Collins Aerospace

INSTALLATION MANUAL

IRT-4400 Iridium High-Speed (Cabin) SATCOM System

Installation Manual

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Collins Aerospace

IRT-4400 Iridium High-Speed (Cabin) SATCOM System

Installation Manual

This manual includes coverage of the following equipment:

Unit	Model	Collins Part Number
Iridium Configuration Module	ICM-4000	822-3584-400
Iridium Receiver Transmitter	IRT-4000	822-3585-400
High Gain Antenna	HGA-4000	822-3586-400

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INTRODUCTION

1. COMMENTS.

This Installation Manual (IM) provides installation and maintenance information regarding the IRT-4400, also referred to as the Iridium NEXT system. Elements found outside of this manual follow:

- For individual low-level component servicing information, refer to the particular Component Maintenance Manual (CMM).
- A publications index is available on-line at www.collinsaerospace.com. You may also register for an account there, so that you can view and download those manuals that support your aircraft. For further assistance contact the Technical Publications department as specified on page T2.

2. ACRONYMS, ABBREVIATIONS, AND MNEMONICS.

The list that follows shows the abbreviations, acronyms, and mnemonics that are used in this publication to describe the avionics system.

ACARS	Aircraft Communications Addressing and Reporting System
ACD	Aircraft Control Domain
AES	Aircraft Earth Station
AISD	Airline Information Services Domain
AOC	Airline Operations Communications
ATM	Air Traffic Management
BAA	Broadband Active Antenna
BAE	Broadband Application Electronics
BCX	Broadband Core Transceiver
BITE	Built In-Test Equipment
CBIT	Continuous Built-In Test
CFDS	Centralized Fault Display System
CMM	Component Maintenance Manual
CNS	Communication, Navigation and Surveillance
COS	Class of Service
CPN	Collins Par Number
DTMF	Dual Tone Multi-Frequency
FAA	Federal Aviation Administration
FDMA/TDMA	Frequency Division Multiple Access/Time Division Multiple Access
GTA	Ground To Air
HGA	High Gain Antenna
IBIT	Initiated Built-In Test
ICM	Iridium Configuration Module
IDP	International (European) Dialing Plan
IP	Internet Protocol
IPL	Illustrated Parts List
IRT	Iridium Receiver Transmitter
IRT NX	Iridium Receiver Transmitter NEXT
LRU	Line Replaceable Unit
MCU	2-Modular Concept Unit
MIC	Microphone
NADP	North American Dialing Plan
ORT	Owners Requirement Table
PBIT	Power-up Built-In Test
PDL	Portable Data-Load
PIESD	Passenger Information & Entertainment Services Domain
POTS	Plain Old Telephone System
PSTN	Public Switched Telephone Networks
RF	Radio Frequency
SATCOM	Satellite Communication

SCDU	System Control Display Unit
SCM	SDU Configuration Module
SDU	Satellite Data Unit
SIM	Subscriber Identity Module
SIP	Session Initiation Protocol
SORT	Secure Requirements Table
SP	Service Provider
TDD	Time Domain Duplex
UG	User Guide
UORT	User Owner Requirements Table
VoIP	Voice over Internet Protocol
WOW	Weight On Wheels

3. GLOSSARY OF TERMS.

Table 1. Glossary of Terms

Term	Definition
Cold Start	The IRT-4000 is powered on from an initial unpowered condition of long duration.
User Owner Requirements Table (UORT)Parameter	Each parameter listed in the UORT has corresponding values and settings. These settings are stored in the ICM-4000 and are used to configure the IRT-4000. A password is required to make changes to these settings using the MCDU.
Secure Requirements Table (SORT) Parameters	Each parameter listed in the SORT has corresponding values and settings. These settings are stored in the ICM-4000 and are used to configure the IRT-4000.
Service Provider	A provider of data, analytics, and/or communications infrastructure, typically paid via a customer subscription or other billing arrangement. Iridium, GLOBALink, and Aeronautical Radio Incorporated (ARINC) Direct are examples of service providers.
Warm Start	The IRT-4000 is powered on from an initial unpowered condition of short duration (i.e., greater than 300 ms, but less than a minute).

4. APPLICABLE DOCUMENTS.

The following documents are listed for reference only. Each document is applicable to this manual only to the extent specified herein.

4.1. External Documents.

Refer to Table 2 for external documents.

Table 2. External Documents

DOCUMENT NUMBER	TITLE
TSO-C159E	Technical Standard Order for Next Generation Satellite Systems (NGSS) Equipment
TSO-C159D	Technical Standard Order for Next Generation Satellite Systems (NGSS) Equipment
DO-160G	Environmental Conditions and Test Procedures for Airborne Equipment
DO-262F	Minimum Operational Performance Standards for Avionics supporting Next Generation Satellite Systems (NGSS)
ARP4754A	Guidelines for Development of Civil Aircraft and Systems
ARINC 771-1	Low-Earth Orbiting Aviation Satellite Communication (SATCOM) System

Table 2. External Documents - Continued

DOCUMENT NUMBER	TITLE
47 CFR Part 1	FCC Rules & Regulations, Practice and Procedure
47 CFR Part 2	FCC Rules & Regulations, Frequency Allocations and Radio Treaty Matters: General Rules and Regulations

SAFETY SUMMARY

1. GENERAL SAFETY INSTRUCTIONS.

This manual describes physical and chemical processes which may cause injury or death to personnel or damage to equipment if not properly followed. This safety summary includes general safety precautions and instruction that must be understood and applied during operation and installation to make sure personnel safety and protection of equipment. Prior to performing any task, the WARNING, CAUTIONS, and NOTES included in that task shall be reviewed and understood.

2. WARNING, CAUTIONS AND NOTES.

WARNINGS and CAUTIONS are used in this manual to highlight operating or maintenance procedures, practices, conditions or statements which are considered essential to protection of personnel (WARNING) or equipment (CAUTION). WARNINGS and CAUTIONS immediately precede the step or procedure to which they apply. WARNINGS and CAUTIONS consist of four parts: heading (WARNINGS, CAUTIONS or Icon [HAZARDOUS MATERIALS WARNING]), a statement of the hazard, minimum precautions, and possible result if disregarded. NOTES are used in this manual to highlight operating or maintenance procedures, practices, conditions or statements which are not essential to protection of personnel or equipment. NOTES may precede or follow the step or procedure, depending upon the information to be highlighted. The headings used and definitions are as follows:

WARNING

HIGHLIGHTS AN ESSENTIAL OPERATING OR MAINTENANCE PROCEDURE, PRACTICE, CONDITION, OR STATEMENT, ETC. WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN INJURY TO, OR DEATH OF, PERSONNEL OR LONG TERM HEALTH HAZARDS.

WARNING

OBSERVE STANDARD SAFETY PRECAUTIONS AND WEAR SAFETY GLASSES AND OTHER PROPER SAFETY GEAR TO PREVENT PERSONAL INJURY DURING INSTALLATIONS.

CAUTION

HIGHLIGHTS AN ESSENTIAL OPERATING OR MAINTENANCE PROCEDURE, PRACTICE, CONDITION, OR STATEMENT, ETC. WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN DAMAGE TO, OR DESTRUCTION OF, EQUIPMENT OR LOSS OF MISSION EFFECTIVENESS.

CAUTION

TURN OFF POWER BEFORE DISCONNECTING ANY COMPONENT FROM WIRING. DISCONNECTING THE COMPONENT WITHOUT TURNING POWER OFF MAY CAUSE VOLTAGE TRANSIENTS THAT CAN DAMAGE THE COMPONENT.

CAUTION

WHILE THE IRT-4000 IS NOT CLASSIFIED AS A STATIC SENSITIVE DEVICE, GOOD SHOP PRACTICES SHOULD BE FOLLOWED WHEN HANDLING AND INSTALLING ALL EQUIPMENT. USE OF GROUNDED CONDUCTIVE SURFACES AND ANTISTATIC MATERIALS IS RECOMMENDED.

IF THE IRT-4000 CHASSIS IS OPENED ITS WARRANTY IS VOIDED. UNDER NO CIRCUMSTANCES SHOULD THE IRT-4000 CHASSIS BE OPENED BY ANYONE OTHER THAN A CERTIFIED REPAIR TECHNICIAN IN A CERTIFIED REPAIR ENVIRONMENT WITH THE EXPRESS CONSENT OF COLLINS AEROSPACE.

PRECAUTIONS SHOULD BE FOLLOWED WHILE INSTALLING THE IRT-4000 DE-ENERGIZE OR DISCONNECT ALL POWER AND SIGNAL SOURCES AND LOADS BEFORE INSTALLING THE IRT-4000 . PLACE THE COMPONENT ON A GROUNDED, CONDUCTIVE SURFACE. GROUND THE INSTALLER THROUGH A CONDUCTIVE WRIST STRAP OR OTHER DEVICE USING A 470-KILOHM OR 1-MEGOHM SERIES RESISTOR TO PROTECT THE EQUIPMENT. GROUND ANY ELECTRICAL TOOLS, SUCH AS SOLDERING EQUIPMENT THAT WILL CONTACT THE COMPONENT. CONTACT WITH THE OPERATOR'S HAND PROVIDES SUFFICIENT GROUND FOR TOOLS THAT ARE OTHERWISE ELECTRICALLY ISOLATED.

DO NOT INSTALL IN LOCATIONS WHERE UNIT MAY COME IN DIRECT CONTACT WITH FLUIDS SUCH AS SKYDROL. REFER TO APPENDIX A.

NOTE

Highlights an essential operating or maintenance procedure, condition, or statement.

CHAPTER 1
SYSTEM DESCRIPTION

1.1. INTRODUCTION.

This chapter lists each piece of Collins Aerospace equipment, and explains what it does at a high level and how the equipment works with other equipment in the system. This chapter gives an overall description of the system, including the system interfaces.

1.2. EQUIPMENT.

The equipment covered Table 1-1 lists the aircraft avionics and avionic software.

NOTE

The following are not provided with the IRT-4400 ship set:

- IRT-4000 2-MCU Tray
- Interface Cabling.

1.2.1. Equipment Covered.

Refer to Table 1-1 for a complete list of the Collins Aerospace avionics equipment covered in this manual.

Table 1-1. Equipment Covered.

UNIT	DESCRIPTION	COLLINS PART NUMBER (CPN)	QUANTITY
ICM-4000	Iridium Configuration Module (ICM)	822-3584-400	1
IRT-4000	Iridium Receiver Transmitter (IRT)	822-3585-400	1
HGA-4000	High Gain Antenna (HGA)	822-3586-400	1
IRTSW-4000	IRT Operational software	810-0620-400	1
ICMSW-4000	ICM Operational software	810-0621-001	1
IRTORT-4000	ORT Tool software	810-0697-001	1

1.3. PURPOSE OF EQUIPMENT.

The Iridium NEXT system (which is comprised of the IRT-4000, ICM-4000 and HGA-4000) (see Figure 1-1) provides Cabin Voice and Data communication through the Iridium network of 66 Low-Earth Orbit cross-linked satellites that provide service anywhere on the planet in all weather conditions without compromise. Iridium satellites orbit at an altitude of 785 km (4485 miles), circling the earth once every 100 minutes. Each satellite is cross-linked to four other satellites; two satellites in the same orbital plane and two in an adjacent plane.

NOTE

Until regulatory guidance on single-channel SATCOM with mixed Aircraft Control Domain (ACD) and Passenger Information & Entertainment Services Domain (PIESD) is available, the IRT-4000 shall only provide cabin voice and data services. At present the Federal Aviation Administration (FAA) requires that systems which provide both ACD/Airline Information Services Domain (AISD) and PIESD connectivity have the PIESD in an isolated partition separate from the ACD/AISD services. TSO C159D and later further states that the loss or failure of this isolation between domains is a MAJOR failure condition.

1.3.1. Features.

The IRT-4000 has the following features provided in a compact 2-MCU package:

- Voice Channel [2 Analog, 3 Voice over Internet Protocol (VoIP)]
- High data rate (kbps) using Active HGA-4000
- IRT-4000, ICM-4000 and HGA-4000 are capable of on-wing software updates by way of a Portable Data-Load (PDL) system, or through the On-Board Network System.

Figure 1-1. Iridium NEXT System

1.4. SYSTEM OVERVIEW.

This section gives you an overview of the Iridium NEXT System.

1.4.1. Iridium Cabin SATCOM System Interfaces.

NOTE

Most units report maintenance information in a diagnostic word to the built-in diagnostic system. This section does not refer to these diagnostic words. Refer to the maintenance section of this manual for diagnostic information.

See Figure 1-2 for Iridium Receiver Transmitter Interfaces.

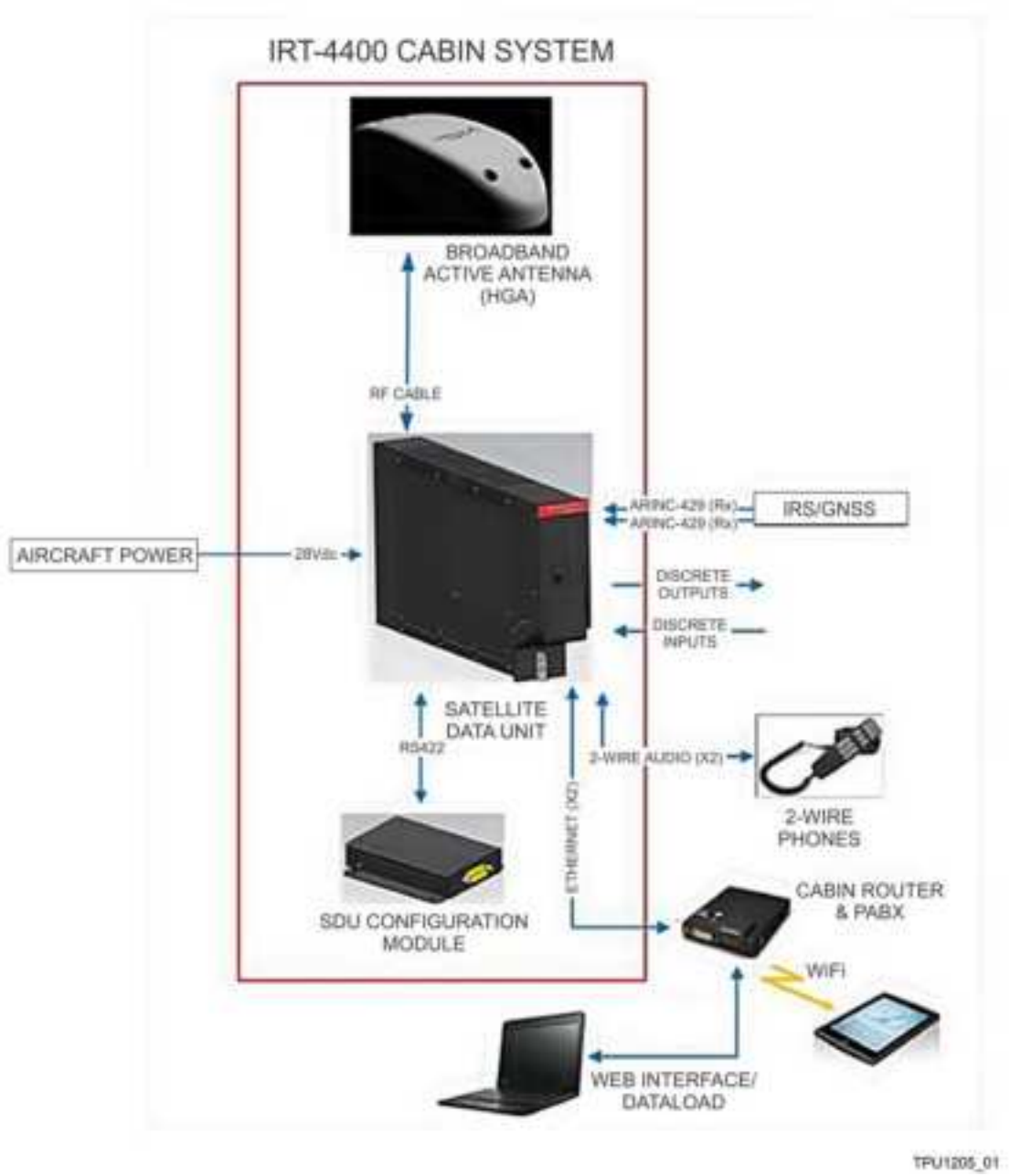


Figure 1-2. Iridium Cabin SATCOM System, Interfaces

1.4.2. Iridium Cabin SATCOM Function.

The IRT-4000 contains a single modem (Iridium Certus™ Broadband Core Transceiver (BCX)). The BCX is the core digital and Radio Frequency (RF) module of the Iridium Certus satellite communications service. Integrated with Broadband Application Electronics (BAE), Broadband Active Antenna (BAA), and appropriate amplifiers, the BCX (uniquely designed to support Iridium Certus L-Band services 1616 to 1626 MHz) provides multiple data speed rates, three simultaneous high-quality voice calls, background IP data. The IRT-4000 is connected to an HGA or high gain antenna that provides data rates of 352/704 up/down. The IRT-4000 or Satellite Data Unit (SDU) follows the ARINC-771 wiring definition.

The Cabin solution IRT-4400 system only connects to the cabin domain or PIESD. The primary function of the IRT-4000 is to provide voice and data communications. A graphical web interface is used for data load and maintenance procedures involving the

IRT-4000. Refer to Paragraph 1.5 for additional information on the Aircraft Service Domains. The IRT-4400 provides service to the PIES Domain, while the IRT-4100 through IRT-4300 is capable of supporting two aircraft domains, the ACD and the AISD.

