AN/TRC-XXX
Troposcatter Transmission (TROPO) System Performance Work Statement (PWS) - Appendix A System Performance Specification

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Appendix A – System Performance Specification

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1 Scope

Per DoDM 4120.24 Defense Standardization Program (DSP) Procedures and MIL-STD-961E Change 2 Section 4, this specification establishes system requirements for the Troposcatter System hereafter referenced as “system”.

1.1 Overview

Project Manager TN and Product Manager Network Modernization will replace the existing AN/TRC-170A V3/V5. The legacy equipment currently fielded will be replaced with modernized Commercial Off-the-Shelf (COTS) products that provide a more flexible, scalable and maneuverable terrestrial Beyond Line of Sight (BLOS) capability.

This transit case based system, transportable by a High Mobility Multipurpose Wheeled Vehicle (HMMWV) and internally transportable in the MV-22, CH-53 and C-130, will reduce size, weight, and power (SWaP), increase performance, and adjust to the IP/Ethernet based architecture currently employed by both services.

The TN network is transitioning from the traditional wide area network mission of primarily supporting Mission Command communications to that of transporting all battlefield data for all Warfighting Functions (WfF). The incorporation of these new capabilities into the expeditionary network will enhance the Warfighting commander's ability to conduct Unified Land Operations and further converge the Army's expeditionary network. The system will provide secure digital trunking between major nodes of ESBs communications networks.

The next generation Troposcatter capability is envisioned to be a modern replacement to the legacy AN/TRC-170A Family of Systems. Further, the follow-on capability must be enduring to meet both current and future challenges identified in Army Transmission CPD. The next generation Troposcatter capability must support decentralized operations in a contested environment and support an expeditionary mindset. The US Army’s requirements were adopted by the Marine Corps are in line with expectations for a future Troposcatter capability. The adopted requirement however is US Army specific in areas that integrate the Force, specifically in the areas of interfacing the Marine Corps tactical network and Marine Corps transportability. Additionally, the Marine Corps recognizes congestion in the current primary spectrum used by legacy Troposcatter systems and requires an alternate band that provides spectrum agility for assured communications. This specification identifies the Marine Corps functional and performance requirements for the next generation Troposcatter system. Further this specification integrates the next generation Troposcatter capability with the Marine Air-Ground Task Force and requires a frequency agile capability to meet challenges in a spectrum congested environment.

The replacement system will be operational in three different modes: (1) Line-of-Sight (LOS) mode, when both terminals are visible to each other and there are only minor obstructions in the pathway; (2) BLOS Diffraction mode, when the terminals are not visible to each other and dominant propagation mode is diffraction; (3) BLOS Troposcatter mode when dominant propagation mode is tropospheric scattering.

Troposcatter mode propagation results in significant RF channel fading, therefore diversity reception is typically used to overcome the fading impacts. Various types of diversity can be used as well as different orders of diversity, although typically dual or quad diversities are utilized. The

modernized system will support a modular configuration where diversity can be scaled up for difficult links to meet mission requirements.

1.2 System Description

The next generation Troposcatter system is a light weight transportable BLOS communication system capable of extending networked node Internet Protocol (IP) traffic over Radio Frequencies (RF) using Troposcatter technology at data rates as high as 50 Mbps and ranges up to 185 kilometers. The system is transportable by both United States Army and United States Marine Corps using internal and commercial transportation method. The Troposcatter system is transit case based and transportable by a single High Mobility Multipurpose Wheeled Vehicle providing an expeditionary advantage over the current fielded AN/TRC-170 family of Troposcatter systems. System deployment resources and associated setup time are dramatically reduced due to the reduction in size, weight, and power. The Troposcatter system provides a reliable low latency alternative to Satellite Communications (SATCOM) for continued networked services in a SATCOM denied environment.

1.3 System Configurations, States, and Modes

1.3.1 Configurations

The configuration shall leverage modular common components to facilitate operations and reduce overall foot print. The intent of the configuration is to provide a single consolidated spectrum agile reduced form factor configuration for transport purposes.

1.3.2 States

The Troposcatter system has two states, transport and operation. The transport state is defined as all system components packaged and enclosed in weatherproof transit cases either ready for transport by a transport medium (i.e. ground vehicle, air lift, sea, etc), in transport by a transport medium, or in storage. The transport state is the primary state of the system when it is not in use. The operational state is defined as system components configured for communications with self-alignment complete. The operational state includes when the system is actively transmitting, set up for transmission in a reserve or staged status, set up with or without external power and baseband interface connections in place.

1.3.3 Modes

The operational states have three operational modes: 1). Beyond Line of Sight (BLOS) Troposcatter, 2). Line of Sight (LOS), and 3). Obstacle gain Diffraction (OGD).

2 Applicable Documents

The documents identified in Table 2-1 (Applicable Documents) of the exact issue shown, or latest version at time of Request for Task Execution Plan (RTEP) release, if undated, form a part of this Specification to the extent specified herein. In the event of conflict between the applicable documents and this specification, the specification shall take precedence. Nothing in this document supersedes applicable laws and regulations unless a specific exemption has been obtained. The most recent revision/date of the referenced document at the time of contract award shall be used unless otherwise specified. Military and Federal standards, performance specifications, and handbooks may be obtained from the Document Automation and Production Service, Building 4/D, 700 Robbins Street, Philadelphia, PA 19111 and in digital form online at DLA QuickAssist.

Document	Title
	Non-EPM Modem For Services Conforming To Class-B Of STANAG 4484
21 CFR 1040	Performance Standards for Light Emitting Products
ACGIH TLV Guide	ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposures Indices
ACGIH TLV Guide	ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposures Indices
American National Standards Institute (ANSI) C95.1 19 Apr 2006	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields
American Society for Testing and Materials (ASTM) D-3951-95	Standard Practices for Commercial Packaging
ANSI Z136.1	Safe Use of Lasers
ANSI Z535.4	Product Safety Signs and Labels
AR 190-51 30 Sep 1993	Security of Unclassified Army Property (Sensitive and Non-Sensitive)
AR 25-2 24 Oct 2007	Information Assurance
AR 385-15 23 Aug 2007	System Safety and Engineering
AR 530-1 26 Sep 2014	Operations and Signal Security – Operations Security (OPSEC)
DoD 4100.39-M, Volume 5, Oct 2009 2009	Federal Logistics Information System

DoD Directive 8100.02	Use of Commercial Wireless Devices, Services, and Technologies in the Department of Defense (DoD) Global Information Grid (GIG), April 14, 2004
DoD Instruction 4630.09	Communication Waveform Management and Standardization
DoDD 5100.35	Military Communications-Electronics Board (MCEB)
DoDI 6055.11	Protection of DoD Personnel from Exposure to Radio Frequency Radiation and Military Exempt Lasers
FIPS 140-2 25 May 2001	Security Requirements for Cryptographic Modules
FM 3-38 February 2014	Cyber Electromagnetic Activities Field Manual
GEIA-STD-0007 10 Feb 2014	Logistics Management Information System
Joint Publication 3-12(R) 5 February 2013	Cyberspace Operations
MIL-HDBK-881C 3 Oct 2011	Work Breakdown Structure for Defense Material Items
MIL-PRF-29612B Not 2 20 Jun 2011	Training Data Products (performance specification)
MIL-STD -130N change 2, 09 Jan 2014	Depart of Defense Standard Practice Identification Marking of U.S. Military Property
MIL-STD -1366E 31 Oct 2006	DoD Interface Standard for Transportability Criteria
MIL-STD -40051-2, REV C 15 Dec 2015	Preparation of Digital Technical Information for page-Based Technical Manuals
MIL-STD-1472G 11 Jan 2012	Human Engineering
MIL-STD-1474E 15 Apr 2015	Noise Limits
MIL-STD-196E 17 Feb 1998	Department of Defense Standard Practice Joint Electronics Type Designation System
MIL-STD-2169B Notice 1 19 Jan 2012	Nuclear High Altitude Electromagnetic Pulse (HEMP) Environment (C), 17 December 1993

MIL-STD-461G 11 Dec 2015	Requirements for the Control of Electromagnetic Interface Characteristics of Subsystems and Equipment
MIL-STD-464C 1 Dec 2010	Department of Defense Interface Standard Electromagnetic Environmental Effects Requirements for Systems
MIL-STD-810G Change 1 15 April 2014	Department of Defense Test Method Standard for Environmental Engineering Considerations and Laboratory Tests
MIL-STD-882E 11 May 2012	Standard Practice for System Safety
MIL-STD-961E Change 3 27 Oct 2015	Department of Defense Standard Practice Defense and Program-Unique Specifications Format and
NAS 411-1	Hazardous Material Target List
MTR 10683 September 1989	AN/TRC-170 Link Engineering Manual
NFPA 70-14	National Electrical Code
NFPA 70B 2013	Recommended Practice for Electrical Equipment
NTIA Redbook May 2014	Manual of Regulations and Procedures for Federal Frequency Management (May 2014 Revision of the May 2013 Edition)
Program Protection Plan Outline and Guidance Version 1.0 dated July 2011	Document provides an outline, content, and formatting guidance for the Program Protection Plan (PPP) required by DoDI 5000.02 and DoDI 5200.39
R201A905A100 Rev F 1 Apr 2009	Timing and Frequency Standard Module Specification for the TN Program SD&D Phase III, BAE Systems,
Title 29, Part 1910	Title 29 code of Federal Regulations
UL 60950-1	Standard for Safety of Information Technology Equipment
TN Integration Framework	NetOps External Monitoring Interface

Table 2-1 Applicable Documents

3 Requirements

Service unique interface requirements are identified by either United States Army **(USA)** or United States Marine Corps **(USMC)**. System configurations produced as a result of this specification will be requested to include either USA or USMC interface requirements but not both. Section 6.2 (Acquisition Requirements) provides statements supporting the acquisition of Service specific Troposcatter system configurations.

3.1 Production Acceptance Test

3.1.1 Production Acceptance Test. When specified (see 6.2), a sample shall be subjected to production acceptance in accordance with Section 4.1.

