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ARINC 781-500 SDU and SCM

System Description, Installation, and Maintenance Manual

D201601000025, Revision 0

This document provides procedures for the equipment listed below.

Model	Part Number
ARINC 781-500 Satellite Data Unit	90402750
ARINC 781-500 SDU Configuration Module - Single SBB	90404775

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SYSTEM DESCRIPTION, INSTALLATION, AND MAINTENANCE MANUAL
ARINC 781-500 SDU and SCM

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ARINC 781-500 SDU and SCM

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ARINC 781-500 SDU and SCM SDIM

Document Number: D201601000025, Revision 0

Revision Table		
Revision	**ECO**	**Description**
0	NA	First release.

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TRANSMITTAL INFORMATION

REVISION 0 DATED 17 MAR 2016

THIS IS AN INITIAL RELEASE OF ARINC 781-500 SDU and SCM SDIMM, ATA NO. 23-15-87, ISSUED FOR USE IN SUPPORT OF THE FOLLOWING:

Table TI-1 shows the applicable components.

Table TI-1. Applicable Components

Component PN	Nomenclature
90402750	ARINC 781-500 Satellite Data Unit
90404775	ARINC 781-500 SDU Configuration Module - Single SBB

Revision History

Table TI-2 shows the revision history of this SDIMM.

Table TI-2. Revision History

Revision	Revision Date
0	17 Mar 2016

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SERVICE BULLETIN LIST

Service Bulletin Number	Subject	Manual Rev. Number	Manual Rev. Date

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INTRODUCTION

This manual provides the specifications, principles of operation, and information necessary to install the ARINC 781-500 Avionics SATCOM System, including the Satellite Data Unit (SDU) and SDU Configuration Module (SCM).

This document is divided into the following sections:

- System Description
- System Operation
- Installation
- Testing and Fault Isolation
- Maintenance and Repair
- Appendix A: Return Material Authorization.

NOTE: An Illustrated Parts List is not included with this manual.

Only qualified avionics personnel who are knowledgeable in the technical and safety issues related to the installation of aircraft communications equipment should perform the installation procedures provided in this manual.

This manual includes general installation guidelines only; it is not intended to provide specific procedures for every type of installation.

If necessary, the information in this manual will be revised. Before attempting the installation procedures presented in this manual, verify that you have a complete and up-to-date release of this document.

1. Illustration of Equipment

Figure INTRO-1 shows the SDU.

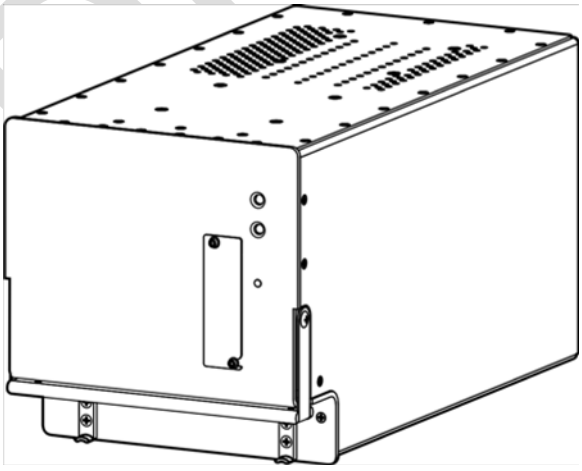

Figure INTRO-1. Satellite Data Unit

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Figure INTRO-2 shows the SCM.

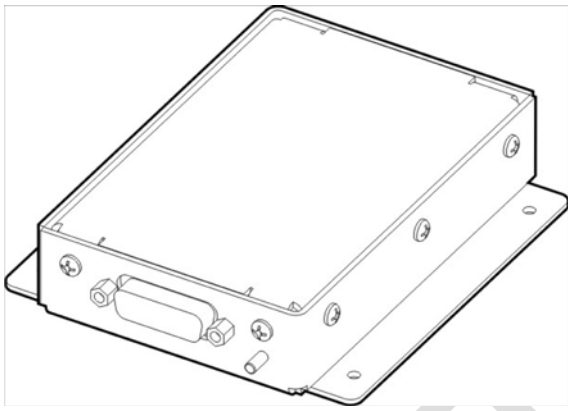

Figure INTRO-2. SDU Configuration Module

2. Acronyms and Abbreviations

AES	Aircraft Earth Station
AMSS	Aeronautical Mobile Satellite Services
AORE	Atlantic Ocean Region-East
AORW	Atlantic Ocean Region-West
APAC	Asia-Pacific
BIT	Built-In-Test
BITE	Built-In-Test Equipment
BSU	Beam Steering Unit
CEPT	Comite Europeen des Postes et Telecommunications
CTU	Cabin Telecommunications Unit
DLNA	Diplexer/Low-Noise Amplifier
DITS	Digital Information Transfer System
EASA	European Aviation Safety Agency
EMEA	Europe, Middle East, and Africa
ESD	Electrostatic Discharge
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FMS	Flight Management System

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GES	Ground Earth Station
GND	Ground
HGA	High Gain Antenna
HPA	High Power Amplifier
ICA	Instructions for Continued Airworthiness
ICAO	International Civil Aviation Organization
I/O	Input/Output
IOR	Indian Ocean Region
IRS	Inertial Reference System
ISDN	Integrated Services Digital Network
LES	Land Earth Station
LRU	Line Replaceable Unit
MCU	Modular Concept Unit
MES	Mobile Earth Station
MHz	Megahertz
MOPS	Minimum Operational Performance Standards
MPU	Maintenance Port Utility
ORT	Owner Requirement Table
POR	Pacific Ocean Region
POTS	Plain Old Telephone System
RF	Radio Frequency
RMA	Return Material Authorization
RTN	Return
Rx	Receive
SATCOM	Satellite Communications
SBB	SwiftBroadband (Inmarsat)
SCM	SDU Configuration Module
SDU	Satellite Data Unit
SLU	Software Logical Unit

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STC	Supplemental Type Certificate
TCP	Tuning and Control Panel
Tx	Transmit
USIM	Universal Subscriber Identity Module
UUT	Unit Under Test
VSWR	Voltage Standing Wave Ratio

3. Safety Advisories

Warnings, cautions, and notes in this manual provide the reader with the following information:

- A WARNING describes an operation, procedure, or condition that, if not obeyed, could cause injury or death.
- A CAUTION describes an operation, procedure, or condition that, if not obeyed, could cause damage to the equipment.
- A NOTE provides supplementary information or explanatory text that makes it easier to understand and perform procedures.

All personnel who install, operate, and maintain the ARINC 781-500 SDU and SCM, and associated test equipment must know and obey the safety precautions listed below. The procedures provided in this manual assume that the person performing installation or maintenance tasks is familiar with and obeys standard aviation shop and safety practices.

The general safety advisories include the following:

WARNING: RADIO FREQUENCY EXPOSURE. OCCUPATIONAL/CONTROLLED EXPOSURE LIMITS APPLY IN SITUATIONS IN WHICH PERSONS ARE EXPOSED TO RADIO FREQUENCY ENERGY AS A CONSEQUENCE OF THEIR EMPLOYMENT. THE RADIO SYSTEM INTEGRATOR SHALL ENSURE OCCUPATIONAL WORKERS ARE FULLY AWARE OF THE POTENTIAL FOR EXPOSURE AND ARE TRAINED TO EXERCSE CONTROL OVER THEIR EXPOSURE AS REQUIRED IN THE FOLLOWING REFERENCES: FCC CFR 47, PART 1.1310, PART 2, 1093; ·INDUSTRY CANADA RSS-102, HEALTH CANADA SAFETY CODE 6; EUROPEAN DIRECTIVE 2004/40/EC.

WARNING: BEFORE HANDLING ANY UNIT OR COMPONENT, GROUND THE REPAIR OPERATOR THROUGH A CONDUCTIVE WRIST STRAP OR OTHER DEVICE THAT USES A 470 KILOHM OR 1 MEGAOHM SERIES RESISTOR TO PREVENT INJURY.