The Cabin solution IRT-4000 uses the HGA antenna that provides data rate of 352/704 but only connects to the cabin domain or PIESD. The PIESD domain is serviced via two Ethernet ports (ETH2, ETH12 per A771-1) These interfaces provide 3 channels of Voice usingSession Initiation Protocol (SIP), Voice over Internet Protocol (VoIP), and IP data services simultaneously.

The IRT-4000 has ARINC-429 inputs for GNSS, discrete inputs for weight on wheels and data load enable. GNSS position data is only used in log files while the ground speed and Weight On Wheels (WOW) discrete are used to limit transmit power while the aircraft is on the ground (this is to protect nearby GLONASS receivers).

1.4.3. Components.

The IRT-4400 system is comprised of the following hardware components:

- IRT-4000 (P/N: 822-3585-400) (Also referred to as the Satellite Data Unit (SDU))
- ICM-4000 (P/N: 822-3584-400) (Also referred to as the SDU Configuration Module (SCM))
- HGA (P/N: 822-3586-400).

NOTE

The following are not provided with the IRT-4400 ship set:

•IRT-4400 Tray

•Interface Cable (IRT-4000 - ICM-4000)

•Interconnect Cable (IRT-4000 - HGA).

1.4.3.1. The IRT-4000, depicted in Figure 1-3, is designed to mount into a standard 2-Modular Concept Unit (MCU) tray. When installed, the IRT-4000's ARINC 600 connector, located on the back panel, mates to a tray-mounted connector, providing a quick-disconnect interface for all of the system Inputs and Outputs (I/O), including power, data, audio, and antenna, as shown in Appendix C - IRT-4000 Interface Wiring Table C-1. The IRT-4000 may be configured by a PDL, or On Board Networking system.. Specifications and dimensions of the IRT-4000 are listed in Appendix A - Equipment Characteristics.

Figure 1-3. IRT-4000 Reference View

1.4.3.2. The ICM-4000 (also referred to as the SDU Configuration Module (SCM)) is a small electronics box with flanges for mounting to a structural surface, as well as a ground stud to attach the ICM-4000 chassis to the aircraft chassis for lightning protection. The ICM-4000 has one I/O port and an access panel on the left side to remove/install the Iridium CERTUS Subscriber Identity Module (SIM) card as shown in ICM-4000 Reference View Figure 1-4.

After power-up, the ICM-4000 is detected by the IRT-4000. The IRT-4400 system reads the configuration settings from the ICM-4000 and completes startup using those settings for operational use.

The ICM-4000 stores and provides the system configuration and directory information and the SIM used by the Iridium network. Primary ICM-4000 software functionality encompasses the following:

- Storage, retrieval and transmission of primary configuration data Owners Requirement Table (ORT) to/from the IRT-4000
- Storage, retrieval and transmission of directory data to/from the IRT-4000
- Reading and transmission of SIM card data to the SDU.

Figure 1-4. ICM-4000 Reference View

1.5. AIRCRAFT SERVICE DOMAINS.

The Aircraft Control Domain (ACD) is data specific for the operation of the aircraft (see Figure 1-5). Continuous advanced connectivity from ground to air enables Communication, Navigation and Surveillance (CNS) data for Air Traffic Management (ATM), flight information and alerting, and direct Airline Operations Communications (AOC), which can impact aircraft safety and efficiency.

The AISD may provide services and connectivity between independent aircraft domains such as avionics, in-flight entertainment, cabin distribution and any connected off-board networks. The AISD provides a security perimeter, incorporating network routing and security functions and services between the AISD and less critical domains PIESD and any connected wireless networks.

The PIESD is characterized by the need to provide passenger entertainment and network services. The PIESD is defined to include more than traditional in-flight entertainment systems; that is, any device or function of a device that provides services to passengers.

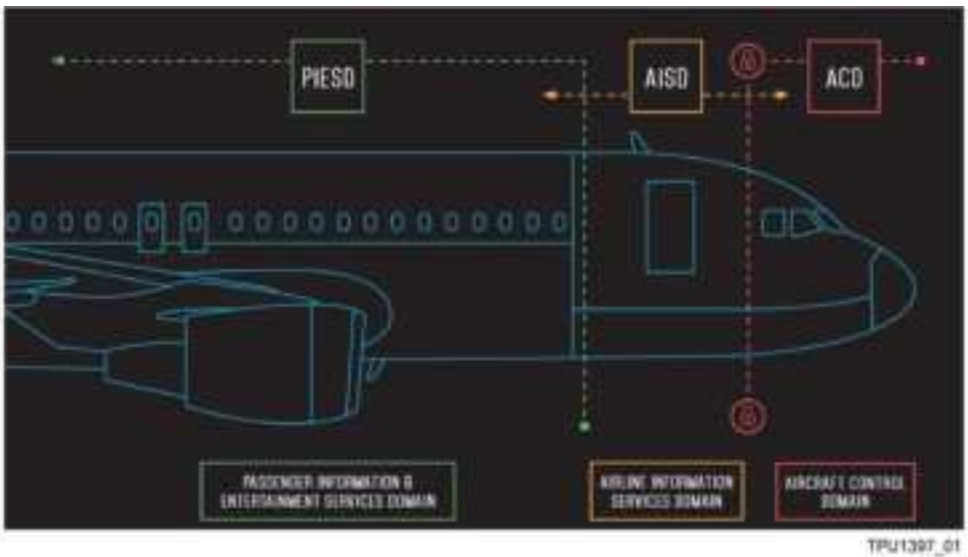


Figure 1-5. Aircraft Service Domains

CHAPTER 2
INSTALLATION

2.1. GENERAL.

This chapter provides installation information for the Iridium NEXT System. Procedures must be performed as described below to make sure proper operation and performance.

NOTE

The information and instructions provided in this chapter are recommendations and do not necessarily correspond with any actual aircraft installation and wiring. This chapter cannot be used in place of a Supplemental Type Certificate (STC) or Type Certificate (TC).

2.2. UNPACKING AND INSPECTING EQUIPMENT.

Unpack the equipment carefully and make a careful visual inspection of the unit for possible shipping damage. All claims for damage should be filed with the transportation company involved. If claims for damage are to be filed, save the original shipping container and materials. If no damage can be detected, replace packing materials in the shipping container and save for future use (for example, storage or reshipment). Perform a visual inspection of the unit and inspect for the following concerns:

1. Any damage or corrosion.
2. All parts are intact and in working order.
3. Connectors for any damage, corrosion and broken or bent pins.

2.3. PRE-INSTALLATION CHECK.

CAUTION

Remove all electrical power to the equipment and/or equipment mounts before installing or removing them.

Prior to installation of the unit in the aircraft, make sure the system equipment interfacing with the Iridium NEXT System is operating properly and all applicable tests have been performed. Refer to the latest revision of the Component Maintenance Manual (CMM) or Illustrated Parts List (IPL) to perform testing of the unit. In the absence of the CMM/IPL, use the Acceptance Test Procedure for the panel variant used to perform testing of the unit.

2.3.1. Cabling Precautions.

The following precautions are to be observed during the preparation of the interconnect wiring cables:

1. Bond and shield all parts of the aircraft electrical system, such as generators and ignition systems.
2. Keep connecting cables away from heavy current carrying circuits, pulse transmitting equipment, and interference sources.
3. Make all external connections to the system equipment through the designated connectors.
4. The required hardware and connector are supplied if specified.
5. Suitable wire should be used in accordance with applicable specifications.
6. Leave slack in the cable to allow free movement of equipment, keeping wires from breaking.

2.4. PLANNING.

Proper and careful planning prior to installation is essential for reliable performance and easy maintenance. The list that follows is a sample of the points to be considered in planning an installation:

1. Installation location. Allow for adequate airflow for cooling, good bonding to aircraft ground, ease of cable routing, room for single/dual/triple mounting in a location that provides structural rigidity.
2. Installation configuration.
3. Compatibility with other equipment and loading considerations.

2.4.1. Installation Configurations.

The complete configuration is dependent on the desired connections to ancillary equipment.

2.4.2. Strapping Options.

There are no strapping requirements for the Iridium NEXT System.

2.4.3. Input Power.

All power required by the Iridium NEXT System is provided by the aircraft in which the system is installed. The Iridium NEXT System requires an input of +28 V dc at 125.0 watts (max) of power for normal operation.

NOTE

The 125.0 watts is required due to the High Gain Antenna (HGA) being powered through the IRT-4000 per ARINC 771-1 (Iridium Low-Earth Orbiting Aviation Satellite Communication (SATCOM) System).

2.4.4. Cooling Considerations.

The IRT-4000 is designed with downward-flowing draw-through air coolant in accordance with ARINC 600. There are no internal cooling fans, and no filtration is required (see Figure 2-1). The IRT-4000 can be operated either passively cooled or with forced cooling air. When using passive cooling the operating high temperature limit is reduced to +55 °C. The mounting tray must not obstruct the cooling air vents on the bottom of the SDU and sufficient space above and below should be kept allowing convection cooling to take place.

2.5. CABLING INSTRUCTIONS.

WARNING

MAKE SURE THAT THE AIRCRAFT BATTERY MASTER IS TURNED OFF BEFORE INSTALLING ANY OF THE INTERCONNECT CABLING. FAILURE TO DO SO COULD CAUSE ELECTRICAL ARCING THAT MIGHT RESULT IN DAMAGE TO THE EQUIPMENT OR SERIOUS INJURY TO MAINTENANCE PERSONNEL.

Interconnect cables should be prepared in accordance with the interconnect diagrams which are part of approved Supplemental Type Certificate (STC) data packages.

2.6. INSTALLATION PROCEDURES.

This section contains procedures for installing the Iridium NEXT System in the aircraft. Procedures must be performed as described below to make sure of proper operation and performance.

2.6.1. IRT-4000 Installation.

See Figure 2-1 and perform the following steps to install the IRT-4000.

a. Ensure power has been removed from the system.

b. If installed, remove protective connector caps before reinstalling IRT-4000.

c. Gently push the IRT-4000 straight and directly into the tray to engage the ARINC 600 mating connectors (plug and receptacle) until it is locked into the tray.

d. On the front of the mounting tray, screw the Self-Locking Hold-Down nut, until it tightens over the lockdown hook.

e. Close previously open circuit breaker(s).

NOTES:

1. THIS DRAWING DEFINES THE INSTALLATION REQUIREMENTS FOR EQUIPMENT TYPE IRT-4000 TOP LEVEL ASSEMBLY (822-3585-1XX).
2. FINISH: BLACK EPOXY PAINT IN ACCORDANCE WITH COMPANY PART NUMBER (580-0194-035). ALL UNPAINTED SURFACES ARE CHEMICAL FILMED IN ACCORDANCE WITH COMPANY PART NUMBER (580-0036-001).
3. ITEMS LOCATED IN PARENTHESIS FOR REFERENCE ONLY.
4. THIS UNIT COMPLIES WITH ALL 2MCU DIMENSION AND TOLERANCE REQUIREMENTS FOR INSTALLATION INTO A STANDARD ARINC 600 EQUIPMENT RACK.

(5) SYMBOL AND ASSOCIATED DIMENSIONS IDENTIFY THE UNIT CENTER OF GRAVITY.

6. INPUT VOLTAGE: 28 VDC.

MODE	AVERAGE POWER INPUT(W)	MAXIMUM HEAT DISSIPATION
IDLE	60	40
FULL BANDWIDTH	100	60

(7) DARKENED HALF OF HEXAGON DESIGNATES THE EXTENDED PORTION OF THE KEYING PIN.

8. UNIT WEIGHT: 8.1 LB [3.68 KG] MAXIMUM, (7.7 LB) [(3.5 KG)] NOMINAL.

(9) THIS UNIT IS DESIGNED FOR UPWARD-FLOWING AND DOWNWARD-FLOWING FORCED AIR COOLANT IN COMPLIANCE WITH ARINC 600 REQUIREMENTS WHEN THE UNIT IS MOUNTED ON A HORIZONTAL SURFACE. OTHER ORIENTATIONS SHALL REQUIRE RETESTING AND APPROVAL BY ROCKWELL COLLINS.

10. COOLANT AIRFLOW RATE SHALL BE IN ACCORDANCE WITH TABLE BELOW AND THE INSTALLATION'S HIGH CONTINUOUS OPERATING TEMPERATURE REQUIREMENT

DIRECTION OF AIRFLOW	COOLANT AIR FLOW RATE (DESIGN CONDITION AT SEA LEVEL)
DOWNWARD FLOWING	58.2 LB/HR [(26.4 KG/HR)]
UPWARD FLOWING	29.1 LB/HR [(13.2 KG/HR)]
NO COOLING	N/A

12. UNLESS OTHERWISE SPECIFIED, DIMENSIONS AND TOLERANCES ARE EXPRESSED IN INCHES [MILLIMETERS] AND SHALL BE INTERPRETED IN ACCORDANCE WITH ASME Y14.5-2009.

(13) FOR UNIT CONNECTOR INFORMATION, REFER TO DETAIL A AND RELATED CHART. MATING CONNECTOR INFORMATION GIVEN FOR REFERENCE ONLY.

(14) DC RESISTANCE SHALL BE 2.5 MILLI-OHMS MAXIMUM BETWEEN THE CONNECTOR SHELL AND THE MOUNTING SURFACE INDICATED.

15. FOR ALL NON-QUADRAX ETHERNET CONNECTIONS, REFER TO DETAIL B FOR WIRING REQUIREMENTS. THE GROUNDING STRAP SHALL BE ATTACHED TO THE TRAY.

(16) WHEN THE IRT-4000 IS OPERATED WITHOUT FORCED AIR COOLANT, A TRAY WITH AN OPENING AROUND THE INDICATED HOLES IS REQUIRED. A CLEARANCE OF TBD IS REQUIRED FOR THERMAL SPACING.

17. DOWNWARD FLOWING COOLANT AIR PRESSURE DROP THROUGH UNIT: .2 ± .12 IN [5 ± 3MM] OF WATER. UPWARD FLOWING COOLANT AIR PRESSURE DROP THROUGH UNIT: .2 ± .12 IN [5 ± 3MM] OF WATER.

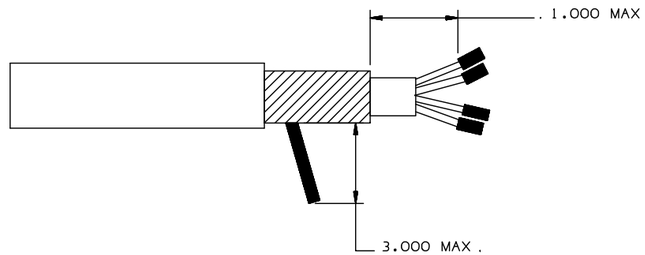
18. REFER TO THE COMPONENT MAINTENANCE MANUAL FOR ENVIRONMENTAL QUALIFICATION DETAILS.

(19) THE NAME PLATE RECORDS THE COLLINS PART NUMBER AND WEIGHT.

(20) THE MOD PLATE RECORDS THE SERIAL NUMBER, MANUFACTURER, DATE OF MANUFACTURE AND MODIFICATION STATUS.