3.2 Production Verification Test

3.2.1 Production Verification Test. When specified (see 6.2), a sample shall be subjected to production verification in accordance with Section 4.2.

3.3 General Requirements

3.3.1 The system shall communicate Beyond Line of Sight (BLOS) from point to point in the frequency range of 4.400 to 5.000 GHz. (See Note 1 in Section 6

3.3.2 The system shall use Troposcatter technology in the frequency range of 4.400 to 5.000 GHz to communicate BLOS. (See Note 2 in Section 6 regarding Troposcatter).

3.3.3 The system shall communicate Line of Sight from point to point in the frequency range of 4.400 to 5.000 GHz.

3.3.4 The system shall communicate from point to point using Diffraction in the frequency range of 4.400 to 5.000 GHz. (See Note 3 in Section 6 regarding Diffraction).

3.3.5 The system shall be designed using Modular Open Systems Architecture (See Note 4 in Section 6 regarding Modular Open Systems Architecture) concepts.

3.4 System Performance

3.4.1 Modularity

3.4.1.1 The system shall be capable of operation in single diversity (See Note 5 in Section 6 regarding Modularity).

3.4.1.2 The system shall be modular in design to support reconfiguration from single diversity to dual diversity using common components from a like system in no more than 30 minutes (See Note 5 in Section 6 regarding Modularity).

3.4.1.3 The system shall be modular in design to support reconfiguration from single or dual diversity to quad diversity using common system components from a like system in no more than 45 minutes (See Note 5 in Section 6 regarding Modularity).

3.4.1.4 The system shall support C-band operations.

3.4.1.5 The system shall reuse at minimum the baseline modem and antenna(s) for additional frequency band(s)

3.4.2 High Power Amplifier

3.4.2.1 The system shall include a GaN Solid State Power Amplifier (SSPA).

3.4.3 HPA Operations

3.4.3.1 All system SSPA output powers proposed on the DD-1494 shall be compliant to NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management (May 2014), paragraph 5.2.2.2 for all modulation, coding, and data rate combinations.

3.4.4 Bandwidth

3.4.4.1 The HPA shall support the full bandwidth of 4.4-5GHz.

3.4.5 Antenna

3.4.5.1 The system shall include Troposcatter antenna(s).

3.4.5.2 The system antenna shall be configured for operation (4.400 – 5.000 GHz) by placing the feed on the system antenna.

3.4.5.3 The system antenna shall support self-alignment (See Note 6 in Section 6 regarding self-alignment).

3.4.5.4 The system antenna shall be ≥ 6 feet in height from the ground to the lowest extent of the aperture when the antenna is fully extended for operation

3.4.5.5 The system antenna shall have a range of motion that spans between -10 and 30 degrees in elevation during operations.

3.4.5.6 The system antenna shall have a range of motion that allows up to 90 degrees in elevation, stowed position, for non-operational periods (parabolic antenna). The system shall enable the local operator to control the antenna by slewing the antenna azimuth using powered control.

3.4.5.7 The system shall enable the local operator to control the antenna by slewing the antenna elevation using powered control.

3.4.5.8 The system shall enable the operator to remove power from the antenna drive motors.

3.4.5.9 The system shall enable the operator to set the antenna azimuth pointing manually without the aid of powered drive mechanisms (See Note 7 in Section 6 regarding Manual Pointing)

3.4.5.10 The system shall enable the operator to set the antenna elevation pointing manually without the aid of powered drive mechanisms (See Note 7 in Section 6 regarding Manual Pointing)

3.4.5.11 The system antenna shall have externally visible elevation indicators to facilitate manual antenna pointing.

3.4.5.12 The antenna shall have an efficiency ≥ 55% as measured at mid C-Band, 4.7GHz

3.4.5.13 The antenna shall be capable of operation at an incline of 10 degrees.

3.4.5.14 The antenna shall be capable of operation at a decline of 10 degrees

3.4.6 Modem

3.4.6.1 The system shall include a Troposcatter communications modem

3.4.6.2 The modem shall provide at least 2 transmit ports to support single, dual, and quad diversity operations.

3.4.6.3 The modem shall provide at least 4 receive ports to support single, dual, and quad diversity operations.

3.4.6.4 The system shall provide Adaptive Coding Modulation to optimize throughput to varying link conditions.

3.4.7 Distance and Throughput Requirements

3.4.7.1 The system shall maintain an average throughput of ≥ 2Mbps at 95% availability with a Bit Error Rate ≤ 10e-6 at a range of 185km when in operation. (See Note 8 in Section 6 regarding Link Characteristics) (Threshold)

3.4.7.2 The system shall maintain an average throughput of ≥ 16Mbps at 95% availability with a Bit Error Rate ≤ 10e-6 at a range of 185km when in operation. (See Note 8 in Section 6 regarding Link Characteristics) (Objective)

3.4.7.3 The system shall maintain an average throughput of ≥ 6Mbps at 95% availability with a Bit Error Rate ≤ 10e-6 at a range of 120km when in operation. (See Note 8 in Section 6 regarding Link Characteristics) (Threshold)

3.4.7.4 The system shall maintain an average throughput of ≥ 22Mbps at 95% availability with a Bit Error Rate ≤ 10e-6 at a range of 120km when in operation. (See Note 8 in Section 6 regarding Link Characteristics) (Objective)

3.4.7.5 The system shall maintain an average throughput of ≥ 16Mbps at 95% availability with a Bit Error Rate ≤ 10e-6 at a range of 85km when in operation. (See Note 8 in Section 6 regarding Link Characteristics) (Threshold)

3.4.7.6 The system shall maintain an average throughput of ≥ 38Mbps at 95% availability with a Bit Error Rate ≤ 10e-6 at a range of 85km when in operation. (See Note 8 in Section 6 regarding Link Characteristics) 50Mbs (Objective)

3.4.7.7 The system shall maintain an average throughput of ≥ 50Mbps at 95% availability with a Bit Error Rate ≤ 10e-6 at a range of 55km when in operation. (See Note 8 in Section 6 regarding Link Characteristics) (Threshold)

3.4.7.8 The system shall maintain an average throughput of ≥ 100Mbps at 95% availability with a Bit Error Rate ≤ 10e-6 at a range of 55km when in operation. (See Note 8 in Section 6 regarding Link Characteristics) (Objective)

3.4.8 Latency

3.4.8.1 The system shall maintain ≤ 50ms one-way transmission latency when operations require it.

3.4.9 System Emissions

3.4.9.1 The systems emissions shall adhere to the NTIA Manual of Regulation and Procedures for Federal Radio Frequency Management (May 2014) Paragraph 5.2.2.2 and applied to data submitted for submission on the DD Form 1494

3.4.9.2 The system waveform(s) shall not exceed the channel size limitations identified in NTIA Manual of Regulation and Procedures for Federal Radio Frequency Management (May 2014) Paragraph 4.3.18 figure 1.

3.4.9.3 The system waveform(s) shall not operate outside the assigned Area/Local Spectrum Manage channel sizes identified in NTIA Manual of Regulation and Procedures for Federal Radio Frequency Management (May 2014) Paragraph 4.3.18 during Adaptive Coding Modulation operations (See Note 9 in Section 6 regarding spectrum compliance and ACM).

3.4.9.4 DD-1494. The contractor shall conduct testing for collection of the data required to complete DD Form 1494, Application for Equipment Frequency Allocation.

3.5 Interface Definition

3.5.1 Signal Interfaces

3.5.1.1 The system signal interfaces shall use non-proprietary commercially available connectors.

3.5.1.2 The system modem transit case shall include a Signal Entry Panel for consolidation of transit case interface connections associated with the modem transit case.

3.5.1.3 The system shall provide monitoring ports for all modem transmit paths between the modem and HPA

3.5.1.4 The system shall provide monitoring ports for all modem receive paths between modem and LNA

3.5.1.5 The system transmit and receive modem monitoring ports shall be accessible to the user without obstruction.

3.5.2 Data and Management Interfaces

3.5.2.1 All system Ethernet physical interfaces for system management shall be RJ-45 compatible. (See Note 10 in Section 6 regarding RJ-45 Ethernet compatibility)

3.5.2.2 All system Ethernet physical interfaces for data management shall be RJ-45 compatible. (See Note 10 in Section 6 regarding RJ-45 Ethernet compatibility)

3.5.2.3 All system RS-232 serial based management interfaces shall provide RJ-45 or DB-9 connection point for console management.

3.5.2.4 All system Internet Protocol networking device's RS-232 serial management interfaces shall provide RJ-45 or DB-9 connection point for console management.

3.5.2.5 All system modem management interfaces shall be user accessible using an external Signal Entry Panel located on the equipment transit case.

3.5.2.6 All system IP equipment management interfaces shall be user accessible using an external Signal Entry Panel located on the equipment transit case.

3.5.2.7 **(USMC).** The system transit case containing the Layer 2 networking switch shall provide a single Mixed Fiber Optic Cable Assembly (MFOCA) Mixed Mode Expanded Beam connector interface with two Single Mode and two Multimode Channels on the transit case Signal Entry Panel.

3.5.2.8 **(USA).** The system transit case containing the Layer 2 networking switch shall provide a single Tactical Fiber Optic Cable Assembly (TFOCA) - II 100fx multi-mode fiber on the transit case Signal Entry Panel supporting both fiber pairs.

3.5.2.9 **(USA).** The system transit case containing the Layer 2 networking switch shall provide a single TFOCA-II 1GigaBit LX/LH multi-mode interface on the transit case Signal Entry Panel supporting both fiber pairs.

3.5.2.10 The system transit case containing the Layer 2 networking switch shall provide three 1000BaseT interfaces on the transit case Signal Entry Panel. (Threshold) (See Note 11 in Section 6 regarding 1000BaseT)

3.5.2.11 The system transit case containing the Layer 2 networking switch shall provide five 1000BaseT interfaces on the transit case Signal Entry Panel. (Objective) (See Note 11 in Section 6 regarding 1000BaseT)

3.5.2.12 The system Internet Protocol devices shall comply with the mandatory requirements of DoD IPv6 Standard Profiles for IPv6 Capable Products published in the DoD Information Technology Standards Registry (DISR).

