



**DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION**

**MINIMUM THRESHOLD DOCUMENT (MTD)
FOR THE ENGINEERING DEMONSTRATION MODEL (EDM)**

**January 10, 2002
DRAFT**

**NEXT GENERATION AIR/GROUND COMMUNICATIONS
(NEXCOM)**

The NEXCOM Integrated Product Team, AND-360

DRAFT

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1 INTRODUCTION

This Minimum Threshold Document (MTD) identifies the Minimum Threshold Requirements (MTRs) for the NEXCOM System Engineering Development Model (EDM), for the Rapid Preliminary Development Effort (RPDE).

1.1 Background

The International Civil Aviation Organization (ICAO) and RTCA, Inc., carried out a comprehensive analysis of the 118 to 137 MHz frequency range, which is used for aviation Air-Ground (A/G) radio communications. It was found that spectrum was short in supply and the efficiency of use of this band needs to be increased in order to avoid running out of frequency allocations between the years 2005 and 2010. The VHF Digital Link Mode 3 (VDL Mode 3) system was recommended as the future A/G Communication System.

The FAA made a decision to implement the Next Generation A/G Communications (NEXCOM) System based upon VDL Mode 3 technology. VDL Mode 3 uses a Time-Division Multiple Access (TDMA) approach to place three or four digital circuits into one 25-kHz frequency assignment. The digital circuits are independent and can be used for voice and data transmission in accordance with the selected VDL Mode 3 system configuration.

NEXCOM focuses on the ground system aspects of the future A/G communications. Figure 1-1 shows a top-level illustration of the NEXCOM System.

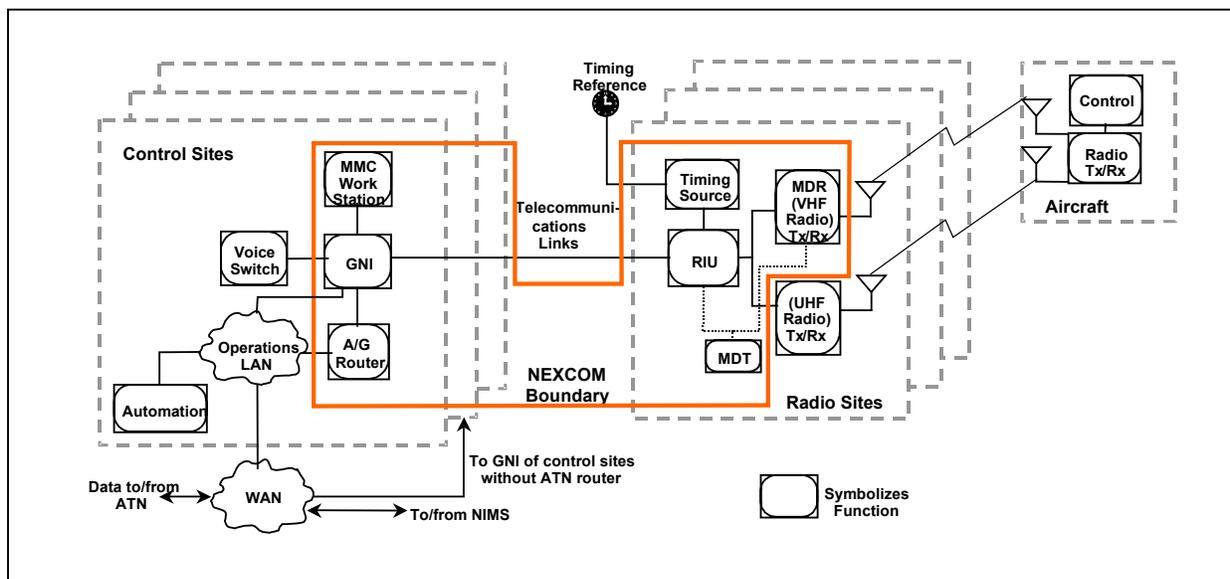


Figure 1-1. Top-Level Illustration of the NEXCOM System

Timely execution of the NEXCOM program is critical to its success. To ensure the overall viability of the NEXCOM program, the FAA is planning to develop a base capability to produce

and implement the NEXCOM system. In order to reduce the risk to the NEXCOM program, the RPDE is introduced. The RPDE consists of the following efforts:

- Development of a set of Subsystem Specifications (SSS) and Interface Control Documents (ICDs) for the Full Scale Development Program (FSDP)
- Development of the EDM, through which an initial minimum threshold capability and the expertise to manufacture and implement the NEXCOM System will be demonstrated.

The RPDE will be followed by the FSDP.

1.2 Purpose of the EDM

The purpose of the EDM is to provide an engineering model from which a basic understanding of the vendors' technical approach can be evaluated and demonstrated against the minimum set of the NEXCOM System requirements. During the EDM development, certain design choices relating to the allocation of functional elements to the NEXCOM Subsystems (such as the GNI and RIU) will be made prior to the FSDP of NEXCOM.

Specifically, the EDM needs to:

- Demonstrate that there is a clear path to the FSDP
- Show understanding of the NAS operation through demonstration of the EDM
- Demonstrate through the EDM that the FSDP will be interoperable with the NAS
- Assure management that the FSDP can be deployed in a timely manner; and that management can proceed with the FSDP acquisition by August 2004
- Demonstrate that the NEXCOM System can be produced and supported.

1.3 Scope

The MTD serves as the procurement document for the EDM. The NEXCOM System Requirements Document (SRD) is the complete set of requirements for the NEXCOM ground system. In order to avoid repetition, the background material given in the SRD is not included in this MDT. It is recommended that the complete SRD and its appendices be carefully reviewed in order to obtain an in-depth understanding of the NEXCOM System requirements.

The requirements stated in this MTD are the subset of the SRD requirements that need to be demonstrated by the EDM. Functions of the SRD to be demonstrated by the EDM are summarized below:

- (1) VDL Mode 3 voice (selected features of the Minimum Aviation System Performance Standards (MASPS), RTCA DO-224A, as specified in Section 3 of this document)
- (2) VDL Mode 3 data (limited features, as specified in Section 3 of this document)
- (3) Security (authentication, information integrity)
- (4) Maintenance, Monitoring, and Control (MMC)
- (5) Signaling (control status of the A/G channel, e.g., PTT)
- (6) Timing (system and subsystem timing distribution)
- (7) Telecommunications (Ground-Ground (G/G) connectivity between the control site and the radio site).

Detailed requirements that will be implemented in the EDM are presented in Section 3 of this MTD. Typical areas that need to be demonstrated through the EDM are system timing, data interfaces, distribution of detailed functionality between the Ground Network Interface (GNI) at the control site and the Radio Interface Unit (RIU) at the radio site, as well as communications between the GNI and the RIU.

1.4 EDM Demonstration Environment

The EDM will be evaluated as part of the source selection process to determine compliance to the MTRs as defined in this document. The demonstration of the EDM will be scheduled and conducted at the William J. Hughes Technical Center (WJHTC), Atlantic City, NJ. The specific location will be identified in the RPDE Screening Information Request/Request for Offer (SIR/RFO).