CONNECTOR INFORMATION (13)

REF DES	CONNECTOR PART NUMBER(S)	CONTACT PART NUMBER(S)	MATING CONNECTOR PART NUMBER(S)	MATING CONTACT PART NUMBER(S)
A1P6	370-0140-030	SIZE 1 COAX CONTACT 370-0067-990	RADIALL PN NSXNB577X00	SIZE 1 SOCKET COAX CONTACT RADIALL PN 620103
		SIZE 22 SOCKET CONTACT 370-0074-030		SIZE 22 PIN CONTACT RADIALL PN 620200
		SIZE 12 PIN CONTACT 370-0172-090		SIZE 12 SOCKET CONTACT RADIALL PN 620340
		SIZE 16 PIN CONTACT 370-0172-080		SIZE 16 SOCKET CONTACT RADIALL PN 620330
		SIZE 8 QUADRAX CONTACT 370-0105-100		SIZE 8 SOCKET QUADRAX CONTACT RADIALL PN 620075050



DETAIL B

TPU0288_01

Figure 2-1. IRT-4000 Installation (Sheet 1 of 3)

PRELIMINARY

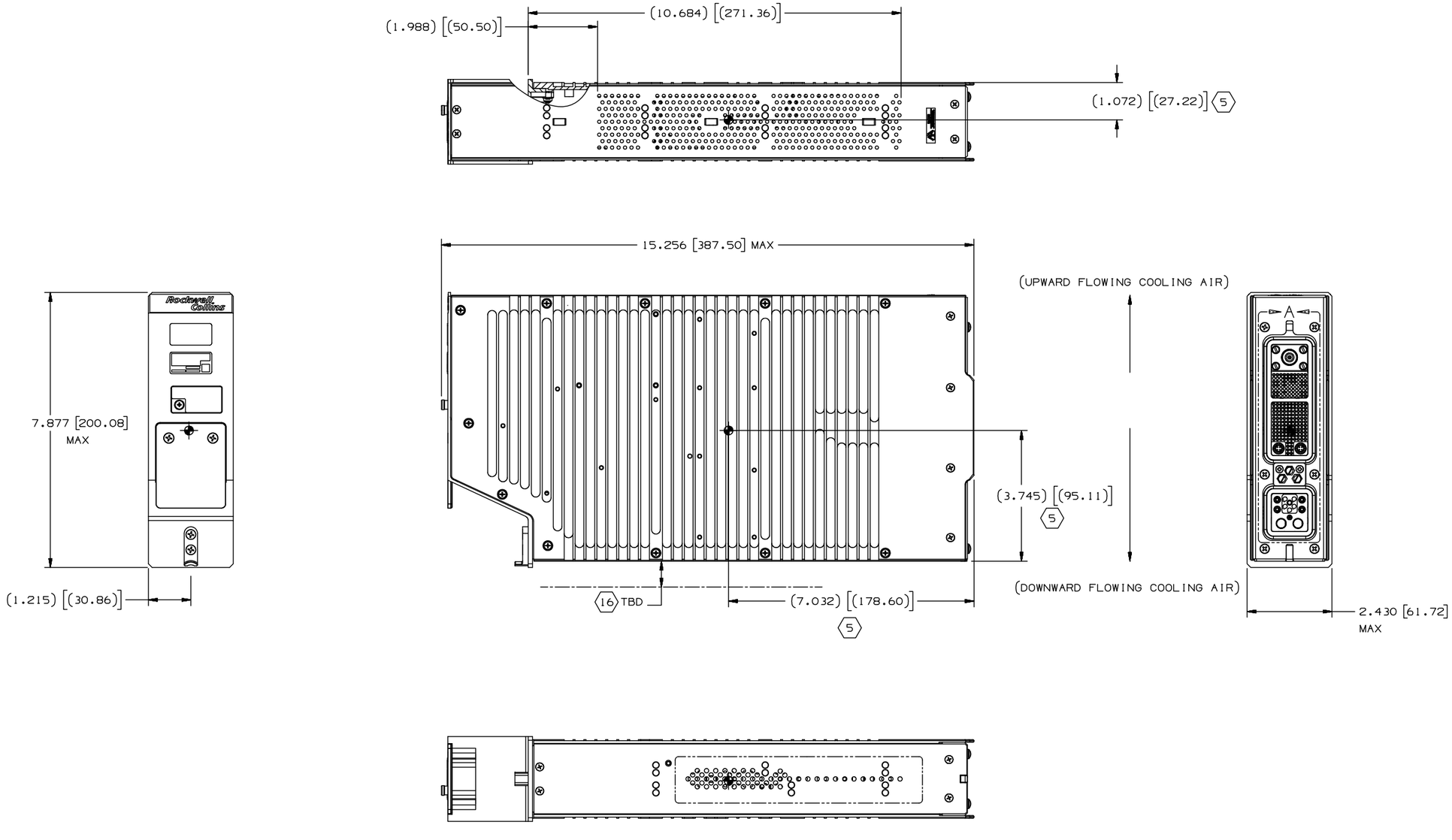
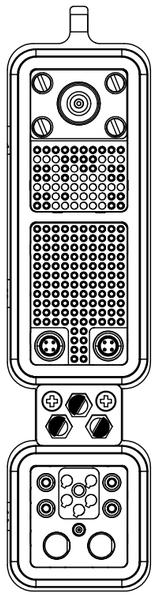


Figure 2-1. IRT-4000 Installation (Sheet 2 of 3)

PRELIMINARY

A1P6 (SHELL SIZE 2 RECEPTACLE SEE CONNECTOR INFORMATION CHART)



DETAIL A

SEE SHEET 2
ZONE B2

TPU0288_03

Figure 2-1. IRT-4000 Installation (Sheet 3 of 3)

PRELIMINARY

2.6.2. ICM-4000 Installation.

See Figure 2-2 and perform the following steps to install the ICM-4000.

a. Mount the ICM by screwing the four (4) ICM fasteners into the ICM mounting flange.

b. On the front of the ICM, push the ICM Interface Cable connector into the DB-15 port.

c. Turn the two (2) cable-connecting screws clockwise to attach the connector.

2.6.2.1. Connect the Chassis Ground Stud

a. Push the ground wire into the ground stud.

b. Screw in the locknut and washer securing the M3 ring terminal ground to the chassis ground stud.

NOTE

Installation details, such as location of the ICM, are left to customer discretion.

The ICM is designed for installation in any orientation. It may be mounted to any suitable structure using suitable fasteners at provided hole locations, where the bottom can have direct contact to a flat, surface of sufficient size. However, it is recommended that the ICM should be within a range of the IRT-4000 such that the interface cable does not exceed 10 meters (~32 feet), which must include allowances for routing, and orientation of both ends.

1. THIS DRAWING DEFINES INSTALLATION REQUIREMENTS FOR EQUIPMENT TYPE ICM-4000 COMPANY PART NUMBER 822-3584-XXX.
2. UNLESS OTHERWISE SPECIFIED, DIMENSIONS AND TOLERANCES ARE EXPRESSED IN INCHES [MILLIMETERS] AND SHALL BE INTERPRETED IN ACCORDANCE WITH ASME Y14.5-2009. DIMENSIONAL TOLERANCES ARE .XX = ± .05 [.X = ± .2] AND .XXX = ± .020 [.XX = ± .08].

(3) ◔ SYMBOL AND ASSOCIATED DIMENSIONS IDENTIFY THE UNIT CENTER OF GRAVITY.

4. UNIT WEIGHT: 0.43 LB ± 0.05 LB [0.20 KG ± 0.02 KG].
5. CAUTION: THIS ASSEMBLY CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE DEVICES AND SHALL BE HANDLED IN ACCORDANCE WITH COMPANY PART NUMBER (489-0004-001).
6. INPUT VOLTAGE: 12 +/- 0.56 VDC,
   POWER DISSIPATION: 1.0 WATTS MAXIMUM.
7. INFORMATION ENCLOSED IN PARENTHESES IS FOR REFERENCE ONLY.

(8) DC RESISTANCE SHALL BE 1.0 MILLI-OHMS MAXIMUM BETWEEN THE CONNECTOR SHELL(S) OR SHIELD TERMINATION LOCATION(S) AND THE UNIT MOUNTING SURFACE(S) INDICATED. UNIT MOUNTING SURFACE MATERIAL IS ALUMINUM AND FINISH/PLATING IS CHEMICAL FILM. AIRCRAFT IS TO PROVIDE SUITABLE CONDUCTIVE MATING SURFACE. REFER TO 523-0775254 INSTALLATION PRACTICES AND 523-0776007 BONDING AND GROUNDING PRACTICES FOR AIRCRAFT BONDING REQUIREMENTS.

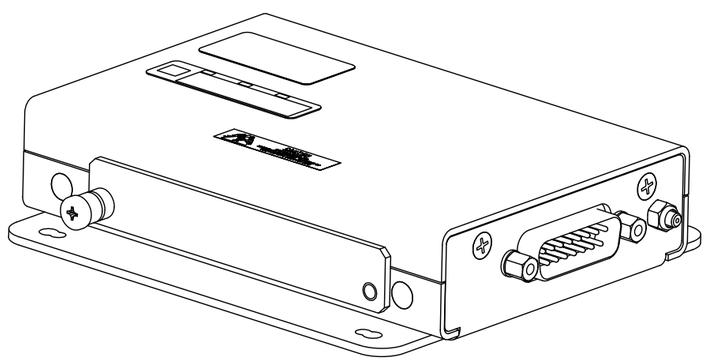
9. THIS UNIT MEETS THE DIMENSIONAL REQUIREMENTS OF ARINC SPECIFICATION 771.

(10) CONNECTOR INFORMATION:
   10A. 15 POSITION D-SUB PLUG, DB15T MIL-DTL-24308
   MATING CONNECTOR : 15 POSITION D-SUB RECEPTACLE MIL-DTL-24308.

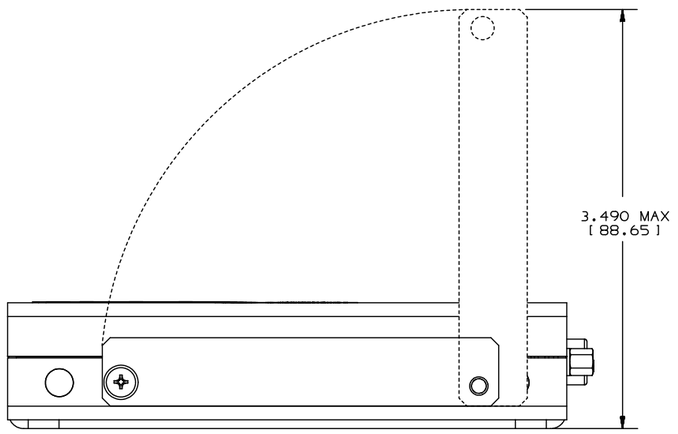
11. THIS UNIT HAS BEEN DESIGNED AND TESTED FOR INSTALLATION ON A VERTICAL SURFACE WITH THE CONNECTOR FACING DOWN. OTHER ORIENTATIONS SHALL REQUIRE RETESTING AND APPROVAL BY ROCKWELL COLLINS.
12. THIS UNIT IS PASSIVELY COOLED AND DOES NOT REQUIRE COOLING AIR. UNIT DOES NOT CONTAIN AN INTERNAL FAN
13. REFER TO THE COMPONENT MAINTENANCE MANUAL FOR ENVIRONMENTAL QUALIFICATION DETAILS.

(14) THE NAME PLATE RECORDS THE COLLINS PART NUMBER AND WEIGHT.

(15) THE MOD PLATE RECORDS THE SERIAL NUMBER, MANUFACTURER, DATE OF MANUFACTURE AND MODIFICATION STATUS.



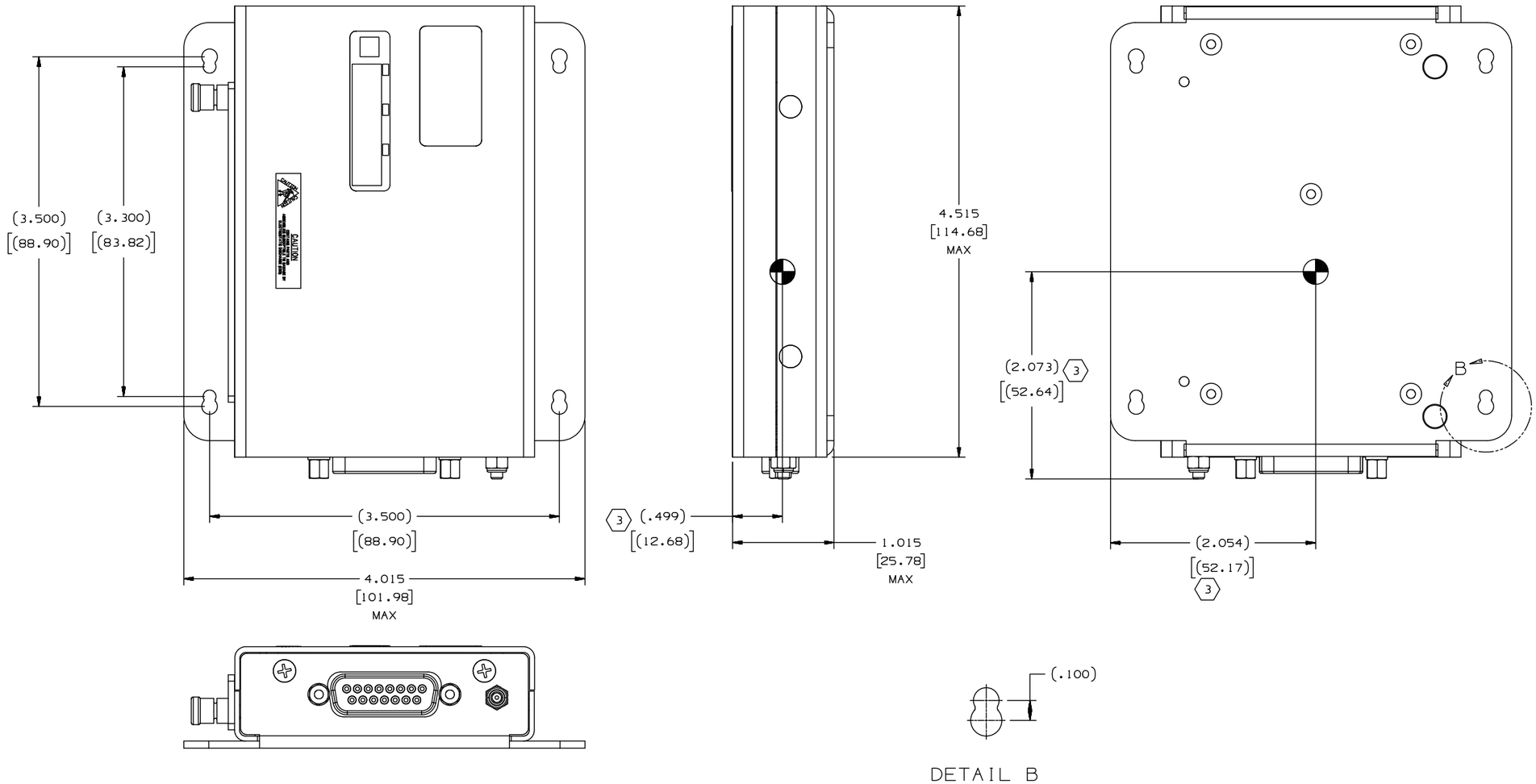
REFERENCE VIEW



TPU0287_01

Figure 2-2. ICM-4000 Installation (Sheet 1 of 2)

PRELIMINARY



TPU0287_02

Figure 2-2. ICM-4000 Installation (Sheet 2 of 2)

PRELIMINARY

2.6.3. Subscriber Identity Module Card Installation.

NOTE

The ICM-4000 Iridium CERTUS Subscriber Identity Module (SIM) card is installed when the unit is shipped. The SIM card is inactive at time of delivery. A Service Provider (SP) must be selected to have the SIM card activated.

Perform the following steps to install the SIM card:

a. Ensure the IRT-4400 system power is off.

b. Open the access cover on the left side of the ICM-4000.

c. Remove the SIM card and then install the replacement SIM card.

d. Close the access cover on the ICM.

e. Apply power to the IRT-4000 system.

2.6.4. HGA-4000 Location.

The HGA-4000 should be mounted on a level horizontal plane, such as on the top centerline of the aircraft fuselage or as close as practical to the centerline. The HGA-4000 antenna is designed to meet performance requirements from 8 to 90 degrees of elevation (measured from horizon). While positioning the antenna off-centerline could impact low elevation performance, the Iridium constellation of 66 satellites provides visibility to multiple satellites insuring connectivity.

Antenna locations must consider the impact an Iridium Certus terminal may have on GNSS receiver operation. The intended output power levels of the Certus antenna requires more than the typical 40 dB of port-to-port isolation when used with most TSO compliant GPS receivers and antennas. Isolation by antenna separation alone may be impractical and require an antenna and/or GPS receiver that is more tolerant of high energy SATCOM signals operating near the L1 GPS band. When multiple SATCOM terminals or L-Band transmitters are installed on the same aircraft, the total output power of all transmitters should also be taken into consideration. Since many MOPS standards exist for both GPS receivers and antennas, the installer should use the tables found below to determine the required Iridium Certus to GPS isolation for the equipment installed, or to be installed.

2.6.4.1. Iridium Certus to GPS Required Isolations

The required isolation between the HGA-4000 and the GPS antenna is the greatest of three considerations:

- Isolation to ensure that the interference mask of the GPS receiver and antenna combination is not exceeded at Iridium Certus transmit frequencies.
- Isolation to ensure the P1dB (in) compression point of the GPS antenna is not exceeded.
- Minimum isolation of 40 dB (5 ft, 1.5m).

Using published MOPS values for the various GNSS antenna and receivers, the required separation between antennas is 405 inches (33.7 ft) to as much as 1050 inches (87.5 ft) for some antenna types. These distances are not practical and are calculated using worst case values. Antenna and receiver manufactures can declare P1dB (EP1dB) and filter performance (EGAP) that exceed published MOPS requirements. The excess performance can then be used to reduce the required distance between antennas. For most GPS and antenna combinations, tables 1 and 2 can be used to determine required separation given the antenna's manufactures declared excess performance. For example, for a DO-228 compliant antenna, an antenna manufacture could declare that the P1dB performance of their antenna is 7.5 dB better than MOPS spec and the frequency rejection at 1618MHz is 19 dB better than the applicable MOPS. Using those values, Table 1 would indicate that the minimum separation should be 120 inches.

If at the aircraft level it is determined that excess antenna performance has been used to mitigate RF interference for other installations/modifications, the declared excess levels must be reduced by the amounts applied in previous installations before using the provided tables. The installer shall record in the certification documentation that excess performance was used and the levels or excess performance needed for the installation. For amended TCs or STCs this might include current SATCOM and GNSS certification information to define the configuration starting point for the modification. The installer should include:

1. A sheet into Aircraft Maintenance Record and/or Aircraft TCDS on 'GNSS Interference Assessment'.
2. Aircraft level configuration of applied or concurrent STCs which might impact GNSS interference, and if possible.
3. Other alterations which might impact GNSS interference.