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

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CAUTION: THIS EQUIPMENT INCLUDES ITEMS THAT ARE ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. ESDS DEVICES ARE SUBJECT TO DAMAGE BY EXCESSIVE LEVELS OF VOLTAGE AND/OR CURRENT. THE LOW-ENERGY SOURCE THAT MOST COMMONLY DESTROYS ESDS DEVICES IS THE HUMAN BODY, WHICH, IN CONJUNCTION WITH NONCONDUCTIVE GARMENTS AND FLOOR COVERINGS, GENERATES AND RETAINS STATIC ELECTRICITY. TO ADEQUATELY PROTECT ESDS DEVICES, THE DEVICE AND EVERYTHING THAT CONTACTS IT MUST BE BROUGHT TO GROUND POTENTIAL BY PROVIDING A CONDUCTIVE SURFACE AND DISCHARGE PATHS. USE STANDARD INDUSTRY PRECAUTIONS TO KEEP RISK OF DAMAGE TO A MINIMUM WHEN TOUCHING, REMOVING, OR SERVICING THE EQUIPMENT.

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SYSTEM DESCRIPTION

This section includes basic information about the A781-500 system, including the following sections:

- Inmarsat System Overview
- Equipment Overview
- Equipment Specifications
- System Interfaces
- User Interfaces
- Software Description.

1. Inmarsat System Overview

This section provides an overview of the Inmarsat satellite communications system and networks.

Satellite communication systems provide users with long-range voice and data communication by accessing global satellite and ground communications networks. Satellite communication systems include global satellite networks, Land Earth Stations (LES), Ground Earth Stations (GES), Aircraft Earth Stations (AES), and Mobile Earth Stations (MES).

The LES/GES is the part of the satellite communication system that is on the ground. These numerous, international stations are responsible for routing voice and data calls from the MES/AES to their destinations around the world. The MES/AES is the part of the satellite communication system that is on the aircraft. GES and AES are the terms associated with Aero-H+ services. LES and MES are the terms associated with other satellite communication services.

Inmarsat is an international organization that operates and maintains multiple geostationary satellites and satellite networks (I-3 and I-4). For more information about I-3 and I-4 satellite beam coverage, refer to the Inmarsat website—www.inmarsat.com.

I-3 satellites provide Inmarsat services for aviation (Aero H+ and Swift 64), shipping, and land-mobile users. The satellites connect to ground telecommunication systems through a network of GESs. Each I-3 satellite is located over an Ocean Region (OR)—the current OR names are:

- Atlantic Ocean Region-East (AOR-E)
- Atlantic Ocean Region-West (AOR-W)
- Indian Ocean Region (IOR)
- Pacific Ocean Region (POR).

I-4 satellites provide worldwide SwiftBroadband (SBB service). Each I-4 satellite has 19 wide spot beams, 228 narrow spot beams, and is capable of accommodating many separate, simultaneous SBB sessions. The SBB service and I-4 satellites support broadband applications. The current I-4 satellites are:

- AMERICAS
- EMEA (Europe, Middle East, and Africa)
- APAC (Asia-Pacific).

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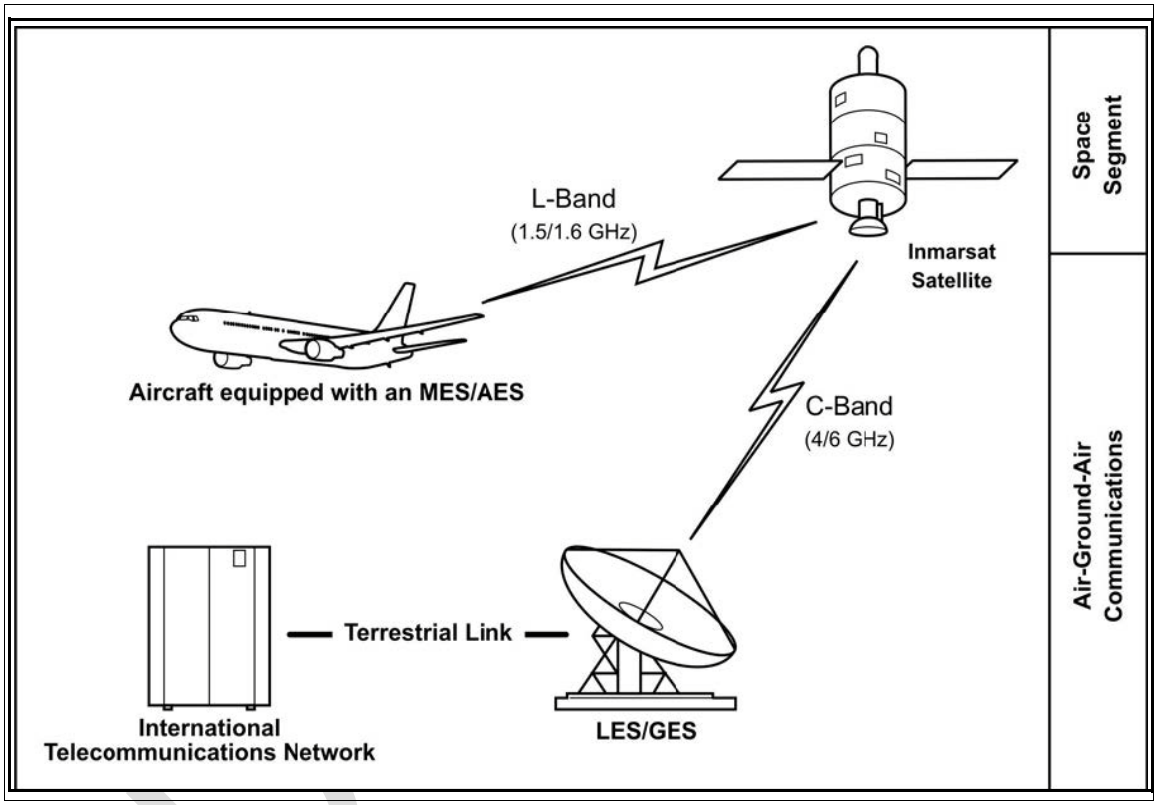
The satellite communication avionics (A781-500 system), in conjunction with an antenna subsystem, act as an AES/MES. The combined system provides users with a data and voice communications link to the satellite network and global telecommunications system.

Figure 1-1 illustrates a simplified satellite communications system.

Figure 1-1. Simplified Aeronautical Satellite Communications System



2. Equipment Overview

The A781-500 system, in combination with the antenna sub-system, provides Aeronautical Mobile Satellite Services (AMSS) by facilitating airborne satellite communications over the Inmarsat network, including the following services:

- Classic Aero-H+—Provides ACARS packet data services at 600, 1,200, or 10,500 bps over the PRT channel combination and half-rate circuit switched voice service over the C channel. FAX data services are not available over Classic Aero-H+.
- SwiftBroadband (SBB)—Provides AMBE+2 voice (circuit-switched) and broadband packet switched services. The equipment can achieve aggregate rates of 432 kbps, but data rates may vary with network load and signal quality.

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The A781-500 system consists of the Satellite Data Unit (SDU) and the Satellite Data Unit Configuration Module (SCM).

Figure 1-2 illustrates the A781-500 system.