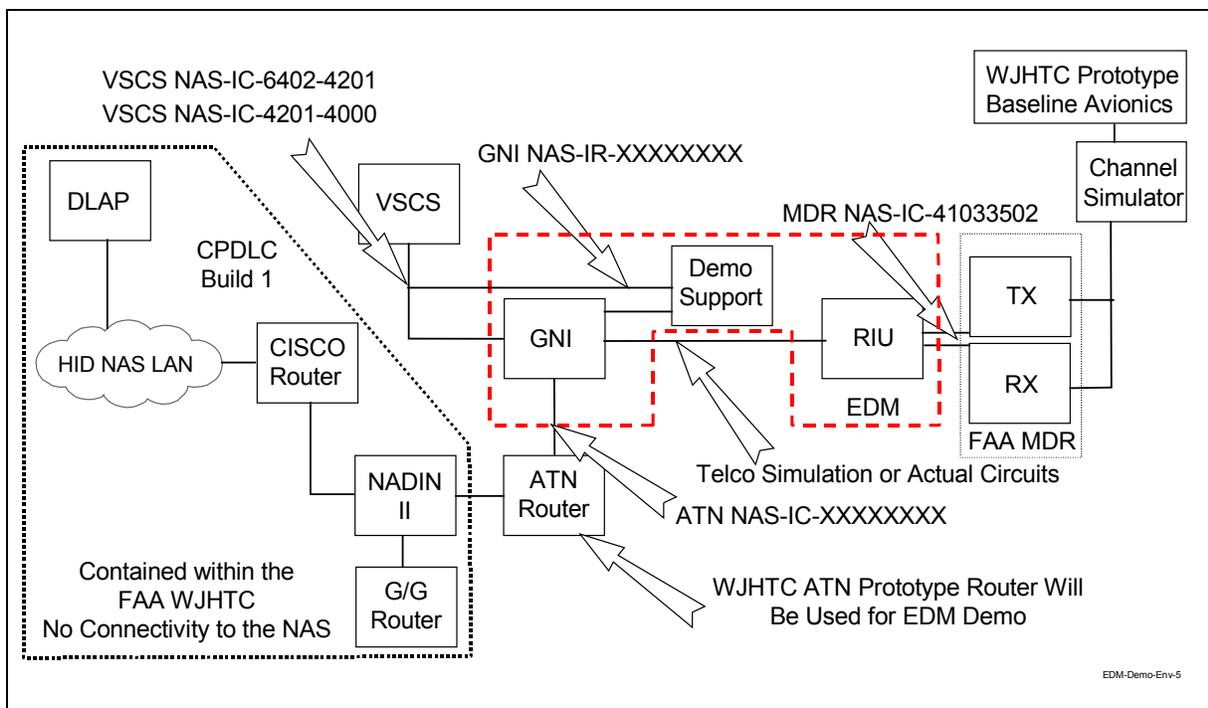


Figure 1-2. Illustration of the EDM Demonstration Environment

Figure 1-2 illustrates the demonstration environment for the EDM. The interfaces between the EDM and the equipment in the demonstration environment are described by a set of interface documents as shown in Figure 1-2 and identified in Section 2 in this MTD. The FAA is providing a Test Capabilities Document (TCD) as part of the RPDE SIR to identify the equipment configuration and other pertinent information needed in order to conduct the demonstration.

The EDM will be evaluated as part of the Offeror's technical submission. In order to conduct the demonstration, the Offeror will provide written demonstration procedures, which will be reviewed and evaluated as part of the technical submission before the conduct of any

demonstration. The FAA will provide an evaluation team whose role will be to witness and verify the results of the EDM demonstration. The FAA's evaluation team will provide the results to the FAA's NEXCOM program office for incorporation into the overall evaluation.

1.5 Document Organization

Section 1 states the purpose and scope of the MTD. For definitions, the reader needs to refer to Section 1.5 of the SRD.

Section 2 lists the applicable reference documents.

Section 3 lists the MTR for the EDM.

Section 4 summarizes the methods of verification of the requirements given in this MTD.

Section 5 describes any special preparation requirements for delivery.

Section 6 contains applicable notes.

1.6 Programmatic Assumptions

The following describes the programmatic assumptions for the RPDE:

- The MTD identifies the full set of requirements needed to build the Engineering EDM.
- The EDM will convey the proposed technical approach to the FAA. The EDM will demonstrate the basic functionality of VDL Mode 3 technology as defined in the MTD.
- For the purposes of conducting the EDM demonstration, vendor documentation will be provided to identify the EDM HW/SW design, demonstration procedures, traceability matrix as defined in the RPDE SIR.
- The results of the EDM demonstration will become part of the technical evaluation for the FSDP and will be observed by a FAA EDM evaluation team. Final demonstration results become part of the overall technical score.
- Concurrent with the EDM the vendor will develop the NEXCOM system architecture and subsystem specifications (SSS) as well as interface documentations (ICDs and IRDs). The documentation is an element of the RPDE and will be evaluated accordingly.
- An EDM Demonstration Environment Document will be provided which provides information on the demonstration test bed/equipment provided as government furnished equipment (GFE) for which the vendor's EDM may interface.

2. APPLICABLE DOCUMENTS

The following listed documents form a part of this MTD to the extent specified herein, unless marked “for reference only.” In event of a conflict between the documents referenced herein and the contents of this MTD, the contents of this MTD shall be considered the superseding requirement.

2.1 Government Documents

2.1.1 FAA Specifications and Interface Documents

Doc. No.	Document Title	Version/Date	Section(s)
FAA-P-2958	<i>Next Generation Air/Ground Communications (NEXCOM) System Requirements Document (SRD)</i>	January 15, 2002	
FAA-E-2938	<i>Subsystem Specification, Multimode Digital Radio (MDR)</i>	September 20, 2000	
NAS-IC-42014000	<i>VSCS to the Existing Radio Control Equipment ICD for the Voice Switching and Control System (VSCS)</i>	October 10, 1997	
NAS-IC-64024201	<i>VSCS to Backup Emergency Communications ICD for the Voice Switching and Control System, (VSCS)</i>	August 8, 1997	
NAS-IC-41033502	<i>Interface Control Document, Multimode Digital Radio/Radio Interface Unit</i>	September 26, 2000	
NAS-IR-xxxxxxx	<i>Ground Network Interface (GNI) to Voice Switching and Control System (VSCS) Interface Requirements Document (DRAFT) for the NEXCOM GNI Engineering Development Model</i>	November 28, 2001	
NAS-IC-xxxxxxx	<i>ATN Air/Ground Router Subnetwork Service Provider to Primary Ground Network Interface Data Port for RPDE</i>	TBD	

2.1.2 Other FAA Documents

Doc. No.	Document Title	Version/Date	Section(s)
NAS-SS-1000	<i>NAS System Specification, Volume I</i>	December, 1986	3.2.x
FAA-G-2100G	<i>Electrical Equipment, General Requirements</i>	October 22, 2001	

2.2 Non-Government Documents

2.2.1 ICAO Standards

Doc. No.	Document Title	Version/Date	Section(s)
RTCA DO-224A	<i>Signal-in-Space Minimum Aviation System Performance Standards (MASPS) for Advanced VHF Digital Data Communications Including Compatibility with Digital Voice Techniques</i>	September 13, 2000	2.0, 3.3, 3.4, 3.5, 3.10, 3.11
ICAO Doc 9705	<i>Manual on the Technical Provisions for the Aeronautical Telecommunications Network (ATN)</i>	Edition 3 / November 2001	
ICAO Annex 10	<i>International Standards and Recommended Practices (SARPs) - Volume III</i>	Amendment 75 / Nov. 2001	Part I, Chapter 6

2.2.2 Industry Standards

Doc. No.	Document Title	Version/Date	Section(s)
Telcordia TR-NWT-000335 (formerly Bellcore)	<i>Voice Grade Special Access Service Transmission Parameter Limits and Interface Combinations</i>	May 1993	based on FAA Order 6000.22A
Telcordia GR-499-CORE (formerly Bellcore)	<i>Transport Systems Generic Requirements (TSGR) Common Requirements</i>	1998	based on FAA Order 6000.47C

Doc. No.	Document Title	Version/Date	Section(s)
NFPA Standard 70	<i>National Electrical Code</i>		6.2
Electronic Industries Association (EIA)-310-E	<i>Cabinets, Racks, Panels, and Associated Equipment</i>	March 17, 1999	

2.3 Other Government Documents

Doc. No.	Document Title	Version/Date	Section(s)
FAA Order 3900.19B	<i>Occupational Safety and Health Program</i>	April 29, 1999	
Executive Order 12699	<i>DOT Implementation of Energy Order 12699</i>		
29 CFR, 1910	<i>Occupational Safety And Health Standards</i>	July 1, 1999	
29 CFR, 1926	<i>Safety and Health Regulations for Construction</i>	Various	
47 CFR Part 68	<i>Connection of Terminal Equipment to the Telephone Network</i>		

Note: 47 CFR Part 68 supersedes FAA Orders 1600.66 and 1600.54B.

2.4 Document Sources

2.4.1 FAA Documents

Copies of FAA specifications, standards, and publications may be obtained from the NEXCOM Contracting Officer, FAA, 800 Independence Avenue SW, Washington, DC 20591. Requests should clearly identify the desired material by number and state the intended use of the material. FAA-G-2100G may be downloaded from the FAA at <http://www.faa.gov/asd/standards/index.htm>.

2.4.2 Military and Federal Documents

Single copies of unclassified military and federal specifications, standards, and publications may be obtained by writing the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA, 19120; or by calling (215) 697-3321 Monday through Friday, 8:00 a.m. to 4:30 p.m. Eastern Standard Time (EST).

2.4.3 American National Standards Institute (ANSI) and International Organization of Standardization (ISO) Documents

Copies of American National Standards Institute (ANSI) and International Organization of Standardization (ISO) documents may be obtained from the American National Standards Institute, 11 West 42nd Street, New York, NY, 10036, or through the web site <http://www.ansi.org>.

