TDC

Theater Deployable Communications

Baseline Requirements Document

Radio Frequency Module
RFM (v3.1)
Nov 2003

ESC/NI4T
5 Eglin Street
Hanscom AFB, MA 01731

Table of Contents

List of Tables

List of Figures

1.0 SCOPE

This requirements document establishes the performance, manufacture and test requirements for the TDC ICAP Radio Frequency Module v3.1.

2.0 APPLICABLE DOCUMENTS

To the extent specified herein, the following documents of latest current issue on the date of this Baseline Requirements Document form part of this BRD.

Table 1 - Standards and Applicable Documents

Document Number	Title
EIA/TIA-232-E Jul-91	Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment employing serial binary data interchange (rates to 20 Kbps)
Bellcore TR-303	High Speed 25-Position Interface for Data Terminal Equipment and Data Circuit-Terminating and Data Circuit-Terminating Equipment. (Mar 87)
ISO/IEC 8802-3 1996 ANSI/IEEE Std 802.3 1996	Information Technology- Local Metropolitan Area Networks Part3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specification. (Documents are one in the same; from IEEE, ANSI, ISO and IEC)
MIL-STD-810F	Environmental Test Methods
	FibeAir 1500 Family Installation and Operation Manual
S.I. Tech Inc.	Operating Instructions 2890 T-1/2891 E-1 Fiber Bit-Driver
Cisco 2950 Manual	Installation and Operation Manual
	TDC Standards Document

3.0 REQUIREMENTS

3.1 Module Definition

The RFM v3.1 provides up to OC-3 capacity wireless LOS transmission links between ICAP nodes and hubs over a maximum distance of 10.1 km (6.3 miles) using the one-foot antennas or 16.7 km (10.4 miles) using the two-foot antennas. The RFM v3.1 has 2 DS1 rate interfaces connected to fiber optic modem interfaces, 6 DS1 rate, RJ-45 interfaces, one 100BaseFX Ethernet interface, one and 12 100BaseTX RJ-45 interfaces. The Indoor Unit (IDU) maps the 8xDS1 ports and the 100BaseFX ports onto the OC-3 for transmission via the Outdoor Unit (ODU). A functional block diagram of the RFM v3.1 is shown in Figure 1.

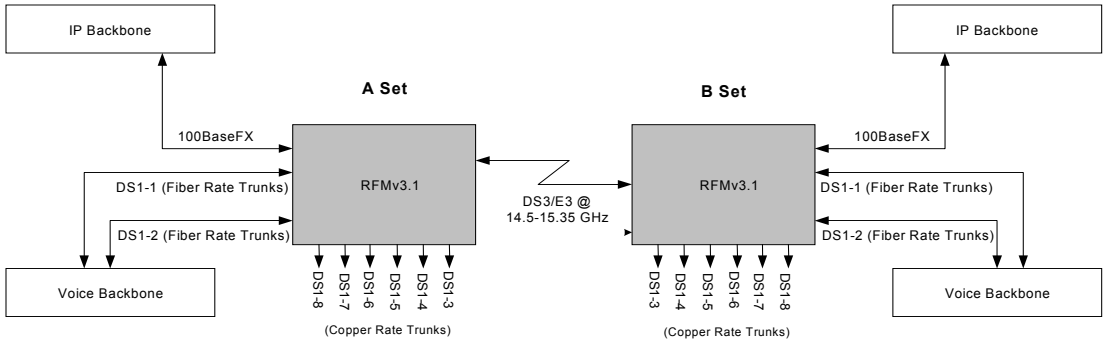


Figure 1 - RFM v3.1 Application in TDC ICAP

The RFM v3.1 contains a baseband assembly with power supply and a dual DS1 modem and Ethernet switch that are operated and maintained inside the transit case located inside user provided facilities. It also contains an RF assembly and antenna that are installed and operated outside the user provided facilities up to 200 feet away.

3.2 Performance Requirements

3.2.1 Electrical Interface Requirements (External)

Access to the RFM v3.1 is through the module's Distribution Frame (DF). The DF is internally wired to provide all required connections, except the input power. The input power connection is at the power conditioner. The access ports on the DFs include the number and type of external interfaces presented in Table 2.

Table 2 - RFM v3.1 External Interface Characteristics

Signal Name	Quantity	Connector	Input/ Output	Primary Interface	Electrical Characteristics
Prime Power	1	IEC-320-C20 Receptacle	I	Local power source	100 - 240 VAC 47-63 Hz
SNMP MGT (10 Base T)	1	RJ45	I/O	Local administrator – I/O DF	IEEE Std 802.3
100BaseFX	1	ST (Fiber Optic)	I/O	IP Backbone	IEEE Std 802.3
DS1 Rate Fiber Trunks (DS1-1 and DS1-2)	2	ST (Fiber Optic)	I/O	Voice Backbone	ANSI T1.603-1990
DS1 Rate Copper Trunks (DS1-3 through DS1-8)	6	RJ45	I/O	Voice Backbone	ANSI T1.603-1990
Baseband Admin (Radio)	1	DB9M	I/O	Local administrator – I/O DF	EIA RS-232
Ethernet Switch Admin	1	DB9M	I/O	Local administrator – I/O DF	EIA RS-232
RF IN/OUT	1	Type N	I/O	Out Door Unit	Ceragon proprietary
RF EOW	1	Mini-Audio	I/O	Local administrator – EOW Headset	Ceragon proprietary

3.2.1.1 Prime Power

The RFM v3.1 shall be designed to operate from both 100 - 240 VAC, 47 - 63 Hz, single phase, three-wire power. The RFM v3.1 shall include an internal power conditioner to minimize line variation and transients. The module's prime power connector shall be an IEC 320 receptacle type.

3.2.1.2 SNMP MGT (10 BaseT)

The Radio Indoor Unit SNMP (Simple Network Management Protocol) connection is an Ethernet 10BaseT interface with a RJ45 connector. SNMP is a protocol that provides local and remote management of the Radio Indoor Unit(s). The interface can be used for status monitoring, alarm management, event logging and error logging of the radio systems. The pinout configuration for the RJ-45 connector is shown in Table 3.

Table 3 - RJ-45 Pin Configuration for the 100BaseTx Connector

Pin	Signal
1	TP0+
2	TP0-

Table 3 - RJ-45 Pin Configuration for the 100BaseTx Connector

Pin	Signal
3	TP1+
4	TP2+
5	TP2-
6	TP1-
7	TP3+
8	TP3-

3.2.1.3 100BaseFX

The 100BaseFX Datagram Switched Network Backbone connections are fiber optic multi mode. Connectors are ST jacks (transmit and receive).

This connection provides 100BaseFX connectivity to the data network. The connector is a multimode fiber-optic cable with ST-type connector.

Protective covers are provided for all fiber connectors and cables. These covers when in place on any fiber Ethernet connectors or cables not in use shield them from dust or damage, minimizing the potential for optical signal attenuation or data loss.

