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**DEPARTMENT OF TRANSPORTATION**
**FEDERAL AVIATION ADMINISTRATION**

# INTERFACE REQUIREMENTS DOCUMENT

# GROUND NETWORK INTERFACE (GNI) TO VOICE SWITCHING AND CONTROL EQUIPMENT (VSCE)

**The NEXCOM Integrated Product Team, AND-360**
**and the Voice Switch Integrated Product Team, AND-320**

## RECORD OF CHANGES

| Revision | Date | Action |
|---|---|---|
| 0.0 | 4/16/2002 | GNI/VSCE IRD 4/5/02 Draft Baselined as Revision 0.0 |

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# 1.0 INTRODUCTION

## 1.1 Scope

This Interface Requirements Document (IRD) is prepared in accordance with FAA-STD-025D. This IRD provides the requirements for an interface between the Next Generation Air/Ground Communication System's (NEXCOM's) Ground Network Interface (GNI) equipment and existing or planned Voice Switching and Control Equipment (VSCE), as listed in Table 1-1. The interface described herein contains the full set of signaling specified by the NEXCOM SRD. This IRD identifies which of these signals are supported by each of these voice switches. The signaling and electrical characteristics of each of the existing voice-switch radio cards are also described.

## 1.2 Subsystem Responsibility

**Table 1.1**

**Subsystem Equipment Responsibility**

| Subsystem/Equipment | Common Name | Responsible Organization |
|---|---|---|
| NEXCOM Ground Network Interface | GNI | AND-360 |
| Voice Switching and Control System (Harris) | VSCS | AND-320 |
| Rapid Deployment Voice Switch (Litton-Denro) | RDVS | AND-320 |
| Small Tower Voice Switch (Litton-Denro) | STVS | AND-320 |
| Enhanced Terminal Voice Switch (Litton-Denro) | ETVS | AND-320 |
| Integrated Communications Switching System (Litton-Denro) | ICSS | AND-320 |
| Automated Flight Service Station Voice Switch (TBD) | AFSSVS | AND-320 |

### 1.2.1 List of Interfaces

Each type of voice switch listed in Table 1-1 supports multiple interfaces in order to accommodate legacy radios. Table 1-2 lists all existing types of interface that are relevant to NEXCOM[1]. This IRD incorporates all interfaces listed in Table 1-2.

[1] Local Radio interfaces, which connect voice switches directly to radios without intervening equipment, will not be a NEXCOM configuration.

**Table 1.2**

**List of Interfaces**

| Switch Name | Interface Name |
|---|---|
| VSCS | VSCS/RCE Type B (GRIM) |
| VSCS | VSCS/RCE Type C (Intelect) |
| VSCS | VSCS/BUEC |
| AFSS | AFSS/RCE |
| ICSS | ICSS Type 1A |
| ICSS | ICSS Type 1B |
| ICSS | ICSS Type 2 |
| STVS | STVS |
| ETVS | ETVS |
| RDVS | RDVS 3080C |
| RDVS | RDVS 3080E |
| RDVS | RDVS 3080F |
| RDVS | RDVS 3080H |

## 1.3 Document Organization

This document is organized as follows:

Section 1, SCOPE, identifies the interfacing systems and provides a summary of the contents of this document.

Section 2, APPLICABLE DOCUMENTS, provides a list of referenced documents, including both Government and Non-government documents.

Section 3, INTERFACE REQUIREMENTS, provides the general, functional, and physical requirements of the interface.

Section 4, QUALITY ASSURANCE PROVISIONS, provides a description of the verification process for the requirements presented in Section 3.

Section 5, PREPARATION FOR DELIVERY, specifies any special preparation requirements for delivery.

Section 6, NOTES, provides a list of applicable definitions used in this document.

Appendix A, INTERFACE MATRIX, lists all signaling for each of the interfaces listed in Table 1-2.

Appendix B provides a list of abbreviations and acronyms.

Appendix C provides the Verification Requirements Traceability Matrix for document requirements.

## 2.0 APPLICABLE DOCUMENTS

The following documents form a part of this IRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this IRD, the contents of this IRD **shall** be the superseding requirements.

### 2.1 Government Documents

#### 2.1.1 FAA Standards

| | |
|---|---|
| FAA-STD-025D | Preparation of Interface Documentation, October 1995. |
| FAA-STD-039B | NAS Open Systems Architecture and Protocols, May 1, 1996. |
| FAA-STD-043A | National Airspace System (NAS) Open System Interconnection (OSI) Priority, May 10, 1994. |
| FAA-STD-047 | National Airspace System (NAS) Open System Interconnection (OSI) Conformance Testing, December 29, 1993. |
| FAA-STD-048 | National Airspace System (NAS) Open System Interconnection (OSI) Interoperability, July 7, 1995. |

#### 2.1.2 FAA Specifications

| | |
|---|---|
| FAA-G-2100G | Electronic Equipment, General Requirements, October 22, 2001. |
| FAA-E-2958 | NEXCOM System Requirements Document, April 16, 2002, V1.0. |
| NAS-IC-42014000 | VSCS to the Existing Radio Control Equipment ICD, October 1997. |
| NAS-IR-64024201 | VSCS to Backup Emergency Communication (BUEC) Interface Control Document, August 8, 1997. |
| FAA-AND-320-C | System Specification, Automated Flight Station Voice Switch (AFSSVS), July 2, 2001. |
| FAA-E-2894A | System Specification, Enhanced Terminal Voice Switch, March 3, 1999. |
| FAA-E-2874A | System Specification, Small tower Voice Switch, June 8, 1993. |
| FAA-E-2767 | System Specification, Integrated Communications Switching System (ICSS), October 30, 1987. |
| FAA-E-2885 | System Specification, Down Scoped radio Control Equipment (DSRCE) (including SCN1), December 15, 1993. |
| NAS-SR-1000 | National Airspace System (NAS) System Specification, October 3, 1990. |

### 2.2 Non-government Documents

| | |
|---|---|
| ANSI/IEEE 1100-1999. | Grounding, Shielding and Bonding, March 22, 1999. |

| | |
|---|---|
| RTCA DO-224A | Signal-in-Space Minimum Aviation System Performance Standards (MASPS) for Advanced VHF Digital Data Communications, Including Compatibility with Digital Voice Techniques, September 13, 2000. |

## 2.3 Document Sources

### 2.3.1 FAA Documents

Copies of FAA specifications, standards, and publications may be obtained from the Contracting Officer, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C., 20591. Requests should clearly identify the desired material by number and date, and state the intended use of the material.

### 2.3.2 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.

### 2.3.3 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.

# 3.0 INTERFACE REQUIREMENTS

## 3.1 General Requirements

This IRD describes the interface requirements for voice and control between NEXCOM GNI and VSCE. This includes both current analog and future digital systems. The GNI and VSCE **shall** exchange communications in order to support the following functions:

a) Communications between Area Control Facility (ACF) controllers or specialists and mobile users via air-ground (A/G) radio equipment.
b) Control by ACF controllers or specialists of A/G radio equipment.
c) Indication to ACF controllers or specialists of the identified status of the A/G radio equipment.

In order to meet these requirements, the GNI and VSCE will exchange voice signals and control signals. To support legacy VSCE, the signal formats are analog voice and discrete control signals. In the future, VSCE will be equipped with a common digital interface. It is envisioned that the future GNI/VSCE interface will replace the analog voice and discrete control signaling with an all-digital, message-oriented format common to all switches. The intent of this IRD is to facilitate the development of a single interface that supports the legacy equipment and can be reconfigured to support an all-digital format when new VSCE is deployed.