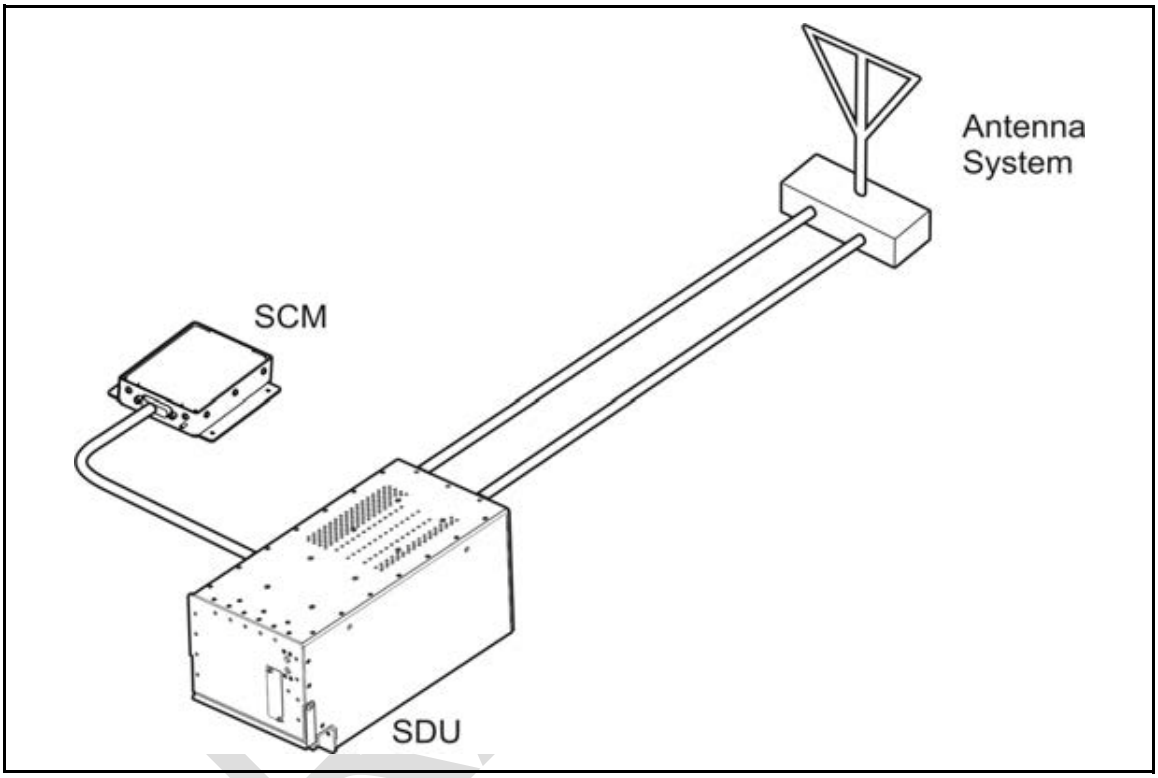

Figure 1-2. A781-500 Avionics System

A. SDU

The SDU is the central communications processing and control unit and largely determines the functionality of the complete SATCOM system. It manages interfaces, routing and priorities, and call channel establishment and tear down. SDU provides RF power amplification using an internal high power amplifier.

The SDU is divided into several shop replaceable units that are electrically connected via the backplane. Various SRUs are also connected using RF cables.

B. SCM

The SCM is an external peripheral of the SDU and provides a dedicated interface to the SDU. It stores Secure and User ORTs. The SCM can accommodate up to four Universal Subscriber Identity Modules (USIM) that store subscriber information for the SBB network.

By storing configuration information independent of the SDU, the SCM facilitates efficient SDU replacement. A new SDU that replaces a faulty SDU does not require any configuration. All configuration information is obtained from the SCM.

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The terms Secure ORT and User ORT are consistent with the industry terminology as defined in the ARINC 781-4 Characteristic. For the Boeing aircraft, the following terms are used:

- Options Selection Software (OSS) = Secure ORT
- Airline Modifiable Information (AMI) = User ORT.

3. Equipment Specifications

This section includes the physical and environmental characteristics of the A781-500 SDU and SCM.

Table 1-1 provides a summary of the physical characteristics and equipment specifications of the SDU component.

Table 1-1. SDU Physical Characteristics and Specifications

CHARACTERISTIC	SPECIFICATION
RELATED DOCUMENTS	
ARINC characteristics	ARINC 781-4 Mark 3 Aviation Satellite Communications System ARINC 600 Air Transport Avionics Equipment Interfaces
RTCA documents	DO-178B, Software Considerations in Airborne Systems and Equipment Certification DO-160E, Environmental Conditions and Test Procedures for Airborne Equipment
SDU SPECIFICATIONS	
Physical size	
Length	14.46 inches (36.73 cm)
Width	7.68 inches (19.51 cm)
Height	7.71 inches (19.58 cm)
Weight	24.9 pounds (11.30 kg)
Heating and cooling	
Cooling air	ARINC 600
Flow rate	28.16 oz//hr 104°F (50 kg/hr 40°C) (max) air
Pressure drop	0.2 ± 0.12 inH_2O (5 ± 3 mmH_2O)
Mounting information	6 MCU tray as per ARINC 600
Electrical interfaces	
Power/control interface	as per ARINC 781
Power requirements	
Input voltage (AC)	100 VRMS to 122 VRMS AC, 300 to 900 Hz
Power consumption	400 VA

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Table 1-2 provides a summary of the physical characteristics and equipment specifications of the SCM component.

Table 1-2. SCM Physical Characteristics and Specifications

Characteristic	Specification
Related Documents	
ARINC characteristics	ARINC 781 Mark 3 Aviation Satellite Communications System
RTCA documents	DO-160E, Environmental Conditions and Test Procedures for Airborne Equipment
SCM Specifications	
Physical size	
Length	4.7 inches (11.94 cm)
Width	4.0 inches (10.16 cm)
Height	1.0 inch (2.54 cm)
Weight	1.0 pound (0.454 kg)
Mounting information	4 x 0.125" holes on 3.3" x 3.5" spacing, per attachment 1-6 of ARINC 781
Electrical interfaces	
Power/control interface	as per ARINC 781
Power requirements	Powered by SDU

Table 1-3 lists the RTCA/DO-160E environmental characteristics of the SDU and SCM.

Table 1-3. ARINC 781-500 SDU and SCM ERTCA/DO-160E Environmental Characteristics

Section	Environmental Condition	Category
4.0	Temperature and Altitude	A2
4.5.1	Ground Survival Low	A2
4.5.2	Operating Low Ambient	A2
4.5.3	Short Time Operating High	A2
4.5.4	Operating High Ambient	A2
4.5.5	In Flight Loss of Cooling	A2
	Ground Survival Low Temperature	A2
	Ground Survival High Temperature	A2
4.6.1	Altitude	A2
5	Temperature Variation	B
6	Humidity	A
7	Operational Shock and Crash Safety	B
8.5.2	Vibration Standard – Random	S, Curve B

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Table 1-3. ARINC 781-500 SDU and SCM ERTCA/DO-160E Environmental Characteristics

Section	Environmental Condition	Category
9.0	Explosive Atmosphere	E
15	Magnetic Effect	A
16.5.1.4	Power Input (AC) Interruptions	A(WF)H
17	Voltage Spike	A
18	Audio Frequency Conducted Susceptibility (AC)	K
19	Induced Signal Susceptibility	CWX
20	Radio Frequency Susceptibility	RR
21	Emission of RF Energy	M
22	Lightning Induced Transient Susceptibility	ZZZZZ
24	Icing	X
25	Electrostatic Discharge (ESD)	A

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4. System Interfaces

This section describes the A781-500 system interfaces.

Figure 1-3 illustrates the block diagram of the A781-500 avionics system.