2.4.4 International Civil Aviation Organization (ICAO) Documents

Copies of final products of International Civil Aviation Organization (ICAO) documents may be obtained from the ICAO Library is 999 University Street, Montreal, Quebec H3C 5H7, Canada, or through the web site <http://www.icao.org>.

Note: For current working documents that are not final products, inquire at ICAO web site <http://www.icao.org>.

2.4.5 RTCA, Inc. Documents

Copies of RTCA, Inc. documents may be obtained from RTCA, Incorporated, 1828 L Street N.W., Suite 805, Washington, DC 20036-4001, by phone (202) 833-9339, or through the web site <http://www.rtca.org>.

2.5.6 Telcordia Documents

Telcordia (formerly Bellcore) documents may be obtained from the web site <http://www.telcordia.com>.

2.4.7 Federal Communications Commission Documents

Copies of 47 CFR, Part 2 and Part 87 may be obtained from the FCC, 445 12th Street, SW, Washington D.C. or by downloading from the FCC web site at www.fcc.gov/oet/info/rules.

2.4.8 Electronic Industries Alliance Documents

Copies of Electronic Industries Alliance (EIA) standards may be obtained from the Electronic Industries Alliance, 2500 Wilson Boulevard, Arlington, VA 22201-3834, by calling (703) 907-7500, or through the web site <http://www.eia.org>.

2.4.9 National Fire Prevention Association (NFPA)

Copies of National Fire Prevention Association materials may be obtained from the NFPA, 1 Batterymarch Park Quincy, MA 02269-9101 USA, Telephone: (617) 770-3000 Fax: (617) 770-0700 or through the web site <http://www.nfpa.org>.

3 REQUIREMENTS

This section contains the MTRs for the EDM. The section numbers, the section titles, and the requirements are derived from the SRD. The comments define the scope of the requirement appropriate for the EDM implementation. For a description of the current A/G communications system see SRD Appendix A, and for a description of the proposed future A/G communications system see SRD Appendix B.

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.2.1.1.1	Site Configurations	<p>a) The NEXCOM System shall support the following site configurations:</p> <ol style="list-style-type: none"> 1. Single Remote Communications Facility (RCF) 3. Primary RCF with backup site (e.g., BUEC) 4. Diversity site group (e.g., multiple RCFs for a User Group) <p><i>Note 1: See SRD Section 3.2.3.5 and Appendix A, Section A.3.2.2 for an explanation of diversity site group</i></p> <p><i>Note 2: A local radio installed at a control facility is considered one of the configurations mentioned above.</i></p>	
3.2.2	Modes of Operation	<p>a) The NEXCOM System shall operate in each of the following selectable modes:</p> <ol style="list-style-type: none"> 1. VDL Mode 3 	For EDM, demonstrate VDL Mode 3, 2V2D configuration only.
3.2.3.1	Voice Communications Requirements	<p>a) The NEXCOM System shall allow all users in a Talk Group to monitor all voice communications within that Talk Group.</p> <p><i>Note 1: This requirement is fulfilled by the proper implementation of the modes of operation specified in SRD Section 3.2.2.</i></p> <p><i>Note 2: This requirement does not require the rebroadcast of voice traffic when the system is configured to operate for a single sector/control airspace.</i></p> <p>b) Data communications, including data communications overloading, shall not prevent the operation of voice communication.</p> <p>c) The NEXCOM System shall route received audio to the NEXCOM/VSCE interface based on the received audio at the remote site.</p> <p><i>Note 3: If audio is received at the remote site, it should be routed to the corresponding audio port at the VSCE. This configuration is only defined when more than one audio output is utilized at the control site.</i></p>	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.2.3.1.1	Voice Channels	a) The NEXCOM System shall interface with existing VSCE (e.g., VSCS, ETVS, ICSS, RDVS, STVS) via existing interfaces (e.g., Single channel VHF + UHF (V+U) and quad channel VHF/UHF/MAIN/STANDBY (V/U/M/S)).	Demonstrate for VSCS Type B and BUEC VHF interfaces only, per NAS-IC-42014000, (<i>VSCS to the Existing Radio Control Equipment ICD</i>), NAS-IC-64024201, (<i>VSCS to Backup Emergency Communications ICD</i>), NAS-IR-xxxxxxx, (<i>GNI to VSCS IRD</i>)
3.2.3.1.2	Voice Encoding/Decoding	a) The NEXCOM/VSCE interface shall include: 1. Analog voice b) Voice encoding/decoding for VDL Mode 3 shall be in accordance with the vocoder algorithm specified in ICAO Annex 10, Vol. III, Part 1, Chapter 6.	
3.2.3.1.3.1	Uplink Path	a) The NEXCOM System shall transmit uplink voice out of the radio at the site(s) selected by the controller. <i>Note: The NEXCOM System should not restrict the ability to transmit from multiple sites per sector. However, the VSCS may have restriction based on its design.</i>	
3.2.3.1.3.2	Downlink Path	a) The NEXCOM System shall route all downlink voice output from all selected receivers to the VSCE. <i>Note: The current system delivers all downlink voice outputs to the VSCE.</i>	
3.2.3.2.1	Data Service	a) The NEXCOM System shall provide for a subnetwork for two-way addressed data communications between ground and Mobile User systems. b) The NEXCOM System shall provide for uplink broadcast using the same subnetwork as the two-way addressed service.	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
		c) The NEXCOM System shall provide for uplink data broadcasts that do not depend on any information received over two-way addressed services. <i>Note: This includes providing an uplink data broadcast subnetwork without supporting two-way service.</i>	
3.2.3.2.1.1	ATN Compatibility	a) The NEXCOM System shall interoperate with ATN-based Air/Ground Routers and avionics routers as defined in the ICAO Annex 10, and ICAO Doc 9705 (Edition 3).	For EDM, interface with router directly per ATN NAS ICD-xxxxxxx.
3.2.3.2.1.3	User Authentication	a) The NEXCOM System shall support authentication of user attempts to initialize connections per RTCA DO-224A, Section 3.3.2.3.2.8.	For EDM, digital signature algorithm shall comply with FIPS 186-2 (e.g., DSA, RSA, Elliptic Curves). The function shall use the SHA-1 hashing algorithm described in FIPS 180-1. This configuration shall be communicated using the 'User Defined' field of the Authentication Exchange Identifier of RTCA DO-224A.
3.2.3.4.1	Entry Into a Talk Group	a) The NEXCOM System shall allow any Mobile User, operating in the correct mode, entry into any Talk Group within the Talk Group's service volume.	
		<i>Note: This is to ensure that the Mobile User can enter a Talk Group regardless of whether or not the Mobile User was instructed to do so by the ground controller. For example, in the case where the Mobile User has lost communication with its own Talk Group, it should still be able to access another Talk Group.</i>	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.2.3.4.2	Automated Transfer of Communication	<p>a) The NEXCOM System shall upload channel assignment information to a Mobile User system via the VDL Mode 3 Next Net capability defined in RTCA DO-224A.</p> <p><i>Note: This requirement is intended to support Transfer of Communication (TOC) via Next Net messaging.</i></p>	Next Net Messaging will be communicated to the EDM by a vendor-supplied device.
3.2.3.5	Ground Station Operations	<p>a) The NEXCOM System shall support diversity site group(s) operation (see SRD Appendix B for VDL Mode 3). When operating in VDL Mode 3:</p> <p>b) The NEXCOM System shall schedule the VDL Mode 3 uplink M-Burst of the ground transmitters to avoid self-interference.</p> <p><i>Note 1: One way of avoiding the interference of M-Bursts for the same User Group radiated from different ground sites is to coordinate uplink M-Burst transmissions to allow only one uplink M-Bursts per MAC cycle.</i></p> <p>c) In any User Group, the active transmitter shall not cause harmful interference with any other User Group operating on the same frequency.</p> <p><i>Note 2: This applies to all Main/Standby and BUEC transmitters.</i></p>	Demonstrate how to prevent RCAG/BUEC interference.
3.2.3.6.1	Push-to-Talk Transmitter Keying (PTT/PTT Release)	<p>a) The NEXCOM System voice channel uplink access shall be based on PTT assertion.</p>	
3.2.3.6.2	PTT/PTT Release Confirmation	<p>a) The NEXCOM System shall provide confirmation of PTT/PTT Release on a per Talk Group basis.</p> <p><i>Note 1: The activation of the Ground Stuck Microphone Correction function, used to disable NEXCOM RF transmissions, releases the PTT signal and will cause the PTT Confirmation to be de-asserted.</i></p>	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.2.3.6.3	Preemption of Mobile Users' Voice Transmissions (Controller Override)	<p>When operating in VDL Mode 3:</p> <p>a) The NEXCOM System shall provide a selectable function that allows the controller to preempt Mobile Users' voice transmissions on a per Talk Group basis as follows.</p> <ol style="list-style-type: none"> 1. Preemption Off (function disabled) 2. Preemption On (Upon PTT activation preemption occurs) 3. Momentary Preemption on a single PTT basis (Dynamic function selectable by the controller) <p><i>Note 1: This pre-emptive access provides a limited capability to cope with various operational issues including the "stuck" microphone condition by allowing authorized ground users to deactivate the transmitter of the offending Mobile User.</i></p> <p><i>Note 2: The Voice Preemption function (also referred to as controller override) is activated only when the PTT is asserted.</i></p> <p><i>Note 3: In momentary preemption mode, preemption is in effect for a single PTT. Controller selects momentary preemption, presses PTT, and preempts Mobile User voice transmissions one time. When PTT is released, preemption reverts to the "Off" state.</i></p>	Demonstration needs to include a VSCS workaround to simulate new signaling feature how to activate preemption. To be supplied with the EDM.
3.2.3.6.4	Preemption Confirmation of Mobile Users' Voice Transmissions	a) The NEXCOM System shall generate to the NEXCOM/VSCE interface a Voice Preemption Confirmation signal during the assertion of preemption by the ground station.	
3.2.3.6.5	Squelch Break	c) In VDL Mode 3, the NEXCOM System shall generate to the NEXCOM/VSCE interface a Squelch Break signal, based on detection of a radio frequency transmission for that Talk Group's voice subchannel above a configurable threshold.	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
		<p><i>Note: Squelch Break is intended to indicate the presence of RF energy for each Talk Group on the voice channel. This includes detecting if two aircraft have simultaneously keyed their radios.</i></p> <p>d) In VDL Mode 3, the NEXCOM System shall implement the squelch function based on RTCA DO-224A Section 3.3.5.</p>	
3.2.3.6.6.1	PTT Mute/Attenuation	<p><i>Note: In the requirements below, muting of the received uplink audio is to prevent the controllers from hearing their own ground station transmissions. These requirements are also impacted by Dual Control (SRD Section 3.2.3.6.9 e) and f).</i></p> <p>For VDL Mode 3 operation:</p> <p>a) The NEXCOM System shall be configurable (on a per Talk Group basis) to mute (at the control site asserting PTT) any received uplink voice bursts attempting to provide audio to the VSCE interface.</p>	Demonstrate VDL Mode 3 only. Show how to prevent hearing own transmissions.
3.2.3.6.7.1	Ground Radio Resource Selection	<p>a) The NEXCOM System shall select Ground Radio Resource (e.g., Main/Standby Select/Deselect, or BUEC Select/Reset as necessary) for voice operation based on operator input (e.g. VSCE, MMCWS, and/or MDT).</p> <p>b) The NEXCOM System shall support independent Ground Radio Resource Selection for voice operation by different Talk Groups.</p> <p>c) The NEXCOM System shall cause no loss of management and user information due to Ground Radio Resource Selection for voice operation.</p> <p>d) When any PTT is activated, the NEXCOM System shall inhibit the Ground Radio Resource Selection for that Talk Group (i.e., inhibit the re-routing of the voice and control signals and inhibit the switching of the antenna transfer relay).</p>	Demonstrate for RCAG/BUEC selection only.
3.2.3.6.7.2	Ground Radio Resource Selection Confirmation	<p>a) The NEXCOM System shall provide confirmation of Ground Radio Resource Selection to the operator (e.g. VSCE, MMCWS, and/or MDT) upon completion of radio selection.</p>	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.2.3.6.8	Channel Busy Signal	<p>a) The NEXCOM System shall provide a Channel Busy signal to the NEXCOM/VSCE interface that indicates the channel keyed by the controller is occupied by a downlink transmission.</p> <p><i>Note 1: This requirement is needed in support of the voice transmit function of VDL Mode 3 described in RTCA DO-224A Section 3.3.5.4.3.</i></p>	
3.2.3.7	Ground Stuck Microphone Correction	<p>a) The NEXCOM System shall provide a Ground Stuck Microphone Correction, which can be enabled, that disables the uplink transmission for that Talk Group.</p> <p>b) Ground Stuck Microphone Correction shall have a configurable time component, so that when the duration of a PTT signal from a controller exceeds the configured time, transmission stops.</p> <p>c) During Dual Control operation, the NEXCOM System shall reset the timer based on a controller gaining access to the radio transmission path.</p> <p>d) The NEXCOM System shall allow the controller to reinitiate the transmission after Ground Stuck Microphone Correction has disabled the transmission by releasing the PTT command and reapplying it.</p> <p><i>Note 1: The NEXCOM System indicates the disabling of the transmission to the controller via the removal of PTT Confirmation.</i></p> <p><i>Note 2: Activation of this function will disable PTT and if preempting, will stop the preemption.</i></p>	Demonstrate for the VDL Mode 3 through GNI/RIU functionality.
3.2.3.8.1	NEXCOM/Telecommunications Interfaces	<p>a) The NEXCOM System telecommunications shall provide full-duplex operation.</p> <p>b) The NEXCOM System shall operate with existing 4-wire analog telecommunications and selected digital telecommunications between control and remote radio facilities.</p> <p><i>Note 1: Information on digital telecommunications for NEXCOM will be defined in the NEXCOM/Telecommunications ICD.</i></p> <p><i>Note 2: The following list is representative of services available. Each has a variation for the characteristics of the service type being ordered.</i></p>	Demonstrate for VG-6 operation and 56kpbs DDC only.