Functionally, the basic subunit of the GNI/VSCE interface, whether analog or digital, consists of audio (voice) and control signals. For the analog interface, signaling format corresponds with each of the functional groups: voice is analog; controls and alarms/alerts are discrete. With an all-digital interface, both voice and control/alert/alarm will be binary serial data. The total interface will be built up of a number of these, that number varying, depending upon the configuration of the control facility. Figure 3-1 depicts several of these basic subunits.

### 3.1.1 Computer-Human Interface Requirements

This topic not applicable to this document.

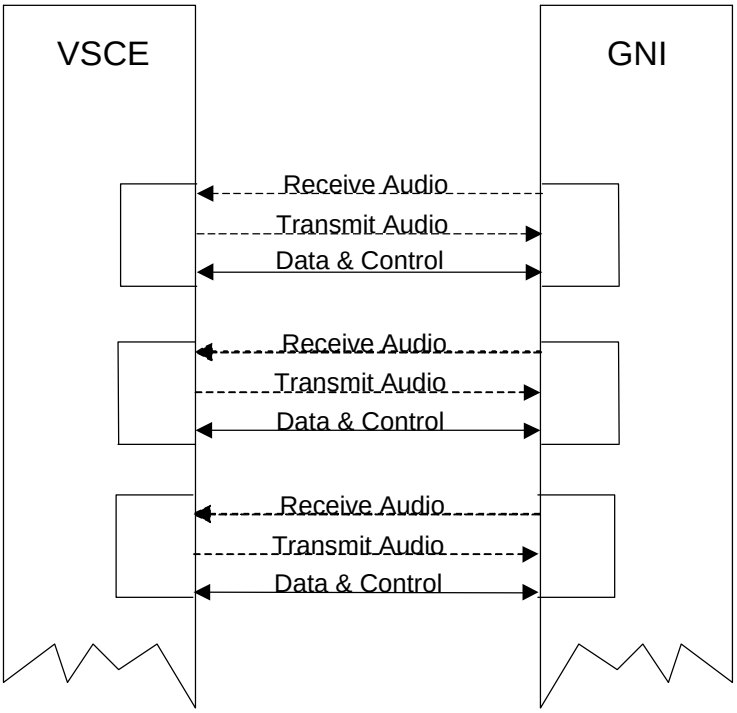


**Figure 3-1**

**GNI Functional Connectivity**

### 3.2 Functional Requirements

Functional requirements of the GNI/VSCE interface are presented in the following subsections. This IRD covers multiple interface subtypes. Not all functions described in the following subsections are required for a given interface subtype. Appendix A describes the variations in the signaling sets for each of the interface subtypes listed in Table 1-2. The requirements of this interface are written to accommodate future voice switch developments:

a) The GNI **shall** be configurable to support each discrete interface subtype in Table 1-2. [SRD 3.6.1]
b) The GNI **shall** provide for a common digital interface. [SRD 3.4.3.1.1]

#### 3.2.1 Application Process

The digital interface is intended to provide a common interface for voice, command/control signaling, status, and alert/alarm to support the current basic voice operation between Controllers and Mobile Users using the emerging VDL Mode 3 technology.

##### 3.2.1.1 Identification of Application Processes (AP)

The Application Processes are:

a) Digital voice delivery
b) Talk group communication management (command/control signaling)
c) Talk group communication monitoring (status, alert, alarm)

#### 3.2.1.2 Types of Service Required by the AP

The services across the digital GNI/VSCE interface are critical services per NAS-SR-1000. The types of service are:

a) Digital voice delivery
b) Delivery of control signaling
c) Delivery of NEXCOM system status
d) Delivery of alerts and alarms

#### 3.2.1.3 Information Units

To be determined through development efforts.

##### 3.2.1.3.1 Information Code/Structure

To be determined through development efforts.

##### 3.2.1.3.2 Information Unit Segmentation

To be determined through development efforts.

##### 3.2.1.3.3 Information Flow

To be determined through development efforts.

##### 3.2.1.3.4 Frequency of Transmission

To be determined through development efforts.

##### 3.2.1.3.5 Responses

To be determined through development efforts.

##### 3.2.1.3.6 Quality of Service

To be determined through development efforts.

##### 3.2.1.3.7 Information Priority

To be determined through development efforts.

##### 3.2.1.3.8 Information Security

Reference FAA-STD-045 for specific security requirements for systems that implement OSI protocols.

##### 3.2.1.3.9 Residual Error Rate

To be determined through development efforts.

##### 3.2.1.3.10 Transfer Time Constraints

To be determined through development efforts.

#### 3.2.1.3.11 Throughput

To be determined through development efforts.

### 3.2.1.4 AP Error Handling

To be determined through development efforts.

## 3.2.2 OSI-Type Interface Requirements

FAA guidance on using standards specified in this section is provided in FAA-HDBK-002: Open Systems Management, and FAA-STD-039: Open Systems Architecture and Protocols. Specific aspects of these guidance documents are cited as appropriate in the VSCE-approved ICDs.

### 3.2.2.1 Application Layer

From digital interface point of view, VSCE is the End System on one side of the A/G ground communication.

### 3.2.2.2 Presentation Layer

VSCE is an End System for the A/G communication link between ATC Controller and mobile users of a talk group. For uplink activities, VSCE will receive the voice (analog or digital) and the control/command signaling originated from the controller and converted them into the designated message format to be delivered through the link layer service. Similarly, the downlink messages received from GNI through the data link service will be converted to the proper form to be presented to the ATC Controller.

### 3.2.2.3 Session Layer

This topic not applicable to this document.

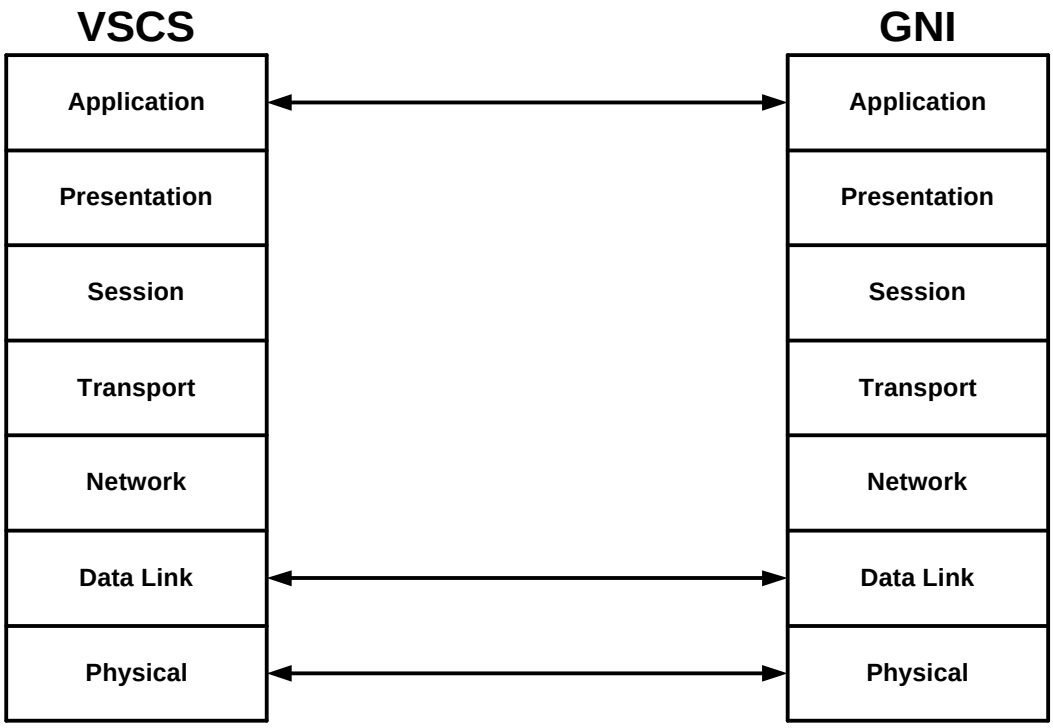


**Figure 3-2**

**VSCS/GNI OSI Reference Model**

#### 3.2.2.4 Transport Layer

This topic not applicable to this document.