Table 2-1. FOR GPS Receivers MOPS: DO-229, DO-253, DO-316, DO-368

	GPS ANTENNA TYPE			
HGA-4000	**DO-228**		**DO-301 & DO-368 GPS**	
Separation (in inches)	Required Minimum EGAP	Required Minimum EP1dB	Required Minimum EGAP	Required Minimum EP1dB
60	13.3	24.8	13.3	16.6
72	11.7	23.2	11.7	15.0
84	10.4	21.9	10.4	13.7
96	9.2	20.7	9.2	12.5
108	8.2	19.7	8.2	11.5
120	7.3	18.8	7.3	10.6
132	6.5	18.0	6.5	9.8
144	5.7	17.2	5.7	9.0
156	5.0	16.5	5.0	8.3
168	4.4	15.9	4.4	7.7
180	3.8	15.3	3.8	7.1
192	3.2	14.7	3.2	6.5
204	2.7	14.2	2.7	6.0
216	2.2	13.7	2.2	5.5
228	1.7	13.2	1.7	5.0
240	1.3	12.8	1.3	4.6
252	0.8	12.3	0.8	4.1
264	0.4	11.9	0.4	3.7
276	0.1	11.6	0.1	3.4
288	-0.3	11.2	-0.3	3.0
300	-0.7	10.8	-0.7	2.6
405	-3.3	8.2	-3.3	0.0
1050	-11.5	0.0	-11.5	-8.2

Table 2-2. FOR GPS Receivers MOPS: DO-208

	GPS ANTENNA TYPE			
HGA-4000	**DO-228**		**DO-301 & DO-368 GPS**	
Separation (in inches)	Required Minimum EGAP	Required Minimum EP1dB	Required Minimum EGAP	Required Minimum EP1dB
60	5.1	24.8	5.1	16.6
72	3.5	23.2	3.5	15.0
84	2.2	21.9	2.2	13.7
96	1.0	20.7	1.0	12.5
108	0.0	19.7	0.0	11.5
120	-0.9	18.8	-0.9	10.6
132		18.0		9.8
144		17.2		9.0
156		16.5		8.3
168		15.9		7.7
180		15.3		7.1
192		14.7		6.5
204		14.2		6.0
216		13.7		5.5
228		13.2		5.0
240		12.8		4.6
252		12.3		4.1
264		11.9		3.7
276		11.6		3.4
288		11.2		3.0
300		10.8		2.6
405		8.2		0.0
1050		0.0		-8.2

Table 2-3. Assumptions and Equations for Table 2-1 and Table 2-2

AIL_gps	-12	Allowable Interference Level at GPS
DO-228_P1dB	-12	
DO-301_P1dB	-3.8	
DO-368_P1dB	-3.8	GPS only GLONASS not allowed on same A/C
Ggps0	-1	GPS antenna gain at horizon
EGRP	0	Excess GPS performance
EIRP 0max	15	HGA-4000 EIRP at 0deg in GPS direction
Msaf	2	Safety margin
Mmu	0	Multiple units
DC	-4.4	Duty Factor
PAPR	7.1	H2 PAPR
EP1dBgps	0	Excess GPS P1dB
DO-208_AIL_gps	-3.8	DO-208 Allowable Interference at GPS
NOTE:		
EGAP = (EIRP 0max + 30) - AILgps - EGRP + Ggps@0 + Msaf + Mmu + DC – ISO EIRP		
EP1dBgps = (EIRP 0max + 30 + PAPR) - P1dBGPS - EP1dBGPS + Ggps@0 + Msaf + Mmu - ISO		

NOTE

1. Some GNSS antenna manufactures may state the actual P1dB and rejection at 1618MHz. The excess performance used in Tables 1 and 2 can be calculated by using the declared values less the MOPS required minimum values (Excess = Manufacture Declared – MOPS Required).

2. Only antenna manufactures can declare the excess performance for their design over all environmental conditions.

3. Tables 1 and 2 are calculated using the formulas and the approach for using excess performance defined in RTCA DO-262F. Should the installer desire to use other approaches (such as excess GPS receiver performance), DO-262F section F.3.1.8 should be consulted.

4. The declared maximum EIRP of the HGA-4000 at 0 degrees elevation (EIRP 0max) = 15 dBW.

2.6.5. HGA-4000 Installation.

See Figure 2-4 and perform the following steps to install the HGA-4000.

a. Place a template on the fore-and-aft centerline at the desired location. Drill the mounting holes and the correct diameter hole for the transmission line cable in the fuselage skin.

b. Install a reinforcing doubler of sufficient thickness to reinforce the aircraft skin.

c. Install the antenna on fuselage, making sure that the mounting bolts are tightened firmly against the reinforcing doubler, and that the mast is drawn tight against the gasket.

d. Route the transmission line coax cable to the receiver, securing the cable firmly along its entire length at intervals of approximately 2 feet.

NOTE

Antenna cable length from IRT-4000 to HGA-4000 must have a total loss that is less than 10 dB at 1.6 GHz and the DC resistance less than 0.6 ohms. The system will be calibrated upon power on as part of the IRT-4000 Power On BIT to account for variation of cable types and lengths.

e. Mount the IRT-4000 as close to the antenna as practical.

2.6.5.1. Antenna Separation Considerations

As a general guideline, the Iridium antenna should be mounted on top of the fuselage, as close to the centerline of the aircraft as possible. Exceeding an offset ± 2° may result in a performance degradation. The antenna should be mounted in a location that would provide at least 8° horizontal view of the horizon and minimizing blockage from the vertical stabilizer or other obstructions. See Figure 2-3. Refer to Figure 2-4 for additional information.

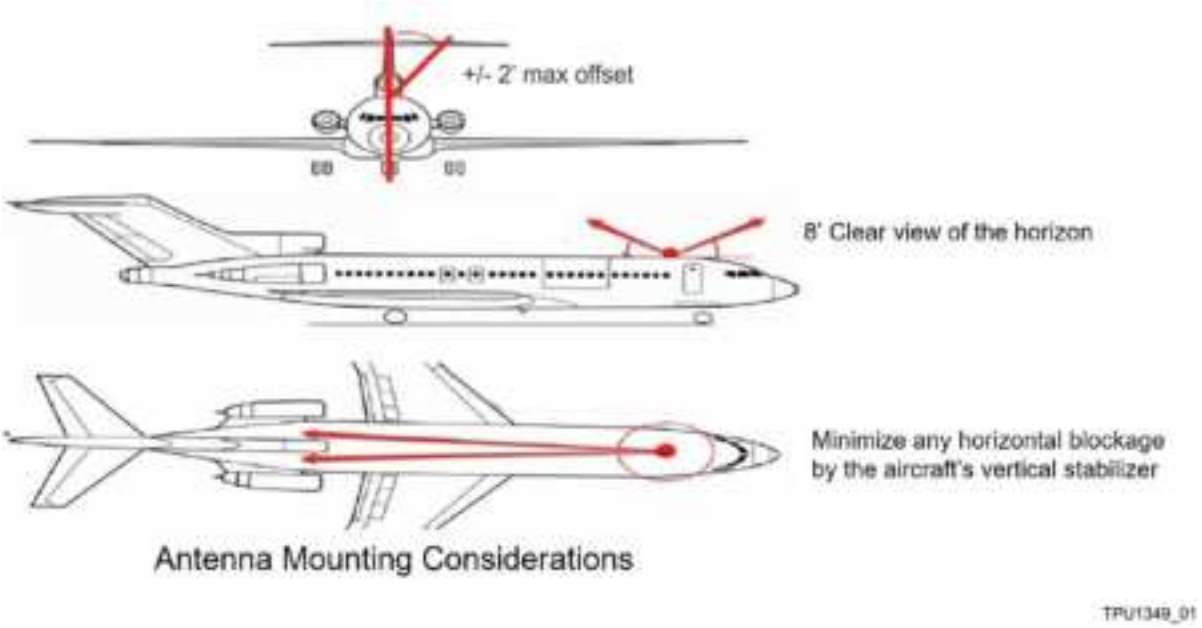


Figure 2-3. Antenna Location

NOTES:

1. THIS DRAWING DEFINES INSTALLATION REQUIREMENTS FOR EQUIPMENT TYPE HGA-4000 COMPANY PART NUMBER 822-3586-001 AND -400.

2. FINISH:
   ANTENNA TOP FINISH: POLYURETHANE PAINT IN ACCORDANCE WITH COMPANY PART NUMBER 580-5560-008.
   ANTENNA TOP COLOR: WHITE, AMS-STD-595 COLOR NUMBER 17925.
   SILKSCREEN COLOR: BLACK
   BASE PLATE MATERIAL: ALUMINUM 6061-T651 IN ACCORDANCE WITH COMPANY PART NUMBER 820-6061-040.
   BASE PLATE FINISH: CHEMICAL FILM IN ACCORDANCE WITH COMPANY PART NUMBER 580-0036-001. (MEETS MIL-DTL-5541, CLASS 3)
   FASTENER SLEEVE MATERIAL: ALUMINUM 6061-T6 IN ACCORDANCE WITH COMPANY PART NUMBER. 820-6061-030.
   FASTENER SLEEVE FINISH: CHEMICAL FILM IN ACCORDANCE WITH COMPANY PART NUMBER 580-0036-001. (MEETS MIL-DTL-5541, CLASS 3)

3. INFORMATION ENCLOSED IN PARENTHESES IS FOR REFERENCE ONLY.

(4) SYMBOL AND ASSOCIATED DIMENSIONS IDENTIFY THE UNIT CENTER OF GRAVITY.

5. INPUT VOLTAGE: 48 VDC.
   MAXIMUM POWER CONSUMPTION: 200W PEAK
   POWER DISSIPATION:
   IDLE: 5W
   MAXIMUM: 60W.

6. UNIT WEIGHT: 3.6 LB [1.63 KG] MAXIMUM, (3.4 LB) [(1.54 KG)] NOMINAL.

7. THIS DRAWING SHALL BE INTERPRETED IN ACCORDANCE WITH ASME Y14.100-2017.

8. UNLESS OTHERWISE SPECIFIED, DIMENSIONS AND TOLERANCES ARE EXPRESSED IN INCHES [MILLIMETERS] AND SHALL BE INTERPRETED IN ACCORDANCE WITH ASME Y14.5-2009.

(9) FOR UNIT CONNECTOR INFORMATION, REFER TO RELATED CHART ON SHEET 1.
MATING CONNECTOR INFORMATION GIVEN FOR REFERENCE ONLY.

(10) DC RESISTANCE SHALL BE 2.5 MILLI-OHMS MAXIMUM BETWEEN CONNECTOR SHELL AND AIRCRAFT STRUCTURE.

(10A) THE BASEPLATE OR FASTENER SLEEVE MAY BE USED AS A BONDING SURFACE.

11. REFER TO THE INSTALLATION MANUAL 523-0833709 OR 523-0834153 FOR ENVIRONMENTAL QUALIFICATION DETAILS.

(12) THE NAME PLATE RECORDS THE COLLINS PART NUMBER AND WEIGHT.

(13) THE MOD PLATE RECORDS THE SERIAL NUMBER, MANUFACTURER, DATE OF MANUFACTURE AND MODIFICATION STATUS.

14. REMOVED.

15. CABLE LOSS, CABLE DC RESISTANCE AND GPS SEPARATION REQUIREMENTS SHALL BE IN ACCORDANCE WITH INSTALLATION MANUAL 523-0833709 OR 523-0834153.

16. ANTENNAS MAXIMUM EIRP AT 0 DEGREE ELEVATION SHALL BE NO MORE THAN 16 dBW.
    FREQUENCY OF OPERATION: 1618 - 1626.5 MHz

17. DUAL DIMENSIONS IN BRACKETS ARE FOR REFERENCE ONLY.

18. SILICON RUBBER PLUGS (COLLINS PART NUMBER 653-4463-580) WILL BE PROVIDED WITH THE HGA-4000. OVER THE AIRCRAFT MOUNTING HARDWARE, PLUGS TO BE INSTALLED BELOW FLUSH WITH ANTENNA SURFACE. ADHESIVE MAY BE USED INSTEAD OF RUBBER PLUGS.

19. IF INSTALLED WITH AN ADAPTER PLATE, THE ADAPTER PLATE SHALL HAVE A MAXIMUM THICKNESS OF .200 [5.08].

CONNECTOR INFORMATION (9)			
REF DES	CONNECTOR PART NUMBERS	CONNECTOR TYPE	MATING CONNECTOR PART NUMBERS
J1	357-0421-010	TNC, FEMALE	AMPHENOL PN 122372

TPU0289_01

Figure 2-4. HGA-4000 Installation (Sheet 1 of 3)

PRELIMINARY

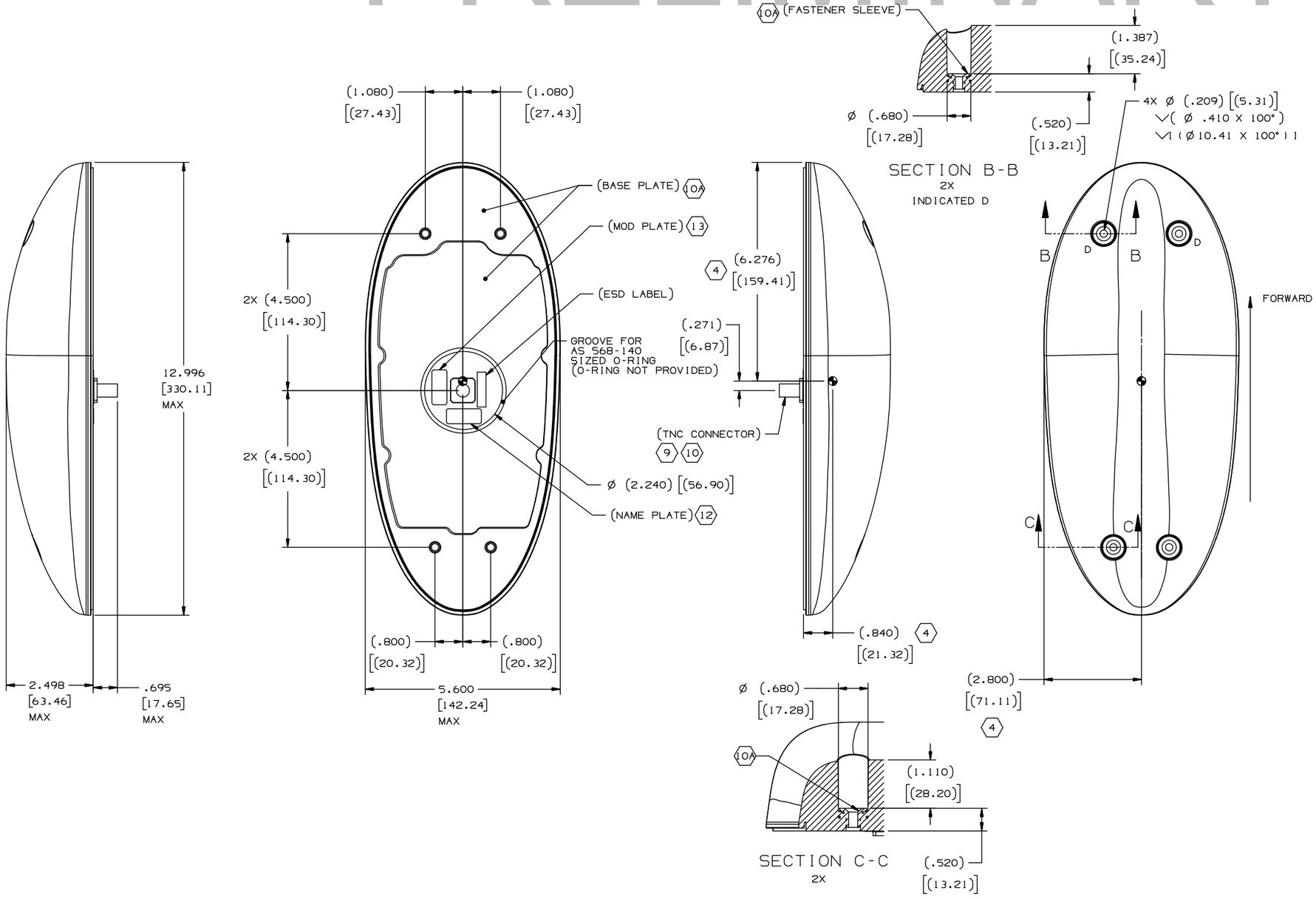
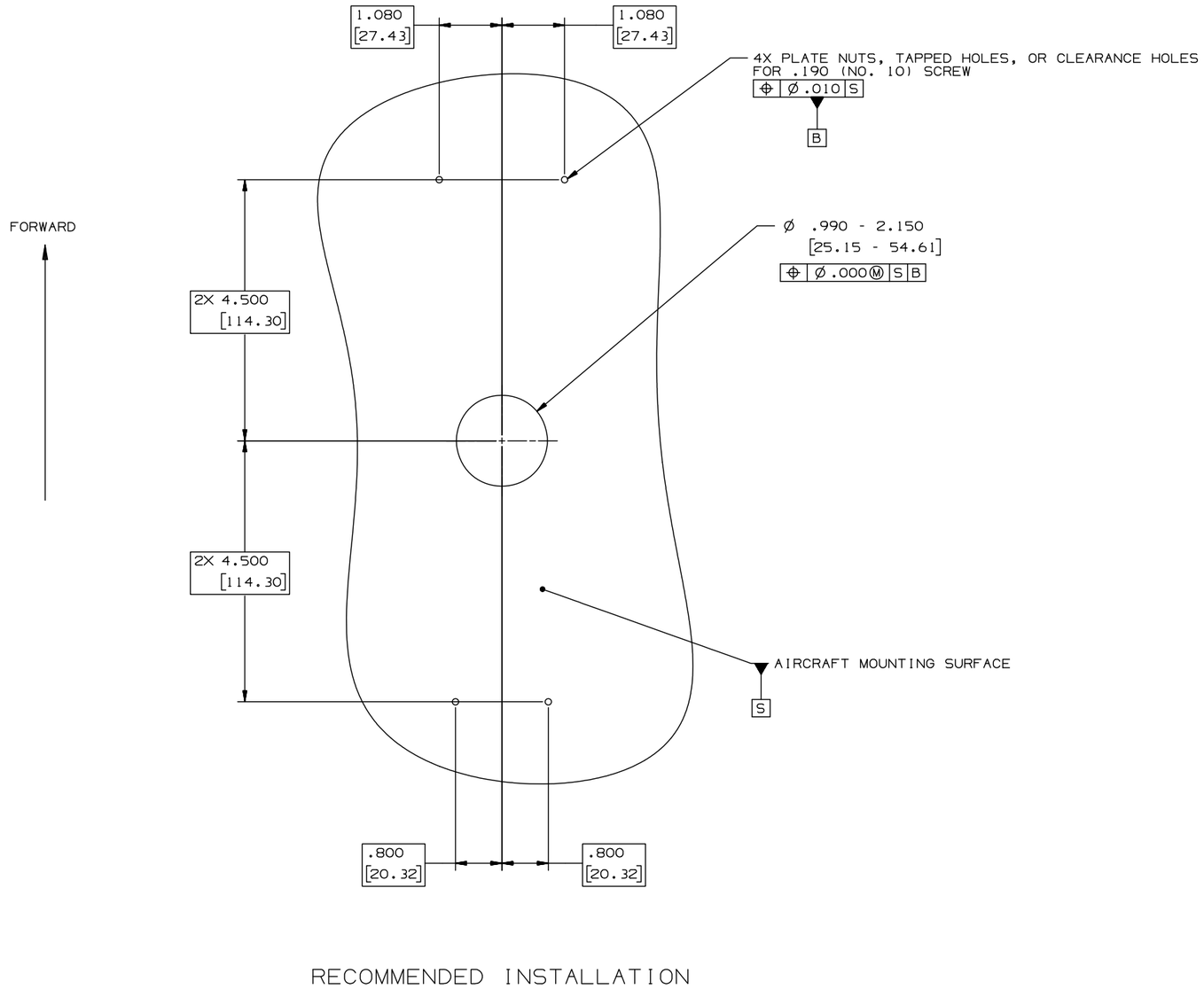