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
		<p>1. Leased Interfacility Communications System (LINCS)</p> <p>2. FAA Telecommunications Infrastructure (FTI)</p> <p>3. The FAA Radio Communications Link (RCL)</p> <p>4. The FAA Low Density Radio Communications Link (LDRCL)</p> <p>5. The FAA Telecommunications Satellite (FAATSAT) Link</p> <p>6. The Alaskan NAS Interfacility Communications System (ANICS)</p> <p>7. Federal Telecommunications System (FTS)–2001 (FTS-2001)</p> <p>Note 3: The list below is representative of some of the service types offered. Not all the service types listed below are offered by the services listed above.</p> <p>1. VG-6 voice grade circuits</p> <p>2. VG-8 voice grade circuits</p> <p>3. Digital Data Services (DDS)</p> <p>4. Direct Digital Connectivity (DDC)</p> <p>5. Fractional T-1 (FT-1) or Nx64 kbps</p> <p>6. T-1 is T-Carrier at 1.544 Mbps</p> <p>Note 4: Multiple analog telecommunications circuits may be required to provide sufficient bandwidth to support all four groups of the VDL Mode 3 radio. For example, if only 9600 bps service can be achieved with each available VG-6 circuit, then four or more circuits will be required to support a VDL Mode 3 radio with all of its User Groups active.</p> <p>c) Analog telecommunications shall meet the interface requirements as specified in Telcordia TR-NWT-000335, based on FAA Order 6000.22A.</p> <p>d) Digital telecommunications shall meet the interface requirements specified in Telcordia GR-499-CORE, based on FAA Order 6000.47.</p> <p>e) The NEXCOM System shall support three telecommunication link redundancy configurations:</p> <p>1. No backup</p> <p>3. Hot telecommunications backup</p>	<p>Demonstrate for VG-6 operation only.</p> <p>Demonstrate for 56kbps DDC operation only. Demonstration environment provides 2 redundant links. (There maybe multiple lines.)</p>

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
		<p>f) The NEXCOM System shall only use the bandwidth from 300 Hz to 3000 Hz for analog telecommunication service.</p> <p>g) The NEXCOM System shall be in compliance with 47 CFR Part 68 regarding c) and d) above.</p> <p><i>Note 5: Multiple telecommunications circuits may be required to comprise a single telecommunications link. For example, multiple VG-6s may service a single RIU to communicate the different user group information.</i></p> <p><i>Note 6: The hot backup configuration is only applicable when redundant telecommunications are available and the worst-case delay of the links is considered acceptable.</i></p> <p><i>Note 8: VG-8 circuit will not be used for data speeds of less than or equal to 9600bps, unless approved by AOS Branch.</i></p>	
3.2.3.8.2.2	Hot Telecommunications Backup Functional Requirements	<p>The following functional requirements are related to NEXCOM service operating with redundant telecommunications while in the hot telecommunications backup configuration.</p> <p>a) Failure or any performance degradation to either one of the telecommunications interfaces in the hot backup configuration shall not degrade the NEXCOM System operation.</p>	
3.2.4.2	Access	<p>a) Access to MMC functions shall be by the following means:</p> <ol style="list-style-type: none"> 1. Local MMC Access (see SRD Section 3.2.4.2.1) 2. Remote MMC Access (see SRD Section 3.2.4.2.2) <p><i>Note 1: See Figures B-6 and B-6a of SRD Appendix B for local and remote relationships in the NEXCOM MMC System Hierarchy.</i></p>	<p>Demonstrate GNI access to MDR only to show that the system passes MDR commands and alerts.</p>