#### 3.2.2.5 Network Layer

This topic not applicable to this document.

#### 3.2.2.6 Data Link Layer

To be determined through development efforts.

#### 3.2.2.7 Physical Layer

To be determined through development efforts.

### 3.2.3 Analog-Type Interface Requirements

Specification details of the GNI/VSCE analog voice interface are given in the following subsections.

#### 3.2.3.1 Voice Path

The voice path is a pair of full duplex audio interfaces for transmission of voice from the VSCE to the GNI (two-wire transmit audio) and for the transmission of voice from the GNI to VSCE (two-wire receive audio.) The signal labeling is different for different switch models (See *Matrix of GNI/VSCE Signals*, Appendix A.)

**Table 3-1**

**Analog Interface Summary**

| Signal | Paragraph | Direction |
|---|---|---|
| Transmit Audio, Main/Frequency 1 | 3.2.3.2 | VSCE to GNI |
| Transmit Audio, Standby/Frequency 2 | 3.2.3.2 | VSCE to GNI |
| Receive Audio, Main/Frequency 1 | 3.2.3.3 | GNI to VSCE |
| Receive Audio, Standby/Frequency 2 | 3.2.3.3 | GNI to VSCE |

#### 3.2.3.2 Transmit Audio to GNI

a) The GNI/VSCE interface **shall** provide audio from the VSCE to the GNI to convey voice communications over A/G radio transmitter equipment. [SRD 3.2.3.1.2.a.1]
b) The transmit audio level at the GNI/VSCE interface, as measured at the GNI/VSCE IDF, **shall** be within ±1 dB of -8 dBm.

#### 3.2.3.3 Receive Audio to VSCE

a) The GNI/VSCE interface **shall** provide audio from the GNI to the VSCE to convey voice communications from remote A/G radio receiver equipment. [SRD 3.2.3.1.2.a.1
b) The receive audio level, as measured at the GNI/VSCE IDF, **shall** be -8 dBm ±1 dB.

### 3.2.4 Discrete-Control Interface Requirements

Discrete control signals are employed on the GNI/VSCE interface for the purpose of controlling and confirming the configuration of the A/G communications channel and reporting equipment status. Electrical characteristics of each of these discrete signals are defined in Section 3.3.1.2 for each type of VSCE covered by this IRD.

Figure 3-3 depicts the discrete control signal exchanges that are requirements of the GNI/VSCE interface. Table 3- 2 provides cross-references to paragraphs describing the electrical characteristics of each discrete signal. This set of discrete control signals represents a combined set from all currently fielded voice switch A/G interfaces, and includes new discrete control signaling imposed by NEXCOM. Each new NEXCOM-imposed requirement is identified by the annotation “**NEXCOM New**”.

#### 3.2.4.1 VSCE to GNI Discrete Control Signaling

a) The GNI/VSCE Interface **shall** support each discrete control listed in Table 3-2

b) Each discrete control signal **shall** have two states: ON and OFF. These states are defined in paragraphs given in Table 3.2.
c) Each discrete control signal **shall** be a single signal that accommodates the various electrical characteristics outlined in paragraphs given in Table 3.2.