3.5.2.13 **(USA).** The system shall provide a layer 2 switch capable network interface to the TN network.

3.5.2.14 **(USMC).** The system switch shall interface to the Marine Corps Combat Data Network (CDN) network.

3.5.2.15 The system switch shall provide 802.1q trunking functionality

3.5.2.16 The system switch shall have eight (8) 10/100/1000 BaseT Ethernet ports.

3.5.2.17 The system switch shall have two (2) fiber ports.

3.5.2.18 The system switch shall have a separate Virtual Local Area Network for the system management network.

3.5.2.19 The system switch shall have a separate Virtual Local Area Network for the system data network.

3.5.2.20 The system switch shall provide a single RJ-45 console port for switch configuration.

3.5.2.21 The system network switch shall be on the DISA Approved Products List (APL)

3.5.3 Global Positioning System (GPS)

3.5.3.1 The system shall not rely on commercial GPS as a primary means of obtaining GPS Information (Position, Navigation, and Timing) per DoDI 4650.08 paragraph 3.

3.5.3.2 If GPS Information (Position, Navigation, and Timing) is used by the system, the system shall be capable of interfacing with an AN/PSN-13A Defense Advanced GPS Receiver to obtain the needed GPS information (See Note 12 in Section 6 regarding GPS).

3.5.3.3 The system shall provide DAGR if GPS is required for deployment and operations.

3.5.4 Power

3.5.4.1 **(USA).** The system shall operate on an Advanced Medium-Size Mobile Power Source (AMMPS) 5 KW power generator, as specified in MIL-DTL-32496.

3.5.4.2 **(USMC).** The system power receptacle for 120/208 VAC 100 Amp and below feeds shall use IEC 60309 Receptacle. (See Note 13 in Section 6 regarding IEC 60309)

3.5.4.3 The system shall provide a 50 ft power cable to support operations on both generator and shore power.

3.5.5 Cabling

3.5.5.1 The system shall include all necessary interconnecting cables to facilitate operation of the transmission system.

3.5.5.2 The system cables shall be shielded in accordance with MIL-STD-188-124B Change Notice 3 paragraph 5.1.2.1.1.4.

3.5.5.3 The system waveguides shall be grounded in accordance with MIL-STD-188-124B Change Notice 3 paragraph 5.1.1.3.8.5.

3.5.5.4 The system cables shall be marked with individual cable reference designator.

3.5.5.5 The system cables shall be marked with individual cable part number.

3.5.5.6 The system cables shall be marked with individual cable manufacturer cage code.

3.5.5.7 The system shall comply with the design criteria in MIL-STD-1472G section 5.4.5.7 for cable labeling.

3.5.5.8 The system shall comply with the design criteria in MIL-STD-1472G section 5.9.14.4 for cable routing.

3.5.5.9 The system shall comply with the design criteria in MIL-STD-1472G section 5.9.14.7 for cable identification.

3.5.6 Connectors

3.5.6.1 The system shall comply with the design criteria of MIL-STD-1472G section 5.9.15 for connectors.

3.5.6.2 The system connectors shall be uniquely keyed to prevent improper mating.

3.5.6.3 The system connectors shall include captive covers to prevent the intrusion of water.

3.5.6.4 The system connectors shall include captive covers to prevent the intrusion of dust.

3.5.6.5 The system connectors shall be electrically bonded to the cable shield.

3.5.7 Fastener Hardware

3.5.7.1 The system shall use captive fasteners in accordance with MIL-STD-1472G section 5.9.10.3.

3.5.7.2 The system shall use corrosion-resistant steel (CRES) for securing equipment assembled in the field.

3.5.7.3 The system shall use CRES for securing equipment disassembled in the field.

3.6 Setup and Antenna Alignment

3.6.1 The system shall complete setup from a transport state in no more than 60 minutes by two trained personnel. (See Note 14 in Section 6 regarding Setup)

3.6.2 The system shall complete setup from a transport state in no more than 120 minutes by two trained personnel in Mission Oriented Protective Posture (MOPP) Level 4 without having to assume a strenuous or difficult position. (See Note 14 in Section 6 regarding Setup) (Threshold)

3.6.3 The system shall complete setup from a transport state in no more than 120 minutes by two trained personnel in Cold Weather Gear without having to assume a strenuous or difficult position. (See Note 14 in Section 6 regarding Setup) (Threshold)

3.6.4 The system shall include all tools required to place the system into an operational state from

a transport state.

3.6.5 The system shall require no special tools to configure the system for operation

3.6.6 The system shall be ready to begin the self-alignment at the completion of system setup from a transport configuration (See Note 14 in Section 6 regarding Setup).

3.6.7 The system shall have an antenna pointing azimuth accuracy of +/- 5 degrees to the distant end when system setup is complete (See Note 14 in Section 6 regarding Setup).

3.6.8 The system shall have an antenna pointing elevation accuracy of +/- 2 degrees to the distant end when system setup is complete (See Note 14 in Section 6 regarding Setup).

3.6.9 The system shall complete self-alignment in no more than 60 minutes to achieve a fully operational state (See Note 6 in Section 6 regarding self-alignment) (Threshold).

3.6.10 The system shall complete self-alignment in no more than 45 minutes to achieve a fully operational state (See Note 6 in Section 6 regarding self-alignment) (Objective).

3.6.11 The system shall achieve an antenna pointing loss not greater than 1.0dB after self-alignment is complete (See Note 6 in Section 6 regarding self-alignment).

3.6.12 The system shall be capable of being completely packaged for transport from a fully operational state within 60 minutes by two trained personnel.

3.6.13 The system shall be capable of being completely packaged for transport from a fully operational state within 120 minutes by two trained personnel in Mission Oriented Protective Posture (MOPP) Level 4 without having to assume a strenuous or difficult position. (Threshold)

3.6.14 The system shall be capable of being completely packaged for transport from a fully operational state within 120 minutes by two trained personnel in Cold Weather Gear without having to assume a strenuous or difficult position. (Threshold)

3.6.15 The system & subcomponents shall not exceed the lifting limits for two personnel identified in MIL-STD-1472G paragraph 5.8.6.3 when the system is being configured for operations from a transport configuration.

3.6.16 The system & subcomponents shall not exceed the lifting limits for two personnel identified in MIL-STD-1472G paragraph 5.8.6.3 when the system is being configured for transport from an operational configuration.

3.6.17 Pointing Loss

3.6.17.1 The system antenna shall not exceed 1.5dB pointing loss on non-penetrating surface types under nominal conditions while in its operational state (See Note 15 in Section 6 regarding Antenna Pointing).

3.6.17.2 The system antenna shall not exceed 2.5dB pointing loss on non-penetrating surface types under sustained wind loads and gusts while in its operational state as defined in paragraph 3.16.16 (See Note 15 in Section 6 regarding Antenna Pointing).

3.6.17.3 The system antenna shall not exceed 1.5dB pointing loss on penetrating surface types under nominal conditions while in its operational state (See Note 15 in Section 6 regarding Antenna Pointing).

3.6.17.4 The system antenna shall not exceed 2.5dB pointing loss on penetrating surface types under sustained wind loads and gusts while in its operational state defined in paragraph 3.16.16 (See Note 15 in Section 6 regarding Antenna Pointing).

3.7 Transportability and Storage

3.7.1 General

3.7.1.1 The system, when configured, shall be transportable on highways as secured cargo using the High-Mobility Multi-Purpose Wheeled Vehicle Heavy Variant Cargo Carrier in accordance with MIL-STD-1366E paragraph 5.1. (See Note 16 Section 6 HMMWV)

3.7.1.2 The system, when configured, should be transportable on highways as secured cargo using the MXXXX Joint Light Tactical Vehicle Cargo Variant in accordance with MIL-STD-1366E paragraph 5.1. (Objective)

3.7.1.3 The system shall be rail transportable as secured cargo in accordance with MIL-STD-1366E paragraph 5.2.

3.7.1.4 The system shall be water transportable as secured cargo in accordance with MIL-STD-1366E paragraph 5.3.

3.7.1.5 The system shall be Air Force fixed-wing air transportable as secured cargo in accordance with MIL-STD-1366E paragraph 5.4.

3.7.1.6 The system shall be Navy/Marine Corps fixed-wing air transportable as secured cargo in accordance with MIL-STD-1366E paragraph 5.4.

3.7.1.7 The system, when configured, shall be Army rotary-wing air transportable as secured cargo in accordance with MIL-STD-1366E paragraph 5.6.

3.7.1.8 The system, when configured, shall be Marine Corps rotary-wing air transportable as secured cargo in accordance with MIL-STD-1366E paragraph 5.6. (See Note 17 in Section 6 regarding Marine Corps rotary and tilt-wing)

3.7.1.9 The system, when configured, shall be Marine Corps tilt-wing air transportable as secured cargo in accordance with MIL-STD-1366E paragraph 5.6. (See Note 17 in Section 6 regarding Marine Corps rotary and tilt-wing)

3.7.2 Transit Cases

3.7.2.1 Transit cases shall have low profile nesting-type feet on top for stacking with other transit case(s).

3.7.2.2 Transit cases shall have low profile nesting-type feet on bottom for stacking with other transit case(s).

3.7.2.3 Transit case external latches shall be provided for latching the case shut. (See Note 18 in Section 6 regarding Latches).

3.7.2.4 Transit cases shall be provided with a pressure relief valve to equalize pressure.

3.7.2.5 Transit cases shall be constructed so that the covers mount to the sides of the transit case. (Objective)

3.7.2.6 Transit cases shall be constructed so that the covers do not interfere with stacking.

3.7.2.7 The transit case-mounted component user interfaces needed for system setup shall be accessible by the user without obstruction during system setup.

3.7.2.8 The transit case-mounted component user interfaces needed to operate the system shall be accessible by the user without obstruction during system operation.

3.7.2.9 The transit case-mounted component system indicators needed for system setup shall be visible by the user without obstruction during system setup.