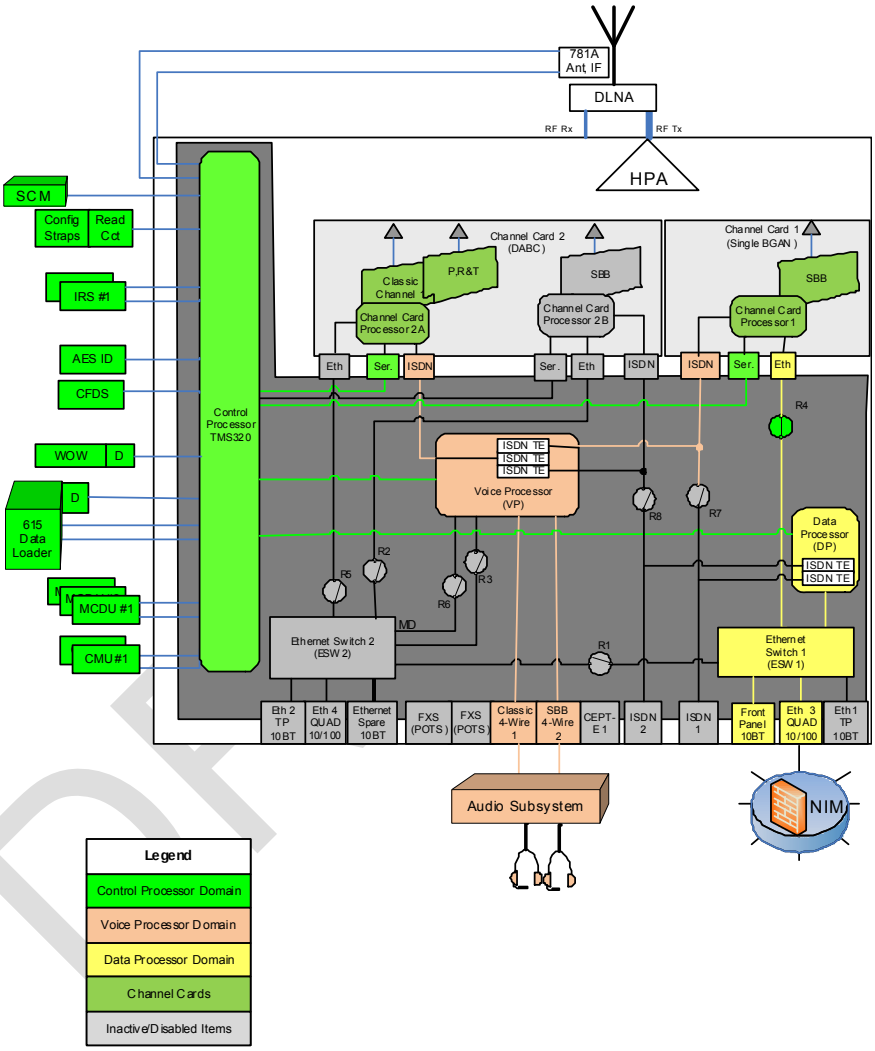

Figure 1-3. A781-500 Avionics System Block Diagram

NOTE: On the aircraft, only the Ethernet3 and 4-wire ports are supported.

A. SDU

The SDU is divided into the following LRUs:

- Channel cards (2)

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- Control and data processor card
- Voice processor card
- High power amplifier
- ARINC backplane
- DIN backplane
- 10 MHz oven controlled crystal oscillator
- Power supply.

The major interfaces of the SDU are listed in Table 1-4.

Table 1-4. SDU System Interfaces

System Interface	Description
ACU/BSU (x1)	Antenna control unit/beam steering unit
TCP (x3)	Tuning and control panel. Interconnected to the SDU multi-purpose control and display port
ACARS CMU (x2)	Aircraft communication addressing and reporting system communication management unit
IRS (x2)/GPS (x1)	Inertial reference system/global positioning system
SCM (x1)	SDU configuration module
AES ID (x1)	Aircraft Earth station identification
Servicing	DE-9 front panel
Button	Test Button front panel
RF	Transmit/receive to the DLNA
Antenna subsystem	ARINC 781 antenna subsystem
Miscellaneous	ARINC discrete input, outputs, and configuration straps

B. SCM

The SCM does not provide any interfaces other than a dedicated interface to the SDU.

The SCM is powered by the SDU.

5. User Interfaces

This section describes the A781-500 SDU interfaces that enable users to access Inmarsat services and monitor the operation of the A781-500 system.

NOTE: There are no user interfaces associated with the SCM.

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A. TCP

The TCP is a device that uses an ARINC 429 interface per ARINC 739, which lets you communicate with individual instruments on an aircraft, including the flight management system, very high frequency radio, and the SDU.

B. 4-Wire Audio

The SDU supports two 4-wire audio interfaces.

C. Ethernet

The SDU supports two Ethernet data interfaces.

D. Maintenance Port

The SDU is equipped with a maintenance port, located on its front panel. The maintenance port provides the physical connection to a password-protected Maintenance Port Utility (MPU) that provides a system interface for users or service personnel who need to monitor or troubleshoot the system.

For more information on configuring the maintenance port, refer to "Connecting to the MPU" on page 4-2.

E. LEDs

The front panel of the SDU has two LEDs to indicate unit status:

- One green LED labeled **Power**
- One red LED labeled **Fault**.

Table 1-5 provides information about the LED signals.

Table 1-5. SDU LED Status

Power LED Status	Fault LED Status	Description of SDU Status
LED is on	LED is off	No fault detected
LED is on	LED is steadily on as long as the fault exists	LRU fault detected
LED is on	Flashing at 1 Hz with a 50% duty cycle while the fault exists	System fault detected but not isolated to the LRU
Alternating flashing of Power and Fault LEDs		Self-test in progress

F. Self-Test Button

The front panel of the SDU has a recessed button labelled **Test.**

NOTE: The Test button is recessed behind a red protective cap. To press the button, use a small and thin tool with no sharp edges. You will not be able to press the button in far enough with just your finger.

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- To reset the unit, press and hold the Test button for at least 5 seconds.
- To initiate self-test (when no LEDs are flashing), momentarily press the Test button.
- When the self test completes (power on or user initiated) the Power LED will illuminate steady for a period of 60 seconds and then it will deactivate for the duration of operation.

  NOTE: During initial power-up or self-test execution, a momentary press of the self-test button is ignored.

The LEDs indicate the results of the self-test. Table 1-5 provides information about the meaning of LED signals.

6. Software Description

All operating software meets RTCA/DO-178B Level D requirements.

The SCM does not contain any software. Only configuration parameters are stored in the SCM.

The SDU software is not partitioned. The software is modular and modules run on individual Software Logical Units (SLUs) within the SDU:

- Each channel card has a single SLU.
- Control and Data Processor card has a Control SLU and a Data SLU.
- Voice card has a Voice SLU.

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SYSTEM OPERATION

The SDU is an integral component in an AES. Together with the SCM, DLNA, Antenna, and HGA subsystem, it provides AMSS by facilitating airborne satellite communication services over the Inmarsat network. These services comprise Classic Aero-H+ and SwiftBroadband (SBB).

The SCM is a dedicated peripheral of the SDU and stores aircraft specific installation configuration critical to the operation of the AES.

This section provides basic information on using the A781-500 system.

1. Registering and Activating Terminals

Registering and activating the A781-500 system has the following steps:

- Obtaining System Addresses
- Choosing Service Providers
- Registering Terminals.

A. Obtaining System Addresses

ICAO: Obtain your ICAO address from your local aeronautical authority. Your service provider will require this address when you register for Classic Aero service.

USIM: Obtain SIM card(s) from your service provider. Your service provider will also activate these cards to enable SBB service. One SIM card is required per channel of SBB service.

B. Choosing Service Providers

Contact Inmarsat for an up-to-date list of Inmarsat Service Providers using the following contact information:

Inmarsat
99 City Road, London
EC1Y 1AX

Tel: +44 20 7728 1000
Fax: +44 20 728 1044

Customer Care
Tel: +44 20 7728 1777
Fax: +44 20 7728 1142
Email: customer_care@inmarsat.com

Web address: www.inmarsat.com

C. Registering Terminals

Contact your Inmarsat service provider and ask for a registration for service activation of Aircraft Earth Station form. With this form, you can register for SBB, and Aero H+ services. The services available depend on your service provider.

To complete the registration form you need the following information:

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- Customer information (address and contact information)
- Service provider details (obtained from your ISP)
- System and terminal information (terminal type, manufacturer, model number, serial number of terminal)
- ICAO 24 bit technical address for Aero H+ services
- Aircraft information (tail number, fuselage/airframe number, manufacturer and model, and country of registration)
- List of services required (for example, Aero H+ data-2, SBB PS, and SBB CS services)
- IMEI and IMSI for SBB services, printed on splash screen during boot-up while connected to the maintenance port.

  NOTE: IMSI is also printed on the SCM label.

  NOTE: IMEIs are printed differently on the front panel maintenance port splash screen from the SATCOM SWIFT CONFIG page on the TCP. The 14 digit IMEI appears in both places. However, on the SATCOM SWIFT CONFIG page on the TCP, it has a 15th digit appended to it. This digit is a check bit to validate the IMEI number.

2. Using the A781-500 System

This section describes how to perform the following tasks:

- Operating the TCP
- Logging On and Off
- Accepting and Making Calls in the Cockpit
- Accepting and Making Calls in the Cockpit
- Viewing BITE Information.

A. Operating the TCP

This section provides information about the TCP and its interfaces—output and input ports, the screen, and the keyboard.screen and the keyboard.

(1) Screen

The TCP displays all data on the screen, as shown in Figure 2-1.