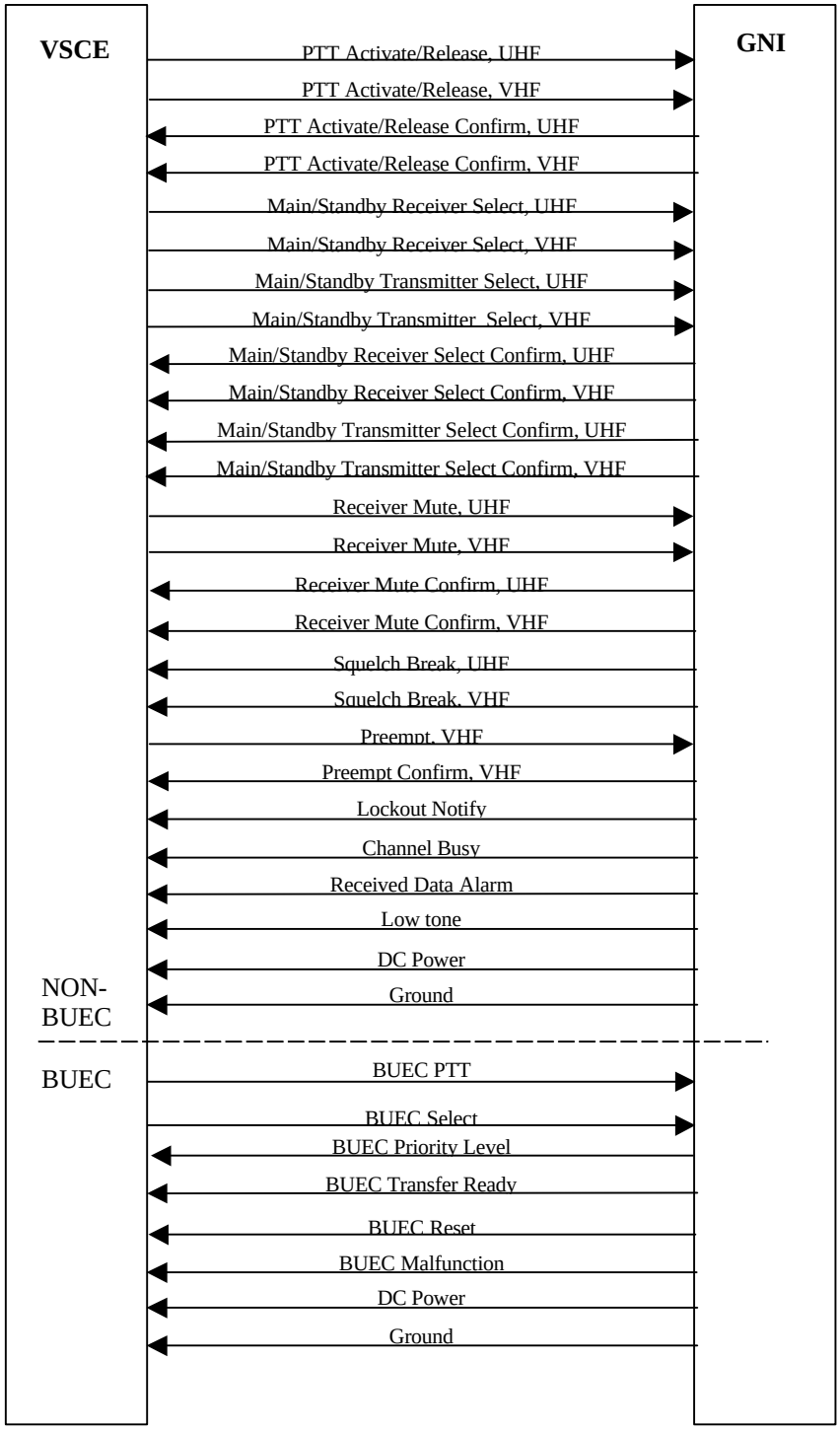


**Figure 3-3**

**GNI/VSCE Discrete Control Interface**

**Table 3-2**

**Discrete Interface Summary**

| Signal | Paragraph | Direction |
|---|---|---|
| PTT Activate/Release UHF | 3.3.1.2.1 | VSCE to GNI |
| PTT Activate/Release VHF | 3.3.1.2.1 | VSCE to GNI |
| PTT Activate/Release Confirm UHF | 3.3.1.2.2 | GNI to VSCE |
| PTT Activate/Release Confirm VHF | 3.3.1.2.2 | GNI to VSCE |
| Main/Standby Receiver Select UHF | 3.3.1.2.3 | VSCE to GNI |
| Main/Standby Receiver Select VHF | 3.3.1.2.3 | VSCE to GNI |
| Main/Standby Transmitter Select UHF | 3.3.1.2.3 | VSCE to GNI |
| Main/Standby Transmitter Select VHF | 3.3.1.2.3 | VSCE to GNI |
| Main/Standby Receiver Select Confirm UHF | 3.3.1.2.4 | GNI to VSCE |
| Main/Standby Receiver Select Confirm VHF | 3.3.1.2.4 | GNI to VSCE |
| Main/Standby Transmitter Select Confirm UHF | 3.3.1.2.4 | GNI to VSCE |
| Main/Standby Transmitter Select Confirm VHF | 3.3.1.2.4 | GNI to VSCE |
| Receiver Mute UHF | 3.3.1.2.5 | VSCE to GNI |
| Receiver Mute VHF | 3.3.1.2.5 | VSCE to GNI |
| Receiver Mute Confirm UHF | 3.3.1.2.6 | GNI to VSCE |
| Receiver Mute Confirm VHF | 3.3.1.2.6 | GNI to VSCE |
| Squelch Break UHF | 3.3.1.2.7 | GNI to VSCE |
| Squelch Break VHF | 3.3.1.2.7 | GNI to VSCE |
| Preempt VHF **NEXCOM New** | 3.3.1.2.8 | VSCE to GNI |
| Preempt Confirm VHF **NEXCOM New** | 3.3.1.2.9 | GNI to VSCE |
| Site Lockout Notify | 3.3.1.2.10 | GNI to VSCE |
| Channel Busy **NEXCOM New** | 3.3.1.2.11 | GNI to VSCE |
| Low Tone Alarm | 3.3.1.2.12 | GNI to VSCE |
| Received Data Alarm | 3.3.1.2.13 | GNI or VSCE |
| BUEC PTT | 3.3.1.2.14 | VSCE to GNI |
| BUEC Select | 3.3.1.2.14 | VSCE to GNI |
| BUEC Priority Level | 3.3.1.2.14 | VSCE to GNI |
| BUEC Transfer Ready | 3.3.1.2.14 | GNI to VSCE |
| BUEC Reset | 3.3.1.2.14 | VSCE to GNI |
| BUEC Malfunction | 3.3.1.2.14 | GNI to VSCE |

### 3.2.5 Interface Requirements

**Table 3-3**

**Interface Requirements**

| Signal Name | Signal Format | Msg Size | BW or Rate | Direction |
|---|---|---|---|---|
| Analog Voice TX | Analog | N/A | 3.000 KHz | VSCE to GNI |
| Analog Voice RX | Analog | N/A | 3.000 KHz | GNI to VSCE |
| Digital Voice TX | Digital | [TBD] | [TBD] | VSCE to GNI |
| Digital Voice RX | Digital | [TBD] | [TBD] | GNI to VSCE |
| PTT Activate/Release UHF | Discrete | N/A | N/A | VSCE to GNI |
| PTT Activate/Release VHF | Discrete | N/A | N/A | VSCE to GNI |
| PTT Confirm UHF | Discrete | N/A | N/A | GNI to VSCE |
| PTT Confirm VHF | Discrete | N/A | N/A | GNI to VSCE |
| M/S TX Select UHF | Discrete | N/A | N/A | VSCE to GNI |
| M/S TX Select VHF | Discrete | N/A | N/A | VSCE to GNI |
| M/S RX Select UHF | Discrete | N/A | N/A | VSCE to GNI |
| M/S RX Select VHF | Discrete | N/A | N/A | VSCE to GNI |
| M/S TX Sel UHF Confirm | Discrete | N/A | N/A | GNI to VSCE |
| M/S TX Sel VHF Confirm | Discrete | N/A | N/A | GNI to VSCE |
| M/S RX Sel UHF Confirm | Discrete | N/A | N/A | GNI to VSCE |
| M/S RX Sel VHF Confirm | Discrete | N/A | N/A | GNI to VSCE |
| RX Mute UHF | Discrete | N/A | N/A | VSCE to GNI |
| RX Mute VHF | Discrete | N/A | N/A | VSCE to GNI |
| RX Mute Confirm UHF | Discrete | N/A | N/A | GNI to VSCE |
| RX Mute Confirm VHF | Discrete | N/A | N/A | GNI to VSCE |
| Squelch Break UHF | Discrete | N/A | N/A | GNI to VSCE |
| Squelch Break VHF | Discrete | N/A | N/A | GNI to VSCE |
| Preempt VHF | Discrete | N/A | N/A | VSCE to GNI |
| Preempt Confirm VHF | Discrete | N/A | N/A | GNI to VSCE |
| Site Lockout Notify | Discrete | N/A | N/A | GNI to VSCE |
| Channel Busy | Discrete | N/A | N/A | GNI to VSCE |
| Low Tone Alarm | Discrete | N/A | N/A | GNI to VSCE |
| Received Data Alarm | Discrete | N/A | N/A | GNI to VSCE |
| BUEC PTT | Discrete | N/A | N/A | VSCE to GNI |
| BUEC Select | Discrete | N/A | N/A | VSCE to GNI |
| BUEC Priority Level | Discrete | N/A | N/A | GNI to VSCE |
| BUEC Transfer Ready | Discrete | N/A | N/A | GNI to VSCE |
| BUEC Reset | Discrete | N/A | N/A | VSCE to GNI |
| BUEC Malfunction | Discrete | N/A | N/A | GNI to VSCE |

*Note: TBD in this table is to be interpteted as an item to be determined through development efforts.*

## 3.3 Physical Requirements

### 3.3.1 Electrical Power/Electronic Requirements

The requirements specified in this section are described in accordance with FAA-G-2100g.

The current VSCE interfaces support the following power and ground resources. Interfaces that do not require power are marked N/R (not required.)

**Table 3-4**

**Interface Power Requirements**

| Equipment | Voltage | Current | Notes |
|---|---|---|---|
| VSCS/GRIM | +12 VDC ±5%, adj | 3.6 A | 0.1% NL-FL regulation[1]<br>1.5mV RMS ripple and noise. |
| VSCS/INTELECT 5134A | N/R | N/R | |
| VSCS/INTELECT 5134C | N/R | N/R | |
| VSCS/BUEC | +24 VDC | [NAv][2] | |
| AFSSVS/RCE | +24 or +48 VDC | [NAv] | Power provided by AFSSVS |
| ICSS/RCE | +12VDC | [NAv] | |
| ETVS/RCE | +24 VDC | [NAv] | |
| RDVS 3080C,E & F/RCE | [NAv] | [NAv] | |
| RDVS 3080H/RCE | [NAv] | [NAv] | |
| STVS/RCE | [NAv] | [NAv] | |

[1] NL-FL = no-load to full-load [2] = Information not available

#### 3.3.1.1 GNI/VSCE Analog Audio Interface Electrical Characteristics

The GNI/VSCE audio circuit interface has the characteristics identified in the following subsections.

##### 3.3.1.1.1 Transmit Audio

a) The GNI/VSCE interface **shall** support a 600 Ohm impedance ±10%, balanced, transformer-coupled, two-wire pair, isolated from ground, per FAA-E-2731.
b) The bandwidth of the transmit audio over the GNI/VSCE interface **shall** be flat to within 1dB from 300 Hz to 3,000 Hz into a resistive load of 600 Ohms.
c) The GNI/VSCE interface **shall** accept transmit audio levels between –16 dB and +12 dB of a nominal VSCE output level of –8 dBm.