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.2.4.2.1	Local MMC Access	a) The Local MMC Access shall provide on-site authorized personnel access to the MMC functions of directly connected NEXCOM Subsystem(s).	For EDM, demonstrate GNI access only. Authorized personnel is anyone who has access to the EDM.
3.2.4.2.2	Remote MMC Access	a) The Remote MMC Access shall provide authorized personnel access to the MMC functions of indirectly connected NEXCOM Subsystems in accordance with SRD Section 3.2.4 a). <i>Note: NIMS is Remote MMC Access.</i>	For EDM, demonstrate GNI access only. Authorized personnel is anyone who has access to the EDM.
3.2.4.4.1	Monitored Parameter Status	a) The system/subsystem level parameters to be monitored shall include the following: 4. Telecommunications Status 5. Subsystem/LRU Status (e.g., Up/Down status for Main/Standby/BUEC elements) b) Upon restoral of connectivity to a remote device, the NEXCOM System shall report as alerts to the appropriate system managers/logs (e.g., MMCWS, NIMS) any configuration changes since the last indication.	For EDM, demonstrate for MDR only. For EDM, use a vendor-supplied MMC monitoring device in place of MMCWS.
3.2.4.4.2	Alerting/Alarming	a) System alarms/alerts shall be sent automatically to: 1. The local MMC interface 2. The remote MMC interface in accordance with SRD Section 3.2.4 a) <i>Note: Alarms indicate when the system is performing outside the normal and alert ranges. An alert is indicated when the unit either changes configuration, or the unit is within the alert range.</i>	For EDM, demonstration, use MDR to generate alarms/alerts for MDR to GNI.

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.2.4.5	System Control Requirements	a) The NEXCOM System shall have control functions that allow authorized personnel to adjust designated parameters or exercise designated operational controls for specific subsystems (e.g., Frequency Tuning, VDL Mode 3 System Configuration, and Diversity Site Configuration).	Demonstrate access to MDR controls from GNI.
3.2.4.6.2	Telecommunications Monitoring	a) The NEXCOM Subsystems that interface with telecommunications functions shall detect telecommunications (except MDRs analog interface) link failure. b) Upon loss of telecommunications service for a site/channel, the affected site/channel shall inhibit its RF transmissions automatically. <i>Note: For sites with redundant telecommunications, all lines for the channel must fail for the RF to be inhibited.</i>	
3.2.6.1	Common Time Conditioning	a) The NEXCOM System shall provide a Timing Source. b) The NEXCOM System shall derive system time from the NEXCOM Timing Source per SRD Section 3.3.6.1.1. <i>Note 1: System time is applicable to the GNI, RIU and MDR per SRD Section 3.3.6.</i> c) The NEXCOM Timing Source shall accept conditioning from an external Timing Reference. <i>Note 2: It should be pointed out that the telecommunications service might be capable of providing a timing reference for many sites, or be capable of providing a backup timing reference. Care must be taken to ensure that the sites being synchronized trace to the same timing reference, as efforts are made to place RCAG sites in a different Local Access and Transport Areas from their associated BUEC site.</i>	
3.2.7.1.1	Single Point of Failure	a) No single failure within the NEXCOM System shall cause loss of User Group communications. <i>Note: This is derived from NAS-SS-1000, Volume I, par. 3.2.4.1.</i>	
3.2.8	Security Measures	i) The NEXCOM System shall authenticate all NEXCOM ground communications.	For EDM, demonstrate for GNI/RIU communications.