Figure 2-4. HGA-4000 Installation (Sheet 2 of 3)

PRELIMINARY



RECOMMENDED INSTALLATION

TPU0289_03

Figure 2-4. HGA-4000 Installation (Sheet 3 of 3)

PRELIMINARY

2.7. TESTING.

Refer to the Maintenance Chapter 5, for test procedures for Iridium NEXT System.

CHAPTER 3
OPERATION

NOTE: Chapter 3 - Operation is T.B.D..

3.1. GENERAL.

Whether a cabin phone is needed, or where the default phone will be placed, is at the discretion of the customer prior to installation.

Cabin voice is provided via SIP/VoIP. Station interfaces are also compatible with standard Plain Old Telephone System (POTS) telephone handsets containing standard Tip and Ring signals. The 2-Wire phone is a back-up to the VoIP interfaces. These phone handsets are typically Dual Tone Multi-Frequency (DTMF) protocol-based.

Standard functional capabilities for a station interface include making outgoing calls, receiving incoming calls, tone generation (e.g., dial tones, busy signals, etc.), off-hook detection, and ring signaling (tones sounded upon incoming calls). Configurable functional capabilities for a station interface include: Making Priority Calls, Microphone (MIC) Audio Adjustment, Ear Audio Adjustment, and Noise Reduction.

3.2. CABIN VOICE.

The Iridium Receiver Transmitter NEXT (IRT NX) SATCOM system will provide 2-wire audio circuits for the cabin. Up to three active voice calls between the aircraft to the ground will be supported. Voice functionality will include:

- Call Priority
- Call Routing
- Call Control.

3.3. MAKING A CALL (POTS PHONES ONLY).

The IRT-4000 permits use of both the standard North American Dialing Plan (NADP) and the International (European) Dialing Plan (IDP), as the device automatically converts the dialing scheme to that required by the Iridium communication network. To make an outbound call from a cabin phone, follow the steps below:

1. Pick up the cabin phone and listen for a dial tone.
2. If a dial-tone is heard, start dialing the desired number. A DTMF tone will be emitted for every number pressed. After dialing the number, the system will generate a ring-tone indicating the attempt to connect to the number dialed.
3. Wait for the ring back signal or busy signal, if the extension is already in use. If the line is answered, the call is connected.
4. Hang up the phone when finished.

NOTE

If no dial-tone is heard when the Cabin phone is picked-up, the system is not operational.

If a number is mis-dialed, the IRT-4000 will pass reorder tones indicating the user needs to hang up and try the call again.

3.3.1. Call Tones.

The IRT-4000 produces the standard set of telephone tones as described below:

Busy	Signal indicating the called number is already engaged.
Ring Back	Signal heard after dialing a number but before the called party answers the telephone.
Reorder	Fast busy signal produced when an improper or unauthorized number is dialed.
Dial Tone	Standard tone heard when picking up the handset of any telephone.

3.3.2. Toll-Free Numbers.

The IRT allows the user to dial toll-free numbers with the below listed prefixes: 1-800, 1-888, 1-887, 1-866, and 1-877.

3.4. NOTIFICATION OF INCOMING CALL.

Upon receiving an incoming call signal, the cabin phone will ring, notifying the answering party of a call. How the call is routed varies upon the location from which the call is placed:

- For Station-to-Station calls, the incoming call will ring the selected extension for the cabin handset.
- For Ground To Air (GTA) calls, incoming calls are routed by priority. Priority 4 calls, designated as Public Correspondence, are the only calls routed directly to the cabin.

3.5. TRANSFERRING A CALL.

The IRT-4000 has the capability to transfer calls, if Class of Service (COS) and Station-to-Station COS are enabled via the Owners Requirement Table (ORT) Tool. The method of call transferring is determined by the telephone manufacturer. Refer to the manufacturer's user guide for instructions on transferring calls with the cabin phone installed on the aircraft.

3.6. RECEIVING CALLS.

When a call comes from either the ground to the aircraft or from one aircraft to another, the IRT will ring the default cabin telephone established during installation on the aircraft. To answer the call, simply pick up the handset.

NOTE

If all transceivers are in use, the caller will hear a busy signal.

3.6.1. Default Telephone.

When the IRT-4000 is initially installed on the aircraft, an extension is assigned as the default telephone. The default is always Ext. 11 unless changed during initial configuration or subsequent reconfiguration. The extension circuits are assigned two-digit numbers to identify the stations. The numbering is as follows:

- 2-wire ports 11-12

3.7. DIALING PLANS AND CODES.

The IRT-4000 is capable of supporting many types of outbound dialing. Typically, two main formats are used: the North American standard and the International standard. The IRT-4000 automatically adds, strips, and changes digits to accommodate the communications network through which the call is being processed. The caller dials a single format and does not need to know the various dialing formats required by the various communications services.

NOTE

Refer to Paragraph 3.8 for a list of country codes for international dialing.

3.7.1. North American Dialing Plan.

Refer to Table 3-1 for North American Dialing Plan.

Table 3-1. North American Dialing Plan.

AIR-TO-GROUND (ATG)	
Calls to North America	1 + Area Code + Number. For example, to call Collins Aerospace: 1-319-295-0594
Calls to other international destinations	011 + Country Code + City Code + Number. For example, to call the U.K.: 011-44-1703-123456
AIRCRAFT TO AIRCRAFT	
Air to Air	011 + 8816 + 8-digit transceiver telephone number

3.7.2. International Dialing Plan.

Refer to Table 3-2 for International Dialing Plan.

Table 3-2. International Dialing Plan.

AIR-TO-GROUND (ATG)	
Calls to North America	00 + Country Code + Area Code + Number
Calls to other international destinations	00 + Country Code + City Code + Number For example, to call the U.K.: 00 + 44 - 1703 - 123456

3.7.3. Making Calls to Iridium Phones.

Refer to Table 3-3 for Making Calls to Iridium Phones.

Table 3-3. Making Calls to Iridium Phones.

CALLS-TO-IRIDIUM PHONE	
Air-to-Iridium	011 + 8816 + 8-digit transceiver telephone number
Ground-to-Iridium	011 + 8816 + 8-digit transceiver telephone number

3.8. INTERNATIONAL COUNTRY CODES.

Most international country codes are listed in Table 3-4 and are in alphabetical order.

Table 3-4. Country Codes

Country	Code	Country	Code	Country	Code
Afghanistan	93	Georgia	995	Niue	683
Albania	355	Germany	49	Norfolk Island	672
Algeria	213	Ghana	233	North Korea	850
American Samoa	1-684	Gibraltar	350	Norway	47
Andorra	376	Greece	30	Oman	968
Angola	244	Greenland	299	Pakistan	92
Anguilla	1-264	Grenada, Carriacou	1-473	Palau	680
Antarctica	672	Grenadine Islands	784	Panama	507
Antigua, Barbuda	1-268	Guadeloupe	590	Papua New Guinea	675
Argentina	54	Guam	1-671	Paraguay	595
Armenia	374	Guantana	53	Peru	51
Aruba	297	Guatemala	502	Philippines	63
Ascension	247	Guiana	594	Poland	48
Australia	61	Guinea	224	Portugal	351
Austria	43	Guinea-Bissau	245	Principe	239
Azerbaijan	994	Guyana	592	Puerto Rico	1-787 1-939
Bahamas	1-242	Haiti	509		
Bahrain	973	Honduras	504	Qatar	974
Bangladesh	880	Hong Kong	852	Reunion Island	262
Barbados	1-246	Hungary	36	Romania	40
Belarus	375	Iceland	354	Russia	7
Belgium	32	India	91	Rwanda	250
Belize	501	Indonesia	62	Saipan	670
Benin	229	Iran	98	San Marino	378
Bermuda	1-441	Iraq	964	Sao Tome	239
Bhutan	975	Ireland	353	Saudi Arabia	966
Bolivia	591	Israel	972	Senegal Republic	221
Bosnia, Herzegovina	387	Italy	39	Serbia, Republic of	381
Botswana	267	Ivory Coast	225	Seychelles	248
Brazil	55	Jamaica	1-876	Sierra Leone	232
British Virgin Islands	1-284	Japan	81	Singapore	65
Brunei	673	Jerusalem	972-2	Sint Maarten	1-721
Bulgaria	359	Jordan	962	Slovakia	421

Table 3-4. Country Codes - Continued

Country	Code	Country	Code	Country	Code
Burkina Faso	226	Kazakhstan	7	Slovenia	386
Burundi	257	Kenya	254	Solomon Islands	677
Cambodia	855	Kiribati	686	Somalia	252
Cameroon	237	Kuwait	965	South Africa	27
Canada	1	Kyrgyzstan	996	South Korea	82
Cape Verde Islands	238	Laos	856	Spain	34
Cayman Islands	1-345	Latvia	371	Sri Lanka	94
Central African Republic	236	Lebanon	961	St. Kitts	1-869
Chad	235	Lesotho	266	St. Helena	290
Chatham Island (NZ)	64	Liberia	231	St. Lucia	1-758
Chile	56	Libya	218	St. Pierre et Miquelon	508
China	86	Liechtenstein	423	St. Vincent	784
Christmas Island	61	Lithuania	370	Sudan	249
Cocos (Keeling) Island	891	Luxembourg	352	Suriname	597
Colombia	57	Macao	853	Swaziland	268
Comoros	269	Macedonia	389	Sweden	46
Congo (Brazzaville)	242	Madagascar	261	Switzerland	41
Congo to Congo (Kinshasa)	243	Malawi	265	Syria	963
Cook Islands	682	Malaysia	60	Taiwan	886
Costa Rica	506	Maldives	960	Tajikistan	992
Croatia	385	Mali	223	Tanzania	255
Cuba	53	Malta	356	Thailand	66
Curacao	399	Mariana Islands	1-670	Togo	228
Cyprus	357	Marshall Islands	692	Tokelau	690
Czech Republic	420	Martinique	596	Tonga	676
Denmark	45	Mauritania	222	Trinidad and Tobago	1-868
Diego Garcia	246	Mauritius	230	Tunisia	216
Djibouti	253	Mayotte	262	Turkey	90
Dominica	1-767	Mexico	52	Turkmenistan	993
Dominican Republic	1-809 1-849 1-829	Micronesia, Federal States	691	Turks & Caicos Islands	1-649
		Midway Islands	808	Tuvalu	688
		Miquelon	508	Uganda	256
Easter Island	56-32	Moldova	373	Ukraine	380
East Timor	670	Monaco	377	United Arab Emirates	971
Ecuador	593	Mongolia	976	United Kingdom	44

Table 3-4. Country Codes - Continued

Country	Code	Country	Code	Country	Code
Egypt	20	Montserrat	1-664	United States	1
El Salvador	503	Montenegro	382	Uruguay	598
Equatorial Guinea	240	Morocco	212	U.S. Virgin Islands	1-340
Eritrea	291	Mozambique	258	Uzbekistan	998
Estonia	372	Myanmar	95	Vanuatu	678
Ethiopia	251	Namibia	264	Vatican City	379
Falkland Islands	500	Nauru	674	Venezuela	58
Faroe Islands	298	Nepal	977	Vietnam	84
Fiji	679	Netherlands	31	Wake Island	808
Finland	358	Neth. Antilles	599	Wallis & Futuna Islands	681
France	33	Nevis	1-869	Western Samoa	685
French Antilles	596	New Caledonia	687	Yemen	967
French Guyana	594	New Zealand	64	Zaire	243
French Polynesia	689	Nicaragua	505	Zambia	260
FYROM (Macedonia)	389	Niger	227	Zanzibar	259
Gabon	241	Nigeria	234	Zimbabwe	263
Gambia	220				

CHAPTER 4
THEORY OF OPERATION

4.1. THEORY OF OPERATION.

NOTE

Chapter 4 - Theory of Operation to be updated for Iridium Certus.

The following paragraphs provide a functional description of the Iridium system.

4.1.1. System Theory.

The Iridium satellite network has a constellation of 66 satellites in low-earth orbit, terrestrial gateways and Iridium Subscriber (IS). The satellites are placed in an approximate polar orbit at an altitude of 780 km. There are six polar planes populated with 11 satellites per orbit constituting the 66 satellite constellation. The near polar orbits of the Iridium constellation provide truly real-time and global coverage from pole-to-pole.

4.1.1.1. The Iridium SATCOM system is designed to operate in the band of 1616 to 1626.5 MHz although the exact frequencies used depend on the local regulating authorities and issued licenses in any particular region. Each satellite projects 48 beams on the surface of the earth, which may be viewed as providing coverage cells on the ground similar to terrestrial systems. Each beam is approximately 600 km in diameter. The 66 satellite constellation has the potential to support a total of 3,168 spot beams; however, as the satellite orbits converge at the poles, overlapping beams are shut down. The satellite footprint is ~4,700 km in diameter. Under each footprint, a satellite is power limited to ~1,100 simultaneous circuits.

4.1.1.2. The Iridium network uses a Time Domain Duplex (TDD) method and transmits and receives in an allotted time window within the frame structure. Since the system is TDD, the IS transmit and receive in the same frequency band. The access technology is a Frequency Division Multiple Access/Time Division Multiple Access (FDMA/TDMA) method whereby an IS is assigned a channel composed of a frequency and time slot in any particular beam. Channel assignments may be changed across cell/beam boundaries and is controlled by the satellite. The system will provide an average link margin of 13.1 dB.

4.1.1.3. The Iridium network makes calculations of the geo-location of an IS each time a call is placed. The technique employed to determine the geo-location of an IS is based on measurements of the IS and satellite propagation delay and Doppler frequency shift. These measurements are used to estimate cosines of spherical angles that identify the IS location relative to the satellite by the gateway.

4.1.1.4. The Iridium network can locate an IS to within 10 km only about 78% of the time. The position of the IS in the radial dimension relative to the satellite can almost always be determined to within 10 km with just one measurement. Errors in the azimuth dimension relative to the satellite are largest along the satellite ground path and tend to increase with distance from the satellite. Geo-location errors in the east-west dimension are sometimes more than 100 times greater than in the north-south dimension.

4.1.2. Terrestrial Segment.

The Terrestrial Segment is comprised of the System Control Segment and Iridium Gateways that connect into the terrestrial telephone/data network. The System Control Segment is the central management component for the Iridium system. It provides global operational support and control services for the satellite constellation, delivers satellite-tracking data to the Iridium Gateways, and performs the termination control function of messaging services. The primary linkage between the System Control Segment, the satellites, and the gateways is via control feeder links and inter-satellite cross-links throughout the satellite constellation.

4.1.2.1. Gateway stations, also called Ground Earth Stations, provide call processing and control activities such as subscriber validation and access control for all calls placed in a Gateway territory. The Gateway station also provides interconnection between terrestrial Public Switched Telephone Networks (PSTN) and the Iridium System by connecting calls made through the Iridium System to and from the PSTN. Gateways communicate with the space segment via Gateway link antennas on the satellites and ground-based antennas at each terrestrial Gateway facility. Each Gateway includes a subscriber database used in call processing activities such as subscriber validation. Each Gateway also keeps a record of all traffic in its territory, controls all user information pertaining to its registered users, and generates call detail records used in billing. Although there are multiple Gateways, a user is registered to a single Gateway. The satellite constellation provides connectivity between users, from a user to their Gateway, and

between Gateways. Within the Iridium network architecture, the satellites are cross-linked allowing IS to IS communication independent of the Gateway after the call connection is established. The U.S. government owns and operates a Gateway in Hawaii.