##### 3.3.1.1.2 Receive Audio

a) The GNI/VSCE interface **shall** support a 600-Ohm impedance ± 10%, balanced, transformer-coupled, two-wire pair, isolated from ground, per FAA-E-2731.

b) The bandwidth of the receive audio over the GNI/VSCE interface **shall** be flat to within 1dB from 300 to 3,000 Hz into a resistive load of 600 Ohms.
c) The GNI/VSCE interface mean audio level **shall** be -8 dBm ±6 dB.

#### 3.3.1.2 GNI/VSCE Discrete Control Interface Electrical Characteristics

The VSCE radio cards provide several electrical interface standards for discrete control. The following subsections list the characteristics of each type of radio card for each control signal

*Note 1: VSCE, as legacy equipment, constrains the control signaling means across the GNI/VSCE interface. Discrete control will continue to be used until new voice switching equipment is procured and new telecommunications gear is in place to provide for message-oriented signaling within VSCE and between VSCE and NEXCOM equipment. Accordingly, the electrical characteristics of the GNI/VSCE given here are those of the existing equipment.*
*Note 2: For the Intelect interfaces, when the control originates on the GNI side of the interface, the GNI interface circuitry sinks current in the ON state and does not sink current when in the OFF state. The Intelect equipment implemented these controls via dry-contact relays. RCE implemented these controls via switching transistors. NEXCOM vendor is not constrained to any particular implementation.*

##### 3.3.1.2.1 PTT Activate/Release Interface Electrical Characteristics

The VSCE actuates this control and presents the result to the interface. The PTT Activate/Release interface electrical characteristics **shall** be as defined in table 3-5 below:

**Table 3-5**

**PTT Activate/Release Interface Electrical Characteristics**

| Equipment | PTT Activated (ON) | PTT Released (OFF) | Notes |
|---|---|---|---|
| VSCS/GRIM | +12 VDC @0.5mA | Open Circuit | |
| VSCS/INTELECT 5134A | Contacts Closed | Contacts Open | |
| VSCS/INTELECT 5134C | Contacts Closed | Contacts Open | |
| VSCS/BUEC | -- | -- | See Table 3-16 |
| AFSSVS/RCE | Contacts Closed | Contacts Open | Two wire |
| ICSS/RCE | +12 VDC @0.5mA | Open Circuit | |
| ETVS/RCE | Contacts Closed | Contacts Open | See Note below |
| RDVS 3080C,E & F/RCE | +12 VDC @0.5mA | Open Circuit | |
| RDVS 3080H/RCE | +12 VDC @0.5mA | Open Circuit | |
| STVS/RCE | Contacts Closed | Contacts Open | Two wire |

*Note: ETVS has an alternative configuration where +24VDC is applied over the transformer-coupled audio when PTT is asserted, and 0VDC is applied when PTT is released. In this configuration, PTT and the Transmit Audio share the transmit audio connection.*

#### 3.3.1.2.2 PTT Activate/Release Confirm Interface Electrical Characteristics

The GNI actuates this control and presents the result to the interface. The PTT Confirm Interface electrical characteristics **shall** be defined as in table 3-6 below:

**Table 3-6**

**PTT Activate/Release Confirm Interface Electrical Characteristics**

| Equipment | Assert Confirmed (ON) | Release Confirmed (OFF) | Notes |
|---|---|---|---|
| VSCS/GRIM | N/A | N/A | |
| VSCS/INTELECT 5134A | Closed switching circuit | Open switching circuit | See sec 3.3.1.2, Note 2 |
| VSCS/INTELECT 5134C | Closed switching circuit | Open switching circuit | See sec 3.3.1.2, Note 2 |
| VSCS/BUEC | N/A | N/A | |
| AFSSVS/RCE | +12 VDC | 0 VDC | Into 10KOhm |
| ICSS/RCE | N/A | N/A | |
| ETVS/RCE | N/A | N/A | |
| RDVS 3080C,E & F/RCE | N/A | N/A | |
| RDVS 3080H/RCE | N/A | N/A | |
| STVS/RCE | N/A | N/A | |

#### 3.3.1.2.3 Main/Standby Receiver/Transmitter Select Interface Electrical Characteristics

The VSCE actuates this control and presents the result to the interface. The Main/Standby Select interface electrical characteristics **shall** be as defined in table 3-7 below:

**Table 3-7**

**Main/Standby Receiver/Transmitter Select Interface Electrical Characteristics**

| Equipment | Main Selected (ON) | Standby Selected (OFF) | Notes |
|---|---|---|---|
| VSCS/GRIM | Contacts Open | +12 VDC ±25% @0.5mA | |
| VSCS/INTELECT 5134A | Contacts Open | Contacts Closed | See Note below |
| VSCS/INTELECT 5134C | Contacts Open | Contacts Closed | See Note below |
| VSCS/BUEC | N/A | N/A | |
| AFSSVS/RCE | Contacts Open | Contacts Closed | |
| ICSS/RCE | +12 VDC @0.5mA | Open Circuit | |
| ETVS/RCE | Contacts Open | Contacts Closed | |
| RDVS 3080C,E & F/RCE | +12 VDC @0.5mA | Open Circuit | |

| | | | |
|---|---|---|---|
| RDVS 3080H/RCE | +12 VDC @0.5mA | Open Circuit | |
| STVS/RCE | Contacts Open | Contacts Closed | |

*Note: For the Intelect interface, a successive application of 1 second pulses ±100 ms causes receiver/transmitter to alternate between main and standby.*

#### 3.3.1.2.4 Main/Standby Receiver/Transmitter Select Confirm Interface Electrical Characteristics

The GNI actuates this control and presents the result to the interface.
The Main/Standby Select Confirm electrical characteristics **shall** be as defined in table 3-8 below:

**Table 3-8**

**Main/Standby Receiver/Transmitter Select Confirm Interface Electrical Characteristics**

| Equipment | Main Confirmed (ON) | Standby Confirmed (OFF) | Notes |
|---|---|---|---|
| VSCS/GRIM | 0 VDC ±1V | 12 VDC ±25% @ 0.5mA | |
| VSCS/INTELECT 5134A | Closed switching circuit | Open switching circuit | See Note below and sec3.3.1.2 Note 2 |
| VSCS/INTELECT 5134C | Closed switching circuit | Open switching circuit | See Note below and sec 3.3.1.2 Note 2 |
| VSCS/BUEC | N/A | N/A | |
| AFSSVS/RCE | +12 VDC ±25% | 0 VDC ±1.0 VDC | Into 10KOhm |
| ICSS/RCE | N/A | N/A | |
| ETVS/RCE | N/A | N/A | |
| RDVS 3080C,E & F/RCE | N/A | N/A | |
| RDVS 3080H/RCE | N/A | N/A | |
| STVS/RCE | N/A | N/A | |

*Note: For the Intelect interfaces only, there are separate Main Select and Standby Select control signals. For this case, column 2 (ON) is to be interpreted as either main or standby select confirmed, and column 3 (OFF) is to be interpreted as main or standby not confirmed.*

#### 3.3.1.2.5 Receiver Mute Electrical Characteristics

The VSCE actuates this control and presents the result to the interface. The Receiver Mute interface electrical characteristics **shall** be as defined in table 3-9 below:

**Table 3-9**

**Receiver Mute Electrical Interface Characteristics**

| Equipment | Mute ON | Mute OFF | Notes |
|---|---|---|---|
| VSCS/GRIM | +12 VDC ±25% @0.5mA | Open Circuit | |
| VSCS/INTELECT 5134A | N/A | N/A | |
| VSCS/INTELECT 5134C | N/A | N/A | |
| VSCS/BUEC | N/A | N/A | |
| AFSSVS/RCE | N/A | N/A | |
| ICSS/RCE | +12 VDC @0.5mA | Open Circuit | |
| ETVS/RCE | N/A | N/A | |
| RDVS 3080C,E & F/RCE | N/A | N/A | |
| RDVS 3080H/RCE | N/A | N/A | |
| STVS/RCE | N/A | N/A | |

### 3.3.1.2.6 Receiver Mute Confirm Electrical InterfaceCharacteristics

The GNI actuates this control and presents the result to the interface. The Receiver Mute Confirm interface electrical characteristics **shall** be as defined in table 3-10 below:

**Table 3-10**

**Receiver Mute Confirm Interface Electrical Characteristics**

| Equipment | Mute Confirm ON | Mute Confirm OFF | Notes |
|---|---|---|---|
| VSCS/GRIM | +12 VDC ±25% @0.5mA | 0 VDC ±1.0 VDC | |
| VSCS/INTELECT 5134A | N/A | N/A | |
| VSCS/INTELECT 5134C | N/A | N/A | |
| VSCS/BUEC | N/A | N/A | |
| AFSSVS/RCE | N/A | N/A | |
| ICSS/RCE | N/A | N/A | |
| ETVS/RCE | N/A | N/A | |
| RDVS 3080C,E & F/RCE | N/A | N/A | |
| RDVS 3080H/RCE | N/A | N/A | |
| STVS/RCE | N/A | N/A | |

### 3.3.1.2.7 Squelch Break Interface Electrical Characteristics

The GNI actuates this control and presents the result to the interface. The Squelch Break interface electrical characteristics **shall** be as defined in table 3-11 below:

**Table 3-11**

**Squelch Break Interface Electrical Characteristics**

| Equipment | Squelch Break ON | Squelch Break OFF | Notes |
|---|---|---|---|
| VSCS/GRIM | +12 VDC ±25% @0.5mA | 0 VDC ±1.0 VDC | |
| VSCS/INTELECT 5134A | Closed switching circuit | Open switching circuit | See sec 3.3.1.2 Note 2 |
| VSCS/INTELECT 5134C | Closed switching circuit | Open switching circuit | See sec 3.3.1.2 Note 2 |
| VSCS/BUEC | N/A | N/A | |
| AFSSVS/RCE | +12 VDC | 0 VDC | Into 10KOhm |
| ICSS/RCE | N/A | N/A | |
| ETVS/RCE | NAv | NAv | |
| RDVS 3080C,E & F/RCE | N/A | N/A | |
| RDVS 3080H/RCE | N/A | N/A | |
| STVS/RCE | N/A | N/A | |

#### 3.3.1.2.8 Preempt Electrical Interface Characteristics **NEXCOM New**

The VSCE actuates this control and presents the result to the interface. The Preempt interface electrical characteristics **shall** be as defined in table 3-12 below:

**Table 3-12**

**Preempt Electrical Interface Characteristics**

| Equipment | Preempt Select ON | Preempt Select OFF | Notes |
|---|---|---|---|
| VSCS/GRIM | TBD | TBD | |
| VSCS/INTELECT 5134A | TBD | TBD | |
| VSCS/INTELECT 5134C | TBD | TBD | |
| VSCS/BUEC | TBD | TBD | |
| AFSSVS/RCE | TBD | TBD | |
| ICSS/RCE | TBD | TBD | |
| ETVS/RCE | TBD | TBD | |
| RDVS 3080C,E & F/RCE | TBD | TBD | |
| RDVS 3080H/RCE | TBD | TBD | |
| STVS/RCE | TBD | TBD | |

*Note: New NEXCOM signaling does not exist on any current VSCE. Vendor will describe these interfaces in an ICD.*

#### 3.3.1.2.9 Preempt Confirm Interface Electrical Characteristics **NEXCOM New **

The GNI actuates this control and presents the result to the interface. The Preempt Confirm interface electrical characteristics **shall** be as defined in table 3-13 below:

**Table 3-13**

**Preempt Confirm Interface Electrical Characteristics**

| Equipment | Preempt Confirm ON | Preempt Confirm OFF | Notes |
|---|---|---|---|
| VSCS/GRIM | TBD | TBD | |
| VSCS/INTELECT 5134A | TBD | TBD | |
| VSCS/INTELECT 5134C | TBD | TBD | |
| VSCS/BUEC | TBD | TBD | |
| AFSSVS/RCE | TBD | TBD | |
| ICSS/RCE | TBD | TBD | |
| ETVS/RCE | TBD | TBD | |
| RDVS 3080C,E & F/RCE | TBD | TBD | |
| RDVS 3080H/RCE | TBD | TBD | |
| STVS/RCE | TBD | TBD | |

*Note: New NEXCOM signaling does not exist on any current VSCE. Vendor will describe these interfaces in an ICD.*

#### 3.3.1.2.10 Site Lockout Notify Interface Electrical Characteristics

The GNI actuates this control and presents the result to the interface. The Site Lockout Notify interface electrical characteristics **shall** be as defined in table 3-14 below:

**Table 3-14**

**Site Lockout Notify Interface Electrical Characteristics**

| Equipment | Locked (ON) | Unlocked (OFF) | Notes |
|---|---|---|---|
| VSCS/GRIM | N/A | N/A | |
| VSCS/INTELECT 5134A | N/A | N/A | |
| VSCS/INTELECT 5134C | N/A | N/A | |
| VSCS/BUEC | N/A | N/A | |
| AFSSVS/RCE | +12 VDC | 0 VDC | Into 10KOhm |
| ICSS/RCE | N/A | N/A | |
| ETVS/RCE | N/A | N/A | |
| RDVS 3080C,E & F/RCE | N/A | N/A | |
| RDVS 3080H/RCE | +12 VDC | 0 VDC | Into 10KOhm |
| STVS/RCE | N/A | N/A | |

#### 3.3.1.2.11 Channel Busy Interface Electrical Characteristics **NEXCOM New **

The GNI actuates this control and presents the result to the interface. The Channel Busy interface electrical characteristics **shall** be as defined in table 3-15 below:

**Table 3-15**

**Channel Busy Interface Electrical Characteristics**

| Equipment | Channel Busy (ON) | Channel Not Busy (OFF) | Notes |
|---|---|---|---|
| VSCS/GRIM | TBD | TBD | |
| VSCS/INTELECT 5134A | TBD | TBD | |
| VSCS/INTELECT 5134C | TBD | TBD | |
| VSCS/BUEC | TBD | TBD | |
| AFSSVS/RCE | TBD | TBD | |
| ICSS/RCE | TBD | TBD | |
| ETVS/RCE | TBD | TBD | |
| RDVS 3080C,E & F/RCE | TBD | TBD | |
| RDVS 3080H/RCE | TBD | TBD | |
| STVS/RCE | TBD | TBD | |

*Note: New NEXCOM signaling does not exist on any current VSCE. Vendor will describe these interfaces in an ICD.*

#### 3.3.1.2.12 Low Tone Alarm

The GNI actuates this control and presents the result to the interface.

#### 3.3.1.2.13 Received Data Alarm

The GNI actuates this control and presents the result to the interface.

#### 3.3.1.2.14 VSCE/BUEC Interface Electrical Characteristics

The electrical characteristics of discrete signaling across the VSCS/BUEC Radio interface **shall** be as defined in table 3-16.