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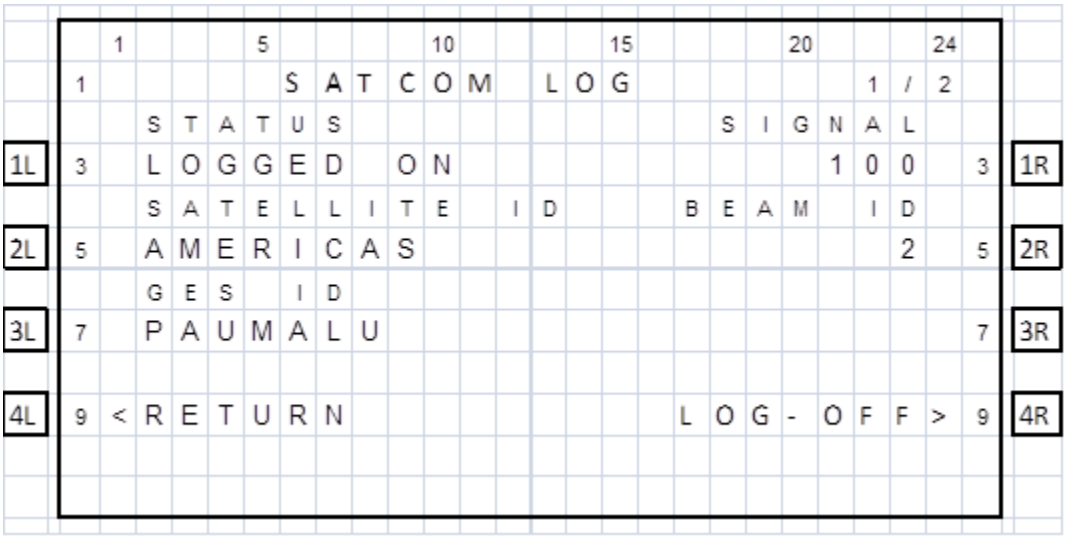

Figure 2-1. TCP Screen

NOTE: The SAT PHONE 1/2 menu shown in Figure 2-1 is an example where classic (SAT-1) and SBB (SAT-2) cockpit calls are supported. Depending on the secure ORT parameter settings, the prompts “SAT-1” and “SAT-2” can be replaced to display any message limited to five characters.

The top of the screen displays the title of the menu on the screen. The bottom of the screen (Line 14) is the scratchpad that displays information that you enter on the keyboard.

The TCP has four buttons on each side of the screen that activate TCP functions. Figure 2-1 displays these buttons on the left and right sides of the screen. When the functions corresponding to a button are available, the function is displayed beside the button.

Other lines on the TCP screen display information relevant to the function or status of the A781-500 system.

When a button has an action associated, there will be either a **<** or **>** symbol beside it.

(2) Keyboard

The TCP’s keyboard includes a set of numeric keys and a set of alphabetic keys, both of which you can use to enter data into the TCP.

The keyboard may include preset keys, such as the following:

- The **IDX** or **MAIN MENU** key: this key returns you to the TCP’s main menu.
- The **CLR** key: this key clears any text you type into the scratchpad.
- The **NEXT PAGE** key: this key brings up the next page of a menu if one is available.
- The **PREV PAGE** key: this key brings up the previous page of a menu if one is available.

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(3) Special Symbols

Because of space constraints on the screen, the TCP uses a number of special symbols to indicate actions:

- **< or >** appears when there is an action associated with that key.
- **NUMBER/NUMBER** appears to tell you which page out of how many pages you are viewing. For example, **1/3** would appear when you are on page 1 of 3 pages in total.

(4) Navigating the TCP

The TCP includes a number of menus, as shown in Figure 2-2.

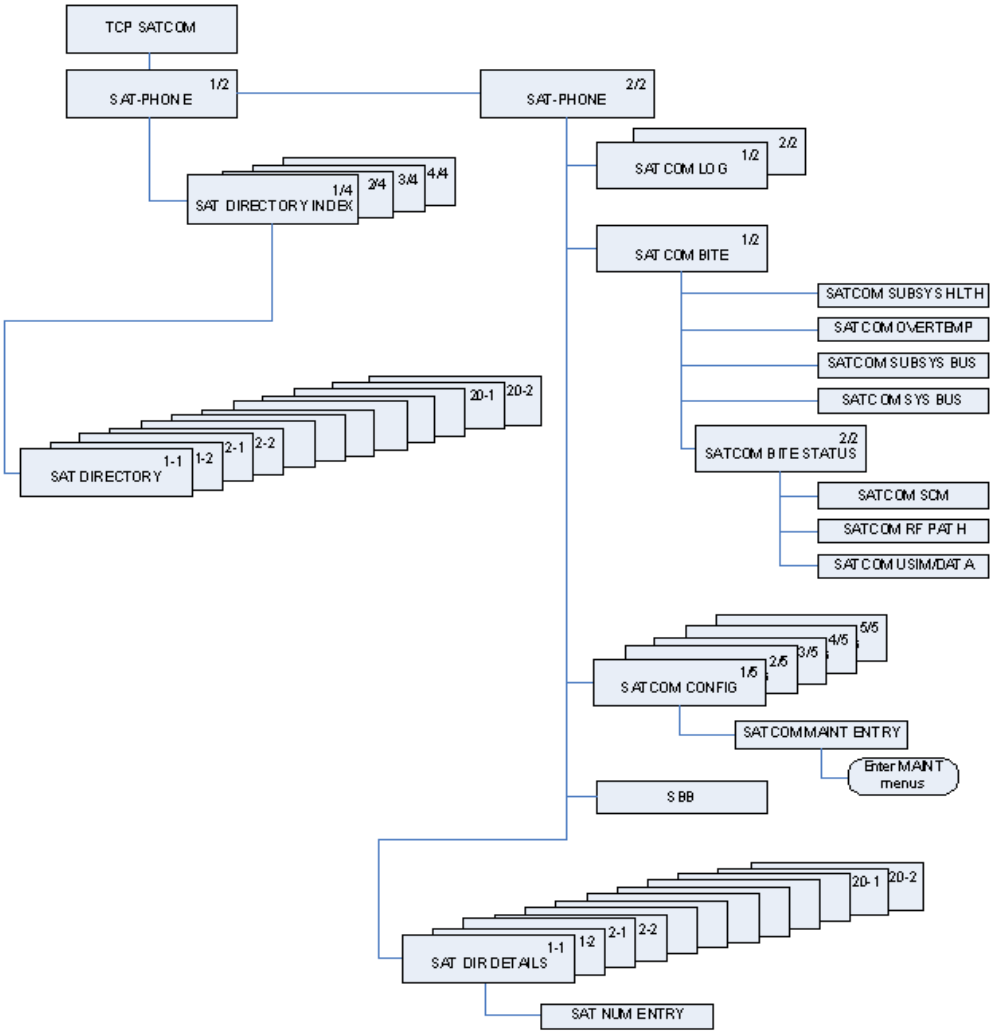

Figure 2-2. A781-500 TCP Menu Structure

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B. Logging On and Off

Using the TCP, you can log on to the satellite network manually or automatically:

- Manual Logon—constrains the logon to use a satellite that you select
- Automatic Logon—logs on using the best available satellite as defined by the ORT.

If specified in the ORT, the initial system logon happens immediately after the A781-500 system powers up, with no TCP input required. If the ORT is not configured as such, you must initiate the logon from the TCP (MANUAL LOG-ON or AUTO LOG-ON command). For more information, see "ORT Overview" on page 3-7.

You can watch the progress of the logon on the SATCOM LOG 1/2 menu, or simply wait until the prompt on the SAT-PHONE 2/2 menu indicates the service is available for use.