3.7.2.10 The transit case-mounted component system indicators needed to operate the system shall be visible by the user without obstruction during system operation.

3.7.2.11 The transit cases shall provide ready access to all Unique Identifications (UID).

3.7.2.12 Transit cases shall comply with the design criteria in MIL-STD-1472G section 5.9.6 for case and cover mounting.

3.7.2.13 Transit cases shall comply with the design criteria in MIL-STD-1472G 5.9.7 for cases.

3.7.3 Weight

3.7.3.1 The system, with the exception of a transit case containing a high-power amplifier, shall be capable of being lifted 3 feet above the floor by no more than four personnel one transit case at a time in accordance with MIL-STD-1472G paragraph 5.8.6.3 when packaged for transport (See Note 19 in Section 6 regarding Weights). (Threshold)

3.7.3.2 The system, with the exception of a transit case containing a high-power amplifier, shall be capable of being carried 33 feet by no more than four personnel one transit case at a time in accordance with MIL-STD-1472G paragraph 5.8.6.3 when packaged for transport (See Note 19 in Section 6 regarding Weights). (Threshold)

3.7.3.3 A system transit case containing a high-power amplifier shall be capable of being lifted 3 feet above the floor by no more than two men in accordance with MIL-STD-1472G paragraph 5.8.6.3 when packaged for transport. (See Note 19 in Section 6 regarding Weights) (Threshold).

3.7.3.4 A system transit case containing a high-power amplifier shall be capable of being carried 33 feet by no more than four men in accordance with MIL-STD-1472G paragraph 5.8.6.3 when packaged for transport. (See Note 19 in Section 6 regarding Weights). (Threshold)

3.7.3.5 The system shall be capable of being lifted 3 feet above the floor by no more than four personnel one transit case at a time in accordance with MIL-STD-1472G paragraph 5.8.6.3 when packaged for transport (See Note 19 in Section 6 regarding Weights). (Objective)

3.7.3.6 The system shall be capable of being carried 33 feet by no more than four personnel one transit case at a time in accordance with MIL-STD-1472G paragraph 5.8.6.3 when packaged for transport (See Note 19 in Section 6 regarding Weights). (Objective)

3.7.3.7 The system shall be capable of being setup by two personnel for all lift and carry requirements in MIL-STD-1472G paragraph 5.8.6.3 (See Note 19 in Section 6 regarding Weights) (Threshold)

3.8 Monitoring and Control (M&C) / Network Operations (NetOps)

3.8.1 General Requirements

3.8.1.1 The system shall provide an event log of all system alarms.

3.8.1.2 The system shall allow for alarms to be cleared from event log individually.

3.8.1.3 The system shall allow for all audible alarms to be cleared from event log simultaneously.

3.8.2 M&C

3.8.2.1 The system components shall be configurable by the operator/user. (See Note 20 in Section 6 Regarding M&C).

3.8.2.2 The system shall be capable of remote network accessed management.

3.8.2.3 The system shall be capable of local network management.

3.8.2.4 **(USA).** Contractor provided software for hosting on the Government provided laptop to support management shall be compatible with the latest Army Gold Master (AGM).

3.8.2.5 **(USA).** The TROPO system's management and control terminal/computer shall be accessible from parent TN node management network via IP

3.8.2.6 **(USA).** The TROPO system's management and control terminal/computer shall run on an ARMY Gold Master (AGM) Windows 10 platform

3.8.2.7 **(USA).** The TROPO system's management and control software shall run on a Windows 10 Secure Host Baseline GFE platform (See Note 21 in Section 6 regarding GFE Laptop)

3.8.2.8 **(USMC).** The system software shall be compatible with the Marine Corps Windows Secure Host Baseline (See Note 21 in Section 6 regarding GFE Laptop)

3.8.2.9 **(USMC).** The system software shall be compatible with the Marine Corps Common Hardware Suite (MCHS) General Purpose Laptop (See Note 21 in Section 6 regarding MCHS Laptop)

3.8.3 NetOps

3.8.3.1 The TROPO system shall support SNMP V3 (ensuring V1 and V2 are not available) to include full support of MIB-2 variables as defined in RFC1213-MIB.

3.8.3.2 The TROPO system shall support MIB-2 for the SysObjectID MIB variable defined by OID 1.3.6.1.2.1.1.2. In addition to MIB-2 support, device support for SNMP shall include private, vendor-specific MIB variables to allow monitoring, management, control, and configuration of system parameters.

3.8.3.3 The TROPO system shall include the development of vendor-specific MIB files/definitions for compilation in NetOps and Network Management software

3.8.3.4 The TROPO system shall support full NetOps M&C by third party NetOps tools through direct control of system components & subcomponents or through intermediary hardware devices or software tools

3.8.4 Transmission Security (TRANSEC)

3.8.4.1 The system shall include a TRANSEC device

3.8.4.2 The TROPO system TRANSEC device shall be Federal Information Processing Standards (FIPS) Publication (PUB) 140-2 Level 2 certified, to provide over the air encryption to protect International Organization for Standardization (ISO) Open Systems Interconnect (OSI) Layer 2 radio data frames.

3.8.4.3 The Transmission Security (TRANSEC) device shall be in line between the layer 2 switch and modems data port (threshold)

3.8.4.4 The TRANSEC device shall reside within the modem (objective)

3.8.5 Information Assurance (IA)

3.8.5.1 The system shall be capable of obtaining authorization for operation as defined in DoD Instruction (DoDI) 8510.01.

3.8.5.2 The system shall conform to DISA Security Technical Implementation Guides (STIGs) for employed technologies.

3.9 Indicators and Alarms

3.9.1 Indicators

3.9.1.1 The system visual indicators shall be readable in direct sunlight. (Objective)

3.9.1.2 The system visual indicators shall have a dimming feature. (Objective)

3.9.1.3 The system visual indicators shall be night vision device compatible in accordance with MIL-STD-1472G paragraph 5.13.2.15.4. (Objective)

3.9.1.4 The system shall provide visual indicators when equipment is energized.

3.9.1.5 The system shall notify the user of faults using a visual indicator.

3.9.1.6 The system visual indicators shall indicate the status of each LRU.

3.9.1.7 The system visual indicators shall display LRU fault conditions.

3.9.1.8 The system visual indicators shall display LRU Built-In Test Status.

3.9.1.9 The system visual fault indicators shall reset after a fault is repaired.

3.9.1.10 The system visual fault indicators shall reset after a fault is cleared.

3.9.2 Alarms

3.9.2.1 The system shall notify the user of faults using an audible alarm.

3.9.2.2 The system audible alarms shall comply with the design criteria in MIL-STD-1472G section 5.3.1.3.4.a regarding acoustical environment.

3.9.2.3 The system audible alarms shall comply with the design criteria in MIL-STD-1472G section 5.3.1.4.3 regarding alarm differentiation.

3.9.2.4 The system verbal audible alarms, if used, shall comply with the design criteria in MIL-STD-1472G section 5.3.1.5.2 regarding verbal alarms.

3.9.2.5 The system audible alarms shall be capable of being muted by the user.

3.9.2.6 The system audible alarms shall reset after a fault is repaired.

3.9.2.7 The system audible alarms shall reset after a fault is cleared.

3.10 Reliability, Availability, Maintainability

3.10.1 Reliability

3.10.1.1 The system shall have a Mean Time Between Failures (MTBF) of 720 hours. (See Note 22 in Section 6 regarding MTBF).

3.10.1.2 The system shall support an average setup and tear down of 10 times per year over a 15-year life cycle without a critical mechanical failure

3.10.2 Availability

3.10.2.1 The system shall meet an inherent availability (Ai) of no less than 0.9995. (See Note 23 in Section 6 regarding Ai).

3.10.3 Maintainability

3.10.3.1 The system shall meet an operator level Mean Time to Repair (MTTR) of 30 minutes. (See Note 24 in Section 6 regarding MTTR)

3.10.3.2 The system organizational MTTR shall not exceed 60 minutes for Operator/Crew (O/C)-level repairs. (See Note 24 in Section 6 regarding MTTR)

3.10.3.3 The Mean Time To Perform Preventive Maintenance shall not exceed 30 minutes.

3.10.3.4 The system shall comply with the design criteria in MIL-STD-1472G section 5.9.1.7 regarding one person equipment handling.

3.10.3.5 The system shall comply with the design criteria in MIL-STD-1472G section 5.9.1.10 regarding operational environment equipment handling.

3.10.3.6 The system shall comply with the design criteria in MIL-STD-1472G section 5.9.1.12 regarding maintainer access.

3.10.3.7 The system shall comply with the design criteria in MIL-STD-1472G section 5.9.1.13 regarding positioning of safety features supporting system maintenance.

3.10.3.8 The system shall comply with the design criteria in MIL-STD-1472G section 5.9.2.1.4 regarding frequent access.

3.10.3.9 The system shall comply with the design criteria in MIL-STD-1472G section 5.7.9.1.16 regarding electrical conductor insulation where maintenance activities occur.

3.10.3.10 The system shall require no special tools for maintenance.

3.11 Safety

3.11.1 General Safety

3.11.1.1 The system shall be safe for use by trained military personnel.

3.11.1.2 The system shall be safe under maintenance conditions by trained military personnel.

3.11.1.3 The system shall incorporate safety devices to protect personnel from serious injury or death during set-up. (See Note 25 in Section 6 regarding Safety Devices)

3.11.1.4 The system shall incorporate safety devices to protect personnel from serious injury or death during tear-down. (See Note 25 in Section 6 regarding Safety Devices)

3.11.1.5 The system shall incorporate safety devices to protect personnel from serious injury or death during operation. (See Note 25 in Section 6 regarding Safety Devices)

3.11.1.6 The system shall incorporate safety devices to protect personnel from serious injury or death during maintenance. (See Note 25 in Section 6 regarding Safety Devices)

3.11.1.7 The system shall incorporate safety devices to protect personnel from serious injury or death during transport. (See Note 25 in Section 6 regarding Safety Devices)

3.11.1.8 The system shall incorporate safety devices to protect personnel from serious injury or death during disposal. (See Note 25 in Section 6 regarding Safety Devices)

3.11.1.9 The system shall have any potential environmental hazards clearly marked and labeled.

3.11.1.10 The system shall have any potential hazards to personnel clearly marked and labeled.

3.11.1.11 The system safety markings shall comply with ANSI-Z535.4, UL 60950-1, or UL-969.

3.11.1.12 The system safety labels shall comply with ANSI-Z535.4, UL 60950-1, or UL-969.

3.11.1.13 The system shall be free of ozone depleting substances per applicable Federal regulations in effect on the date of manufacture.