**Table 3-16**

**VSCE/BUEC Interface Electrical Characteristics**

| Equipment | ON | OFF | Notes |
|---|---|---|---|
| BUEC PTT | 0 VDC (-0 + 0.6) | +5 VDC (-2.0 + 0 V) | |
| BUEC Select | 0 V Pulse (-0 + 0.6 V) | +5 VDC (-2.0 + 0 V) | |
| BUEC Priority Level | 0 VDC at all times | 0 VDC at all times | No longer used to select priority |
| BUEC Transfer Ready | Closed Contact | Open Contact | |
| BUEC Reset | 0 V Pulse (-0 + 0.6 V) | +5 VDC (-2.0 + 0 V) | |
| BUEC Malfunction | +1 VDC (-0.8 +1.0 V) | +5 VDC (±0.5 V) | |

#### 3.3.1.3 Connectors

To be determined through Development Effort

#### 3.3.1.4 Wire/Cable

To be determined through Development Effort

#### 3.3.1.5 Electrical Power/Electronic Referencing (Grounding)

Grounding, bonding and shielding **shall** be as specified in ANSI/IEEE STD 1100-1999.

#### 3.3.1.6 Fasteners

Fasteners **shall** be as specified in FAA-G-2100.

#### 3.3.1.7 Electromagnetic Compatibility

Electromagnetic compatibility **shall** be as specified in FAA-G-2100.

## 4.0 QUALITY ASSURANCE PROVISIONS

Compliance with the requirements stated in this IRD are deemed met when all the requirements specified in a paragraph are verified by one or more of the methods outlined in the subsequent subparagraphs. The results of the verification activities **shall** be expressed as either pass or fail.

### 4.1 Responsibility For Verification

### 4.2 Special Verification Requirements

#### 4.2.1 ISO Conformance

The system under test (SUT) **shall** consist of all ISO protocols specified in this document, along with that part of the physical device required to support these protocols. Proof of ISO conformance **shall** be provided by the contractor, indicating that the product has been certified as ISO conformant by an accredited testing agency. Any ISO protocol specified in this document, and not tested in the test suite used by the testing agency, must be demonstrated to be conformant, by the contractor, using some other test method, subject to FAA approval. Conformance testing information is contained in FAA-STD-047.

#### 4.2.2 ISO Interoperability

This topic not applicable to this document.

#### 4.2.3 Non-ISO Interoperability

Prior to the start of integration level verification, functional interoperability not related to ISO protocols **shall** be demonstrated at the William J Hughes Technical Center (WJHTC) System Support Computer Complex (SSCC), or other appropriate demonstration site.

### 4.3 Verification Requirements Traceability Matrix

Verification Requirements Traceability Matrix may be found in Appendix C.

### 4.4 Verification Levels And Methods

The levels and methods of verification appropriate for use in the VRTM, presented in Section 4 of the IRD, are defined in the following paragraphs.

#### 4.4.1 Verification Levels

a) Subsystem Level. This level of verification is usually accomplished at the contractor's facility and culminates in the formal acceptance of a contractual end-item.
b) Integration-level. This level of verification is conducted at the WJHTC, or at a key site. The verification conducted will determine if the hardware, software, or subsystem to be deployed for site installation will perform in a NAS environment and in accordance with NAS system-level operational and functional requirements.

c) Site-level. This level of verification is usually performed at the designated site. The verification portion of the subsystem installation and checkout will emphasize demonstration of the overall system performance requirements. It includes the demonstration of an end-item, subsystem and/or system, the final acceptance demonstrations, and commissioning activities.

### 4.4.2 Verification Methods

There are four verification methods that can be used at any of the three verification levels. Verification methods are:

a) INSPECTION. Inspection is a method of verification to determine compliance without the use of special test equipment, procedures, or services, and consist of a non-destructive static-state examination of the hardware, software, and/or the technical data and documentation.
b) 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 to the success criteria stipulated in the IRD or project specification. The process uses standardized laboratory equipment, procedures, hardware, and/or services.
c) DEMONSTRATION. Demonstration is a method of verification where qualitative determination of properties is made for configuration items, including software, and/or technical data and documentation measured, in a dynamic state.
d) ANALYSIS. This method of verification consists of comparing hardware or software 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. When certain elements of design are comprised of previously qualified elements such as commercial OFF the shelf (COTS) equipment, then analysis of previous qualification testing in meeting specification requirements may be used to reduce the amount of qualification testing.

## 5.0 PREPARATION FOR DELIVERY

This topic not applicable to this document.

## 6.0 NOTES

### 6.1 Definitions

### 6.2 Abbreviations And Acronyms

The list of abbreviations and acronyms may be found in appendix B.

# APPENDIX A

## Matrix Of GNI/VSCE Signals

## Table A-1

## Matrix Of GNI/VSCE Signals

| GROUP | SIGNAL NAME | VSCS/GRIM | VSCS/INTELLEC 5134A | VSCS/INTELLEC 5134C | VSCS/BUEC | AFSSVS/RCE | ICSS/RCE | ETVS/RCE | RDVS 3080C,E & F/RCE | RDVS 3080H/RCE | STVS/RCE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Audio | Transmit Audio (Main) | x | x | x | x | x | x | x | x | x | x |
| Audio | Receive Audio (Main) | x | x | x | x | x | x | x | x | x | x |
| Audio | Transmit Audio (Standby) | | | | | | | x | | | |
| Audio | Receive Audio (Standby) | | | | | | | x | | | |
| PTT | PTT Frequency 1 | x | x | x | | | x | | | | x |
| PTT | PTT Frequency 2 | x | x | x | | | x | | | | |
| PTT | PTT Main | | | | | x | | x | x | x | |
| PTT | PTT Standby | | | | | | | | x | x | |
| PTT | PTT Confirm Frequency 1 | | x | x | | | x | | | | |
| PTT | PTT Confirm Frequency 2 | | x | x | | | x | | | | |
| PTT | PTT Confirm Main | | | | | x | | | | | |
| PTT | PTT Confirm Standby | | | | | | | | | | |
| PTT | PTT Return | | x | x | | | | | | | |
| PTT | PTT Confirm Return Frequency 1 | | | | | | | | | x | |
| PTT | PTT Confirm Return Frequency 2 | | | | | | | | | | |
| M/S Select | M/S Select Receiver 1 | x | x | | | x | x | x | x | x | x |
| M/S Select | M/S Select Receiver 2 | x | x | | | | x | | | | |
| M/S Select | MS/Verify Receiver 1 | x | | | | x | | | | | |
| M/S Select | MS/Verify Receiver 2 | x | | | | | | | | | |
| M/S Select | M/S Select Transmitter 1 | x | x | | | x | x | x | x | | x |
| M/S Select | M/S Select Transmitter 2 | x | x | | | | x | | | | |
| M/S Select | MS/Verify Transmitter 1 | x | | | | x | | | | | |
| M/S Select | MS/Verify Transmitter 2 | x | | | | | | | | | |
| M/S Select | Transmitter Frequency 1 Main Confirm | | x | x | | | | | | | |
| M/S Select | Transmitter Frequency 2 Main Confirm | | x | x | | | | | | | |
| M/S Select | Transmitter Frequency 1 Standby Confirm | | x | x | | | | | | | |
| M/S Select | Transmitter Frequency 2 Standby Confirm | | x | x | | | | | | | |
| M/S Select | Transmitter Frequency 1 Standby Select | | | x | | | | | | | |
| M/S Select | Transmitter Frequency 2 Standby Select | | | x | | | | | | | |
| M/S Select | Receiver Frequency 1 Standby Select | | | x | | | | | | | |
| M/S Select | Receiver Frequency 2 Standby Select | | | x | | | | | | | |