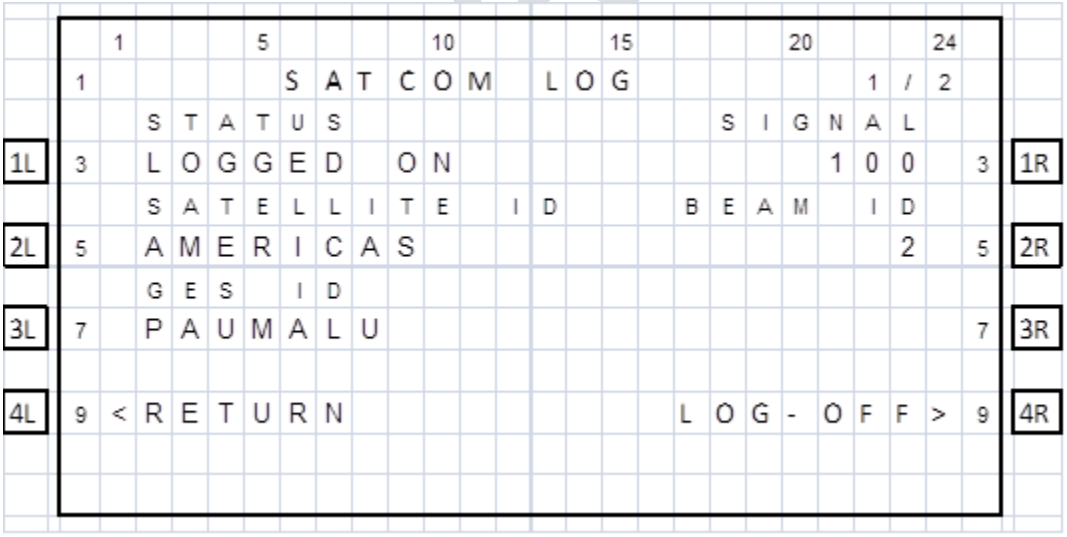
(1) Logging On Automatically

When you initiate an automatic logon, the system selects a satellite and GES based on the preferences specified in the ORT.

To log on automatically:

(a) On the SAT-PHONE 2/2 menu, press the button next to **LOG**.

The SATCOM LOG menu appears.



(b) On the SATCOM LOG menu, press the button next to **AUTO LOG-ON**.

If you return to the SAT-PHONE 1/2 menu, then the SAT-L and SAT-R channels are updated with READY status after the logon completes.

NOTE: The TCP does not display the AUTO LOG-ON and MANUAL LOG-ON functions when the A781-500 system is already logged on.

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NOTE: On the SAT-PHONE 2/2 menu, SAT-L shows the Classic Aero channel status and SAT-R shows the SBB channel status. The A781-500 system logs on the Classic Aero channels first, and then logs on the SBB channels.

(2) Logging On Manually

To log on manually, you must select a satellite and GES.

To log on manually:

(a) On the SAT-PHONE 2/2 menu, press the button next to **LOG**.

The SATCOM LOG menu appears.

(b) Press the button next to **SATELLITE ID** until the TCP screen shows the satellite ID to which you want the A781-500 system to log on.

(c) Press the button next to **GES ID** until the TCP screen shows the GES to which you want the A781-500 system to log on.

(d) On the SATCOM LOG menu, press the button next to **MANUAL LOG-ON**.

The TCP returns to the SAT-PHONE 2/2 menu and updates the SAT-L and SAT-R channels with READY status after the log on completes.

NOTE: SAT-L shows the Classic Aero channel status and SAT-R shows the SBB channel status. The A781-500 system logs on the Classic Aero channels first, and then searches for SBB services on the satellite determined by the Classic Aero log-on.

(3) Logging Off Classic Aero Services

WARNING: THIS OPTION DOES NOT LOG OFF SBB OR SWIFT 64 SERVICES. IF EITHER OF THESE SERVICES IS RUNNING, THEY WILL CONTINUE TO RUN AND POTENTIAL CHARGES COULD BE MADE TO THE CABIN. TO COMPLETELY LOG OFF, POWER DOWN THE A781-500 SYSTEM.

To log off:

(a) On the SAT-PHONE 2/2 menu, press the button next to **LOG**.

The SATCOM LOG menu appears.

(b) On the SATCOM LOG menu, press the button next to **LOG-OFF**.

The A781-500 system logs off the satellite network.

(4) Viewing Log Status

The log status defines whether the A781-500 system is logged on or logged off. Valid values are shown in Table 2-1.

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Table 2-1. A781-500 System Log Status

Log Status	Description
SAFE MODE	Configuration error detected
HSR NOT READY	High stability oscillator is in a warming condition
AES ID NOT READY	Displayed until a non-zero ICAO address is present
NAV DATA UNAVAIL	Insufficient navigation data available
CC NOT READY	Channel card has not fully booted
LOGGED OFF	A781-500 system not logged on to the satellite network. Awaiting input from the user
TUNING TO SAT	Tuning and scanning for reception from the selected satellite
DET SYS TABLE	Updating the Satellite table
SPOT BEAM SEARCH	Selecting the optimal spot beam
WAIT LOGON CONF	Awaiting the logon confirmation from the satellite
WAIT LOGON ACK	Awaiting for logon acknowledge from the GES
LOGGED ON	Successfully logged on to GES
REJECT-TEMPORARY	Logon rejected by the GES, but the condition is temporary
REJECT-PERMANENT	Logon rejected by the GES, and the condition is permanent
REJECT-INV PARAM	Logon rejected by the GES due to invalid parameters, and the condition is permanent
REJECT-AES INVAL	ICAO address was not accepted by the GES, the condition is permanent
LOGGING OFF	Starting the logoff process
Note: For the 4 reject states, these statuses only stay on the display for 4 seconds.	

To view log status:

(a) On the SAT-PHONE 1/2 menu, press the button next to **LOG**.

The SATCOM LOG menu appears.

(b) The log status appears on the line below **STATUS**.

C. Accepting and Making Calls in the Cockpit

You can make air-to-ground and air-to-air calls using the ARINC 781 system, the TCP, and one or two four-wire headsets. You can manually dial calls or dial previously saved telephone numbers from the TCP's telephone directory.You can make air-to-ground and accept ground-to-air voice calls using the A781-500 system, the TCP, the Audio Control Panel (ACP), and a four-wire cockpit headset.

The four-wire cockpit headset supports Push to Talk (PTT) mode. Push to Talk mode mimics the way an HF radio functions. The user's voice is only transmitted when the 'Mic On' input is asserted i.e. grounded.

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(1) Making Cockpit Calls

You can manually dial calls or dial previously saved telephone numbers from the TCP's telephone directory.

When the SDU cannot complete a call, the TCP displays CALL FAIL.The call and event logs provide information about the cause of the call failure. Call and event logs are accessible to avionics technicians through the maintenance port of the SDU.

(a) Making Calls from the Scratchpad

A call can only be initiated using the buttons on the TCP.

To make a call:

(1) Navigate to the SAT-PHONE 1/2 page.

(2) Enter a number in the TCP scratchpad using the following pattern.

00+CC+NNN+NUMBER (for calls within North America)

011+CC+NNN+NUMBER (for International calls)

where:

- 00 and 011 are access codes
- CC is the country code (Country Code may be up to 4 digits)
- NNN is the city or area code.

NOTE:

- You can enter up to 18 characters in the scratchpad (including hyphens), but the maximum number of digits that can be dialed is 17.
- Hyphens are not necessary. If you wish to use hyphens, press the +/- key on the scratchpad.
- To delete an incorrect character, press CLR on the scratchpad.
- To delete a number, press CLR on the TCP.

  The number appears at the bottom of the TCP screen and MANUAL ENTRY appears under the channel label.