Table 4 - ST Fiber Optic Connector Specification

100Base-FX
ISO/IEC 9314-3
62.5 micron with a optical loss of no more than 9 dB

3.2.1.4 DS1 Rate Fiber Trunks (DS1-1 and DS1-2)

There are two Voice Backbone signals that are a 1.544 Mbps serial data framed as T1/ ISDN-PRI trunks. The connections are fiber optic multi-mode ST jacks (transmit and receive).

3.2.1.5 DS1 Rate Copper Trunks (DS1-3 through DS1-8)

Six Voice Backbone T1 rate framed ports are available for use from the FibeAir 1528P-AES via RJ45 connectors located on the rear distribution panel. The T1 interfaces operate at 1.544 Mbps.

3.2.1.6 Baseband Admin (Radio)

The FibeAir 1528P-AES administration ports are in accordance with the DB9 RS-232 standards using the VT100 Emulators. The interface supports a 19.2 Kbps data rate, 8 data bits, no parity, 1-stop bit. Each PC administration cable is a DB9M with pin assignments as shown in Table 5. This port interfaces to the Terminal port on the IDU.

Table 5 - Administration Port Pin Assignments

Pin	Signal	Pin	Signal	Pin	Signal
1	No Connected	4	No Connected	7	No Connected
2	Received Data	5	Signal Ground	8	No Connected
3	Transmitted Data	6	No Connected	9	No Connected

3.2.1.7 Ethernet Switch Admin

The Ethernet Switch Administration port is in accordance with the DB9 RS-232 standards using VT100 emulators. The interface supports a 9.6 kbps data rate, 8 data bits, no parity, 1-stop bit. Each PC administration cable is a DB9M with pin assignments as shown in Table 6. This port interfaces with the Ethernet Switch port on the DF.

Table 6 - Ethernet Switch Administration Port Pin Assignments

Pin	Signal	Pin	Signal	Pin	Signal
1	Data Carrier Detect	4	Data Set Ready	7	Clear to Send
2	Transmitted Data	5	Signal Ground	8	Request to Send
3	Received Data	6	Data Terminal Ready	9	No Connect

3.2.1.8 RF In/Out

The RF In/Out interface is a 50-ohm, Type N connection that is lightning protected internal to the RFM v3.1. This in the interface provided for the Ceragon Outdoor Unit.

3.2.1.9 RF EOW (Emergency Order Wire)

The Ceragon FibeAir 1528P-AES radio EOW is an ADM utilizing continuously variable slope delta modulation schemes to digitize analog voice signals to 64 kbps. Emergency Order Wire (EOW) provides voice connection between both ends of the radio link by connecting the headset to the miniature audio jack on the front panel of the IDU.

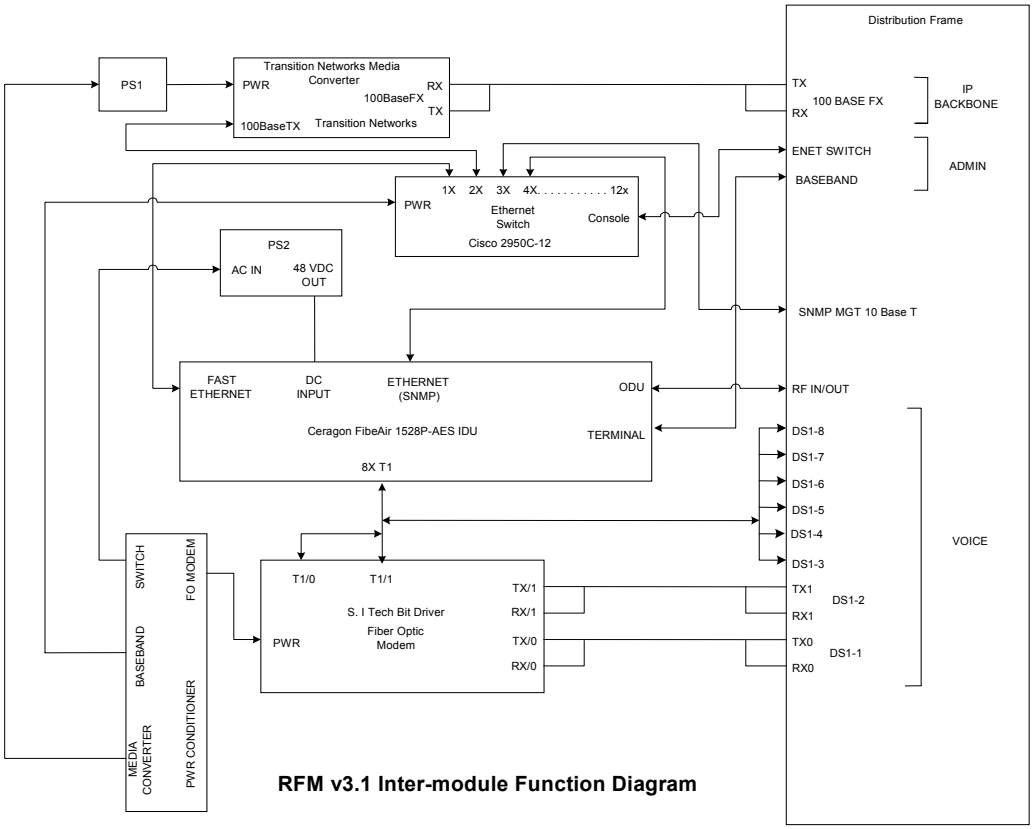
3.2.2 Electrical Interface (Internal)

This documentation shows the internal wiring of the major module components and the details of each cable assembly internal to the module. This information is found in Paragraph 6.3.

3.2.3 Functional Requirements

3.2.3.1 Basic Configuration

Figure 2 provides a block diagram of the RFM v3.1 showing internal module functions.



RFM v3.1 Inter-module Function Diagram

Figure 2 - RFM v3.1.1 Block Diagram Internal Module Functions

The RFM v3.1 contains a baseband assembly with power supply, Ethernet switch, and a dual DS1 modem that is operated and maintained inside the transit case located inside user provided facilities. It also contains a RF assembly and antenna that are installed and operated outside the user provided facilities up to 200 feet away using 50-ohm, type N terminated, RG-142 cable.

3.2.3.2 Indoor Equipment

DS1 Voice trunks and Ethernet IP data signals are inputs to the RFM v3.1 through fiber optic I/O ports or RJ45 connections on the module's distribution frame. Two DS1 signals are routed through a dual DS1 fiber optic modem to convert the signals from optical to electrical.
The 10BaseT Ethernet IP data signal is routed from the SNMP connection to the Ethernet port on the IDU. The 100BaseFX external fiber optic inputs are connected to an internal fiber optic media converter, which transforms the 100BaseFX fiber optic inputs into 100BaseTX signals.

Both the Ethernet (10BaseT) and Fast Ethernet (100BaseTX) signals are connected to the Ethernet switch.