| GROUP | SIGNAL NAME | VSCS/GRIM | VSCS/INTELLEC 5134A | VSCS/INTELLEC 5134C | VSCS/BUEC | AFSSVS/RCE | ICSS/RCE | ETVS/RCE | RDVS 3080C,E & F/RCE | RDVS 3080H/RCE | STVS/RCE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M/S Select | Receiver Frequency 1 Main Confirm | | x | x | | | | | | | |
| M/S Select | Receiver Frequency 2 Main Confirm | | x | x | | | | | | | |
| M/S Select | Receiver Frequency 1 Standby Confirm | | x | x | | | | | | | |
| M/S Select | Receiver Frequency 2 Standby Confirm | | x | x | | | | | | | |
| M/S Select | M/S Confirm Return | | x | x | | | | | | | |
| Site Select | Primary/Secondary Site Select Frequency 1 | | | | | | | | | | |
| Site Select | Primary/Secondary Site Select Frequency 2 | | | | | | | | | | |
| Site Select | Primary/Secondary Site Select Confirm Frequecy 1 | | | | | | | | | | |
| Site Select | Primary/Secondary Site Select Confirm Frequecy 2 | | | | | | | | | | |
| Muting | Mute Frequency 1 | x | | | | | x | | | | |
| Muting | Mute Frequency 2 | x | | | | | x | | | | |
| Muting | Mute Verification Frequency 1 | x | | | | | | | | | |
| Muting | Mute Verification Frequency 2 | x | | | | | | | | | |
| Squelch Break | Activity (Squelch Break) Frequency 1 | x | x | x | | | | x | | | |
| Squelch Break | Activity (Squelch Break) Frequency 2 | x | | | | | | x | | | |
| Squelch Break | Vox (Squelch Break) Return | | x | x | | | | | | | |
| Lockouts | Secondary Site Lockout Notify | | | | | x | | | | x | |
| Lockouts | Preempt (VDL Mode-3) | | | | | | | | | | |
| Lockouts | Preempt Confirm (VDL Mode-3) | | | | | | | | | | |
| Lockouts | Channel Busy (VDL Mode-3) | | | | | | | | | | |
| BUEC | BUEC PTT | | | | x | | | | | | |
| BUEC | BUEC Select | | | | x | | | | | | |
| BUEC | BUEC Priority Level | | | | x | | | | | | |
| BUEC | BUEC Transfer Ready | | | | x | | | | | | |
| BUEC | BUEC Reset | | | | x | | | | | | |
| BUEC | BUEC Malfunction | | | | x | | | | | | |
| Alarms | Received Data Alarm | x | | | | | | | | | |
| Alarms | Low Tone Alarm | x | | | | | | | | | |
| Power and Ground | +12 VDC | x | | | | | x | | | | |
| Power and Ground | +24 VDC | | | | x | | | x | | | |
| Power and Ground | +48 VDC | | | | | x | | | | | |
| Power and Ground | Ground | x | | | x | x | x | | | | |
| Power and Ground | PTT and Change Common | | x | x | | | | | | | |
| Power and Ground | M/S Confirm Common | | x | x | | | | | | | |
| | | | | | | | | | | | |

# APPENDIX B

## Abbreviations and Acronyms

### B.1 Abbreviations And Acronyms

| | |
|---|---|
| ACF | Area Control Facility |
| A/G | Air-to-Ground |
| ANSI | American National Standards Institute |
| AP | Application Process |
| CDI | Common Digital Interface |
| FAA | Federal Aviation Administration |
| GNI | Ground Network Interface (NEXCOM) |
| ICD | Interface Control Document |
| IRD | Interface Requirements Document |
| ISO | International Organization for Standardization |
| M/S | Main/Standby |
| NAS | National Airspace System |
| NEXCOM | Next Generation Air/Ground Communication System |
| PTT | Push To Talk |
| P/S | Primary/Secondary site |
| RX | Receiver |
| SRD | System Requirements Document (NEXCOM) |
| TX | Transmitter |
| UHF | Ultra-High Frequency |
| VDL | VHF Data Link |
| VHF | Very-High Frequency |
| VRTM | Verification Requirements Traceability Matrix |
| VSCS | Voice Switching and Control System (Harris Government Systems) |
| WJHTC | William J Hughes Technical Center (Atlantic City NJ) |

# APPENDIX C

## Verification Requirements Traceability Matrix

### Table C-1

### Verification Requirements Traceability Matrix

(Verification Methods: D - Demonstration, I - Inspection, A - Analysis, T - Test, X - Not Applicable)

| Section | Requirements | Verification Phase and Method | | | |
|---|---|---|---|---|---|
| | | Sub-system Level | Integration Level | Site Level | Remarks |
| 3.1.a | Support A/G communications | D | D | D | |
| 3.1.b | Control A/G equipment | D | D | D | |
| 3.1.c | Indicate A/G equipment status | D | D | D | |
| 3.2.a | Be reconfigurable to meet requirements of each interface variation. | D | D | D | |
| 3.2.b | Provide for a common digital interface | I, D | I, D | D | |
| 3.2.3.2.a | Provide transmit audio connection | D | D | D | |
| 3.2.3.2.b | Maintain transmit audio level | T | T | T | |
| 3.2.3.3.a | Provide receive audio connection | D | D | D | |
| 3.2.3.3.b | Maintain receive audio level | T | T | T | |
| 3.2.4.1.a | Support discrete controls in table 3.2 | D | D | D | |
| 3.2.4.1.b | Discrete controls have ON/OFF states | D | D | D | |
| 3.2.4.1.c | Discrete controls' electrical characteristics pointed to in table 3.2 | D, T | D, T | D, T | |
| 3.3.1 | Provide power and ground resources | D, T | D, T | D, T | |
| 3.3.1.1.1.a | Transmit audio impedance | T | T | T | |
| 3.3.1.1.1.b | Transmit audio bandwidth | T | T | T | |
| 3.3.1.1.1.c | Transmit audio level | T | T | T | |
| 3.3.1.1.2.a | Receive audio impedance | T | T | T | |
| 3.3.1.1.2.b | Receive audio bandwidth | T | T | T | |
| 3.3.1.1.2.c | Receive audio level | T | T | T | |
| 3.3.1.2.1 | PTT Electrical Characteristics | D | D | D | |
| 3.3.1.2.2 | PTT Confirm Electrical Characteristics | D | D | D | |
| 3.3.1.2.3 | Main/Standby Select Electrical Characteristics | D | D | D | |
| 3.3.1.2.4 | Main/Standby Select Confirm Electrical Characteristics | D | D | D | |
| 3.3.1.2.5 | Receiver Mute Electrical Characteristics | D | D | D | |

| | | | | | |
|---|---|---|---|---|---|
| 3.3.1.2.6 | Receiver Mute Confirm Electrical Characteristics | D | D | D | |
| 3.3.1.2.7 | Squelch Break Electrical Characteristics | D | D | D | |
| 3.3.1.2.8 | Preempt Electrical Characteristics | D | D | D | |
| 3.3.1.2.9 | Preempt Confirm Electrical Characteristics | D | D | D | |
| 3.3.1.2.10 | Site Lock Out Notify Electrical Characteristics | D | D | D | |
| 3.3.1.2.11 | Channel Busy Electrical Characteristics | D | D | D | |
| 3.3.1.2.12 | Low Tone Alarm Electrical Characteristics | D | D | D | |
| 3.3.1.2.13 | Received Data Alarm Electrical Characteristics | D | D | D | |
| 3.3.1.2.14 | VSCE/BUEC Interface Electrical Characteristics | D | D | D | |
| 3.3.1.5 | Electrical Power and Ground | I | I | I | |
| 3.3.1.6 | Fasteners | I | I | I | |
| 3.3.1.7 | Electromagnetic Compatibility | T | T | X | |