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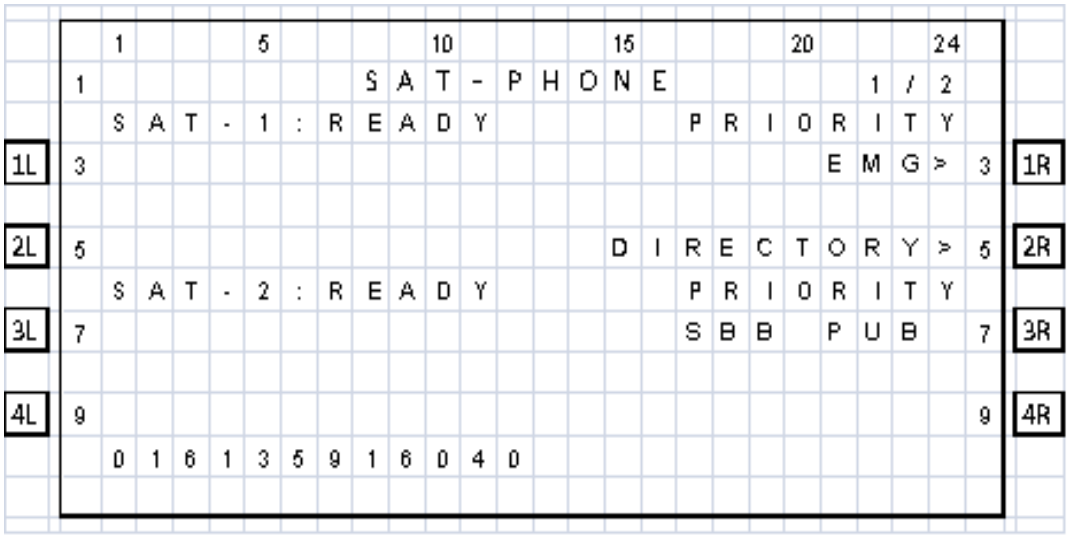
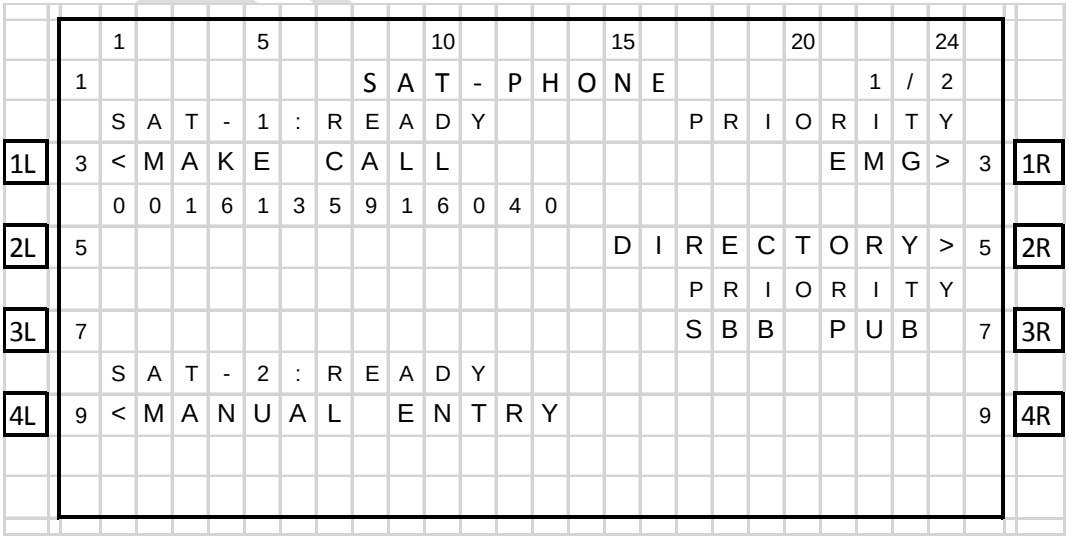


(3) Press the button next to **MANUAL ENTRY**.

NOTE: If an entry has MANUAL ENTRY under the SAT-1 label, that entry can be dialed on Classic Aero channels. If an entry has MANUAL ENTRY under the SAT-2, that entry can be dialed on SBB channels.

MAKE CALL and the number appear under the channel label.



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(4) To set the priority, press the button next to **PRIORITY**.

Available priorities are as follows, all in order from highest to lowest.

- 1 EMERGENCY (EMG)—highest
- 2 OP-HIGH (HGH)
- 3 OP-LOW (LOW)
- 4 PUBLIC (PUB)—lowest.

NOTE: You can only set the priority for a Classic call. All calls made over SBB are considered equal to public priority.

(5) On the TCP, press the button next to **MAKE CALL.**

The channel status displays DIALING, RINGING, and then ANSWERED when connected.

(b) Making Calls from the Telephone Directory

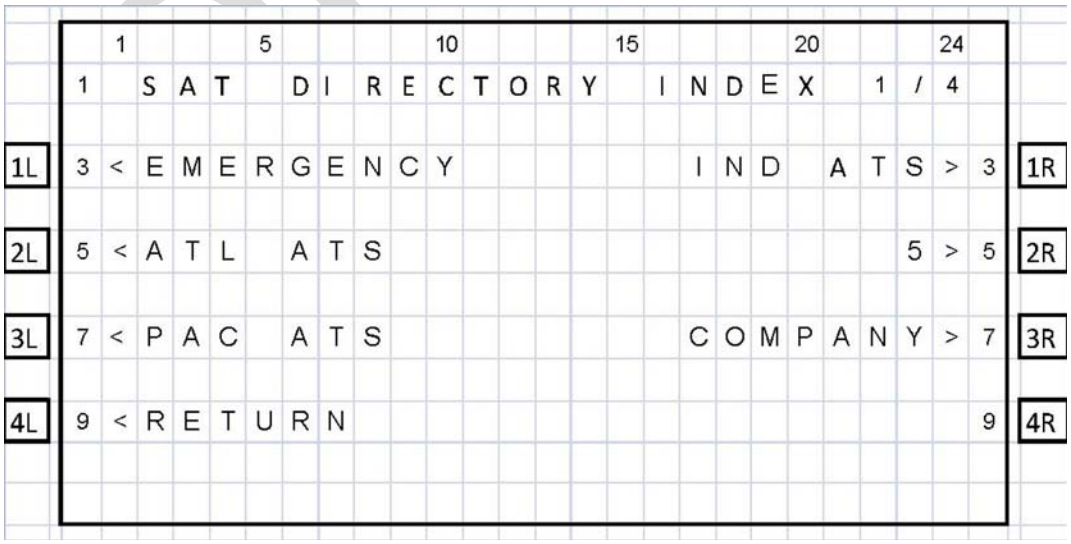
You can make voice calls from the numbers you have saved in the TCP's telephone directory. Numbers can be saved in the telephone directory using the TCP or the ORT. For more information on the ORT, see "ORT Overview" on page 3-7.

To make a call from the telephone directory:

(1) On the TCP main menu, press the button next to **SAT.**

(2) On the TCP keyboard, press the **NEXT PAGE** key to advance to the second page of the **SAT-PHONE** menu, and then press the button next to **DIRECTORY**.

The SAT DIRECTORY INDEX menu appears.



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(3) To access phone numbers in a directory, press the key next to a directory name.

The SAT DIRECTORY page appears.

NOTE: If an entry has the **<** symbol in the SAT-L column, that entry can be dialed on Classic Aero channels. If an entry has the **>** symbol in the SAT-R column, that entry can be dialed on SBB channels. If there is no symbol, the entry cannot be dialed on that channel.

```
     1         5         10        15        20        24
1                SAT  DIRECTORY          1/2
     SAT-1          DIR2             SAT-2
1L  3<---FLIGHT  DISPATCH----      3  1R
         001-719-555-5555
2L  5<---MAINT  WATCH----------> 5  2R
         001-206-555-5555
3L  7<---ENGINEERING----------     7  3R
         001-425-555-7777
4L  9<RETURN                       9  4R
```

(4) Press the button to the left or right of the number you wish to dial.

- Pressing the left button loads the number on the Classic Aero channel.
- Pressing the right button loads the number on the SBB channel.

The TCP returns to page one of the SAT-PHONE menu and the number is displayed under the selected channel.

(5) To set the priority, press the button next to **PRIORITY**.

NOTE: You can only set the priority for a Classic call. All calls made over SBB are considered equal to public priority.

(6) Press the button next to **MAKE CALL**.

The channel status displays DIALING, RINGING, and then ANSWERED when connected.

(c) Answering Calls

To answer a call:

- On the **ACP**, transition the **MIC ON** discrete from **ON HOOK** to **OFF HOOK**.

OR

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On the TCP, press the button next to **ANSWER** to answer the call or press the button next to **REJECT** to reject the call.

(d) Ending Calls

To end a call:

- On the TCP on the menu, press the button next to **END CALL**.

  OR

  On the ACP, assert the **Place/End** switch.

(2) Call Priority

The A781-500 system has four priority settings for calls:

- 1 EMERGENCY (EMG)—highest
- 2 OP-HIGH (HGH)
- 3 OP-LOW (LOW)
- 4 PUBLIC (PUB)—lowest.

(a) Setting the Call Priority

You can set the priority for an air-to-ground four-wire Classic call before making the call.

This priority setting allows for preemption of existing lower priority Aero H+ calls if insufficient satellite resources exist to establish an independent call, and for preemption of calls and services within the cabin.

If the four-wire Classic call is the same priority as an existing call, the established call will be retained and the new call will be queued.

Cockpit calls over SBB are Public priority calls. You can not change the priority.

All calls made from the interfaces other than the cockpit four-wire phones or ACARS CMU are Public priority calls.