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
		<p>j) The NEXCOM System shall provide integrity assurance for the information within NEXCOM.</p> <p><i>Note 4: See SRD Appendix C for further information on security.</i></p>	For EDM, demonstrate for GNI/RIU communications.
3.3.1.1.2.1	Size	<p>a) Each NEXCOM Subsystem shall be 19" rack-mountable into standard Electronic Industries Association (EIA - 310) compliant racks.</p> <p>b) Each NEXCOM LRU shall be no more than 18 inches in depth, including connectors.</p> <p>c) Each NEXCOM Subsystem shall be mounted into a rack(s) that is less than or equal to 84 inches tall.</p>	
3.3.1.1.3	Cable Requirements	<p>a) All NEXCOM cables shall meet the performance requirements specified in the following:</p> <p>1. NFPA Standard 70, National Electrical Code</p>	
3.3.1.1.5.2	Hazardous Materials	<p>a) The NEXCOM System shall be free of asbestos, polychlorinated biphenyls (PCBs), lead, and class 1 ozone depleting substances.</p> <p>b) The NEXCOM System shall limit personnel exposure to hazardous materials to the levels permitted by 29 CFR 1910 Subpart Z.</p>	
3.3.1.1.5.3	Personnel Safety Requirements	<p>a) The NEXCOM System shall comply with the requirements of 29CFR Parts 1910 and 1926.</p> <p>b) The NEXCOM System shall comply with FAA Order 3900.19B.</p>	
3.3.1.1.5.5	Equipment Safety	<p>a) Connecting cables consistent with proper operation to or disconnecting cables from equipment in the NEXCOM System while the equipment is powered and the system is in operation shall not cause damage to any equipment in the NEXCOM System.</p>	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.3.1.2.1	Radio Frequency Interference and Electromagnetic Interference Requirements	a) The NEXCOM System shall meet the RFI/EMI requirements specified in FAA-G-2100G.	
3.3.3.1.2.1	Audio Clipping	a) The NEXCOM System shall not truncate the voice signal received or transmitted. <i>Note 1: During Voice Preemption there maybe momentary RF contention between voice transmissions until the mobile transmitter can react to the override signaling.</i> <i>Note 2: This truncation refers to the nulling of the signal especially at the front end of a transmission.</i>	
3.3.3.1.3.1	Uplink Path	b) The uplink audio throughput delay shall be no greater than 173 ms in digital voice mode. <i>Note 2: A -12 ms adjustment is made to the total budget due to the fact that vocoder frame 1 is to be modulated 12 ms prior to vocoder frame 6 in the MDR.</i>	
3.3.3.1.3.2	Downlink Path	b) The downlink audio throughput delay shall be no greater than 61 ms in digital voice mode.	
3.3.3.2.1.3	Subnetwork Integrity	a) The NEXCOM subnetwork shall guarantee a probability of undetected packet error of less than 10^{-9} .	
3.3.3.2.1.4	Subnetwork Transit Delay	a) The NEXCOM System shall successfully communicate 95% of the packets from one end of the subnetwork to the other based on the required class of service per SRD Table 3-1. <i>Note: The requirement means that full prioritization will have to be supported by an efficient scheduler.</i> <i>Refer to SRD Table 3-1 Class and Delay</i>	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.3.3.4.3	Subnetwork Leave Event Issuance Delay	<p>a) The NEXCOM System shall issue Leave Events to the A/G Router based on the required class of service 95% of the time per SRD Table 3-3, measured from when the connection is lost to when the Leave Event is sent to the A/G Router. Different performance is specified depending on whether or not data traffic is present.</p> <p><i>Refer to SRD Table 3-3 Delay with and without NPDU</i></p>	
3.3.3.5	Ground Station Operations	<p>b) Each NEXCOM Talk Group's voice communications resources shall be controllable independent from all other Talk Groups' voice communications resources.</p> <p>c) The NEXCOM System shall support operation of multiple ground sites for one User Group in a sector having two to twelve diversely located RCFs.</p> <p><i>Note 1: All sites are operating on the same frequency assignment and all using the time slot(s) assigned to the User Group. This includes both voice and data resources depending on the configuration in effect for VDL Mode 3 at the time.</i></p> <p><i>Note 2: The operational configuration stated above refers to the Diversity Site Group operation.</i></p> <p><i>Note 3: In this operation, each site may have unique airspace coverage relative to all other sites but will also have coverage in common with 1 or more other sites.</i></p> <p>d) The NEXCOM System shall provide uplink M beacons to all Mobile User within a service volume to maintain timing state TS1 as defined in RTCA DO-224A.</p> <p><i>Note 4: A 5.76 second interval allows for the worst-case situation where a particular site ceases beacon transmission. Mobile User radios may delay searching for new beacons for up to 5.76 seconds, thus at least one beacon pair from an alternate site will be available before a Mobile User radio enters TS2 (approximately 12 seconds after losing the primary beacon signal). This note is based on voice only operation. For data operation see Note 1 above.</i></p>	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.3.3.6.1	Push-to-Talk Transmitter Keying (PTT/PTT Release)	a) For VDL Mode 3, the NEXCOM System shall transmit/cease transmit audio within 175 ms of the arrival of the PTT/PTT Release signal at the NEXCOM/VSCE interface for 99.9% of the events.	
3.3.3.6.3	Preemption of Mobile Users' Voice Transmissions (Controller Override)	<p>a) The NEXCOM System shall initiate transmission of a VDL Mode 3 Voice Preemption signal in the next two scheduled uplink M-burst opportunities for the associated primary and backup radio sites when the condition of simultaneous presence of a Voice Preemption control signal and a PTT control signal occurs at the NEXCOM/VSCE interface.</p> <p><i>Note 1: The Voice Preemption should be transmitted in the first available uplink M-burst for the primary and its associated backup radio sites, if possible.</i></p> <p>b) The Voice Preemption signal shall be contained in the next scheduled uplink Beacon that occurs at least 50 ms after the reception of the Voice Preemption and PTT signals from the NEXCOM/VSCE interface for 99.9% of the preemption events.</p> <p><i>Note 2: For diversity site group operation, the scheduled uplink M-bursts will rotate around the various ground stations in the diversity site group to ensure all Mobile User in the coverage area will receive a Voice Preemption signal.</i></p> <p>c) When configured for diversity site group operation and during an attempted Voice Preemption, the NEXCOM System shall disable current downlink transmissions with the next uplink M-burst opportunity.</p> <p><i>Note 3: This requirement implies that the ground station will change whatever rotation of uplink M-bursts so that the ground station (pair) from which the Mobile User currently is receiving timing will send the next uplink M-burst(s). It may be desirable that the next ground station (pair) be the ground station selected for voice transmission.</i></p> <p><i>Note 4: The timeliness of the Voice Preemption is considered of equal importance to that of the PTT signal.</i></p>	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.3.3.6.4	Preemption Confirmation of Mobile Users' Voice Transmissions	<p>a) The NEXCOM System shall provide, back to the NEXCOM/VSCE interface, confirmation of Voice Preemption activation within 350 ms of its transmission for 99.9% of the events.</p> <p><i>Note: The timeliness of the Voice Preemption indication is considered of equal importance to that of the PTT confirmation.</i></p>	
3.3.3.6.5	Squelch Break	<p>a) The NEXCOM System shall indicate to the NEXCOM/VSCE interface squelch breaks in the receiver within 100 ms for 99.9% of the squelch break indication events.</p> <p><i>Note 1: Squelch break is a continuous indicator with an overall latency of up to 350 ms.</i></p> <p><i>Note 2: The timeliness of the squelch break indication is considered of equal importance to that of the Channel Busy signal, as some regions use this signal to route audio.</i></p>	
3.3.3.6.7.1	Ground Radio Resource Selection	<p>a) The NEXCOM System shall select radio resources (e.g., Main/Standby Select/Deselect, or BUEC Select/Reset as necessary) within 100 ms of receipt of the signal from the NEXCOM/VSCE interface for 99.9% of the Ground Radio Resource Selection events.</p>	Demonstrate RCAG / BUEC only.
3.3.3.6.7.2	Ground Radio Resource Selection Confirmation	<p>a) The NEXCOM System shall confirm Ground Radio Resource Selection (e.g., Main/Standby Select/Deselect, or BUEC Select/Reset as necessary) within at most 250 ms from the time of switching for 99.9% of the Ground Radio Selection events.</p> <p><i>Note: The radio resource selection confirmation has an overall latency of up to 425 ms from generation to display at the controller.</i></p>	
3.3.3.6.8	Channel Busy Signal Performance	<p>The Channel Busy signal is an indicator to the controller that a channel is not available. It is an indicator that is a feedback to a controller action, and it is a factor in the operational suitability of the system. An overall latency of 300 ms appears suitable, of which 125 ms can be allocated to the NEXCOM System.</p> <p>a) The NEXCOM latency for the Channel Busy indicator shall be at most 125 ms for 99.9% of the channel busy events.</p>	
3.3.3.7	Ground Stuck Microphone Correction	<p>a) The Ground Stuck Microphone timeout shall be configurable to be enabled or disabled.</p>	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
		b) The Ground Stuck Microphone timeout, when enabled, shall be configurable from 5 seconds to 5 minutes in 5 second increments.	Demonstrate GNI/RIU capabilities for VDL Mode3.
3.3.3.8.1	Telecommunications Delay and Delay Variations	<p>a) The NEXCOM System shall operate when the telecommunications one-way delay is up to 600 ms.</p> <p><i>Note 1: It is desirable to limit one-way transfer delay to a minimum and below 25 ms. There are, however, circumstances that longer-delay telecommunication links, e.g., satellite links, are the only viable alternatives. The worst-case delay scenario defined for the NEXCOM System is for a double satellite hop link with a maximum transfer delay of 600 ms (as defined by ANICS).</i></p> <p>b) The NEXCOM System shall operate with transfer delay variations.</p> <p><i>Note 2: Variations may be due to line switching, packet path variations, or clock slips.</i></p> <p><i>Note 3: The extent of the variation will be addressed in future documentation.</i></p>	
3.3.3.8.2	Telecommunications Restoration Performance	<p>The following are performance requirements associated with telecommunications restoration:</p> <p>a) The restoration time, defined to be the combined time to detect the link failure, to transfer operation to a backup link, and to restore operations, shall be 6 seconds or less.</p> <p><i>Note: The conditions for declaring link failure will be defined in the NEXCOM/Telecommunications ICD.</i></p> <p>b) For telecommunications service interruption of less than 1 second in duration, the NEXCOM System shall restore the communications service within 120 ms after the condition that caused the service interruption is removed.</p>	
3.3.4.1.2	Non-Interference MMC	a) The NEXCOM MMC function shall not degrade system performance unless a commanded self-test, supported in SRD Section 3.2.4.6.1 h), requires that the NEXCOM System temporarily prohibit operational use for the thread(s) under test.	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
		<i>Note: The NEXCOM MMC function should not impact the performance of a thread under any condition, but an exclusion is made to allow the NEXCOM System to enter a more comprehensive testing state where the operation, exclusive to the thread(s) under test, may or may not be impacted depending on the design and the confidence level associated with the test.</i>	
3.3.4.5.1	Frequency Range	a) The NEXCOM System shall provide communications services in the range of 112 -137 MHz. <i>Note: It is anticipated that the NEXCOM System will operate initially on the 118 – 136.975 MHz assigned channels.</i>	
3.3.4.5.2	RF Power Output	a) The RF output power of the NEXCOM System shall be adjustable from 2 to 50 watts (33 dBm to 47 dBm). <i>Note: The RF power range applies to all NEXCOM System modes.</i>	
3.3.5.1.1.2	NEXCOM System Throughput	b) The NEXCOM System shall operate with full occupancy of all voice and data slots.	
3.3.6.1.1	Timing Accuracy	a) When the NEXCOM System is operating in VDL Mode 3 under normal operating conditions, the RF transmissions emanating from the NEXCOM System shall not be more than $\pm 23.55 \mu\text{s}$ from their scheduled event time with respect to the Timing Standard specified in SRD Section 3.3.6.3. b) When the NEXCOM System is operating in VDL Mode 3 with loss of the Timing Reference, the RF transmissions emanating from the NEXCOM System shall not be more than $\pm 190 \text{ ms}$ from their scheduled event time with respect to the Timing Standard specified in SRD Section 3.3.6.3 and the Timing Drift period specified in SRD Section 3.3.6.2. <i>Note: See SRD Appendix G for an explanation of the timing synchronization requirements.</i>	
3.4.2.1.1	RIU Physical Layer Functions	a) The RIU shall encode and decode Reed-Solomon (72, 62) codewords for VDL Mode 3 data burst operation per RTCA DO-224A, Section 3.3.1.3.3.3.	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.4.2.1.2	RIU Media Access Control (MAC) Functions	<p>a) The RIU shall implement the ground portion of the VDL Mode 3 MAC sublayer for voice, data and management functions as defined in RTCA DO-224A Section 3.3.2.1, except for requirements related to system configurations 3T, 3S and 2S1X.</p> <p><i>Note: System configurations 3T, 3S and 2S1X are exempted from the initial implementation, but provide them as an upgrade capability.</i></p>	Demonstrate for 2V2D only.
3.4.2.1.3	RIU Subsystem VDL Mode 3 DLS Functions	<p>a) The RIU shall provide the DLS acknowledgment (ACK) processing and priority queuing functions as defined in RTCA DO-224A, Section 3.3.2.2.</p> <p>b) The RIU shall perform error detection and address identification (ID) on all DLS frames received from an MDR receiver as defined in RTCA DO-224A, Section 3.3.2.2.1.</p>	
3.4.2.1.4	RIU Link Management Entity (LME) Functions	<p>a) The RIU shall provide the following LME functions as defined in RTCA DO-224A, Section 3.3.2.3, for all VDL Mode 3 system configuration except 3T, 3S, and 2S1X:</p> <ol style="list-style-type: none"> 1. Net Initialization 2. Net Entry 3. Link Maintenance (e.g., polling) 4. Link Release 5. Expedited Recovery <p><i>Note: System configurations 3T, 3S, and 2S1X are exempted to simplify the initial implementation, yet provide them as an upgrade capability.</i></p>	
3.4.2.2.1.1.2	RIU Subsystem Vocoder Operation	<p>b) The RIU shall support both normal voice and downlink truncated voice data rates.</p> <p><i>Note 2: This requirement is to ensure that the ground station can provide received truncated voice to the controller in cases where the Mobile User comes into coverage in the middle of a voice transmission.</i></p>	
3.4.2.2.1.2.1	RIU Subsystem VDL Mode 3 Data Operation	<p>a) For VDL Mode 3 data operation, the RIU shall schedule data access per the Manual for the Implementation of VDL Mode 3, Section 4.9.</p>	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
		<i>Note 1: For diversity site group operations with respect to Section 4.9 of the referenced Manual, voice preemption signaling will also contend for M uplink channel resources and may complicate scheduling.</i>	
3.4.2.3.2	RIU Telecommunications Monitoring	a) The RIU shall inhibit RF transmissions upon detection of the loss of telecommunications service. <i>Note: For dual control operation, this requires the loss of both control site connections.</i>	
3.4.2.4	RIU Subsystem Interfaces	a) The RIU shall have the following interfaces: 2. RIU/MDR Digital Interface (see SRD Section 3.4.2.4.7) 4. RIU/Timing Source Interface (see Note) 5. RIU/Telecommunications Link Interface to GNI (see SRD Section 3.4.2.4.1) <i>Note: The RIU/Time source interface may be internal to the RIU.</i>	
3.4.2.4.1	RIU/Telecommunications Interfaces	a) The RIU shall interface with at least a 56 kbps digital service via a DDC interface to access the remote GNI. b) The RIU shall support usage of analog 4-wire VG-6 ground telecommunications circuits to access the remote GNI when the digital interface is not being used. f) When configured for hot telecommunications backup with a GNI, the RIU shall simultaneously communicate over the redundant telecommunications interfaces with that GNI. g) When configured for hot telecommunications backup with a GNI, the RIU shall be able to use information from either interface without interfering with the operation of the communications system.	
3.4.2.4.7	RIU/MDR Digital Interfaces	a) An RIU shall support up to two MDR transmitters and two MDR receivers.	Demonstrate for one each TX and RX.
3.4.2.5	Signaling	b) The RIU shall be configurable to either pass through an MDR generated PTT/PTT Release Confirmation signal or generated the signal locally per c).	PTT/PTT Release Confirmation limited to MDR generated signal.

