

RTCA, Inc.
1828 L Street, N.W. Suite 805
Washington, D.C. 20036

**MINIMUM AVIATION SYSTEM PERFORMANCE
STANDARDS (MASPS) FOR THE HIGH FREQUENCY DATA
LINK (HF DL) OPERATING IN THE OPERATING IN THE
AERONAUTICAL MOBILE (ROUTE) SERVICE (AM (R)S)**

RTCA/DO-277
March 5, 2002

Prepared by SC-188
©2002 RTCA, Inc.

Copies of this document may be obtained from

RTCA, Inc.
1828 L Street, NW, Suite 805
Washington, DC 20036

Telephone: 202-833-9339
Fax: 202-833-9434
Internet: www.rtca.org

Please call RTCA for price and ordering information.

Currently in preview, click buy full version

FOREWORD

This document was prepared by RTCA Special Committee 188 (SC-188). It was approved by the Program Management Committee on March 5, 2002.

RTCA, Incorporated is a not-for-profit corporation formed to advance the art and science of aviation and aviation electronic systems for the benefit of the public. The organization functions as a Federal Advisory Committee and develops consensus based recommendations on contemporary aviation issues. RTCA's objectives include but are not limited to:

- coalescing aviation system user and provider technical requirements in a manner that helps government and industry meet their mutual objectives and responsibilities;
- analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity and efficiency;
- 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
- assisting in developing the appropriate technical material upon which resolutions for the International Civil Aviation Organization and the International Telecommunication Union and other appropriate international organizations can be based.

The organization's recommendations are often used as a basis for government and private sector decisions as well as the foundation for many Federal Aviation Administration Technical Standard Orders.

Since RTCA is not an official agency of the United States Government, its recommendations may not be regarded as statements of official government policy unless so enunciated by the U. S. government organization or agency having statutory jurisdiction over any matters to which the recommendations relate.

Appendices C and E are normative appendices.

This page intentionally left blank.

Currently in preview, click buy full version

TABLE OF CONTENTS

1	PURPOSE AND SCOPE.....	1
1.1	Introduction	1
1.2	System Overview	2
1.2.1	System Architecture	2
1.2.2	ICAO Global CNS/ATM and System Performance Concepts.....	2
1.2.3	HF Data Link System Overview	3
1.2.4	End-to-End Communications Environments.....	5
1.2.4.1	The Aeronautical Telecommunications Network (ATN).....	5
1.2.4.2	FANS 1/A Data Link.....	5
1.2.5	HF Data Link Service Responsibilities	5
1.3	Operational Applications.....	6
1.3.1	Air Traffic Services.....	6
1.3.2	Aeronautical Operational Control	6
1.3.3	Non-Safety Communications Services.....	6
1.3.4	Data and Voice Communications.....	6
1.4	Operational Goals.....	6
1.4.1	Coverage	6
1.4.2	Compatibility and Interoperability	6
1.4.3	Priority And Precedence.....	7
1.4.4	Failure Modes, Warnings, and Flags.....	7
1.4.5	Human Factors Considerations	7
1.5	Assumptions	7
1.5.1	Assumptions Regarding the Required Communications Performance (RCP) Concept.....	7
1.5.2	Assumptions Regarding the ATN	8
1.5.3	Assumption Regarding Use of HF Data Link Avionics.....	8
1.5.4	Assumption Regarding Independence of Avionics and Ground System Failures.....	8
1.6	Verification Procedures	8
1.7	Reference Documents.....	8
1.8	Definition of Terms	9
2	SUBNETWORK PERFORMANCE REQUIREMENTS	11
2.1	General Requirements	11
2.2	Specific Requirements.....	11
2.2.1	Standard Operating Conditions	12
2.2.2	Spectrum Requirements	12
2.2.2.1	Emission Designators	13
2.2.2.2	Interference	13
2.2.2.2.1	Emissions	13
2.2.2.2.2	Undesired Signal Rejection.....	14
2.2.3	Coverage Volume.....	14
2.2.4	Priority, Precedence and Preemption	14
2.2.4.1	Priority Levels	15
2.2.4.2	Precedence	15
2.2.4.3	Preemption.....	15
2.2.5	Subnetwork Installed Communications Performance (ICP)	15
2.2.5.1	Transfer Delay	15
2.2.5.1.1	Traffic Model	16
2.2.5.1.2	Subnetwork Model.....	16
2.2.5.1.3	Transfer Delay Minimum Performance	17
2.2.5.1.4	Transfer Delay Characterization of HF Data Link Subnetwork	17
2.2.5.2	Integrity	18