The baseband assembly and the RF assembly are interconnected via coaxial cable. Two hundred feet of cable is supplied with each the module.

3.2.3.3 Outdoor Equipment

The RF assembly is coupled directly to a one-foot parabolic antenna. The user may select between horizontal and vertical polarization through the orientation of the RF assembly relative to the fixed mounting position of the antenna after installation. Also included with the outdoor equipment is a specially machined mounting bracket. This bracket provides the mounting interface between the outdoor equipment and the TDC provided mast and tripod and their tilting mechanisms.

3.2.3.4 IP Backbone Connectivity

One 100BaseFX fiber optic multi mode output port is provided at the I/O Distribution Frame. This port is provided for connectivity to the 100Mbps Datagram Switched Network backbone and interconnections to other modules that are collocated (for example Red Data Module, Crypto Interface Module, and Basic Access Module).

3.2.3.5 SCN Backbone Connectivity

The RFM v3.1 provides two 1.544 MBPS serial data trunk connections to the TDC ICAP SCN backbone. The SCN Backbone connections are fiber optic multi-mode ST jacks (transmit and receive) for interconnection with modules such as the Basic Access Module, Large Voice Module, and Secure Voice Module shown in Figure 3.

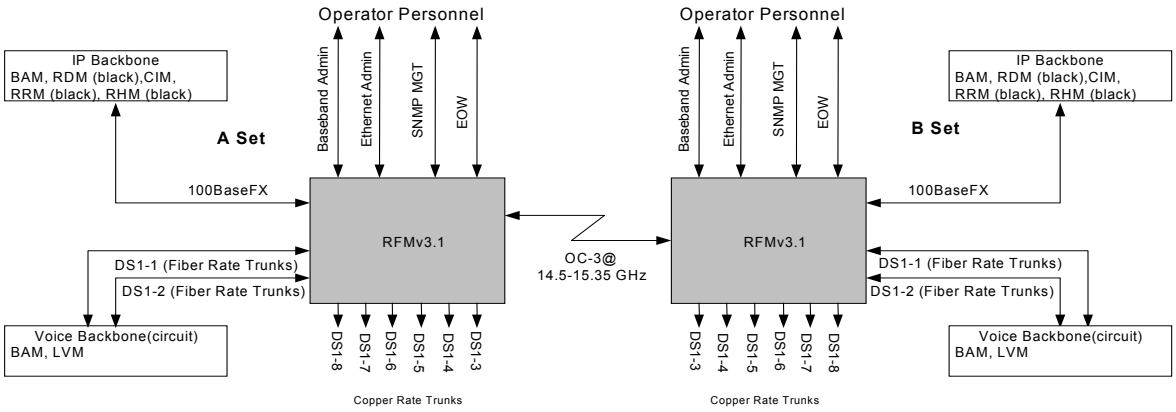


Figure 3 - RFM v3.1.1 Block Diagram of SCN Connectivity

3.2.3.6 Administration

The functions of the RFM v3.1 are administered via an external PC computer interconnected to the baseband assemblies' administration port connectors. Alternatively, SNMP or Web based configuration and monitoring can be accomplished via the Ethernet ports on the baseband multiplexer. SNMP based configuration can be accomplished via the SNMP port on the radio's baseband assembly. Management of the following functions is provided:

a) Configuration
b) Status
c) Control

3.2.3.7 Configuration Options (Kits)

Many of the system level and maintenance kits can be used for RFMv3 module.

- Fireberd Analyzer Kit
- Cable Maintenance Kit
- LAN Kit
- Fiber Cable Kit
- Circuit Extension Kit
- Laptop Computer Kit
- Small UPS Kit
- Large UPS Kit
- Tripod Kit

- Antenna Mast Kit
- RF Microwave Antenna Kit v3

3.2.4 Physical Characteristics

3.2.4.1 Transit Case

The module is housed in a 13U transit case, approximately 22.5”W x 34.5”D x 26.5”H. The transit case is designed to stack on top of and mechanically interlock to like cases. The frame inside the transit case is designed to slide out of the case to allow removal and replacement of Line Replaceable Units in the field. Transit cases with their covers in place are designed to protect the electronic equipment inside from direct exposure to environmental conditions; e.g., rain, snow, ice, dust, etc., likely to be encountered during world wide military transit.

3.2.4.2 Weight

The module, including all internally carried cables and accessories, shall not exceed 160 pounds.

3.2.4.3 Storage Space

The module includes storage pouches within its covers to contain cables, manuals, etc. that must be transported and used with the module.

3.2.4.4 Marking

See TDC Standards Document for required markings.

3.2.5 Cables and Accessories

The module includes the cables listed in Table 7, stored within the covers. Unique cables are marked with the modules Black and Purple color code as indicated. Strain relief and cable management hardware are provided with the module.

Table 7 - Cables included with RFM

Function	Color Code	Quantity	Description
Power	Black/Purple	1	IEC-320 C20 Jack to NEMA 5-15P
Cable assembly	Black/Purple	1	Fiber Optic (DS1) Cable, 3 pair, ST-ST plug, 20 ft.
Cable assembly	Black/Purple	1	Admin cable, DB9 plug to DB9 jack
Cable reel assembly	Black/Purple	1	RF cable reel, 200 ft.
Emergency Order Wire (Part of IDU)	Black/Purple	1	Radio Headset

Table 7 - Cables included with RFM

Function	Color Code	Quantity	Description
Antenna Alignment Patch Cord (Part of ODU)	Black/Purple	1	BNC to Miniature audio jack

3.2.6 Reliability

The module, with its standard complement of LRUs, has a mean time between failure (MTBF) commensurate with similar commercial equipment in its class. The actual MTBF for the major system components are shown in Table 8. Where reliability data is not readily available from the vendor, this is indicated.

Table 8 - MTBF of Major Components

Component	MTBF
Ceragon IDU	40 years
Ceragon ODU	50 years
Cisco 2950C - 12 ethernet switch	Not Available
SI Tech Fiber Optic Modem	Not Available
Media Converter	Not Available

3.2.7 Maintainability

Maintainability characteristics will be part of the selection criteria for all hardware. Ease of maintenance, such as accessibility to Line Replaceable Units, fault detection/isolation software capability, and fault annunciation will be considered.

3.2.7.1 Mean Time Between Preventive Maintenance

The Mean Time Between Preventive Maintenance, during operation, is 30 days. The duration of preventive maintenance actions such as corrosion control, cleaning filters, etc., does not exceed 30 minutes.

3.2.8 Environmental Conditions

During storage, transport and operation the modules can withstand exposure to temperatures as shown in Table 9.

3.2.8.1 Temperature

Temperature characteristics for the major equipment components are shown in Table 9.