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
		d) The RIU shall use the End of Message (EOM) bit or lack of voice messages to indicate squelch break inactive, while operating in VDL Mode 3.	
3.4.2.7	RIU Site Configuration	a) The RIU shall support a configuration with a common RIU supporting the transmitters and receivers associated with a User Group.	
3.4.2.8	RIU System Timing Source	a) The RIU shall provide timing to the MDR transmitters and receivers. <i>Note 1: This timing is to allow for intersite synchronization to prevent interslot interference.</i> b) The RIU shall provide timing to the GNI. <i>Note 2: This timing is to allow the GNI vocoders to track the VDL Mode 3 timing to minimize end-end voice delay.</i>	
3.4.3.2.1	Air/Ground Voice and Data	a) The GNI shall multiplex voice and data for transmission to the appropriate ground station RIU.	
3.4.3.2.1.1	GNI Subsystem Voice Operation	When supporting voice operations, the following apply: a) The GNI shall encode/decode speech using the vocoder specified in ICAO Annex 10, Vol. III, Part 1, Chapter 6 for each Talk Group.	
3.4.3.2.1.2.1	VDL Mode 3 Data Operation	b) The GNI shall provide CLNP frame mode compression, as requested by Mobile Users, as defined in RTCA DO-224A, Section 3.3.3, and Appendix K. c) The GNI shall provide raw subnetwork interface data transfer services for non-ATN messaging, as defined in RTCA DO-224A, Section 3.3.3. e) The GNI shall provide CLNP data transfer services, as requested by Mobile Users, as defined in RTCA DO-224A, Section 3.3.3.	
3.4.3.3.1	GNI Subsystem Remote Monitoring Functions	c) The GNI shall monitor the functional status of its associated MDRs.	
3.4.3.3.2	GNI Subsystem Remote Control Functions	b) The GNI shall support remote control of its associated MDRs. d) The GNI shall coordinate operation of primary and backup site radio strings for a given User Group.	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
		<p><i>Note: This includes coordination of the data protocol states between the sites and Beaconing control.</i></p>	
3.4.3.4.1	GNI/Telecommunications Interfaces	<p>a) The GNI shall interface with at least a 56 kbps digital service via a DDC interface to access the remote RIU.</p> <p>b) The GNI shall support usage of analog 4-wire VG-6 ground telecommunications circuits to access the remote RIU, when the digital interface is not being used.</p> <p>d) The GNI shall support redundant telecommunications interfaces for each RIU per SRD Section 3.2.3.8.1 e).</p> <p><i>Note 1: The telecommunications interfaces may be on dissimilar media.</i></p> <p>f) When configured for hot telecommunications backup with an RIU, the GNI shall simultaneously communicate over the redundant telecommunications interfaces with that RIU.</p> <p>g) When configured for hot telecommunications backup with an RIU, the GNI shall be able to use information from either interface without interfering with the operation of the communications system.</p>	<p>Demonstrate 3.2.3.8.1 e) 1. and 3. only.</p>
3.4.3.4.2	GNI/RIU Interfaces	<p>a) The GNI shall interface with RIUs via the GNI/Telecommunications interface.</p> <p><i>Note 1: This includes the capability for Local Radios, where RIUs will be required.</i></p> <p>b) The GNI shall be scalable in the number of RIUs that may be supported.</p>	
3.4.3.4.6	GNI/VSCE Interfaces	<p>a) The GNI shall interface with existing VSCE (e.g., VSCS, ETVS, ICSS, RDVS, STVS) via existing interfaces (e.g., Single channel (V+U) and quad channel (V/U/M/S)).</p> <p><i>Note: The intent is for this to be an interface common to all VSCE that will be defined in the ICD yet to be coordinated with the Voice Switching Group.</i></p>	<p>Demonstrate for VSCS Type B and BUEC VHF interfaces only.</p>