4.1.2.2. The Iridium space segment utilizes a constellation of 66 operational satellites in low-Earth orbit. The satellites are located in six distinct planes (see Figure 4-1) in near-polar orbit at an altitude of approximately 485 miles and circle the Earth approximately once every 100 minutes, travelling at a rate of approximately 16,830 mph. The 11 mission satellites, which are evenly spaced within each plane, perform as nodes in the communication network. The six co-rotating planes are spaced 31.6 degrees apart in longitude (approximately 2,180 miles at the equator), resulting in a spacing of 22 degrees (approximately 1,518 miles at the equator) between Plane 6 and the counter rotating portion of Plane 1. Satellite positions in adjacent odd and even numbered planes are offset from each other by one-half of the satellite spacing. This constellation ensures that every region on the globe is covered by at least one satellite at all times. There are ten additional satellites functioning as in-orbit spares ready to replace any unserviceable satellite in case of a failure.

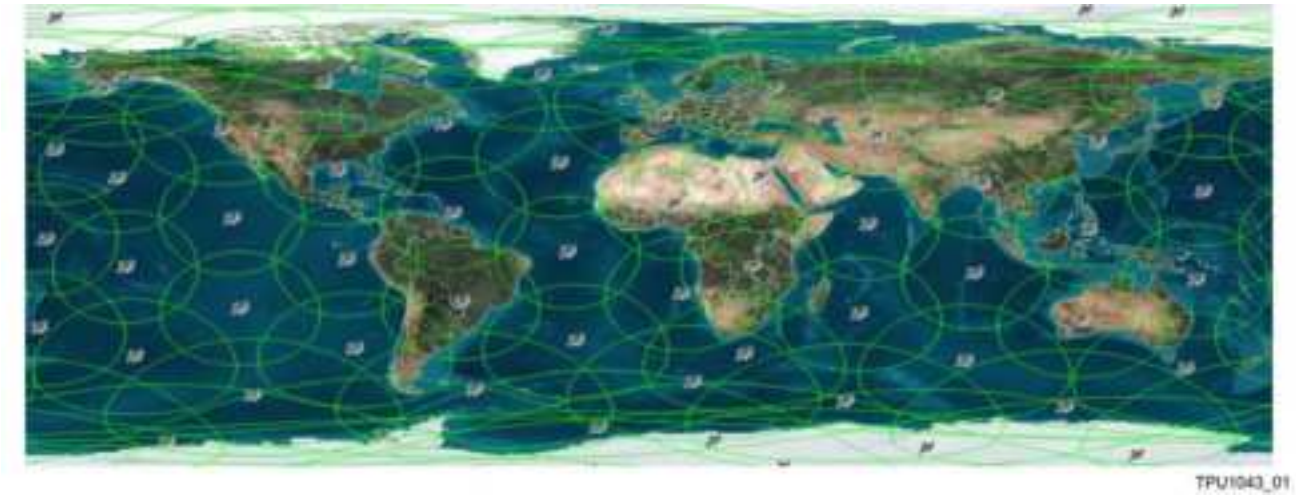


Figure 4-1. Iridium Satellite Network

4.1.2.3. Each satellite has four cross-link antennas to allow it to communicate with and route traffic to the two satellites that are fore and aft of it in the same orbital plane, as well as neighboring satellites in the adjacent co-rotating orbital planes. These inter-satellite links operate at approximately 23 GHz. See Figure 4-2.

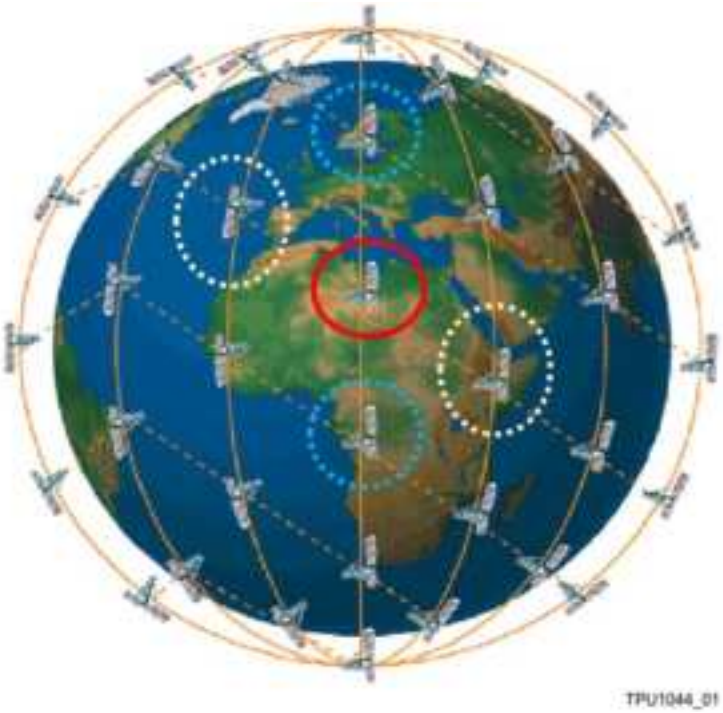


Figure 4-2. Iridium Satellite Cross-Link

4.1.3. Space Segment.

Each satellite communicates with the Aircraft Earth Station (AES) through tightly focused antenna beams that form a continuous pattern on the earth. An AES is an aircraft including all avionics on board necessary for implementing satellite communications. These beams, known as spot beams, may be viewed as providing coverage cells on the ground similar to terrestrial systems. Under each footprint, a satellite is power limited to approximately 1,100 simultaneous circuits. Each satellite uses three L-band phased-array antennas for the user links (within the 1616-1626.5 MHz band), each contains an array of transmit/receive modules. The phased-array antennas of each satellite create 48 spot beams (each approximately 373 miles in diameter) arranged in the configuration (see Figure 4-3) covering a circular area with a diameter of approximately 2,920 miles. The 66 satellite constellation has the potential to support a total of 3,168 spot beams. A consistent sharing of load among satellites is maintained at high latitudes by selectively deactivating outer-ring spot beams in each satellite. This beam control also results in reduced inter-satellite interference and increased availability in high latitudes due to overlapping coverage.

4.1.3.1. The Iridium system architecture incorporates certain characteristics, such as call hand-off, which allows the Space Segment communications link with subscriber equipment to be transferred from beam to beam and from satellite to satellite as such satellites move over the area where the subscriber is located. This transfer is transparent to the user, even during real-time communications.

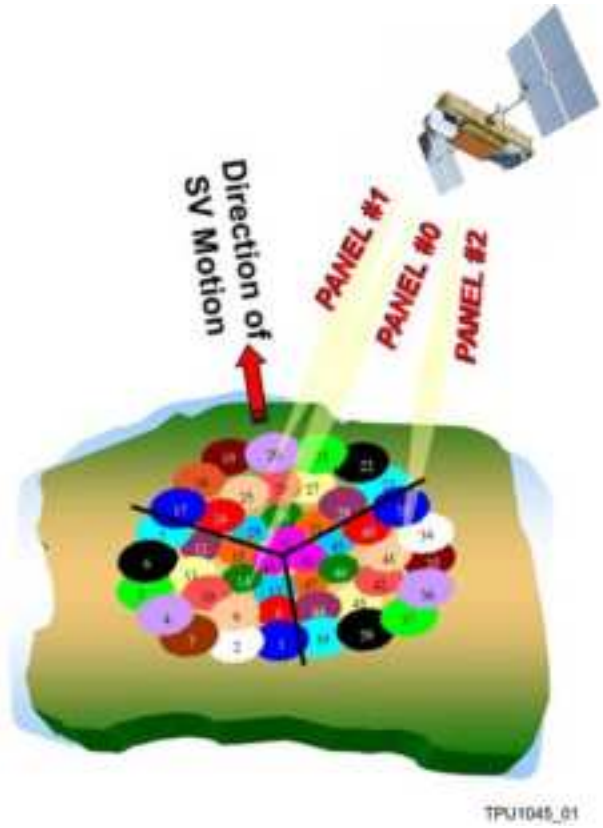


Figure 4-3. Spot Beams

4.1.4. Hand Off.

The spot beams move rapidly with respect to ISs and other satellites. Hand off is the process of automatically transferring a call in progress from one beam to another (or sometimes within a beam) to avoid adverse effects of either user or satellite movement. This is required in three situations. First, an IS must be handed off between satellites as they move relative to the IS (Inter-satellite). Second, an IS must be handed off between beams on a satellite as beam patterns move relative to the IS (Intra- satellite). Last, an IS must be handed off to another channel within a beam for frequency management and to reduce interference (Intra-beam). Although the Iridium system may force a hand off, hand off processing is primarily IS initiated. As a satellite moves away (for example, moves over the horizon) and a new satellite approaches (for example, comes into view over the horizon), an IS must transfer from the current satellite (the losing satellite) to the new satellite (the gaining satellite). This Inter-satellite hand off, on the average, occurs approximately every 5 minutes during a telephone call. It may be initiated as frequently as 5 seconds or as long as 10 minutes, depending on link geometry.

4.1.4.1. As satellites move from the equator to a pole, the actual distance between adjacent satellites decreases to a few kilometers and then increases to several thousand kilometers as the satellites again approach the equator. To avoid radio interference, beams near the edges of a satellite coverage field are turned off as the satellite approaches a pole and then turned on again as it approaches the equator. Additionally, the same radio channels are never available in adjacent beams on a satellite or between nearby satellites. Thus, as the satellite and its beams pass by, an IS must frequently transition to a new beam. This Intra-satellite hand off occurs approximately every 50 seconds during a call.

4.1.4.2. As the inter-satellite geometry changes, radio channels must be reallocated among the beams to avoid interference. This process can cause an IS to be handed off to a different channel in the same beam. This is called Intra-beam hand off. An IS can also request an Intra-beam hand off to reduce interference. If the Iridium system detects an allocation change coming up where it will not have enough channels to support the number of current users, the satellite will ask for volunteers to hand off into other beams so calls will not have to be dropped when the resource change takes place. Hand offs made under these conditions are called Volunteer hand offs. Volunteer hand offs may result in one of two situations requiring hand off, namely Inter-satellite or Intra-satellite, but are initiated by the IS (at the request of the Iridium system) rather than by the Iridium system itself. These hand offs are handled automatically and are transparent to the user.

CHAPTER 5
MAINTENANCE

5.1. GENERAL.

This chapter provides flight line maintenance instructions for an IRT-4400 system.

5.2. SOFTWARE COMPONENTS.

No software component installations are required. The IRT-4000 and ICM-4000 have default software and configuration pre-loaded. Additionally, User ORT and Secure ORT, which are capable of modification, are loadable via PDL or On-Board Networking system. Refer to the IRT-4000 Iridium NEXT System ORT Configuration User's Guide 523-0833711 for additional information.

5.3. ORT CONFIGURATION FILES.

The configuration file for User ORT and Secure ORT settings is created by using the IRT-4000 Iridium NEXT SATCOM System ORT Configuration User Guide (UG) . Within the UG is the User Manual for the Owner Requirements Table (ORT) Tool and Directory Editor (hereafter referred to as the ORT Tool). This section details how to install and use the ORT Tool to create phone directories, and modify and upload configuration settings to the IRT-4X00.

5.3.1. The IRT-4000 Configuration Files.

The configuration file contains the IRT-4000 unit default configuration parameters. During normal operations, the system reads the product configuration from the ICM when the ICM is detected by the system during system power-up. If the ICM is not detected, or if the product configuration data stored in the ICM is missing or corrupted, the built-in product configuration data will be used instead.

5.4. ORT PARAMETERS.

ORT parameters are loaded to the IRT-4000/ICM-4000 via the ARINC 615 Ethernet connection as illustrated in Figure 1-2 IRT-4000 System Interfaces. The ORT Tool may be run on any personal computer that meets the necessary requirements.

NOTE

An example ATS phone directory file is included with the ORT Tool. This phonebook is not updated or maintained by Collins Aerospace. Contact Iridium directly to obtain a complete, updated ATS directory.

5.5. ETHERNET DATA LOAD.

The IRT NX SATCOM system supports data loading via an Ethernet-based per ARINC 615A-2. The physical interfaces for data load include an IRT-4000 front panel Ethernet maintenance port (refer to Figure 5-1) and an IRT-4000 rear interconnect Ethernet 3 port. The loadable software parts that are loaded onto the IRT NX SATCOM system are formatted per ARINC 665 industry specification. Loadable software parts include:

- Operational Software
- Antenna Software
- User ORT Configuration
- Secure ORT Configuration
- Certificate Container.

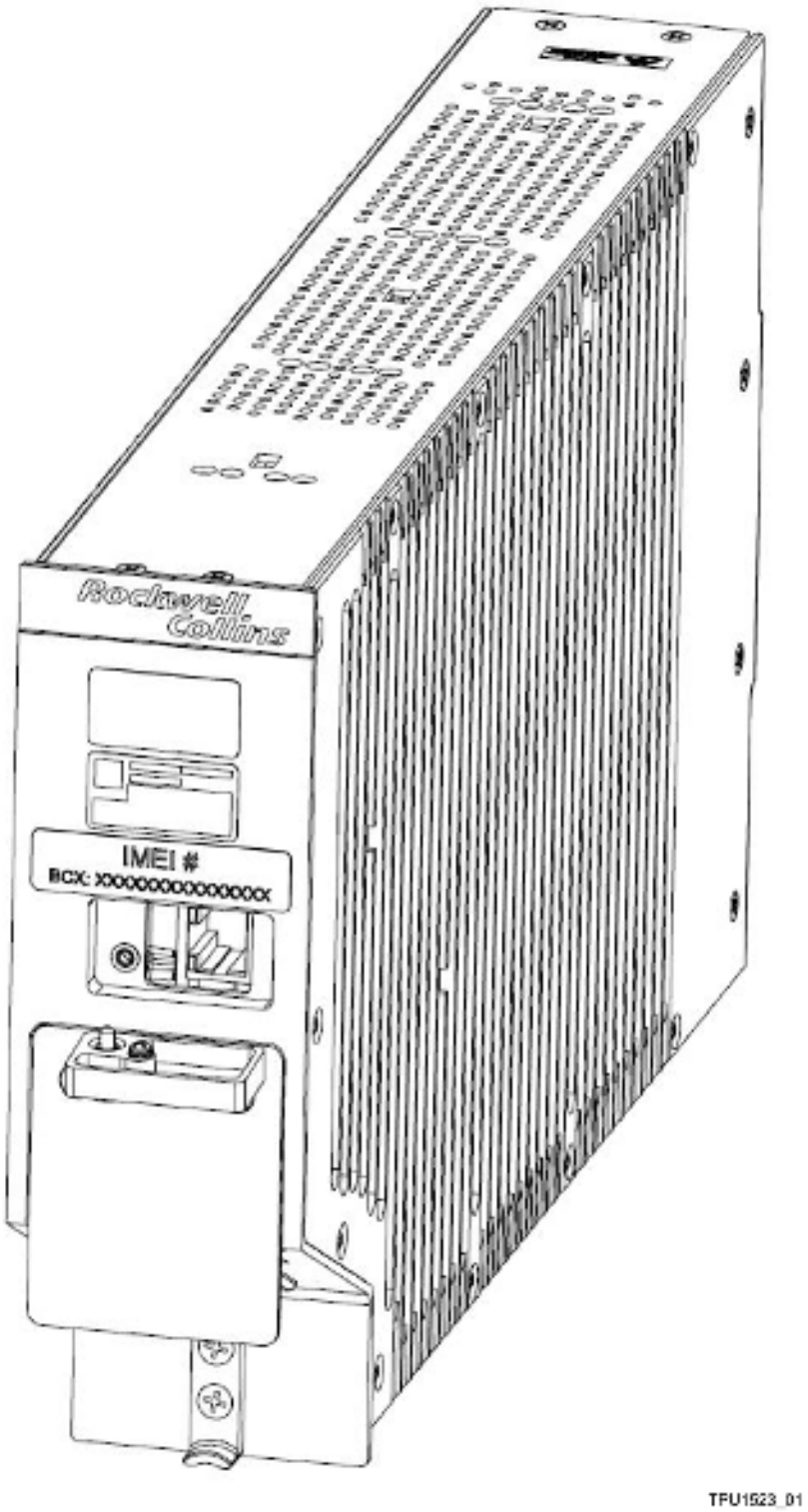


Figure 5-1. IRT-4000 Ethernet Maintenance Port

5.5.1. Ethernet Dataload Operations.

The IRT NX SATCOM system supports the following ARINC 615A-2 data load operations:

- Upload Operation
- FIND operation (targets on network)
- Information operation (configuration of target)
- Download operation (log, ORT extraction).

NOTE

During normal operation where all data load conditions are met, these data load operations can be performed without rebooting in-and-out of the resident data load software.

5.5.2. Upload Operations.

The Upload operations can be performed without rebooting in-and-out of the resident data load software. The upload operations will always cause the IRT NX SATCOM system to enter into resident data load software and perform a Cold Start when the upload completes. Uploading will complete in 15 minutes or less.

The download operation supports the capability to download/extract files that include User ORT Configuration, Secure ORT Configuration, Fault Log, Engineering Data Log (includes transition, operational/usage, and expanded shop fault log data) and Security Event Log.

