
Table I-16: Multiplexing Header Packet Structure I-32
Table I-17: VDL Mode 3 Subnetwork Timers I-33
Table I-18: 8208 Compression System Parameters I-34
Table I-19: ADSA Parameter I-34
Table I-20: GDTE Parameter I-34
Table I-21: VER Parameter I-35
Table I-22: M-BIT Parameter I-35
Table I-23: DCE Special Cases I-37
Table I-24: DTE Effect on DCE Restart States I-37
Table I-25: DTE Effect on DCE Call Setup and Clearing States I-39
Table I-26: DTE Effect on DCE Reset States I-41
Table I-27: RESERVED I-42
Table I-28: DTE Effect on DCE Flow Control Transfer States I-42
Table I-29: XDCE Effect on DCE Restart States I-43
Table I-30: XDCE Effect on DCE Call Setup and Clearing States I-43
Table I-31: XDCE Effect on DCE Reset States I-44
Table I-32: RESERVED I-44
Table I-33: GNI (ANI) Effect on ADCE (GDCE) Packet Layer Ready States I-44
Table I-34: GNI (ANI) Effect on ADCE (GDCE) Call Setup and Clearing States I-45
Table I-35: GNI (ANI) Effect on ADCE (GDCE) Reset States I-47
Table I-36: RESERVED I-48
Table I-37: GNI (ANI) Effect on ADCE (GDCE) Flow Control Transfer States I-48
Table I-38: DCE Effect on ADCE (GDCE) Call Setup and Clearing States I-49

Table I-39: DCE Effect on ADCE (GDCE) Reset States I-50
Table I-40: RESERVED I-51
Table J-1: CT1 Parameter J-8
Table J-2: CT2 Timer J-9
Table J-3: CT3 Timer J-9
Table K-1: Free Space and Ground Reflection Loss vs. Range, Aircraft Flight Level and Ground Antenna Height, (Median refractive conditions or effective Earth radius factor □ = 4/3) K-4
Table K-2: Free Space and Ground Reflection Loss vs. Range, Aircraft Flight Level and Ground Antenna Height (Worst case sub-refractive conditions or effective Earth radius factor □ = 1) K-4
Table K-3: Parameters for Sample Link Budgets K-7
Table K-4: Sample Ground-to-Air Long-Range Link Budgets Using Ray-Tracing and Effective Earth Radius Factor $\kappa = \frac{4}{3}$ (Median) K-8
Table K-5: Sample Ground-to-Air Long-Range Link Budgets Using Ray-Tracing and Effective Earth Radius Factor $\kappa = 1$ (Worst Case) K-9
Table K-6: Sample Ground-to-Air Long-Range Link Budgets Using Johnson-Gierhart Propagation Model (95th Percentile) K-10
Table K-7: Sample Air-to-Ground Long-Range Link Budgets Using Ray-Tracing and Effective Earth Radius Factor $\kappa = \frac{4}{3}$ (Median) K-12
Table K-8: Sample Air-to-Ground Long-Range Link Budgets Using Ray-Tracing and Effective Earth Radius Factor $\kappa = 1$ (Worst Case) K-13
Table K-9: Sample Air-to-Ground Long-Range Link Budgets Using Johnson-Gierhart Propagation Model (95th Percentile) K-14
Table L-1: VHF Channel Labels L-2

1 INTRODUCTION

The purpose of this document is to provide RTCA Minimum Aviation System Performance Standards (MASPS) that define the signal-in-space characteristics for advanced Very High Frequency (VHF) digital data communications, including compatibility with digital voice techniques. This document examines the VHF communications system characteristics and principles of operation for both VHF voice and data system elements. Aviation user requirements and system requirements are considered, and technical characteristics are developed for aircraft transceivers and ground transmitters/receivers. Finally, considerations are examined with regard to accommodating existing systems while making a transition to a new improved VHF data link.

1.1 VHF Communications System Characteristics

1.1.1 Introduction

The characteristics of the present air/ground VHF communications system are contained in the Federal Communications Commission (FCC) Rules (47 CFR Part 87), the International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs) (Annex 10, Volume I, Chapter 4 Paras. 4.5 - 4.7), and RTCA/DO-186B *Minimum Operational Performance Standards for Airborne Radio Communications Equipment*. These documents set forth the minimum mandatory and desired operational performance standards for VHF air/ground communications systems. The following list summarizes pertinent industry standards.

Reference Document Name	**Doc. #**
ARINC Specification – Air-Ground Character-Oriented Protocol Specification	618
ARINC Specification – VHF Digital Link (VDL) Mode 2 Implementation Provisions	631
ARINC Characteristic – VHF Data Radio	750
ARINC Characteristic – Communications Management Unit (CMU) Mark 2	758
ICAO Document - Manual of Technical Provisions for the Aeronautical Telecommunication Network	9880
ICAO Document - Comprehensive Aeronautical Telecommunication Network Manual	9739
ICAO Document - Manual on VHF Digital Link (VDL) Mode 2	9776
ICAO Document - Manual on VHF Digital Link (VDL) Mode 3	9805
ISO Standard - Information Technology -- Telecommunications and information exchange between systems -- High-level data link control (HDLC) procedures -- Frame Structure	3309*
ISO Standard - Information Technology -- Telecommunications and information exchange between systems -- High-level data link control (HDLC) procedures -- Elements of procedures	4335*

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Reference Document Name	Doc. #
ISO Standard - Information Technology -- Telecommunications and information exchange between systems -- High-level data link control (HDLC) procedures -- Classes of procedures	7809*
ISO Standard - Information Technology -- Data Communications -- X.25 Packet Layer Protocol for Data Terminating Equipment	8208-1990
ISO Standard - Information Technology -- Protocol for providing the connectionless-mode network service	8473
ISO Standard - Information Technology -- Telecommunications and information exchange between systems -- High-level data link control (HDLC) procedures -- General purpose XID frame information field content and format	8885-1993*
ISO Standard - OSI Data Link Service Definition	8886.3
ISO Standard - Information Technology -- Telecommunications and information exchange between systems -- End system to intermediate system routeing exchange protocol for use in conjunction with the Protocol for providing the connectionless-mode network service (ISO 8473)	9542
ISO Standard - Local Area Networks -- MAC Service Definition	DP 10039
ISO Standard - Information Technology -- Telecommunications and information exchange between systems -- Protocol for exchange of Inter-Domain Routeing Information among intermediate systems to support forwarding of ISO 8473 PDUs	10747
ITU-T Standard - International Numbering Plan for Public Data Networks	X.121
RTCA VHF Air-Ground Communications System Improvements Alternatives Study and Selection of Proposals for Future Action	DO-225

**It should be noted that the HDLC standards referenced are obsolete by ISO and have been replaced by ISO13239. It should be noted that there are still sources for these obsolete standards and that ISO13239 is not fully interoperable with the referenced standards.*

All of these documents in the list above fall under the proprietary disclaimer note.

1.1.2 Definitions of Terms

Please note that these terms and definitions are to be used for the purposes of this MASPS.

Administration Field: A field within the Aeronautical Telecommunications Network (ATN) Network Service Access Point (NSAP) address which is used to sub-divide the Network Addressing Domain that is identified in the Version field of the address. The partition of the Network Addressing Domain permits domain management by separate administrations or organizations.

Administration Region Selector (ARS): A field within the ATN NSAP address which identifies a Network Addressing Domain that will correspond to each identified Routing Domain.

Aeronautical Mobile Service: A mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which survival craft stations may