3.11.1.14 The system shall contain warning labels on each piece of equipment weighing greater than 31 pounds listing the exact weight and the recommended number of personnel required for safe lifting in accordance with MIL-STD-1472G section 5.8.6.3.12.

3.11.1.15 The system shall have all exposed edges and corners rounded to prevent cuts and punctures per MIL-STD-1472G Section 5.7.9.2.3.

3.11.1.16 The system shall comply with the design criteria in MIL-STD-1472G section 5.7.7.6 regarding edge rounding.

3.11.1.17 The system shall not produce a sound pressure level equal to or exceeding an 8-hour time weighted average of 85 dBA at a distance of at least one meter away from the system in accordance with MIL-STD-1474E section 4.2.3.1.

3.11.1.18 The system shall include warning labels where noise levels are exceeded during maintenance.

3.11.2 Electrical Requirements

3.11.2.1 The system shall not expose the operator exposure to voltages exceeding 30V.

3.11.2.2 The system shall not expose the operator to stored energy shock when the user is connecting cables.

3.11.2.3 The system shall not expose the operator to stored energy shock when the user is disconnecting cables.

3.11.2.4 The system shall not expose the maintenance personnel contact with voltages exceeding 30V.

3.11.2.5 The system shall individually isolate current sources exceeding 25A to prevent accidental short circuiting.

3.11.2.6 The system shall provide a means for maintainers to discharge capacitor charge to less than 30V and 20J energy prior to maintainer access or exposure.

3.11.2.7 The system shall completely enclose circuits with voltages exceeding 500V.

3.11.2.8 The system shall provide an interlock for circuits with voltages exceeding 500V.

3.11.2.9 The system shall completely enclose components with voltages exceeding 500V.

3.11.2.10 The system shall provide an interlock for components with voltages exceeding 500V.

3.11.2.11 The system interlocks shall comply with UL 60950-1, section 2.8.

3.11.2.12 The system shall have embedded ground fault circuit interrupter (GFCI) where extension cords conducting Alternating Current are used in accordance with NFPA 70-14, Articles 210.8, 525.23, 550.13, and 551.41.

3.11.2.13 The system interface with power sources shall have a readily accessible disconnecting means shall be IAW NFPA 70-14, and UL 60950-1, sec 3.4.

3.11.2.14 System equipment with multiple-input power capabilities shall be protected from damage when connected to incorrect input power/voltage levels or polarity in compliance with UL 60950-1, par 3.2.1 and 4.3.6.

3.11.2.15 Equipment grounding shall comply with the requirements of NFPA 70-14, article 250.

3.11.2.16 Equipment grounding shall comply with the requirements of UL 60950-1, par 1.6.4 and section 2.6.

3.11.2.17 Equipment leakage current to ground shall not exceed 3.5 mA when tested UL 60950- 1, section 5.1.

3.11.2.18 Redundant equipment grounding conductors and labeling shall be required where currents exceed 3.5 mA.

3.11.2.19 Wiring shall comply with the requirements of UL 60950-1, paragraphs 3.1.1 - 3.1.3.

3.11.2.20 AC supply conductors shall be color-coded IAW MIL-STD-686C, paragraph 5.1.1.2.2.

3.11.2.21 The system shall comply with the design criteria in MIL-STD-1472G section 5.7.9.1.6.b regarding personnel electric shock prevention danger markings.

3.11.2.22 The system shall comply with the design criteria in MIL-STD-1472G section 5.7.9.1.6.c regarding personnel electric shock prevention danger signs.

3.11.3 Mechanical Safety

3.11.3.1 The system equipment shall possess adequate mechanical strength in accordance with UL 60950-1, Sections 4.1 and 4.2.

3.11.3.2 The system shall be capable of operation at an incline of 10 degrees.

3.11.3.3 The system shall be capable of operation at a decline of 10 degrees

3.11.3.4 Provisions shall be made to prevent accidental pulling out of drawers or rack mounted equipment.

3.11.3.5 Operator accessible parts shall comply with the temperature limits specified in UL 60950-1, Section 4.5.4.

3.11.3.6 Equipment using hazardous voltages shall possess adequate mechanical strength IAW UL 60950-1, Sections 4.1, 4.2., and Section 6.

3.11.3.7 Equipment power switches shall be protected to prevent accidental actuation, if such an action could pose a hazard to operators or maintainers.

3.11.3.8 Battery compartments shall prevent electrolyte from being expelled in the event of battery leakage or rupture.

3.11.3.9 All system Lithium batteries shall meet requirements for design, testing, evaluation, use, packaging, storage, transportation and disposal per the Naval Lithium Battery Safety Program as documented in NAVSEA S9310-AQ-SAF-010 Rev 2 of July 2010.

3.11.4 Other Safety

3.11.4.1 Pressurized components shall be provided with blowouts or relief valves which will vent in a safe location and manner.

3.11.4.2 Colors of safety critical controls shall be yellow for caution.

3.11.4.3 Colors of safety critical controls shall be red for danger.

3.11.4.4 Colors of safety critical indicators shall be yellow for caution.

3.11.4.5 Colors of safety critical indicators shall be red for danger.

3.11.4.6 Safety markings and labels shall be provided identifying any potential hazards to personnel.

3.11.4.7 Safety labels shall comply with the requirements of ANSI Z535.4.

3.11.4.8 Safety markings shall comply with the requirements of ANSI Z535.4.

3.11.4.9 RF radiation hazards shall use the signal word WARNING.

3.11.4.10 RF radiation voltages more than 30V shall use the signal word WARNING.

3.11.4.11 Voltages of more than 500V shall use the signal word DANGER.

3.11.4.12 Safety labels shall comply with the durability requirements of UL 60950-1, paragraph 1.7.11 and/or UL 969.

3.11.4.13 Labels shall be readily visible.

3.11.4.14 Labels shall not be removed when a barrier or access door is removed.

3.11.4.15 Labels shall not be removed when a barrier or access door is opened.

3.11.4.16 All equipment capable of emitting RF radiation shall be limited to values listed in ANSI C95.1 where exposure by personnel is required to operate the system.

3.11.4.17 RF radiation labels shall warn personnel of danger zones.

3.11.4.18 Shields which require removal during maintenance subjecting the maintainer to a radiation overexposure risk shall be interlocked (non-bypassable).

3.11.4.19 Covers which require removal during maintenance subjecting the maintainer to a radiation overexposure risk shall be interlocked (non-bypassable).

3.11.4.20 Fiber Optic Interfaces shall meet Class 1 or Class 1M laser Accessible Emission Limits IAW ANSI Z136.1 during use of components.

3.11.4.21 Fiber Optic Interfaces shall meet Class 1 or Class 1M laser Accessible Emission Limits IAW ANSI Z136.1 during maintenance of components.

3.11.4.22 Fiber Optic Interfaces shall meet Class 1 or Class 1M laser Accessible Emission Limits IAW ANSI Z136.1 during installation of components.

3.11.4.23 Where power levels must exceed Class 1 levels during normal operation with all fiber optic cables connected, Automatic Power Reduction (APR) shall be used to reduce laser radiation levels to Class 1 limits.

3.11.4.24 Where power levels must exceed Class 1 levels during maintenance, APR shall be used to reduce laser radiation levels to Class 1 limits.

3.11.4.25 Warning labels shall be applied to the equipment in accordance with ANSI Z136.1 where Class 1 levels are exceeded.

3.12 Human Factors

3.12.1 The system shall include the physical features (e.g., supports, guides, size or shape differences, fastener locations and alignment pins) necessary to prevent improper mounting.

3.12.2 The system shall include the physical features (e.g., supports, guides, size or shape differences, fastener locations and alignment pins) necessary to prevent improper assembling.

3.12.3 The system shall include the physical features (e.g., supports, guides, size or shape differences, fastener locations and alignment pins) necessary to prevent improper installing.

3.12.4 The system shall include the physical features (e.g., supports, guides, size or shape

differences, fastener locations and alignment pins) necessary to prevent improper connecting.

3.12.5 The system shall include the physical features (e.g., supports, guides, size or shape differences, fastener locations and alignment pins) necessary to prevent improper operating.

3.12.6 The system shall comply with the design criteria of MIL-STD-1472G section 5.9.15 for connectors.

3.12.7 The system shall have protective measures that prevent accidental activation of power switches.

3.12.8 The system shall have protective measures that prevent accidental deactivation of power switches. The system shall provide visual indicators when equipment is energized.

3.12.9 The system shall indicate critical malfunctions in accordance with MIL-STD-1472G section 5.9.18.1.3.

3.12.10 The system shall be capable of being operated by personnel wearing full Nuclear, Biological, and Chemical (NBC) contaminant protective gear up to Mission Oriented Protective Posture Level 4 (MOPP 4). (Objective)

3.12.11 The system shall be capable of being maintained by personnel wearing full Nuclear, Biological, and Chemical (NBC) contaminant protective gear up to Mission Oriented Protective Posture Level 4 (MOPP 4). (Objective)

3.12.12 The system shall be capable of being operated by personnel wearing cold weather gear. (Objective)

3.12.13 The system shall be capable of being maintained by personnel wearing cold weather gear. (Objective)

3.12.14 The system shall comply with the design criteria in MIL-STD-1472G section 5.4 for labeling.

3.13 Electromagnetic Environmental Effects (E3)

3.13.1 General E3

3.13.1.1 The system threshold EMI conducted and radiated emissions shall meet the requirements for Class A equipment as specified in 47CFR15 Subpart B (Unintentional Radiators).