5.6. BUILT IN-TEST EQUIPMENT.

The IRT-4000 system maintenance function includes Built In-Test Equipment (BITE), system events and system security events. When an occurrence of any of the maintenance function exists, the system would report and log the faults and/or events. The BITE capabilities include the following:

- Power-up Built-In Test (PBIT) - Automated during system Cold Start
- Initiated Built-In Test (IBIT) - Commanded via System Control Display Unit (SCDU) or Centralized Fault Display System (CFDS)
- Continuous Built-In Test (CBIT) - Continuous monitoring.

5.7. FAULT DETECTION.

The fault detection and recording capabilities include the following:

- Fault detection of Line Replaceable Unit (LRU) internal, intra-LRU and system external. LRU internal includes IRT-4000 - Antenna, IRT-4000 - ICM-4000, IRT-4000, ICM-4000 and Antenna. System external includes all external interfaces.
- Fault logging of a detected fault organized by flight leg.
- Fault event to assist in customer and engineering troubleshooting.

5.8. FAULT STORAGE.

The IRT NX SATCOM system provides fault storage in Non-Volatile Memory (NVM), segregated into flight memory and ground memory.

The fault recording of flight memory includes 64 flight legs, 32 faults/flight leg. Flight memory is overwritten when the limit is exceeded. The fault recording of ground memory includes 32 faults and ground memory is overwritten when the limit is exceeded as well. The system reports detected faults in fault summary words (CFDS output bus), shop fault data and SCDU BITE status pages.

Events can be extracted through live-streamed via the front panel Ethernet port and ARINC 615A-2 download operation. Event data extracted through front panel Ethernet port may be recorded on a connected external device. For event data downloaded via ARINC 615A-2 download operation, the data is extracted from NVM.

5.9. AIR WORTHINESS.

5.9.1. Airworthiness.

The IRT-4000 is not flight critical and has no airworthiness limitations for Part 23 or Part 25 aircraft. FAR 25.1529 Instructions for Continued Airworthiness follows the instructions: The IRT-4000 should only be removed on the condition of failure. There is no required maintenance. If the IRT-4000 is removed due to a catastrophic failure, return it to Collins Aerospace or to a Collins Aerospace-approved repair facility for repair or replacement.

CHAPTER 6
BULLETINS

6.1. SERVICE BULLETINS AND SERVICE INFORMATION LETTERS.

For the most current Service Bulletin (SB) and Service Information Letter (SIL) data, please refer to the Collins Aerospace Technical Publications Index/Online Library.

6.1.1. Accessing the Technical Publications Index/Online Library.

To access the Collins Aerospace Technical Publications Index/Online Library, do the steps that follow:

a. Access the Collins Aerospace home page at https://www.collinsaerospace.com.

(1) On the home page, select the Index tab at the top right of the menu bar to open the Index Log in page.

(2) On the Log In, select the "T " letter and the Menu appears in the page.

b. After logging in, access the Collins Aerospace Technical Publications Index/Online Library.

c. On the Publications/Training Publications Index Search screen, enter the Equipment Type and Publication Type required, see Figure 6-1 .

NOTE

The Equipment Type is the product type number.

The Publication Type will be SB for Service Bulletins and SIL for Service Information Letters.

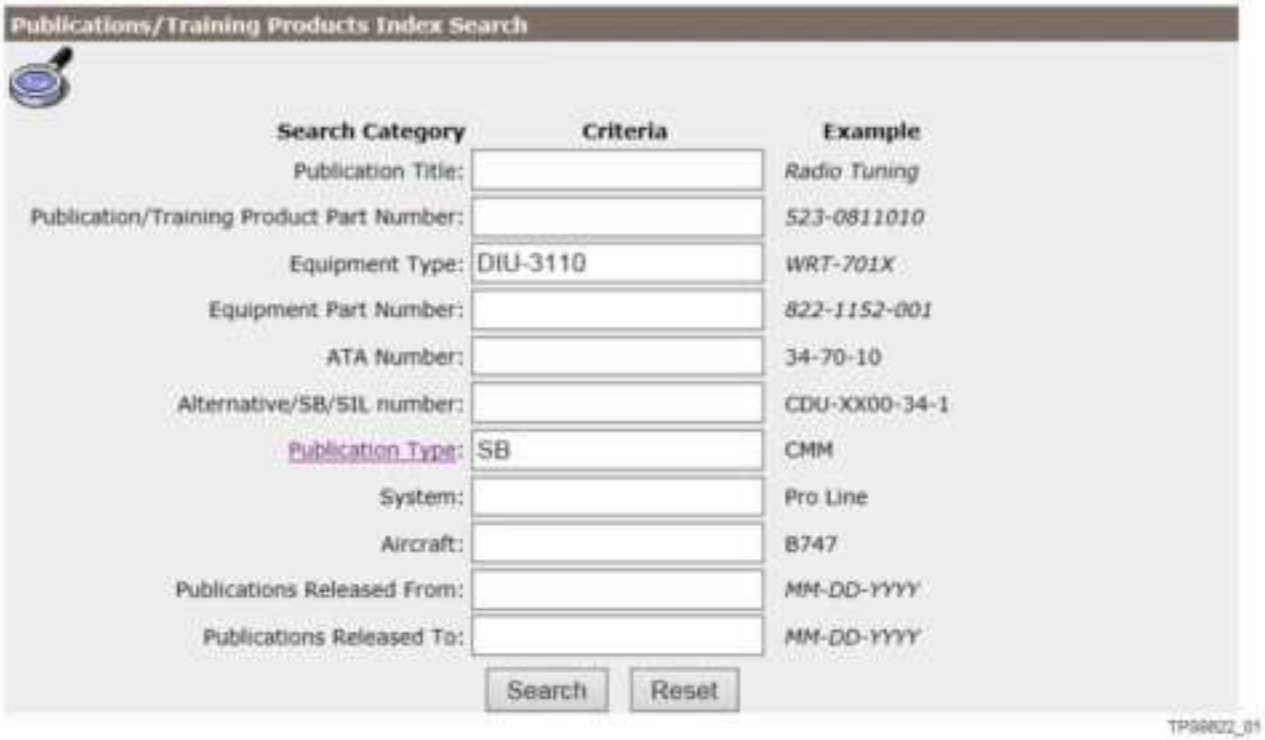


Figure 6-1. Publications/Training Products Index Search

d. Select the Search button.

e. The Search results will show for the identified Equipment Type and Publication Type selected, see Figure 6-2.

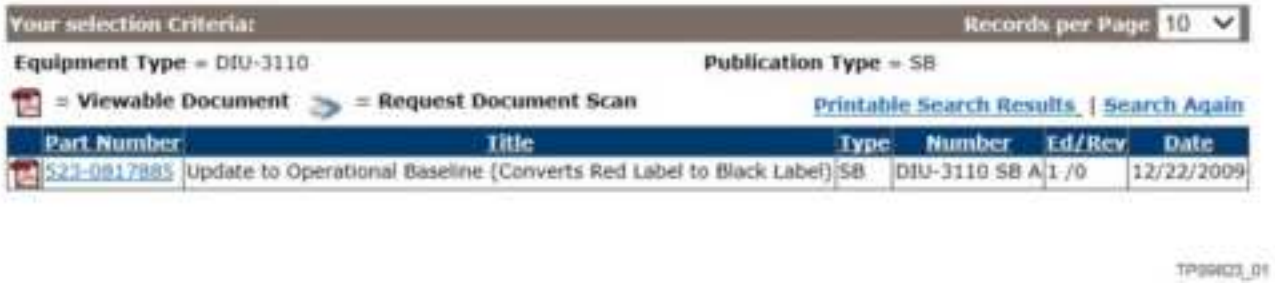


Figure 6-2. Publication Selection Criteria

f. Select the PDF icon next to the required SB or SIL Part Number. The Continue with Download page shows, see Figure 6-3.

Figure 6-3. Continue with Download Page

g. Select the Continue with Download button to open the SB or SIL PDF.

APPENDIX A
EQUIPMENT CHARACTERISTICS

A.1. GENERAL.

Refer to Table A-1 and Table A-2 for DO-160G equipment characteristics.

Table A-1. IRT-4000 and ICM--4000 DO-160G Testing Categories

TEST CONDITIONS	ENVIRONMENT NOTES	CATEGORY (IRT)	CATEGORY (ICM)
Bonding	≤ 2.5mΩ	None	None
Temperature (Note 1)	For IRT passive cooling configuration ONLY Operating Low Temperature -40°C Operating Low Temperature -55°C (Note 5) Ground Survival Low Temperature -55°C Operating High Temperature +55°C Short-Time Operating High Temperature +70°C Ground Survival High Temperature +85°C	(A1)(F1)	(A1)(F1)
	For IRT Forced Air Cooling configuration ONLY Operating Low Temperature -40°C Ground Survival Low Temperature -55°C Operating High Temperature +70°C Ground Survival High Temperature +85°C	(A2)(F1)	(A2)(F1)
Loss of Cooling Air	40.0°C for 180 minutes minimum. ICM and HGA loading will be included in the setup (Note 2).	P	X
Altitude	55,000 ft	(A2)(F2)	(A2)(F2)
Decompression	Start @ 8,000 ft to 55,000 ft	(A2)(F2)	(A2)(F2)
Overpressure	Exception that absolute pressure is 199kPa with a rate of change of 3.0 psi/min	(A2)(F2)	(A2)(F2)
Temperature Variation	5°C (minimum) / Minute	B	B
Humidity	2 Days / 95%	A	A
Operational Shock, Crash Safety	6G / 11ms, 6g / 20ms (Operational) 20G / 11ms (Impulse) 20g / 3s (Sustained)	BD	BD
Vibration	Random and High Level Short Duration.	(RBB1) (HR)	(RBB1) (HR)
Explosion Proofness	ONLY cabin configuration tested Equipment is not hermetically sealed.	E	E
Waterproofness	For cockpit configuration ONLY 140L/m2/hr.	Y	W
Fluid Susceptibility (Note 3)	Selected fluids will be tested through spray method only.	F	F
Sand & Dust	Dust only.	D	D

Table A-1. IRT-4000 and ICM--4000 DO-160G Testing Categories - Continued

TEST CONDITIONS	ENVIRONMENT NOTES	CATEGORY (IRT)	CATEGORY (ICM)
Fungus Resistance	Qualified by analysis.	F	F
Salt Spray	Not tested.	X	X
Magnetic Effect (Note 4)	0.3m < distance of deflection ≤ 1m from compass HGA loading included in setup.	A	A
Power Input (Note 4)	ONLY cockpit configuration tested ICM and HGA loading included in setup.	[(BZ)XI]	X
Voltage Spikes (Note 4)	ONLY cockpit configuration tested ICM and HGA loading included in setup.	A	X
AF Conducted Susceptibility (Note 4)	ONLY cockpit configuration tested ICM and HGA loading included in setup.	R	R
Induced Signal Susceptibility	DO-160G sections 19.3.3, 19.3.4 and 19.3.5: All bundles tested in the cockpit configuration. Retest the bundles for cabin configuration that are different. DO-160G section 19.3.1, Note 4 applies.	[CWX]	[CWX]
RF Susceptibility (Conducted)	All bundles tested in the cockpit configuration. Retest the bundles for cabin configuration that are different..	R	R
RF Susceptibility (Radiated)	Test in both cockpit and cabin configurations.	R	R
RF Emission (Conducted)	All bundles tested in the cockpit configuration. Retest the bundles for cabin configuration that are different. HGA loading included in setup.	M	M
RF Emission (Radiated)	Test in both cockpit and cabin configurations. HGA loading included in setup.	M	M
Lightning (Indirect Effects)	Pin Injection All Ethernet pins are to be included in the test.	B3	B3
Lightning (Indirect Effects)	Cable induced lightning – All bundles tested in the cockpit configuration. Retest the bundles for cabin configuration that are different.	[K3L3]	[K3L3]
Lightning (Direct Effects)	Not tested.	X	X
Icing	Not tested.	X	X
Electrostatic Discharge (Note 4)	ONLY cockpit configuration tested 15 kV discharge. 10 times positive/negative polarity.	A	A
Flammability	Qualified by analysis.	C	C
NOTES			
Note 1: During the Short-Time Operating High Temperature test, the IRT will operate for 10 minutes and after 10 minutes, the IRT may enter a state where performance cannot be verified (i.e. – may be in an idle state or shut itself down) due to thermal protection mechanism.			
Note 2: The ICM may be exposed to the environment as part of the test setup; however, the test is not applicable to the ICM because it does not receive forced air cooling.			

Table A-1. IRT-4000 and ICM--4000 DO-160G Testing Categories - Continued

TEST CONDITIONS	ENVIRONMENT NOTES	CATEGORY (IRT)	CATEGORY (ICM)
Note 3: Fluid Susceptibility will include the following fluids tested through spray test method only. In accordance with DO-160G [28] section 11.4.1, it is planned to combine the fluids into the 6 test groups as detailed below. • Cleaning Solvents (Isopropyl Alcohol and Denatured Alcohol) • Disinfectants (Calla 1452 Zip Chem) • Extinguishing Agents (Halon 1211) • Insecticide One (Pyrethroid Pesticide) • Insecticide Two (Callington One Shot) • Heat Transfer Fluids (Galden HT 135 from Solvay) • Smoke Generator Fluids (Glycerin, CAS# 000056-81-5 [Corona Colt IV smoke generator]; and White Mineral Oil USP [Corona Aviator smoke generator). It is planned on claiming compliance to Halon 1211 by analysis with the following justification: it is assumed that the chemical Halon 1211 (CF2ClBr) is used on the subject aircraft. Use of this product for purposes other than actual fire fighting is banned in the US by the Environmental Protection Agency (EPA), due to its harmful reaction with the ozone layer. Thus, it was determined that the unit could not be tested using the Halon 1211. In lieu of being able to perform actual physical testing utilizing Halon 1211, analysis was performed. Review of the Material Safety Data Sheet (MSDS) for this chemical shows that the only materials with which this chemical is incompatible are active metals, such as powdered magnesium. No materials of this kind are present in the IRT-4000 and ICM-4000. Based on this analysis, the IRT-4000 and ICM-4000 are considered to be compliant with the Halon 1211 fluids susceptibility requirement. IRT can be installed either with forced air cooling configuration, or passive cooling configuration. The hardware configuration of the IRT is the same in either aircraft cooling configuration.			
Note 4: This test is only performed on the cockpit configuration only. There are no differences in the performance of the unit. The EUT operates the same with the same kind of circuitry regardless of the cable harness that are attached. The Ethernets may differ but there are no differences in the circuit cards for a cockpit unit vs cabin unit.			
Note 5: At temperatures below -40°C, the IRT-4000 and ICM-4000 will not function. Power may be applied to the IRT-4000 at temperatures below -40°C and the IRT-4000 power supply will be energized at -55°C (F2 Operating Low Temperature). The IRT-4000 power supply will keep the rest of the IRT-4000/ICM-4000 off. Once the IRT-4000 internal temperature reaches -40°C, and power is already applied, the IRT-4000/ICM-4000 will automatically turn on and function.			

Table A-2. HGA-4000 DO-160G Testing Categories

TEST CONDITIONS	ENVIRONMENT NOTES	CATEGORY
Bonding	< 2.5mΩ	None
Temperature	Operating Low Temperature -55°C Ground Survival Low Temperature -55°C Operating High Temperature +70°C Ground Survival High Temperature +85°C	F2
Altitude	55,000 ft	F2
Decompression	Not tested.	X
Overpressure	Not tested.	X

Table A-2. HGA-4000 DO-160G Testing Categories - Continued

TEST CONDITIONS	ENVIRONMENT NOTES	CATEGORY
Loss of Cooling	Air Not tested.	X
Temperature Variation	-55ºC to 70ºC, 10ºC/min 2 cycles	A
Humidity	6 cycles	C
Operational Shock, Crash Safety	6G / 11ms, 6g / 20ms (Operational) 20G / 11ms, 20g / 20ms (Impulse) 20g / 3s (Sustained)	BE Type 5 Test R
Vibration	Random and Sine	R(CC1) H(R)
Explosion Proofness	Not tested.	X
Water Proofness		S
Fluid Susceptibility	See Table A-3.	F
	Sand & Dust	S
Fungus Resistance	Qualified by analysis.	F
Salt Spray		T
Magnetic Effect	Only applicable to HGA (Note 2).	A
Power Input	Not applicable (Note 1).	X
Voltage Spikes	Not applicable (Note 1).	X
AF Conducted Susceptibility	Not applicable (Note 1).	X
Magnetic Fields Induced Into the Equipment	Not applicable (Note 3).	X
Electric Fields Induced Into the Equipment	Not applicable (Note 3).	X
Magnetic Fields Induced Into Interconnecting Cables	The tests will be run concurrently with the IRT TSO qualification.	CW
Electric Fields Induced Into Interconnecting Cables	The tests will be run concurrently with the IRT TSO qualification.	CW
Spikes Induced Into Interconnecting Cables	The tests will be run concurrently with the IRT TSO qualification.	CW
RF Susceptibility	For the Interconnecting Signal I/O the tests will be run concurrently as part of the IRT TSO qualification.	RR
RF Emission	Meet RF emission limits at maximum power/duty cycle.	H

Table A-2. HGA-4000 DO-160G Testing Categories - Continued

TEST CONDITIONS	ENVIRONMENT NOTES	CATEGORY
Lightning (Indirect Effects)	Pin Injected: WF3 600V/24A, WF5A 300V/300A Cable Induced: • Multiple Stroke: WF3 600V/120A subs 300V/60A, WF5A 300V/1000A subs 60V/200A. • Multiple Burst: WF3 360V/6A. For the Interconnecting Signal I/O the tests will be run concurrently as part of the IRT TSO qualification.	B3K3L3
Lightning (Direct Effects)	Damage to antenna and its installation will not compromise flight characteristics, safety and landing of the aircraft. No loss or detachment of any part. For the high current test the induced voltage, then measured across the center conductor pin of 50Ω load, is to be <300V. This requirement is based on level 3 WF4 pin injection lightning levels (section 22 DO-160). A TNC coax breakout cable will connect the antenna to the 50Ω load. The induced current on the center pin of the coax will be determined by calculation. There is no requirement to measure the bulk induced current. The current of each waveform component is to be recorded. Tested in two configurations: • non conductive gasket • without gasket.	2A2A
Icing	Ice thickness of 3mm	C
Electrostatic Discharge (ESD) (Note 4)		A
Flammability	Not tested.	X
NOTES		
Note 1: Since the Antenna receives power from IRT-4000, this test is not applicable.		
Note 2: This test is applicable only to equipment that are in close proximity with the compass in the aircraft cockpit.		