Table 9 - Module Temperature Characteristics

Equipment	Temperature (degrees C)	
	Operating	Non-Operating
Ceragon IDU	-5 to 45	Not Available
Ceragon ODU	-35 to 55	Not Available
Cisco 2950C - 12 ethernet switch	-5 to 45	-25 to 70
SI Tech Fiber Optic Modem	0 to 50	-40 to 85
Media Converter	0 to 50	-20 to 85

3.2.8.2 Relative Humidity

Relative humidity characteristics for the major equipment components are shown in Table 10.

Table 10 - Module Humidity Characteristics

Equipment	Humidity
	Non-condensing
Ceragon IDU	Up to 95%
Ceragon ODU	Up to 100%
Cisco 2950C - 12 ethernet switch	10 to 95%
SI Tech Fiber Optic Modem	0 t0 95%
Media Converter	5 to 95%

3.2.8.3 Altitude

Altitude characteristics for the major equipment components are shown in Table 11.

Table 11 - Module Altitude Characteristics

Equipment	Altitude (feet)	
	Operating	Non-Operating
Ceragon IDU	Up to 15,000 ft	Not Available
Ceragon ODU	Up to 15,000 ft	Not Available
Cisco 2950C - 12 ethernet switch	-500 ft to 10,000 ft	-1000 to 30,000 ft
SI Tech Fiber Optic Modem	Up to 15,000 ft	Not Available
Media Converter	0 to 10,000 ft	Not Available

3.2.8.4 Sand and Dust

During storage and transport, the modules are protected when exposed to sand and dust in accordance with the best commercial practices for close proximity to operating aircraft. During

operation with covers removed, the modules can withstand sand and dust in accordance with the best commercial practices for natural conditions.

3.2.8.5 Shock

Module equipment racks are equipped with rubber shock isolation mounts and is protected from shocks induced during handling, setup and tear down. Modules and components can operate without degradation following exposure to the non-operating shock environment described by Method 516.5, Procedure VI (Bench Handling) of MIL STD 810F.

3.2.8.6 Vibration

The modules are equipped with rubber shock isolation mounts so that the modules can withstand the vibration encountered while being transported by commercial and military airlift, sealift and vehicular (over unimproved roads) systems. MIL-STD-810F, Method 514.5, Procedure I, Categories 4, 7 and 8. applies; alternative procedures may be substituted after TDC Program Office approval.

3.3 Design and Construction

3.3.1 Material Parts and Processes

This module is built to good commercial practices. Mechanical and electrical interchangeability exists between like systems, subsystems, assemblies, subassemblies and replaceable parts.

3.3.2 Safety

This module shall not present a safety, fire or health hazard to personnel.

3.3.2.1 Electrical Safety

This module is designed to eliminate the hazard to personnel of inadvertent lethal voltage contact. All electrical conductors carrying voltages in excess of 70 volts shall be insulated to prevent contact or covered by a protective barrier. All removable protective barriers shall be interlocked to automatically disconnect power behind the barrier upon removal or clearly marked with a warning label that indicates the voltage potential that will be encountered behind the barrier. All warning labels shall remain visible after the cover has been removed.

3.3.2.2 Mechanical Safety

Sharp surfaces shall have protective covers or other suitable features to minimize injury where personnel are likely to be exposed to such surfaces.

3.4 Logistics

This module accommodates a two level maintenance concept: organizational (Air Force personnel) and depot (contractor personnel). Removal and replacement of an LRU is defined at

the organizational level and any needed repair of the LRU is defined at the depot level. Any special test or support equipment required to effect removal or replacement of an LRU at the organizational level can be provided as part of the module. No more than two persons shall be required to remove or replace an LRU.

An LRU is defined as the lowest element of the module which can be isolated to be faulty through inspection; built-in test; technical manuals; TDC-ICAP system performance; spares substitution; or other diagnostic aid approved by the Government for organizational level maintenance, exclusive of expendables such as fuses, lamps and LEDs. An LRU is defined at the card/module level or higher.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 General

The quality assurance program includes tests and other evaluations to the extent specified herein. The quality assurance program is designed to verify the electrical, mechanical and functional characteristics of each module. The purpose is to ensure that each module complies with or performs better than the requirements specified herein.

4.2 Responsibility for Inspection

Unless otherwise specified in the contract, the contractor shall be responsible for the performance of all inspection requirements and may use his own or any other facilities suitable for the performance of the inspection requirements. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

4.3 Product Qualification Test (PQT)

Inspections, analyses, demonstrations and tests verify compliance of Section 3 of this specification on the first production unit.

4.4 Production Acceptance Test (PAT)

Each module delivered to the Government undergoes an Acceptance Test Process as identified in Table 12. The acceptance test verifies that the module interfaces are operating properly prior to delivery to the Government.

4.5 Verification Cross Reference Matrix (VCRM)

Table 12 provides a list of each Section 3 requirement and the verification method to be used. The following paragraphs define the codes employed in the VCRM. Unless otherwise noted, where more than more one verification method is shown, one method or a combination of methods may be used to show compliance.

4.5.1 Not Required (N/R)

This method indicates that verification is not required because the paragraph is a title, heading, general introductory paragraph or statement of a goal and contains no “shall” or “must” statements.

4.5.2 Inspection

Inspection is a method of verification of the module performance or characteristics by examination of the equipment or associated documentation. Inspections are conducted with the use of inspection tools, measurement devices, visual means and comparison. Most inspections apply to verification of requirements associated with physical characteristics such as size, weight,

appearance, adherence to specified standards and engineering practices, quality design, and construction supported with quality documentation. Inspections also include the auditing of manufacturer's data that verifies the performance of non-developmental items that comprise the TDC module. Inspections may occur during any assembly stage of the unit under test.

4.5.3 Analysis

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

4.5.4 Demonstration

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 requirement does not contain a specific numerical parameter that must be measured. Demonstrations may occur during verification of a unit under test at any assembly stage. Pass/fail criteria are simple yes/no indications of functional performance since no quantitative values are specified.

4.5.5 Test

Test is a method to verify that a specified requirement is met by thoroughly exercising the applicable item under specified conditions and by using the 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 practicable to make direct or indirect measurement of a specified numerical parameter to verify compliance with a 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. Measurement accuracy is precise enough to ensure that the measured value is within the specified tolerance.