3.13.1.2 System components that are susceptible to the effects of High Altitude Electromagnetic Pulse as defined in MIL-STD-2169B(C) shall be capable of removal and replacement using on-site spares within 30 minutes.

3.13.1.3 The system shall perform all mission essential functions following a Near Strike Lightning (NSL) environment as specified in MIL-STD-464C.

3.13.2 Electromagnetic Radiation

3.13.2.1 The system shall protect against Hazards of Electromagnetic Radiation to Ordnance (HERO) by indicating safe stand-off distances through appropriate labeling in accordance with DoDI 6055.11 and MIL-STD-464C.

3.13.2.2 The system shall protect against Hazards of Electromagnetic Radiation to Personnel (HERP) by indicating safe stand-off distances through appropriate labeling in accordance with DoDI 6055.11 and MIL-STD-464C.

3.13.2.3 The system shall protect against Hazards of Electromagnetic Radiation to Fuels (HERF) by indicating safe stand-off distances through appropriate labeling in accordance with DoDI 6055.11 and MIL-STD-464C

3.13.3 Electromagnetic Compatibility (EMC)

3.13.3.1 The system shall be electromagnetically compatible within itself in accordance with MIL-STD-464C paragraph 5.2.

3.13.4 Electromagnetic Interference (EMI)

3.13.4.1 The system shall meet the requirements of MIL-STD-461G CE-102 from 10 kHz to 10MHz. (Objective)

3.13.4.2 The system shall meet the requirements of MIL-STD-461G CE-106 from 10 kHz to 40 GHz. (Objective)

3.13.4.3 The system shall meet the requirements of MIL-STD-461G CS-101 from 30 Hz to 150 kHz. (Objective)

3.13.4.4 The system shall meet the requirements of MIL-STD-461G CS-103 from 15 kHz to 10 GHz. (Objective)

3.13.4.5 The system shall meet the requirements of MIL-STD-461G CS-104 from 30Hz to 20 GHz. (Objective)

3.13.4.6 The system shall meet the requirements of MIL-STD-461G CS-105 from 30Hz to 20 GHz. (Objective)

3.13.4.7 The system shall meet the requirements of MIL-STD-461G CS-114 from 10 kHz to 200 MHz. (Objective)

3.13.4.8 The system shall meet the requirements of MIL-STD-461G CS-115. (Objective)

3.13.4.9 The system shall meet the requirements of MIL-STD-461G CS-116 from 10 kHz to 100 MHz. (Objective)

3.13.4.10 The system shall meet the requirements of MIL-STD-461G RE-102 from 2 MHz to 18 GHz. (Objective)

3.13.4.11 The system shall meet the requirements of MIL-STD-461G RS-103 from 2 MHz to 40 GHz. (Objective)

3.14 Grounding Bonding and Shielding

3.14.1 The grounding, bonding and shielding scheme of the system shall provide effective shielding and minimize ground loops and common current returns for signal and power circuits.

3.14.2 The system shall provide external grounding provisions to control electrical current flow in accordance with MIL-STD-464C paragraph 5.12. (See Note 26 in Section 6 regarding Grounds and Bonds)

3.14.3 The system shall be electrically connected to a local earth grounding point using an Earth Electrode Subsystem per MIL-STD-188-124B paragraph 5.1.1.1 such that the resistance to earth does not exceed 10 ohms.

3.14.4 The system shall include lightning protection to mitigate the effects of a near lightning strike per MIL-STD-464C paragraph 5.5.

3.14.5 The system shall maintain performance characteristics of the antenna when the antenna is mounted on the mast per MIL-STD-464C paragraph 5.11.2.

3.14.6 The system signal cable shields shall be electrically connected to the terminal ground terminal lug.

3.14.7 Electrical resistance shall be 10 milliohms or less from the equipment enclosure to system structure, including the cumulative effect of all faying surface interfaces per MIL-STD-464C paragraph 5.11.3.a.

3.14.8 Electrical resistance shall be 15 milliohms or less from cable shields to the equipment enclosure, including the cumulative effect of all connector and accessory interfaces per MIL-STD-464C paragraph 5.11.3.b.

3.14.9 Electrical resistance shall be 2.5 milliohms across other individual faying surfaces within the equipment, such as between subassemblies or sections per MIL-STD-464C paragraph 5.11.3.c.

3.14.10 The system shall comply with the design criteria in MIL-STD-1472G section 5.7.9.1.3 regarding ground potential.

3.15 Chemical, Biological and Radiological Contamination

3.15.1 The system shall be CBR contamination survivable against the harmful effects of CBR agents when in the transport configuration.

3.15.2 The system shall be CBR decontamination survivable against the harmful effects of CBR decontaminants the transport configuration.

3.16 Environmental Compliancy

3.16.1 The system shall operate at 14 degrees Fahrenheit without system damage per MIL-STD-810G CN1 METHOD 502.6 PROCEDURE II LOW TEMPERATURE.

3.16.2 The system shall operate at 122 degrees Fahrenheit with the heating effects of solar radiation at a rate of 1120+/-47W/m2 “355+/- 14 BTU/ft2/hr” without system damage per MIL-STD-810G CN1 METHOD 501.6 PROCEDURE II HIGH TEMPERATURE.

3.16.3 The system shall operate after storage at -22 degrees Fahrenheit without system damage per MIL-STD-810G CN1 METHOD 502.6 PROCEDURE I LOW TEMPERATURE.

3.16.4 The system shall operate after storage at 140 degrees Fahrenheit without system damage per MIL-STD-810G CN1 METHOD 501.6 PROCEDURE I HIGH TEMPERATURE.

3.16.5 The system shall be capable of storage at 95% humidity (non-condensing) ambient temperature 105F without system damage per MIL-STD-810G CN 1 METHOD 507.6 PROCEDURE I.

3.16.6 The system shall be capable of storage at 5% humidity (non-condensing) ambient temperature 120F without system damage per MIL-STD-810G CN 1 METHOD 507.6 PROCEDURE I.

3.16.7 The system shall be capable of withstanding rainfall of 1.7 millimeters per minute with a velocity of 30 miles per hour using varying droplets sized from 0.5mm to 4.5mm in diameter without system damage per MIL-STD-810G CN 1 METHOD 506.6 PROCEDURE I.

3.16.8 The system shall operate after being subjected to transit shock per MIL-STD-810G CN1 METHOD 516.7 PROCEDURE IV.

3.16.9 The system shall be capable of operating when subjected to temperature shock per MIL-STD-810G CN1 METHOD 503.6 PROCEDURE I-D.

3.16.10 The system shall be capable of operating when subjected to solar radiation per MIL-STD-810G CN1 METHOD 505.6 PROCEDURE I.

3.16.11 The system shall be capable of operating when subjected to blowing sand per MIL-STD-810G CN1 METHOD 510.6 PROCEDURE II.

3.16.12 The system shall be capable of operating after being subjected to secured cargo transportation per MIL-STD-810G CN1 METHOD 514.7 PROCEDURE I.

3.16.13 The system shall be capable of operating when subjected to ice/freezing rain 6 - 13 millimeters per MIL-STD-810G CN1 METHOD 521.4.

3.16.14 The system shall be capable of storage/air transport at 40,000 feet per MIL-STD-810G CN1 METHOD 500.6 PROCEDURE I

3.16.15 The system shall withstand a steady wind speed of 40 mph with wind gusts up to 65 mph for 90 minutes per each vulnerable face.

4 Verification

System verification shall be executed by analysis, demonstration, inspection and/or tests in accordance with Table 4-1 (Requirements Verification Cross Reference Matrix).

Inspection (I)

Inspection is a method of verification of the physical characteristics by examination of the equipment and associated documentation. Inspections are conducted with the use of inspection tools, measurement devices, visual means, and by comparison. Most inspections apply to verification of requirements associated with physical characteristics such as size, weight, appearance, adherence to specified standards, engineering practices, and construction supported with quality documentation. Inspections may occur during any assembly stage of the unit under test (UUT).

Analysis (A)

Analysis is a method of verification through technical evaluation of calculations, computations, models, analytical solutions, use of studies, reduced data, results from previously performed tests, and/or representative data to determine that the item conforms to the specified requirements in Section 3.

Demonstration (D)

Demonstration is a method of verification whereby the properties, characteristics, and parameters of the item are determined by observation alone and without the use of instrumentation for quantitative measurements. This method is used when a Section 3 requirement does not contain a specific numerical parameter that must be measured. Demonstrations may occur during verification of a UUT at any assembly stage. Pass/fail criteria are simple yes/no indications of functional performance since no quantitative values are specified.

Test (T)

Test is a method to verify that a specified requirement is met by thoroughly exercising the applicable item under specified conditions and by using appropriate instrumentation in accordance with test procedures. This method requires the use of laboratory equipment, simulators, or services to verify compliance to the specified requirements. This method is used when it is possible to make a direct or indirect measurement of a specific numerical parameter to verify compliance with a Section 3 requirement. Tests may occur during verification of a unit at any assembly stage. Actual measured values are recorded, and pass/fail is determined by comparing the measured value with the specified value as required by Paragraph 4.1.2. Measurement accuracy shall be in accordance with Paragraph 4.1.3 to ensure that the measured value is within the specified tolerance.