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.4.3.4.7	GNI/Router Interfaces	<p>a) A GNI shall interface with an A/G Router via a GNI Data Switch function, per SRD Appendix B.4.</p> <p><i>Note 1: GNIs may share the data switch function to interface with the A/G Router.</i></p>	For EDM, interface with router directly per ATN NAS ICD-xxxxxxx. No data switching function need be demonstrated.
3.4.3.4.9	GNI/Automation Interfaces	<p>a) The GNI shall interface with the automation system to receive Next Channel Uplink information.</p> <p>b) The GNI shall receive confirmation from the radio site as to the success of the uplink of the Next Channel Uplink information.</p> <p>c) The GNI shall present to the automation system the confirmation signal on success of the Next Channel Uplink transmission.</p> <p>d) The GNI shall provide indication to the automation system of the login status of the Mobile User.</p> <p>f) The GNI shall provide indication to the automation system of received Urgent Downlink Requests for VDL Mode 3.</p>	Demonstrate Next Channel uplink function. Trigger for this function to be supplied with the EDM. This also requires some type of indication that signal has been received. EDM needs to include a workaround (means to display indication) for demonstrating this capability.
3.4.3.5	Signaling	<p>b) The GNI shall pass the signaling from the RIU to the VSCE as indicated in SRD Section 3.4.2.5 b), d), and g).</p> <p><i>Note: The Automation interface may introduce additional signaling to support its functions.</i></p>	Demonstrate 3.4.2.5 b) and d) only.
3.4.3.6.1	GNI Redundancy	<p>a) The failure of any thread(s) within the GNI to its RIU shall not degrade communications of any other GNI/RIU threads.</p> <p>b) A failure within a GNI shall not cause loss of communications within a User Group.</p> <p>c) Failure of a single GNI thread shall not cause loss of A/G communications services.</p>	
3.4.7.1	Time Conditioning	<p>a) The Timing Source shall synchronize timing with the Timing Reference.</p> <p>b) The Timing Source shall provide timing to connected RIU(s).</p>	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.4.7.2	Timing Source Interfaces	a) The Timing Source shall interface with the Timing Reference.	
3.5.2.2.1.2.1	RIU/GNI Message Delays	a) The RIU shall complete the transmission of a valid DLS frame over the RIU/GNI telecommunications link no later than 500 ms after the last data burst message associated with the DLS frame is received from the MDR Receiver. b) The RIU shall provide timing signals to the GNI to minimize end-end voice delay.	EDM validate transmission time required between RIU and GNI using.
3.5.2.4.1.1	Transmission Path Failure Restoration	b) For telecommunications service interruption of less than 1 second in duration, the RIU shall restore communications to the GNI within 120 ms.	
3.5.2.5.1	RIU Signaling Integrity	a) The RIU shall ensure that no more than one control signal in one million is falsely interpreted or not completed.	
3.5.3.2.1.2.1	GNI Data Processing Delay	a) The processing delay for multiplexing VDL Mode 3 voice and data of a GNI subsystem shall be less than 10 ms. b) MMC data processing shall not delay uplink or downlink voice and control data processing or distribution.	
3.5.3.4.1.1	Transmission Path Failure Restoration	b) For telecommunications service interruption of less than 1 second in duration, the GNI shall restore communications to the RIU within 120 ms.	
3.5.3.5.1	GNI Signaling Integrity	a) The GNI shall ensure that no more than one control signal in one million is falsely interpreted or not completed.	
3.5.3.5.2.1	PTT/PTT Release	a) Based on VSCE PTT signaling, the RIU shall provide the PTT signal at the RIU/Analog Radio interface from 15 - 25 ms prior to the audio for 99.9% of the events. c) The response time from the instant the GNI receives a PTT/PTT Release signal from the VSCE, to the instant the RIU provides/removes VDL Mode 3 voice packets at the RIU/MDR interface shall not exceed 165 ms for 99.9% of the events.	

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.5.3.5.2.2	PTT/PTT Release Confirmation	c) The response time from the instant the RIU provides/removes the VDL Mode 3 voice bursts at the RIU/MDR interface, to the instant that the GNI provides a PTT/PTT Release Confirmation signal at the NEXCOM/VSCE interface shall not exceed 340 ms for 99.9% of the events.	
3.5.3.5.2.4	Preemption Confirmation of Mobile Users' Voice Transmissions	a) The response time from the instant the Voice Preemption signal is generated at the RIU to the instant when the Voice Preemption Confirmation signal is received at the NEXCOM/VSCE interface shall not exceed 340ms for 99.9% of the events.	
3.5.3.5.2.5	Squelch Break	b) The response time from the instant the MDR provides/removes voice bursts at the RIU/MDR interface, to the instant that the GNI provides a Squelch Break indication at the NEXCOM/VSCE interface shall not exceed 100 ms for 99.9% of the events.	

4. METHODS OF VERIFICATION

The following four verification methods are generally utilized in determining compliance of individual requirements contained in FAA purchase descriptions: TEST, DEMONSTRATION, ANALYSIS, and INSPECTION. They are listed below in decreasing order of complexity, and are described as follows:

1. TEST. Test is a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance. The process uses laboratory equipment, procedures, items, and services.
2. DEMONSTRATION. Demonstration is a method of verification where qualitative determination of properties is made for an end item, including the use of technical data and documentation. The items being verified are observed, but not quantitatively measured, in a dynamic state.
3. ANALYSIS. Analysis is a method of verification that consists of comparing hardware design with known scientific and technical principles, procedures and practices to estimate the capability of the proposed design to meet the mission and system requirements.
4. INSPECTION. Inspection is a method of verification to determine compliance without the use of special laboratory appliances, procedures, or services, and consists of a non-destructive static-state examination of the hardware, the technical data and documentation.

For the EDM DEMONSTRATION (as defined in 2 above) is to be used wherever possible. For requirements where a demonstration is not feasible, ANALYSIS needs to be performed. Where critical performance parameters need to be verified, TESTING can be performed. Testing is to be held to a minimum.

5. PREPARATION FOR DELIVERY

The EDM equipment will be delivered in accordance with Section F of the contract/SOW.

6. NOTES

6.1 Abbreviations and Acronyms

A/G	Air/Ground
ACK	Acknowledge
ANICS	Alaskan NAS Interfacility Communications System
ANSI	American National Standards Institute
AOS	FAA Operational Support Services
ATN	Aeronautical Telecommunication Network
BUEC	Backup Emergency Communications
CFR	Code of Federal Regulations
CPDLC	Controller Pilot Data Link Communications
DDC	Direct Digital Connectivity
DDS	Digital Data Services
DLAP	Data Link Applications Processor
DLS	Data Link Service or Data Link Sub layer
DOT	Department of Transportation
EDM	Engineering Development Mode
EIA	Electronic Industries Alliance
EMI	Electromagnetic Interference
EST	Eastern Standard Time
ETVS	Enhanced Terminal Voice Switch
FAA	Federal Aviation Administration
FAATSAT	FAA Telecommunications Satellite
FCC	Federal Communications Commission
FSDP	Full Scale Development Program (FSDP)
FT-1	Fractional T-1 or Nx64 kbps
FTI	FAA Telecommunications Infrastructure
FTS	Federal Telephone System
G/G	Ground to/from Ground
GFE	Government Furnished Equipment
GNI	Ground Network Interface
Hz	Hertz
HID	Host Interface Device
HW	Hardware
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
ICSS	Integrated Communication Switching System
ID	Identification

ISO	International Organization for Standardization
IRD	Interface Requirements Document
kHz	kilohertz
LAN	Local Area Network
LDRCL	Low Density Radio Control Link
LINCS	Leased Interfacility Communications System
LME	Link Management Entity
LRU	Lowest Replaceable Unit
M/S	Main/Standby
MAC	Media Access Control
MASPS	Minimum Aviation System Performance Standards
MDR	Multimode Digital Radio
MDT	Maintenance Data Terminal
MHz	Megahertz
MMC	Maintenance, Monitoring, and Control
MMCWS	Maintenance Monitoring and Control Work Station
MOPS	Minimum Operational Performance Standards
ms	millisecond
MTD	Minimum Threshold Document
MTR	Minimum Threshold Requirement
NADIN	National Airspace Data Interchange Network
NAS	National Airspace System
NEXCOM	Next Generation Air/Ground Communications
NFPA	National Fire Prevention Association
NIMS	NAS Infrastructure Management System
NPDU	Network Protocol Data Unit
PCB	Polychlorinated Bi-Phenol
PTT	Push-to-Talk
RCAG	Remote Center Air/Ground Facility
RCF	Remote Communications Facility
RCL	Radio Communications Link
RDVS	Rapid Deployment Voice Switch
RF	Radio Frequency
RFI	Radio Frequency Interference
RFO	Request for Offer
RIU	Radio Interface Unit
RMA	Reliability, Maintainability, and Availability
RMM	Remote Maintenance Monitoring
RMMC	Remote Maintenance Monitoring and Control
RMMS	Remote Maintenance Monitoring System
RPDE	Rapid Preliminary Development Effort

RTCA	RTCA, Inc. (formerly Radio Technical Commission for Aeronautics)
Rx	Receiver
SARPs	Standards and Recommended Practices
SIR	Screening Information Request
SOW	Statement of Work
SRD	System Requirements Document
SSS	Subsystem Specification
STVS	Small Tower Voice Switch
SW	Software
T-1	T-Carrier at 1.544 Mbps
Tx/Rx	Transmit/Receive or Transmitter/Receiver
TCD	Test Capabilities Document
TDMA	Time Division Multiple Access
Telco	Telephone Company
TS1	Timing State 1
TS2	Timing State 2
TSGR	Transport Systems Generic Requirements
Tx	Transmit
UHF	Ultra High Frequency
V + U	VHF + UHF
VDL	VHF Digital Link
VG-6	Voice Grade 6 Circuits
VG-8	Voice Grade 8 Circuits
V/U/M/S	VHF/UHF/MAIN/STANDBY
VHF	Very High Frequency
VSCE	Voice Switching and Control Equipment
VSCS	Voice Switching and Control System
WAN	Wide Area Network
WJHTC	William J. Hughes Technical Center