Table 12 - Verification Cross Reference Matrix

		Verification Method					
			PQT				
Paragraph	Title	N/R	Inspect	Analysis	Demo	Test	ATP
3.0	Requirements	X					
3.1	Module Definition	X					
3.2	Performance Requirements	X					
3.2.1	Electrical Interface Requirements (External)	X					
3.2.1.1	Prime Power					X	X
3.2.1.2	SNMP MGT (10 Base T)				X		X
3.2.1.3	100BaseFX Backbone				X		X

Table 12 - Verification Cross Reference Matrix

Paragraph	Title	Verification Method					
			PQT				
		N/R	Inspect	Analysis	Demo	Test	ATP
3.2.1.4	DS1 Rate Fiber Trunks (DS1-1 and DS1-2)				X		X
3.2.1.5	DS1 Rate Copper Trunks (DS1-3 through DS1-8)				X		X
3.2.1.6	Radio Baseband Admin				X		X
3.2.1.7	Ethernet Switch Admin				X		X
3.2.1.8	RF In/Out					X	X
3.2.1.9	RF EOW (Emergency Order Wire)				X		X
3.2.2	Electrical Interface (Internal)	X					
3.2.3	Functional Requirements	X					
3.2.3.1	Basic Configuration	X					
3.2.3.2	Indoor Equipment				X		X
3.2.3.3	Outdoor Equipment				X		X
3.2.3.4	IP Backbone Connectivity				X		X
3.2.3.5	SCN Backbone Connectivity				X		X
3.2.3.6	Administration				X		X
3.2.3.7	Configuration Options (Kits)	X					
3.2.4	Physical Characteristics	X					
3.2.4.1	Transit Case		X				
3.2.4.2	Weight					X	
3.2.4.3	Storage Space		X				
3.2.4.4	Marking		X				
3.2.5	Cables and Accessories				X		
3.2.6	Reliability			X			
3.2.7	Maintainability			X			
3.2.7.1	Mean Time Before Preventative Maintenance (MTBPM)			X			
3.2.8	Environmental Conditions	X					
3.2.8.1	Temperature					X	
3.2.8.2	Relative Humidity			X			
3.2.8.3	Altitude			X			
3.2.8.4	Sand and Dust			X			
3.2.8.5	Shock					X	
3.2.8.6	Vibration					X	
3.3	Design and Construction	X					
3.3.1	Materials Parts and Processes			X			
3.3.2	Safety	X					

Table 12 - Verification Cross Reference Matrix

Paragraph	Title	Verification Method					
			PQT				
		N/R	Inspect	Analysis	Demo	Test	ATP
3.3.2.1	Electrical Safety			X		X	
3.2.2.2	Mechanical Safety		X	X			
3.3.2.3	RF Safety			X	X		
3.4	Logistics			X			

5.0 PREPARATION FOR DELIVERY

Each module is packaged for shipment and the package marked in accordance with the requirements of the contract under which the module is ordered.

6.0 BASELINE CONFIGURATION

6.1 Equipment

Table 13 - RFM v3.1 Components

Device	Manufacturer	Part Number	Description	Quantity
RF Indoor Unit	Ceragon	15P-IDU-AES-100TX8T1	FibeAir 1528 Basic Indoor Unit 1528P-AES with 100BaseTX ans8-T1 interfaces	1
RF Outdoor Unit	Ceragon	15-0-15-420-1W8TLA or 15-0-15-420-1W8THB	15GHz Outdoor Unit- Channel 1-8 TX High or Low Frequency	1
Antenna	Ceragon	A-1-15-A-LM	1-foot, 15 GHz antenna w/flange & mounting hardware	1
Software	Ceragon	CVEM	CeraView Element Manager (in pouch)	1
Power Supply	TBD	TBD	Radio Power Supply	1
Manual	Ceragon	SYS – DOC	Installation and Operation Manual (in pouch)	1
Ethernet Switch 12 10/100 ports	Cisco	WS-C2950-12	Ethernet Switch 12 10/100 ports (Software Version 12.1(14) EA1)	1
Media Converter	Transition Networks	SBFTF1011-100	100BaseTX to 100BaseFX Bridging Media Converter	1
Fiber Optic Modem	S.I. Tech	2890-2R-ASP-1	Dual T1 Fiber Optic Modem	1
Conditioner	Marway	411355	Switched outlet power conditioner	1
Case	ECS Composites	11722	Transit Case	1
Power Supply	Ault	SW109MA0002F02	Media Converter Power Supply	1
Cable Loop	Leviton Telcom	41020-SPR	Polytie Cable Loop(in pouch)	2
Cable Mgmt Bar	Leviton Telcom	41150-019	Polytie Cable Mgmt Bar (in pouch)	2
Lightning Protector	Polyphaser Corp.	101-0605S-A	RF Lightning Protector	2
Connector	Fiber Systems Int.	BSTA2000	Bulkhead Coupler	6
P1 (RF Cable/Reel)	TBD	TBD	RF cable reel, 200 feet (shipped with RFM v3.1)	1
W1	TBD	TBD	100BaseFX Media Converter to DF Fiber Optic Cable	1
W2	TBD	TBD	100 BaseTX to Media Converter	1
W3	TBD	TBD	Media Converter Power Cable	
W4	TBD	TBD	Radio Ethernet port to SNMP port	1
W5	TBD	TBD	RF I/O Coax Cable IDU to DF	1
W6	TBD	TBD	Baseband IDU Admin Cable to DF	1

Table 13 - RFM v3.1 Components

Device	Manufacturer	Part Number	Description	Quantity
W7	TBD	TBD	DS1s Cable IDU to FO Modem & DF	1
W8, W9	TBD	TBD	PRI/T1 Fiber Optic modem to DF	2
W10	TBD	TBD	Ethernet Switch Admin Cable to DF	1
W11	TBD	TBD	Ethernet Switch Power Cable	1
W12	TBD	TBD	Ethernet 2x port to Media Converter 100BaseTX port	1
W13	TBD	TBD	Ethernet Switch 4X port to Radio Ethernet port	1
P2 Cable (In Pouch)	TBD	TBD	3-pair Fiber Optic Cable, ST-ST plug, 20 ft.	1
P3 Cable (In Pouch)	TBD	TBD	Admin cable, Laptop (PC) to DF	1
P4 Cable	TBD	TBD	ODU head to lightening suppressor	1