Table 0-1: Requirements Verification Cross Reference Matrix

METHOD OF VERIFICATION
1 – Analysis
2 – Demonstration
3 – Inspection
4 - Test

CLASS OF VERIFICATION
A – Production Verification Test
B – Production Acceptance Test

Section 3 Requirement	Section 4 Method	Verification Methods				Verification Class	
		1	2	3	4	A	B
3.1 Production Acceptance Test	4.1	X	X	X	X		
3.2 Production Verification Test	4.2	X	X	X	X		
3.3 General Requirements	4.3	X			X		
3.4 System Performance							
3.4.1 Modularity	4.4.1				X		X
3.4.2 High Power Amplifier	4.4.2				X		X
3.4.3 HPA Operations	4.4.3				X		X
3.4.4 Bandwidth	4.4.4				X		X
3.4.5 Antenna	4.4.5		X	X	X		X
3.4.6 Modem	4.4.6			X	X		X
3.4.7 Distance and Throughput Requirements	4.4.7				X	X	
3.4.8 Latency	4.4.8				X	X	
3.4.9 System Emissions	4.4.9	X		X		X	
3.5 Interface Definition							
3.5.1 Signal Interfaces	4.5.1			X			X
3.5.2 Data and Management Interfaces	4.5.2			X	X		X
3.5.3 Global Positioning System (GPS)	4.5.3		X				X
3.5.4 Power	4.5.4				X	X	X
3.5.5 Cabling	4.5.5			X			X

METHOD OF VERIFICATION
1 – Analysis
2 – Demonstration
3 – Inspection
4 - Test

CLASS OF VERIFICATION
A – Production Verification Test
B – Production Acceptance Test

Section 3 Requirement	Section 4 Method	Verification Methods				Verification Class	
		1	2	3	4	A	B
3.5.6 Connectors	4.5.6			X			X
3.5.7 Fastener Hardware	4.5.7			X			X
3.6 Setup and Antenna Alignment	4.6	X	X		X	X	
3.6.17 Antenna Pointing	4.6.17				X	X	
3.7 Transportability and Storage							
3.7.1 General	4.7.1	X	X			X	
3.7.2 Transit Cases	4.7.2			X		X	
3.7.3 Weight	4.7.3		X	X		X	
3.8 Monitoring and Control (M&C / Network Operations (NetOps)							
3.8.1 General Requirements	4.8.1		X			X	X
3.8.2 M&C	4.8.2		X			X	X
3.8.3 NetOps	4.8.3		X			X	X
3.8.4 Network Security	4.8.4			X	X	X	X
3.8.5 Information Assurance (IA)	4.8.5			X	X	X	X
3.9 Indicators and Alarms							
3.9.1 Indicators	4.9.1		X	X			X
3.9.2 Alarms	4.9.2		X	X			X
3.10 RAM							
3.10.1 Reliability	4.10.1	X			X	X	
3.10.2 Availability	4.10.2	X			X	X	
3.10.3 Maintainability	4.10.3		X			X	

METHOD OF VERIFICATION
1 – Analysis
2 – Demonstration
3 – Inspection
4 - Test

CLASS OF VERIFICATION
A – Production Verification Test
B – Production Acceptance Test

Section 3 Requirement	Section 4 Method	Verification Methods				Verification Class	
		1	2	3	4	A	B
3.11 Safety							
3.11.1 General Safety	4.11.1			X	X		X
3.11.2 Electrical Requirements	4.11.2			X	X		X
3.11.3 Mechanical Safety	4.11.3	X	X	X	X		X
3.11.4 Other Safety	4.11.4	X	X	X	X		X
3.12 Human Factors	4.12	X	X	X		X	
3.13 Electromagnetic Environmental Effects (E3)							
3.13.1 General E3	4.13.1	X	X		X	X	
3.13.2 Electromagnetic Radiation	4.13.2	X			X	X	
3.13.3 Electromagnetic Compatibility (EMC)	4.13.3				X	X	
3.13.4 Electromagnetic Interference (EMI)	4.13.4				X	X	
3.14 Grounding Bonding and Shielding	4.14				X	X	
3.15 Chemical, Biological and Radiological Contamination	4.15	X				X	
3.16 Environmental Compliancy	4.16				X	X	

4.1 Production Acceptance Test (PAT)

PAT is verification of production items to demonstrate that items procured fulfill requirements and specifications of the procuring contract or agreements. The system performance requirements shall be verified by analysis, demonstration, inspection and test or a combination thereof in accordance with Table 4-1 (Requirements Verification Cross Reference Matrix).

1. All equipment shall undergo visual/mechanical inspection to include: physical and mechanical requirements, parts and materials, finishing, marking, and general workmanship
2. All equipment shall undergo electrical testing
3. All equipment shall undergo functional testing
4. Examination, testing and inspection shall be in accordance with Government approved, contractor developed test plans and procedures.
5. Any system equipment which deviates from the contractor's standard product or which has been redesigned or modified shall be subjected to regressive Production Verification testing as determined by the Government.

4.2 Production Verification Test (PVT)

PVT is a system-level Developmental Test conducted post-FRP (full-rate production) to verify that the production item meets critical technical parameters and contract specifications, to determine the adequacy and timeliness of any corrective actions indicated by previous tests, and to validate the manufacturer's facilities, procedures, and processes. The system performance requirements shall be verified by analysis, demonstration, inspection and test or a combination thereof in accordance with Table 4-1 (Requirements Verification Cross Reference Matrix).

4.3 General Requirements

The Requirements in Section 3.3 shall be verified by a combination of test and analysis. Requirement 3.3.9 regarding Modular Open Systems Architecture shall be verified by analysis. All other requirements shall be verified by test.

4.4 System Performance

4.4.1 Modularity

The requirements in 3.4.1 shall be verified by test.

4.4.2 High Power Amplifier

The requirements in Section 3.4.2 shall be verified by test.

4.4.3 HPA Operations

The requirements in Section 3.4.3 shall be verified by test.

4.4.4 Bandwidth

The requirements in Section 3.4.4 shall be verified by test.

4.4.5 Antenna

The requirements in Section 3.4.5 shall be verified by a combination of inspection, demonstration and test. Requirements 3.4.5.1, 3.4.5.5, 3.4.5.6, 3.4.5.7, 3.4.5.13, and 3.4.5.14 shall be verified by inspection. Requirements 3.4.5.15 and 3.4.5.16 shall be verified by test. All other requirements

shall be verified by demonstration.

4.4.6 Modem

The requirements in Section 3.4.6 shall be verified by a combination of inspection and test. Requirement 3.4.6.1 shall be verified by inspection. All other requirements shall be verified by test.

4.4.7 Distance and Throughput Requirements

The requirements in Section 3.4.7 shall be verified by test.

4.4.8 Latency

The requirements in Section 3.4.8 shall be verified by test.

4.4.9 System Emissions

The requirements in Section 3.4.9 shall be verified by a combination of inspection and analysis. The system spectrum certification shall be inspected using the approved Stage 4 (Operational) DD1494 as objective evidence to support compliance.

4.5 Interface Definition

4.5.1 Signal Interfaces

The requirements in Section 3.5.1 shall be verified by inspection.

4.5.2 Data and Management Interfaces

The requirements in Section 3.5.2 shall be verified by a combination of inspection and test. All physical interfaces shall be verified by inspection. All functional/logical interfaces shall be verified by test.

4.5.3 Global Positioning System (GPS)

The requirements in Section 3.5.3 shall be verified by demonstration.

4.5.4 Power

The requirements in Section 3.5.4 shall be verified by test.

4.5.5 Cabling

The requirements in Section 3.5.5 shall be verified by inspection.

4.5.6 Connectors

The requirements in Section 3.5.6 shall be verified by inspection.

4.5.7 Fastener Hardware

The requirements in Section 3.5.7 shall be verified by inspection.

4.6 Setup and Antenna Alignment

The requirements in Section 3.6 shall be verified by analysis and test. Requirements 3.6.15 and 3.6.16 shall be verified by analysis. The analysis must quantitatively prove that two personnel (male and female population) will not exceed listing or carry limits identified in MIL-STD-1472G. All other requirements are considered MET when system set up is accomplished in the specified timeframes, within the limits of accuracy for elevation and alignment, and using the identified personnel clothing requirements.

4.6.17 Antenna Pointing

The requirements in Section 3.6.17 shall be verified by test.

4.7 Transportability and Storage

4.7.1 General

The requirements in Section 3.7.1 shall be verified by a combination of demonstration and analysis. The system shall be packaged and secured by demonstration within the cargo area of the HMMWV Heavy Variant Cargo Carrier. All other requirements shall be verified by analysis.

4.7.2 Transit Cases

The requirements in Section 3.7.2 shall be verified by inspection accordance with MIL-STD-1472G.

4.7.3 Weight

The requirements in Section 3.7.3 shall be verified by inspection and demonstration accordance with MIL-STD-1472G.

4.8 Management and Control (M&C) / Network Operations (NetOps)

4.8.1 General Requirements

The requirements in Section 3.8.1 shall be verified by demonstration.

4.8.2 M&C

The requirements in Section 3.8.2 shall be verified by demonstration.

4.8.3 NetOps

The requirements in Section 3.8.3 shall be verified by demonstration.

4.8.4 Network Security

The requirements in Section 3.8.4 shall be verified by a combination of inspection and test.

4.8.5 Information Assurance (IA)

The requirements in Section 3.8.5 shall be verified by a combination of inspection and test.

4.9 Indicators and Alarms

4.9.1 Indicators

The requirements in Section 3.9.1 shall be verified by a combination of inspection and demonstration.

4.9.2 Alarms

The requirements in Section 3.9.2 shall be verified by a combination of inspection and demonstration.

4.10 Reliability, Availability, Maintainability

4.10.1 Reliability

The requirements in Section 3.10.1 shall be verified by a combination of analysis and test.

4.10.2 Availability

The requirements in Section 3.10.2 shall be verified by analysis and test.

4.10.3 Maintainability

The requirements in Section 3.10.3 shall be verified by demonstration.

4.11 Safety

4.11.1 General Safety

The requirements in Section 3.11.1 shall be verified by a combination of inspection and test.

4.11.2 Electrical Requirements

The requirements in Section 3.11.2 shall be verified by a combination of inspection and test.

4.11.3 Mechanical Safety

The requirements in Section 3.11.3 shall be verified by a combination of analysis, demonstration, inspection, and test.

4.11.4 Other Safety

The requirements in Section 3.11.4 shall be verified by a combination of analysis, demonstration, inspection, and test.

4.12 Human Factors

The requirements in Section 3.12 shall be verified by analysis, demonstration, and inspection in accordance with MIL-STD-1472G.