Table A-2. HGA-4000 DO-160G Testing Categories - Continued

TEST CONDITIONS	ENVIRONMENT NOTES	CATEGORY
Note 3: This test only applies to the magnetic and electric fields within the aircraft.		
Note 4: This test applies to the handling and servicing of the equipment. Where as, the antenna is mounted.		

Table A-3. DO-160G Section 11 Fluids

CLASS OF CONTAMINATION FLUID	TEST FLUID	FLUID TEMPERATURE DEGREES C
Fuel	Aviation Jet A Fuel	40 (Note 1)
Hydraulic Fluids/De-Icing Fluid	Phosphate Ester-Based (Synthetic), Type IV (Note 2) Synthetic Hydrocarbon Base	70 70
	AEA Type 1 50% solution of water and potassium formate or potassium acetate	50 50
Insecticides	Pyrethroid Pesticide (commercially available min 0.92% concentration by volume)	23
NOTES		
Note 1: This temperature exceeds the critical flash point temperature. Testing should always be performed in a suitable pressure vessel.		
Note 2: These fluids are electrically conductive. Suitable precautions should be taken after exposure to the fluids before operating the equipment.		

APPENDIX B
ORT CONFIGURATION

B.1. GENERAL.

The Owner Requirement Table (ORT) configures the system for operation, refer to Table B-1 for an example.

Table B-1. ORT Configuration

ORT Folder	ORT Parameter	IRT-4000 Configuration
Interfacing Systems Configuration	ICAO Code Source	ARINC 429 Data Bus - AES ID Input
	AES ID Input Bus Speed	ARINC 429 High Speed Data Bus
	GPS Position Data	GPS Position Data Not Present
	Primary IRS Input	Inertial Data Present
	Secondary IRS Input	GPS Position Data Present
	CMU 1	Not Connected
	CMU 2	Not Connected
	CMU Bus Speed	High Speed
	SCDU Controller Type	739A MCDU
	SCDU 1	Not Connected
	SCDU 2	Not Connected
	SCDU 3	Not Connected
	SCDU Bus Speed	Low Speed
	CFDS Type	CFDS Not Connected
	Data from GNSS to IRT-4000	Not Connected
	Aircraft Communications Addressing and Reporting System (ACARS) Service Provider	ARINC Direct
	Maintenance Password	IRT4X00
Ethernet Ports Configuration	Ethernet Port 1 Configuration	Not Connected
	Ethernet Port 2 Configuration	Connected - Speed Auto Detect
	Ethernet Port 3 (Quadrax) Configuration	Not Connected
	Ethernet Port 4 (Quadrax) Configuration	Not Connected
	Ethernet Port 5 Configuration	Not Connected
	Ethernet Port 11 Configuration	Not Connected
	Ethernet Port 12 Configuration	Connected - Speed Auto Detect
	Front Panel Ethernet	Enabled
	AISD Data	Enabled

Table B-1. ORT Configuration - Continued

ORT Folder	ORT Parameter	IRT-4000 Configuration
	Ethernet Port 1 DHCP Server Enable	Disabled
	Ethernet Port 2 DHCP Server Enable	Enabled
	Ethernet Port 11 DHCP Server Enable	Disabled
	Ethernet Port 12 DHCP Server Enable	Enabled
	Ethernet Port 1 Host Name	AISD1
	Ethernet Port 2 Host Name	PIESD2
	Ethernet Port 11 Host Name	AISD11
	Ethernet Port 12 Host Name	PIESD12
	AISD Security Log Extraction	Enabled
	SNMP Server Options Community String	Public
DHCP Server Option	Ethernet Port 1 DHCP Minimum IP Address	192.168.101.50
	Ethernet Port 2 DHCP Minimum IP Address	192.168.102.50
	Ethernet Port 11 DHCP Minimum IP Address	192.168.111.50
	Ethernet Port 12 DHCP Minimum IP Address	192.168.112.50
	Ethernet Port 1 DHCP Number Of Host IPs	100
	Ethernet Port 2 DHCP Number Of Host IPs	100
	Ethernet Port 11 DHCP Number Of Host IPs	100
	Ethernet Port 12 DHCP Number Of Host IPs	100
	Ethernet Port 1 DHCP IP Address Of Default Gateway	192.168.101.1
	Ethernet Port 2 DHCP IP Address Of Default Gateway	192.168.102.1
	Ethernet Port 11 DHCP IP Address Of Default Gateway	192.168.111.1
	Ethernet Port 12 DHCP IP Address Of Default Gateway	192.168.112.1
	Ethernet Port 1 DHCP Subnet Mask	255.255.255.0
	Ethernet Port 2 DHCP Subnet Mask	255.255.255.0
	Ethernet Port 11 DHCP Subnet Mask	255.255.255.0
	Ethernet Port 12 DHCP Subnet Mask	255.255.255.0
	Static DNS IP Address	8.8.8.8
IP Settings	Ethernet Port 1 Static IPv4 Address	192.168.101.1
	Ethernet Port 2 Static IPv4 Address	192.168.102.1
	Ethernet Port 3 Static IPv4 Address	192.168.103.1
	Ethernet Port 4 Static IPv4 Address	192.168.104.1
	Ethernet Port 5 Static IPv4 Address	192.168.105.1
	Ethernet Port 11 Static IPv4 Address	192.168.111.1
	Ethernet Port 12 Static IPv4 Address	192.168.112.1
	Ethernet Port 1 Static IPv4 Subnet Mask	255.255.255.0

Table B-1. ORT Configuration - Continued

ORT Folder	ORT Parameter	IRT-4000 Configuration
	Ethernet Port 2 Static IPv4 Subnet Mask	255.255.255.0
	Ethernet Port 3 Static IPv4 Subnet Mask	255.255.255.0
	Ethernet Port 4 Static IPv4 Subnet Mask	255.255.255.0
	Ethernet Port 5 Static IPv4 Subnet Mask	255.255.255.0
	Ethernet Port 11 Static IPv4 Subnet Mask	255.255.255.0
	Ethernet Port 12 Static IPv4 Subnet Mask	255.255.255.0
Cockpit Voice Configuration	Cockpit Voice 1 Installed	Not Wired
	Cockpit Voice 2 Installed	Not Wired
	Cockpit Voice 1 Dedication	Not Connected to Cockpit or Cabin Analog Phone System
	Cockpit Voice 2 Dedication	Not Connected to Cockpit or Cabin Analog Phone System
	Ground-Initiated Priority 4 Call Routing	Disallowed
	Cockpit Voice Noise Reduction	Disabled
	Cockpit Voice Hookswitch Signaling Method	Switched PTT And/Or SCDU Line Switch(es).
	SCDU LSK Prompts For Cockpit ATG	SCDU Line Select Key (LSK) - Prompts Provided.
	Chime Discrete For Cockpit Air-To-Ground Call	Never
	Placement Of Cockpit Call Using ACP	Disabled
	Cockpit Voice Dialing Restriction	Allow All
	Cockpit Voice 1 Ear Audio Gain	0 dB
	Cockpit Voice 2 Ear Audio Gain	0 dB
	Cockpit Voice 1 Mic Audio Gain	0 dB
	Cockpit Voice 2 Mic Audio Gain	0 dB
	Cockpit Voice 1 Sidetone Gain	0 dB
	Cockpit Voice 2 Sidetone Gain	0 dB
	Cockpit Voice Conference Calls	Disabled
	ACP Call Light Indicator	Disabled
Cabin Voice Configuration	Cabin Voice 1 Installed	Not Wired
	Cabin Voice 2 Installed	Not Wired
	Cabin Voice Dedication	Cabin Only - Analog Phone System
	Cabin Voice Noise Reduction	Enabled
	Cabin Voice 1 Ear Audio Gain	0 dB
	Cabin Voice 2 Ear Audio Gain	0 dB

Table B-1. ORT Configuration - Continued

ORT Folder	ORT Parameter	IRT-4000 Configuration
	Cabin Voice 1 Mic Audio Gain	0 dB
	Cabin Voice 2 Mic Audio Gain	0 dB
	Cabin Voice Routing Preference	Cabin 1
	Cabin Voice Dialing Restriction	Allow All Excluding Short Codes
	Incoming Public Voice Switch	Allow
Miscellaneous Configuration Settings	Use of Flight ID	Disabled
	Antenna Configuration	ARINC 771 HGA
Safety Data Services Configuration	Airborne Datalink Gateway Control	Disable
Telephone Directory	Telephone Directory	N/A
	Telephone Number - Directory Name	N/A
	Telephone Number - Directory Entry	N/A
	Telephone Number - Directory Priority	N/A
	Telephone Directory and Entry Directory Name	N/A
Other Configurations	Airline Information Services Domain (AISD) Data	Disabled
	Security Log Event Severity	Severity 7
	Aircraft Model	Product Line
	SATCOM Active Behavior	Auto
Menu and Interface Control	MCDU System Prompt	SAT
	Audio Line Prompt	SAT-1 and SAT-2
	Priority Display Format	Alpha
	Call ID Display Format	By Name

APPENDIX C
IRT- 4400 INTERFACE WIRING

C.1. GENERAL.

Refer to Table C-1 for the IRT-4000 interface wiring and Figure C-1 for the IRT-4000 A1P6 connector.

Table C-1. IRT-4000 Interface Wiring

IRT-4000 Connector	Description	IRT-4000 Connector	Description
TP03D	Config Pin 1 Discrete (0V Common) [OUT]	MP02K	Data from Secondary IRS/GNSS B [IRS/GNSS]
TP03F	Config Pin 3 Discrete (Parity) [GND] - Ground = Odd, Open - Even	MP03D	Data to SCM A [RS422 OUT]
TP03G	Config Pin 4 Discrete (Pin Programming) [OPEN]	MP04D	Data to SCM B [RS422 OUT]
TP04D	Config Pin 5 Discrete (IRT-4000 Number) [OPEN] - SDU 1	MP05D	Data from SCM A [RS422 IN]
TP06A	Ethernet #2 from SDU to User [TX+] Cabin Data 1 (PIESD)	MP06D	Data from SCM B [RS422 IN]
TP06B	Ethernet #2 from User to SDU [RX+] Cabin Data 1 (PIESD)	MP06J	Data from GNSS to SDU Input A [A429 IN]
TP06D	Config Pin 13 (Weight On Wheels (WOW) Orientation) [OPEN] - TP06D "OPEN" and MP07D "GND" indicates "Aircraft on Ground".	MP06K	Data from GNSS to SDU Input B [A429 IN]
TP06J	Ethernet #12 from SDU to User [TX+] Cabin Data 2 (PIESD)	MP07A	AES ID Input A [ATC XPDR] [A429 IN]
TP06K	Ethernet #12 from User to SDU [RX+] Cabin Data 2 (PIESD)	MP07B	AES ID Input B [ATC XPDR] [A429 IN]
TP07A	Ethernet #2 from User to SDU [RX-] Cabin Data 1 (PIESD)	MP07D	WOW Input 1 [Aircraft Airborne Status]
TP07B	Ethernet #2 from SDU to User [TX-] Cabin Data 1 (PIESD)	MP011A	POTS 1 TIP [2-Wire Voice]
TP07J	Ethernet #12 from User to SDU [RX-] Cabin Data 2 (PIESD)	MP011B	POTS 1 RING [2-Wire Voice]
TP07K	Ethernet #12 from SDU to User [TX-] Cabin Data 2 (PIESD)	MP011E	Cabin Transceiver Functional Block Discrete Input
TP71	RF Block - Antenna [Input/Output #1 TX/RX 50 ohms coax]	MP011F	System Health Status Discrete Output
MP01D	SCM Power +8 to +15V [SCM]	MP011J	POTS 2 TIP [2-Wire Voice]
MP01G	External Reset Discrete Input	MP011K	POTS 2 RING [2-Wire Voice]
MP02A	Data from Primary IRS/GNSS A [IRS/GNSS]	BP02	28V HOT

Table C-1. IRT-4000 Interface Wiring - Continued

IRT-4000 Connector	Description	IRT-4000 Connector	Description
MP02B	Data from Primary IRS/GNSS B [IRS/GNSS]	BP03	Chassis GND
MP02D	SCM Power Return 0V [SCM]	BP04	28V GND
MP02J	Data from Secondary IRS/GNSS A [IRS/GNSS]	Front Port RJ-45	Front Port Ethernet - Enabled [Laptop/Maintenance Terminal]

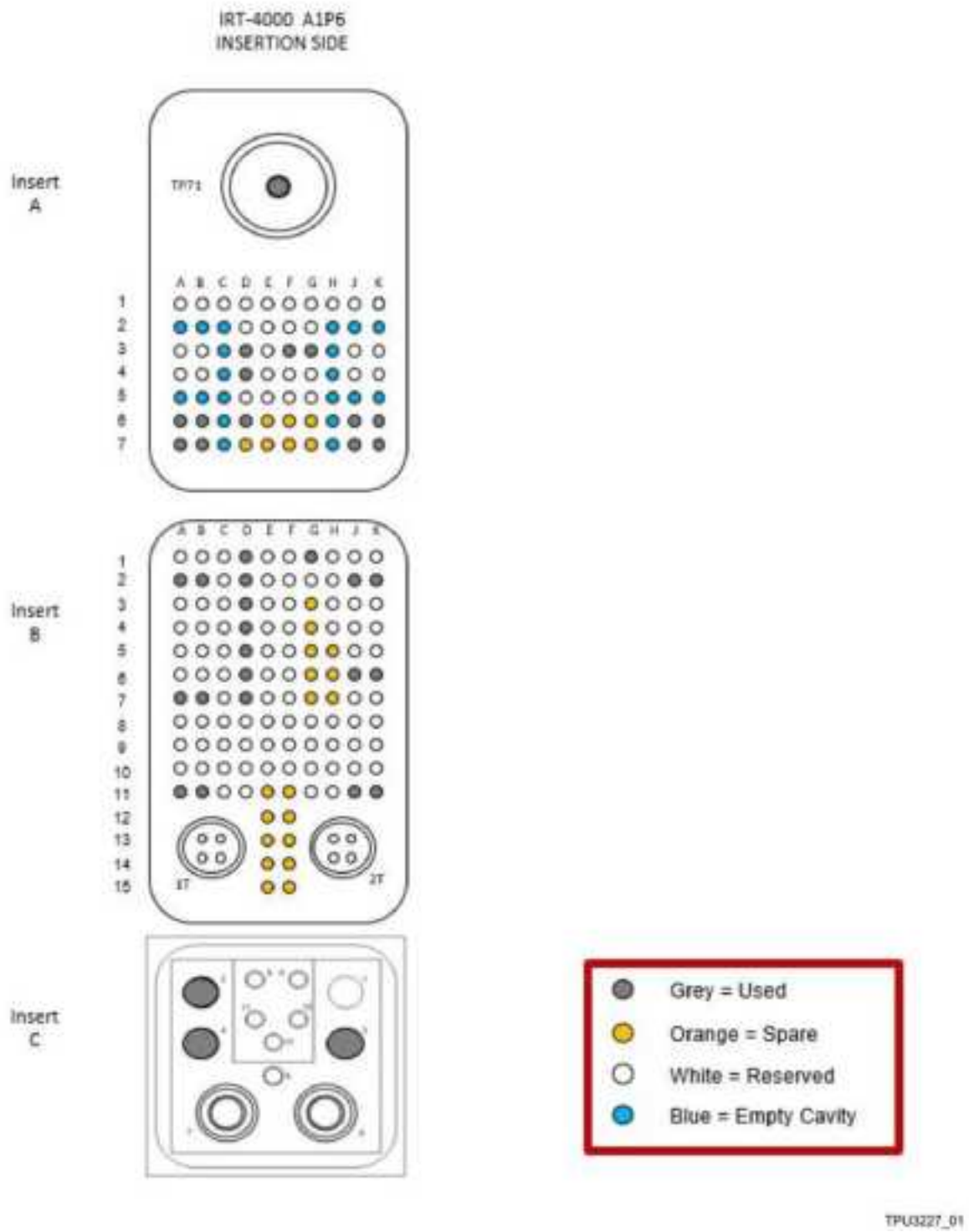


Figure C-1. IRT-4000 A1P6 Connector

Collins Aerospace