6.2 Elevation Drawings

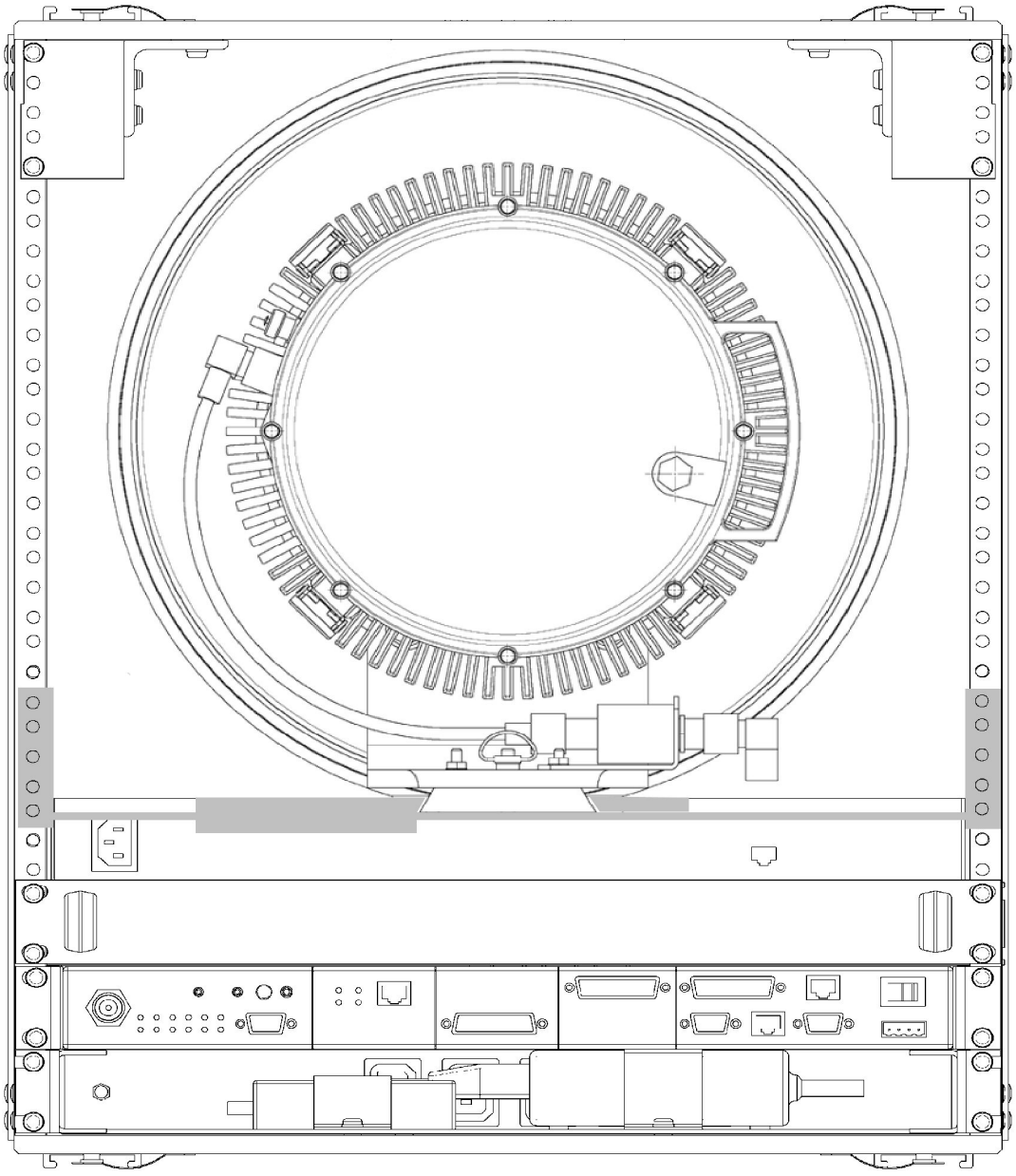


Figure 4 - Front Elevation

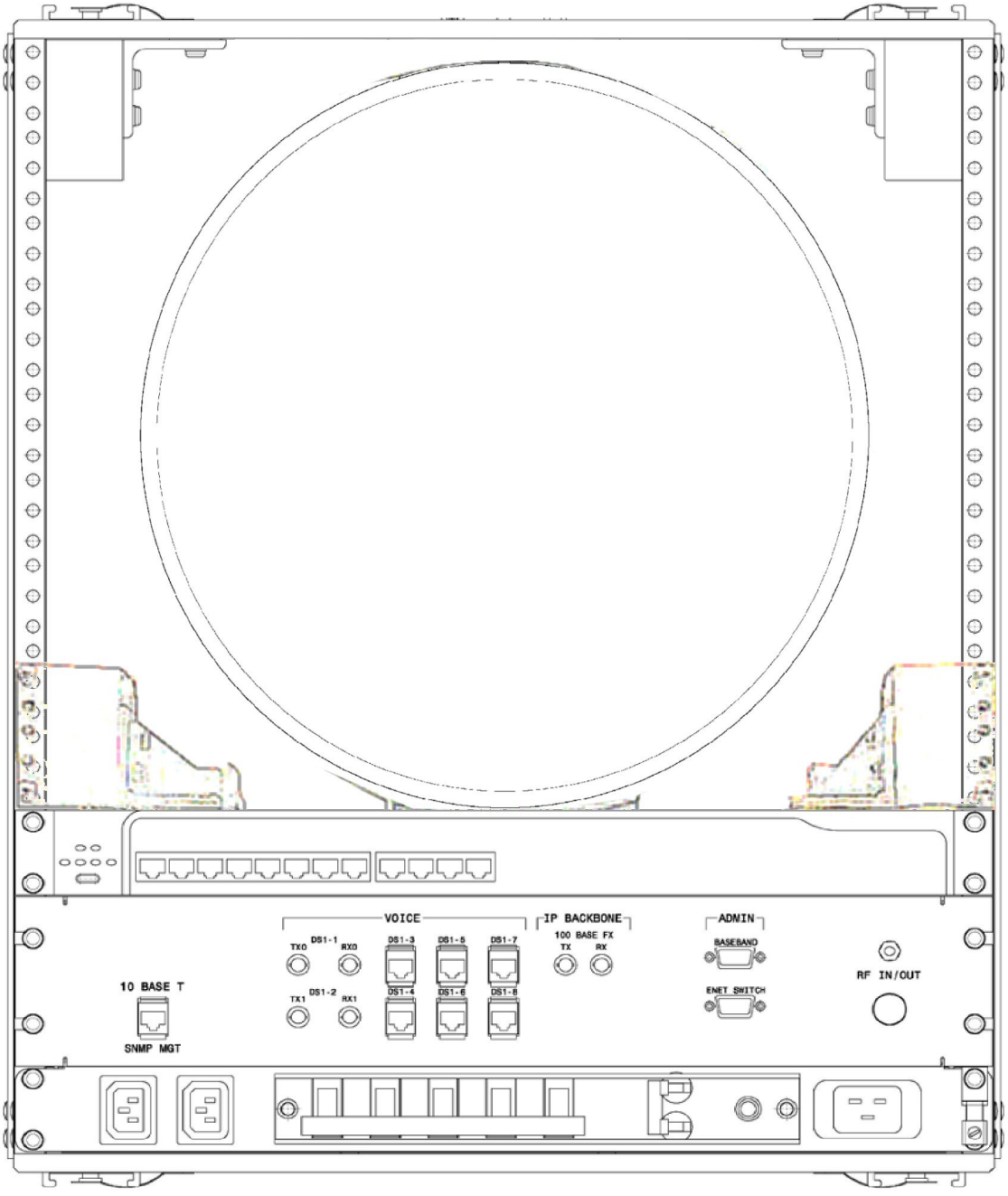


Figure 5 - Rear Elevation

6.3 Cable Diagrams

Table 14 - RFM v3.1 Cable Assembly List

Wire Number	Manufacturer	Part Number	Description
W1	TBD	TBD	100BaseFX Media Converter to DF Fiber Optic Cable
W2	TBD	TBD	Ethernet Switch 1X port to Radio Fast Ethernet port.
W3	TBD	TBD	Media Converter Power Cable
W4	TBD	TBD	Radio Ethernet port to SNMP port
W5	TBD	TBD	RF I/O Coax Cable IDU to DF
W6	TBD	TBD	Baseband IDU Admin Cable to DF
W7	TBD	TBD	DS1s Cable IDU to FO Modem & DF
W8, W9	TBD	TBD	PRI/T1 Fiber Optic modem to DF
W10	TBD	TBD	Ethernet Switch Admin Cable to DF
W11	TBD	TBD	Ethernet Switch Power Cable
W12	TBD	TBD	Ethernet 2x port to Media Converter 100BaseTX port
W13	TBD	TBD	Ethernet Switch 4X port to Radio Ethernet port
P1 (On Reel)	TBD	TBD	Cable reel and 200 ft. cable
P2 (In Pouch)	TBD	TBD	3-pair Fiber Optic Cable, ST-ST plug, 20 ft.
P3 (In Pouch)	TBD	TBD	Admin cable, Laptop (PC) to DF
P4	TBD	TBD	ODU head to lightning suppressor

Cable W1
Pin Assignments
100 BaseFX Media Converter to DF Fiber Optic Cable