2.2.5.3	Service Availability Criteria.....	18
2.2.5.3.1	Service Outages.....	19
2.2.5.3.2	Availability Ratio.....	19
2.2.5.4	Continuity of Service Criteria.....	19
2.2.5.4.1	Continuity of Service Event.....	20
2.2.5.4.2	Continuity of Service.....	20
2.2.6	Service Monitoring and Reporting.....	20
2.2.6.1	Outage Reporting.....	20
2.2.6.2	Availability Monitoring.....	20
2.2.6.3	Transfer Delay Monitoring.....	20
2.2.6.4	Integrity Monitoring.....	20
2.2.7	Subnetwork Interoperability.....	21
2.2.7.1	Subnetwork Communications Protocols.....	21
2.2.7.2	Transparency to User Data.....	21
2.2.7.3	Interactions with Elements External to the HF Data Link Subnetwork.....	21
2.2.7.3.1	Connection Establishment Delay.....	21
2.2.7.3.2	Connectivity Events.....	21
2.2.7.3.3	System Control Interactions.....	21
3	SUBSYSTEM REQUIREMENTS.....	23
3.1	Performance Partitioning Methodologies.....	24
3.1.1	RF Performance.....	24
3.1.2	Transfer Delay Partitioning Methodology.....	24
3.1.2.1	Latency Transfer Delay Component.....	24
3.1.2.2	Mean Transfer Delay.....	24
3.1.2.3	95th Percentile Transfer Delay.....	25
3.1.3	Integrity Performance.....	25
3.1.4	Availability Methodology.....	25
3.1.5	Continuity Methodology.....	25
3.2	AS Subsystem Requirements.....	26
3.3	Subnetwork Infrastructure (SNI) Requirements.....	26
3.3.1	SNI Performance Requirements.....	26
3.3.1.1	RF Link Performance Requirements.....	26
3.3.1.2	Mitigation of Harmful Interference.....	26
3.3.1.3	Network Coordination and Control Function.....	27
3.3.1.3.1	Intrasystem Coordination.....	27
3.3.1.3.2	Intersystem Coordination.....	27
3.3.2	SNI Functional Requirements.....	27
4	SUBNETWORK PERFORMANCE VERIFICATION PROCEDURES.....	29
4.1	Verification Techniques.....	29
4.2	Verification of Specific Requirements.....	30
4.2.1	Standard Operating Conditions.....	30
4.2.2	Spectrum Requirements.....	30
4.2.2.1	Emissions Designators.....	30
4.2.2.2	Interference.....	31
4.2.2.2.1	Emissions.....	31
4.2.2.2.2	Undesired Signal Rejection.....	31
4.2.3	Coverage Volume.....	31
4.2.4	Priority, Precedence and Preemption.....	32
4.2.4.1	Priority Levels.....	32
4.2.4.2	Precedence.....	33
4.2.4.3	Preemption.....	33

4.2.5	Subnetwork Installed Communications Performance	33
4.2.5.1	Transfer Delay	33
4.2.5.1.1	Traffic Modeling	34
4.2.5.1.2	Subnetwork Model	34
4.2.5.1.3	Minimum Acceptable Transfer Delay Performance	34
4.2.5.1.4	Transfer Delay Characterization	35
4.2.5.2	Integrity	37
4.2.5.3	Service Availability Criteria	37
4.2.5.3.1	Service Outages	37
4.2.5.3.2	Availability Ratio	38
4.2.5.4	Continuity of Service Criteria	38
4.2.5.4.1	Continuity of Service Events	38
4.2.5.4.2	Continuity of Service	39
4.2.6	Service Monitoring and Reporting	39
4.2.6.1	Outage Reporting	39
4.2.6.2	Availability Monitoring	40
4.2.6.3	Transfer Delay Monitoring	40
4.2.6.4	Integrity Monitoring	40
4.2.7	Subnetwork Interoperability	41
4.2.7.1	Subnetwork Communications Protocols	41
4.2.7.2	Transparency to User Data	41
4.2.7.3	Interactions with External Elements	42
4.2.7.3.1	Connection Establishment Delay	42
4.2.7.3.2	Connectivity Events	42
4.2.7.3.3	System Control Interactions	43
4.3	Verification of Section 3 Requirements	43
	Membership	45