4.13 Electromagnetic Environmental Effects (E3)

4.13.1 General E3

The requirements in Section 3.13.1 shall be verified by a combination of analysis, demonstration, and test. Requirement 3.13.1.1 shall be verified by test. Requirement 3.13.1.2 shall be verified by identifying High Altitude Electronic Magnetic Pulse susceptible components by analysis followed by demonstrating the removal and replacement of susceptible components within 30 minutes. On site spares may be collocated with the equipment during the demonstration. Requirement 3.13.1.3 shall be verified by analysis.

4.13.2 Electromagnetic Radiation

The requirements in Section 3.13.2 shall be verified by a combination of analysis and test.

4.13.3 Electromagnetic Compatibility (EMC)

The requirements in Section 3.13.3 shall be verified by test.

4.13.4 Electromagnetic Interference (EMI)

The requirements in Section 3.13.4 shall be verified by test in accordance with MIL-STD-461G.

4.14 Grounding Bonding and Shielding

The requirements in Section 3.14 shall be verified by test.

4.15 Chemical, Biological and Radiological Contamination

The requirements in Section 3.15 shall be verified by analysis.

4.16 Environmental Compliancy

The requirements in Section 3.16 shall be verified by test in accordance with MIL-STD-810G CH1.

5 Packaging

For acquisition purposes, the packaging requirements shall be as specified in the contract or order. When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6 Notes

This section contains information of a general or explanatory nature that may provide further clarification.

6.1 Intended Use

The system is used to extend US Army and Marine Air-Ground Task Force IP network traffic using a terrestrial BLOS RF link between networked nodes. The expeditionary transit case based system operates in two separate frequency bands, C and X, for spectrum agility. The system has three modes of operation: Troposcatter BLOS, LOS, and OGD. The system can operate at ranges of up to or exceeding 185KM with a maximum data transfer rate of 50Mbps.

6.2 Acquisition Requirements

a. Title, number, and date of this specification, and of all reference documents cited in Section 2 and applicable documents from Section 6.

b. Requirement for Production Verification Test.

c. Requirement for Production Acceptance Test.

e. Requirement for either USA or USMC Service specific interfaces.

f. Packaging requirements (see 5.0).

6.3 Expanded Information

Table 6-1: Expanded Information

Note Number	Section Reference	Term	Definition/Description/Information
1	3.3.1 3.3.2	BLOS	Communication from point to point using Radio Frequency transmission as a physical medium where line of sight from the local end to the distant end is impeded due to obstacles or the curvature of the earth.
2	3.3.3 3.3.4	Troposcatter	Radio Frequency BLOS communication mode relying on RF forward scattering due to tropospheric irregularities to reach the distant radio terminal
3	3.3.7 3.3.8	Diffraction	Radio Frequency BLOS communication mode relying on RF diffraction due to terrain obstacles to reach the distant radio terminal / Communication from point to point using Radio Frequency transmission as a physical medium where the signal is passed over an obstacle such as a terrain feature (hill or mountain) resulting in the signal being bent.

Note Number	Section Reference	Term	Definition/Description/Information
4	3.3.9	Modular Open Systems Architecture	A system that employs modular design, uses widely supported and consensus based standards for its key interfaces, and has been subjected to successful validation and verification tests to ensure the openness of its key interfaces. [OSA Contract Guidebook]
5	3.4.1.1 3.4.1.2 3.4.1.3	Modularity	Various diversity types exist (space, frequency, polarization, angle, time) and various diversity orders can be obtained (single, dual, quad, others)
6	3.4.5.5 3.6.9 3.6.10 3.6.11	Self-Alignment	The antenna self-alignment process is defined as “performed by the system without user interaction once initiated”. Minimal operator actions clearly described by procedure to initiate the self-alignment process are allowed. The antenna shall maintain pointing accuracy after self-alignment process is complete.
7	3.4.5.11 3.4.5.12	Manual Pointing	Special tool restriction does not apply to this requirement
8	3.4.7.1 3.4.7.2 3.4.7.3 3.4.7.4 3.4.7.5 3.4.7.6 3.4.7.7 3.4.7.8	Link Characteristics	The offeror shall use MTR 10683 AN/TRC-170 Link Engineering Manual dated September 1989 to perform the path loss analysis for their proposed system. The stated conditions and parameters shall be used to determine path loss to determine the proposed system’s performance for each distance. For all calculated data points the proposed system shall adhere to NTIA Manual of Regulation and Procedures for Federal Radio Frequency Management (May 2014) guidelines for emissions to include 5.2.2.2 spectral mask. a) Distances/Locations: 55km, 85km, 120km,

Note Number	Section Reference	Term	Definition/Description/Information
			and 185km b) Terrain Model: Smooth Earth c) Availability: 95% d) Climate Number: 6 (Continental Temperate) (MTR 10683 Table 5-11) e) Typical Mean Annual Ns: 320 (MTR 10683 Table 5-11) f) BER: ≤10e-6 g) Fade: Flat, 10Hz h) Standard Multipath Delay Profile: (MTR 10683 Table 2-3) 1) For 55km use Profile A 2) For 85km and 120km use Profile B 3) For 185km use Profile C
9	3.4.9.3	Spectrum Compliance and ACM	Example, Area/Local Spectrum Manager assigns a 10MHz channel the modem shall only use waveforms during ACM operations that do not exceed the assigned channel size.
10	3.5.2.1 3.5.2.2	RJ-45 Ethernet compatibility	Includes modem, IP networking equipment. May be accomplished natively or with conversion cables.
11	3.5.2.10 3.5.2.11	1000BaseT	A management interface may be leveraged as one of these 1000BaseT interfaces.
12	3.5.3.2	GPS	GPS is not a system requirement by government. However, specification is written if system implementation by vendor requires GPS for operations.
13	3.5.4.2	IEC 60309	1P-3W or 3P-5W type connector.
14	3.6.1 3.6.2 3.6.3 3.6.6	Setup	a) Setup is defined as the period required to place the system into a configuration where all components are installed for operations and ready for self-alignment from a

Note Number	Section Reference	Term	Definition/Description/Information
	3.6.7 3.6.8		transport state. Setup shall be considered complete based on vendor procedure to include meeting safety, grounding, wind, and pointing accuracy requirements as stated in this Appendix A (this document). b) Time required to offload the system from a transport medium such as a HMMWV and inventory of the system are not part of setup. The 4-person and 4-man lift and carry and lift requirements stated in Note 19 and corresponding requirements are applicable for off-loading cases from the transport medium and pre-positioning prior to setup. c) Setup time starts when the system cases are on the ground, inventoried, and pre-positioned. Setup stops when the system is ready to begin the self-alignment process. d) Included in the setup time is positioning the system antenna to +/- 2 degrees of elevation and +/- 5 degrees azimuth by operators for the self-alignment process to begin.
15	3.6.17.1 3.6.17.2 3.6.17.3 3.6.17.4	Antenna Pointing	The antenna shall maintain pointing loss while in its operational state per requirements defined in section 3.6.17
16	3.7.1.1 3.7.1.2	HMMWV	HMMWV Cargo Area Dimensions: 84.3" Length, 39.1" High, 52" Wide Wheel Well (2 Areas): 84.3” Length, 17” Wide, 25.5” High. Secured as Cargo.
17	3.7.1.12 3.7.1.13 3.7.1.16 3.7.1.19	Marine Corps Rotary & Tilt-wing	Applicable to the following aircraft; Rotary CH-53E Tilt-Wing V-22 a) TECHNICAL MANUAL: CARGO HANDLING MANUAL V-22 TILTROTOR. Publication A1-V22AB-

Note Number	Section Reference	Term	Definition/Description/Information
			CLG-000, 1 August 2015. b) The following dimensions are maximum limits for cargo: Height=60 inches; Width=60 inches; Length=228 inches; Floor loading=300lbs/ft^2
18	3.7.2.3	Latches	Latches and catches should be evaluated for snap down and release forces that could be hazardous to handle during operation.
19	3.7.3	Weights	Four-person carry (up to 33ft) solution as defined by the MIL-STD-1472G requirements (42lb x 3.5 = 147lb) maximum case weight. Two-man lift (up to 3ft) solution as defined by the MIL-STD-1472G requirements (87 x 2= 174lb) maximum case weight. Four-Man carry (up to 33ft) requirement for the HPA is constrained by the Two-man lift weight limit. The HPA case shall not exceed 174lbs. Two person weights shall include any setup that requires lift over 5ft and carry up to 33ft.
20	3.8.2.1	M&C	Includes antenna(s), power amplifier(s), modem, filters, network switches, and any other configurable components.
21	3.8.2.7 3.8.2.8 3.8.2.9	GFE Laptop	• i5-6300U Processor - (Dual Core, 2.4GHz 3M cache) • 8GB RAM (compatible with processor) 8GB (1x8GB) 2133MHz DDR4 Memory • 500GB (7200 RPM) Hard Disk Drive (HDD) 500GB 7200rpm HDD • Integrated 14 inch (no smaller than) wide screen (Not to exceed 15 inches) 14.0" HD (1366x768) Non-Touch Anti-Glare LCD • Integrated full-duplex 10/100/1000 BASE-TX UTP NIC, RJ 45 Network Connector • One (1) external video display (1) HDMI & (1) VGA port • Three (3) USB 3.0 ports (3) USB 3.0 Ports

Note Number	Section Reference	Term	Definition/Description/Information
22	3.10.1.1	MTBF	Calculated as the total functioning life of a population of an item divided by the total number of failures within the population during the measurement interval.
23	3.10.2.1	Ai	Calculated as: MTBF / (MTBF+MTTR)
24	3.10.3.1 3.10.3.2	MTTR	Calculated as the summation of active repair times during a given period of time divided by the total number of malfunctions during the same time interval.
25	3.11.1.3 3.11.4.4 3.11.1.5 3.11.1.6 3.11.1.7 3.11.1.8	Safety Devices	The system shall be designed such that it does not rely solely on warnings, cautions, or procedures/training for control of risk where the potential for serious injury, death, or damage to the equipment possible.
26	3.14.1	Grounds and Bonds	MIL-HDBK-419A, MIL-HDBK-1857, NFPA 70, and IEEE Standard 1100 may be used for additional guidance.