ST Plug Media Converter 100BaseFX	Signal	Direction	ST Plug I/O DF 100BaseFX
1	Tx	---->	1
2	Rx	<----	2

Cable W2, W4, W12, W13
Pin Assignments
(W2) Ethernet Switch 1X port to Radio Fast Ethernet port
(W4) Radio Ethernet port to SNMP port
(W13) Ethernet Switch (2X port) to Media Converter (100BaseTx port)
(W14) Ethernet Switch (4X port) to Radio Ethernet port

RJ45 (SOLID) Plug Fast Ethernet Ethernet	Signal	Plug 100BaseTX 10BaseT RJ45 (SOLID)
1	TP0+	1
2	TP0-	2
3	TP1+	3
4	TP2+	4
5	TP2-	5
6	TP1-	6
7	TP3+	7
8	TP3-	8

Cable W10
Ethernet Switch Admin Cable to DF
Pin Assignments

RJ45 (solid) Plug Switch A5 Console	Signal	Direction	DB09F Receptacle Ethernet Switch Admin
1	RTS	→	8
2	DTR	→	6
3	TxD	→	2
4	GND		5
5	GND		5
6	RxD	←	3
7	DSR	←	4
8	CTS	←	7

Cable W5
Pin Assignments
RF I/O Coax Cable IDU to DF

50-ohm Type N Right Angle Plug Radio	50-ohm Type N Straight Angle Plug
ODU	Lightning Protector

DATA SIGNAL -

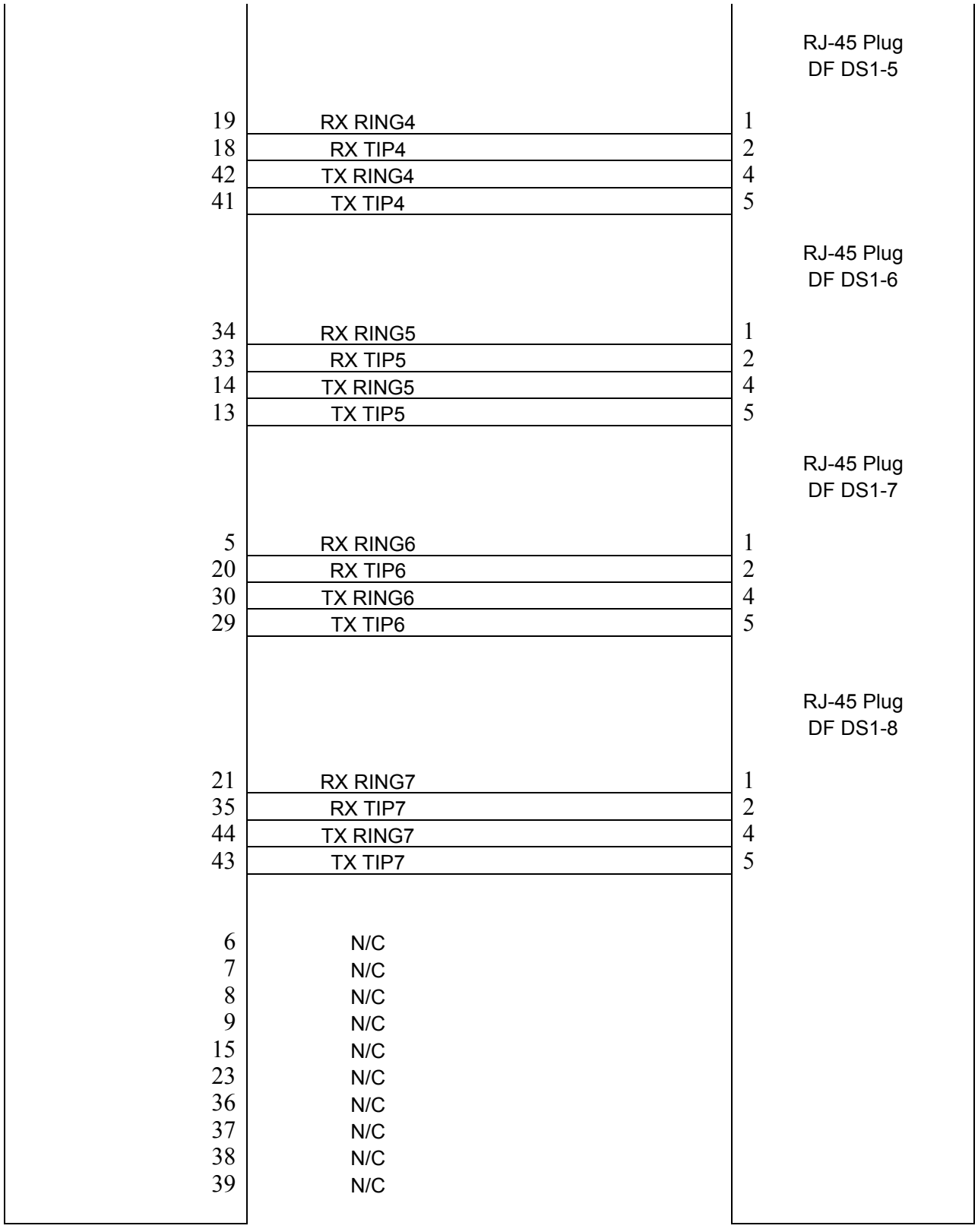
DATA SIGNAL +

Cable W6
Pin Assignments
Baseband IDU Admin Cable to DF

DB9M Plug Baseband IDU Terminal	Signal	Direction	DB9F Receptacle Baseband Admin I/O DF
1	DCD		1
2	TXD	---->	2
3	RXD	<----	3
4	DSR		4
5	GND		5
6	DTR		6
7	CTS		7
8	RTS		8
9	N/C		9