APPENDICES

Acronyms and Glossary	A-1
RF Link Analysis Methodology	B-1
Availability and Continuity of Service Analysis Methodology(Normative)	C-1
Analysis of HF Data Link Integrity	D-1
Traffic Model (Normative)	E-1
Tutorial Appendix on HF Data Link and ATN	F-1
Statistical Transfer Delay Analysis	G-1

TABLE OF FIGURES

Figure 1-1: End-to-End Packet-Mode Services System Structure2
Figure 1-2: High Frequency Data Link End-to-End Model4
Figure 2-1: HF Data Link Subnetwork and Performance Reference Points11
Figure 2-2: Transmit Spectrum Limits14
Figure 3-1: Partitioning Air-to-Ground Subnetwork into AS and HNI.....23
Figure 4-1: Example of To-Aircraft-Direction Transfer Delay Measurement System3

TABLE OF TABLES

Table 2-1: Quantitative Requirements for System Characteristic Declaration.....12
Table 2-2: Tables for Transfer Delay Characteristics17

1 PURPOSE AND SCOPE

1.1 Introduction

This document contains minimum aviation system performance standards for communications utilizing High Frequency Data Link systems for the air-ground communications subnetwork in an Aeronautical Telecommunications Network (ATN) environment. The FANS 1/A data link environment is also addressed. These standards specify characteristics that should be useful to designers, installers, manufacturers, service providers and users of systems intended for operational use within the United States National Airspace System (NAS). Where systems are global in nature, the system may have international applications that are taken into consideration.

Compliance with these standards is recommended as one means of assuring that the system and each subsystem will perform its intended function(s) satisfactorily under conditions normally encountered in routine aeronautical operations for the environments intended. The MASPS may be implemented by one or more regulatory documents and/or advisory documents (e.g., certification, authorization, approval, commissioning, advisory circular, notice, etc.) and may be implemented in part or in total. Any regulatory application of this document is the sole responsibility of appropriate governmental agencies.

It is anticipated that regional service contracts may require additional declaration of performance values for smaller coverage volumes using the methodologies described in this document and its appendices.

Section 1 of this document describes a generalized High Frequency Data Link (HF Data Link) System, and the data link environment in which it is used, and provides information needed to understand the rationale for system characteristics and requirements that are stated within this document. This section also contains typical applications and envisioned operational goals and assumptions necessary to establish a basis for the subsequent sections.

Section 2 defines the general requirements of an HF Data Link subnetwork, specific requirements for its elements, and specific minimum Installed Communications Performance (ICP) requirements when viewed as an air/ground subnetwork of an end-to-end data network. The ICP requirements include delay, integrity, availability and continuity of service parameters.

Section 3 establishes requirements for specific information that must be provided in the system-specific attachments and establishes pro-forma tables and methodology by which the information is to be provided. The purpose of this disclosure is to provide confidence that the subnetwork design will achieve the "Point B-to-Point C" performance specified in Section 2, prior to the approval of that system for HF Data Link. A system-specific attachment will not require RTCA approval or publication. The ultimate proof of performance at the subnetwork level is the verification procedures of Section 4.

Section 4 describes procedures recommended for verifying compliance of the subnetwork and its elements with the minimum performance requirements in Section 2.

Appendices of this document are structured to contain either normative or informative material, and are so identified in each case. Normative appendices contain material, such as descriptions of acceptable analytic methodologies, where the inclusion of such material