Cable W7
Pin Assignments
DS1s Cable IDU to FO Modem and DF

DB44 Plug Baseband IDU 8X T1	Signal	Direction	DB15M Plug Fiber Optic Modem T1/0
2	RX RING0	<----	1
1	RX TIP0	<----	9
22	Chassis GND		2
10	TX RING0	---->	3
25	TX TIP0	---->	11
24	Chassis GND		2
			DB15M Plug Fiber Optic Modem T1/1
17	RX RING1		1
16	RX TIP1		9
22	Chassis GND		2
26	TX RING1		3
40	TX TIP1		11
24	Chassis GND		2
			RJ-45 Plug DF DS1-3
32	RX RING2		1
31	RX TIP2		2
12	TX RING2		4
11	TX TIP2		5
			RJ-45 Plug DF DS1-4
4	RX RING3		1
3	RX TIP3		2
28	TX RING3		4
27	TX TIP3		5


RJ-45 Plug
DF DS1-5
19 RX RING4 1
18 RX TIP4 2
42 TX RING4 4
41 TX TIP4 5
RJ-45 Plug
DF DS1-6
34 RX RING5 1
33 RX TIP5 2
14 TX RING5 4
13 TX TIP5 5
RJ-45 Plug
DF DS1-7
5 RX RING6 1
20 RX TIP6 2
30 TX RING6 4
29 TX TIP6 5
RJ-45 Plug
DF DS1-8
21 RX RING7 1
35 RX TIP7 2
44 TX RING7 4
43 TX TIP7 5
6 N/C
7 N/C
8 N/C
9 N/C
15 N/C
23 N/C
36 N/C
37 N/C
38 N/C
39 N/C

Cable W8, W9
Pin Assignments
PRI/T1 Fiber Optic modem to DF

ST Fiber Optic Modem TX/1, RX/1 TX/0, RX/0	Signal	Direction	ST Plug I/O DF DS1-2 TX1, RX1 DS1-1 TX0, RX0
1	Tx	---->	1
2	Rx	<----	2

Cable W3, W11
Media Converter Power Cable
Ethernet Switch Power Cable

Power RECEPTACLE IEC-320/C-14 Power Conditioner	Signal	Direction	Power RECEPTACLE IEC-320/C-13 Media Convert Power Supply A5 Switch
1	Line	----	1
2	Neutral	----	2
3	GND	----	3

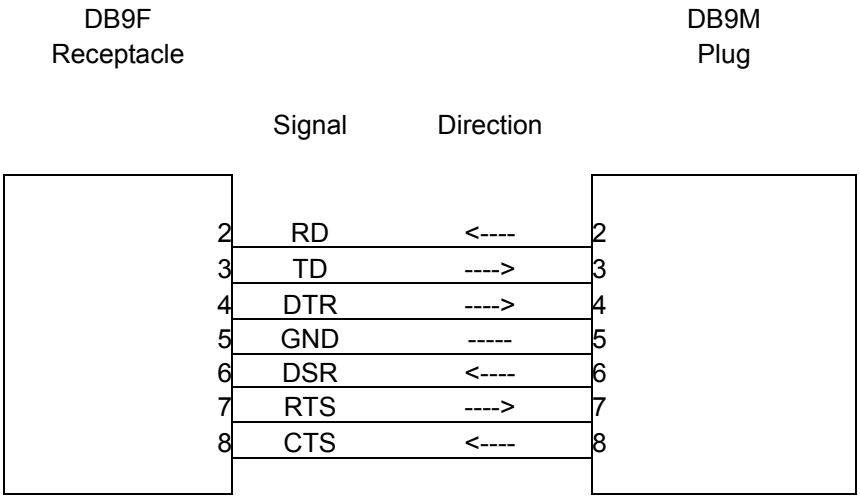
Cable P1
Pin Assignments
RF cable reel, 200 ft. (shipped with RFM v3.1)

50-ohm Type N Straight Angle Plug	50-ohm Type N Straight Angle Plug
RF Out	RF Out

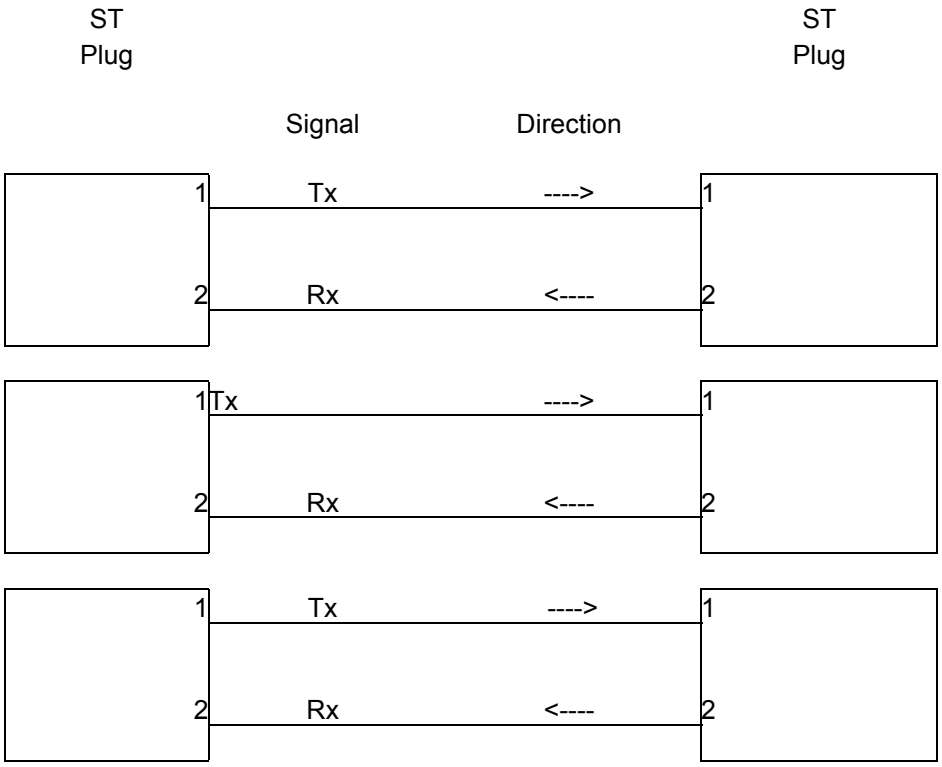
DATA
SIGNAL -

D

Cable P3
Pin Assignments
Admin cable, Laptop to DF (stored in pouch)



Cable P2
Pin Assignments
3-pair Fiber Optic Cable, ST-ST plug, 20 ft. (stored in pouch)



Cable P4
Pin Assignments
ODU head to Lightening suppressor

50-ohm Type N Right Angle Plug Radio	50-ohm Type N Straight Angle Plug
ODU head	Lightning suppressor
DATA SIGNAL -	
D	

6.4 Interconnect Diagram