(b) Receiving a Priority Call

If a cockpit call is in progress and a higher priority ground-to-air call is received, the higher priority incoming call will preempt the existing call. The preemption is automatic, and the caller in the cockpit has no option to choose between calls.

(3) Saving Telephone Numbers in the Telephone Directory

You can save telephone numbers to the TCP's telephone directory to use later, and you can dial telephone numbers from the telephone directory.

NOTE: Saving telephone numbers in the directory may be inhibited by ORT options.

To save telephone numbers to the telephone directory:

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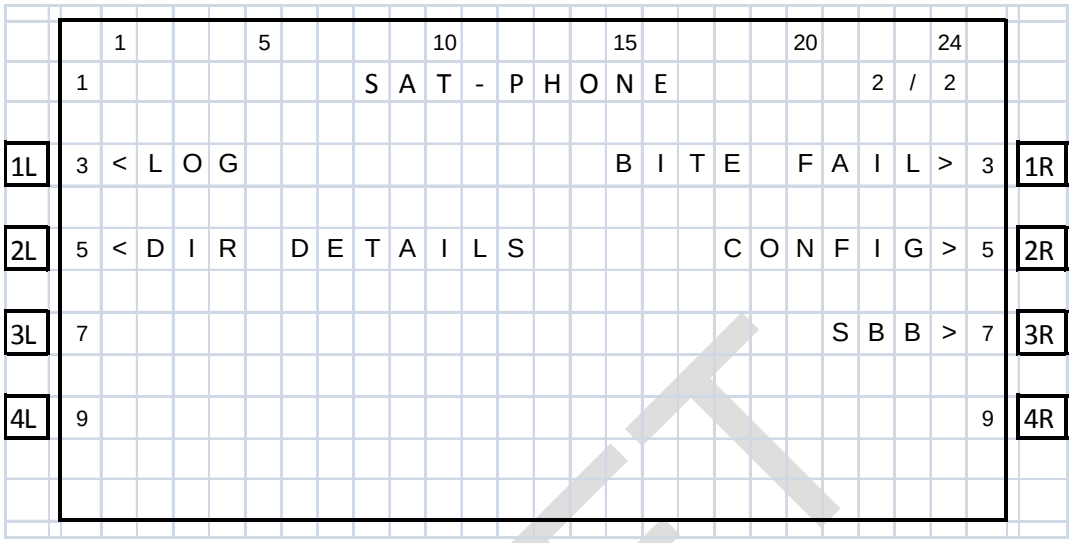
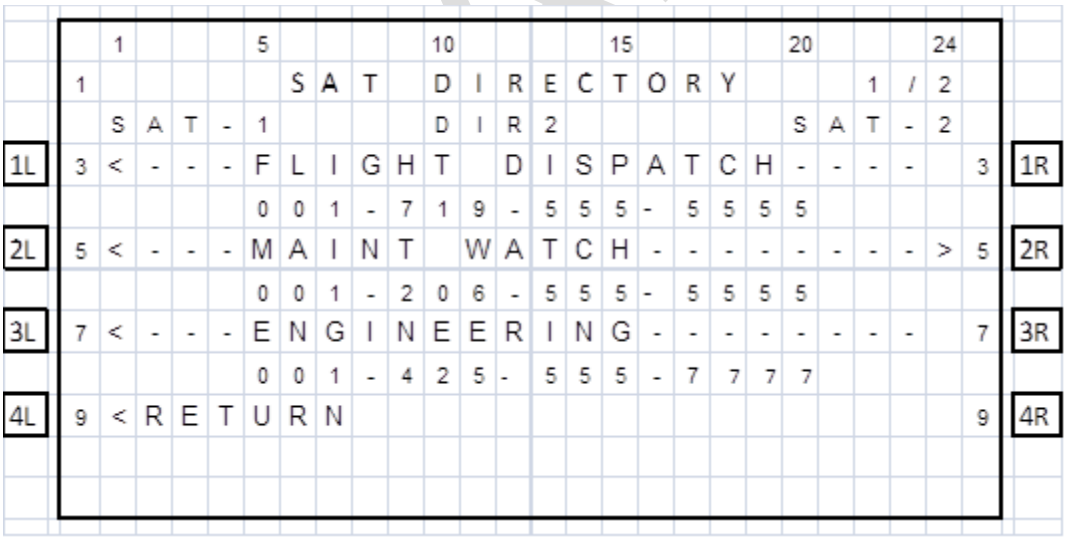
(1) Navigate to the SAT-PHONE 2/2 menu and press the button next to **DIR DETAILS**.



The SAT DIR DETAILS menu appears and shows directory page 1. There are 20 phone directories with five phone number entries available in each directory.



Use **NEXT PAGE** and **PREV PAGE** to navigate to the directory in which you want to add or modify a phone number entry.

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(2) To modify an entry, press the button next to the entry. To add a new entry, press the button next to an empty line.

(3) Type the name associated with the telephone number in the scratchpad and then press the button next to the name field on the TCP screen.

- The maximum number of characters for a name is 14.

(4) Enter a number in the TCP scratchpad using the following pattern.

00+CC+NNN+NUMBER (for calls within North America)

011+CC+NNN+NUMBER (for International calls)

where:

- 00 and 011 are access codes
- CC is the country code (Country Code may be up to 4 digits)
- NNN is the city or area code

NOTE:

- You can enter up to 18 characters in the scratchpad (including hyphens), but the maximum number of digits that can be dialed is 17.
- Hyphens are not necessary. If you wish to use hyphens, press the +/- key on the scratchpad.

(5) Press the button next to the phone number field on the TCP screen.

(6) Press the button next to **PRIORITY** to select a priority for the phone number.

(7) To save the entry, press the button next to **STORE.** To cancel the new entry, press the button next to **CANCEL**.

(8) Press the button next to **CONFIRM**.

The entry is saved.

NOTE: You can protect directory entries using the Phonebook ORT parameter. If an entry is protected, it cannot be modified or deleted. For more information about the Phonebook ORT parameter, refer to "ORT Overview" on page 3-7.

D. Viewing BITE Information

From the SATCOM BITE menu, you can view BITE information to determine subsystem health.

To view BITE information:

(a) On the TCP main menu, press the button next to **SAT.**

(b) On the TCP keyboard, press the **NEXT PAGE** key to advance to the second page of the SAT-PHONE menu, and then press the button next to **SATCOM BITE**.

The SATCOM BITE menu appears.

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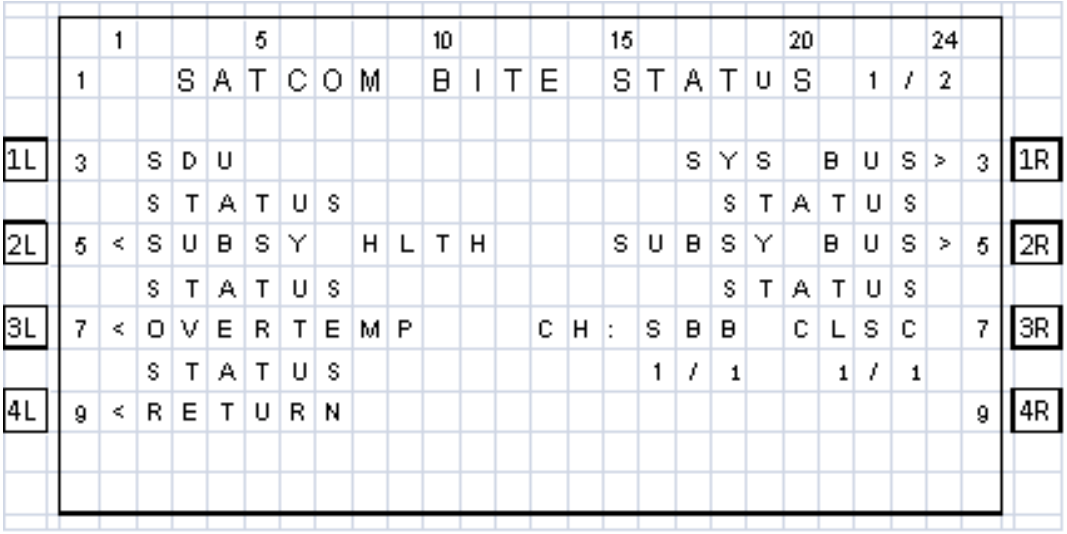

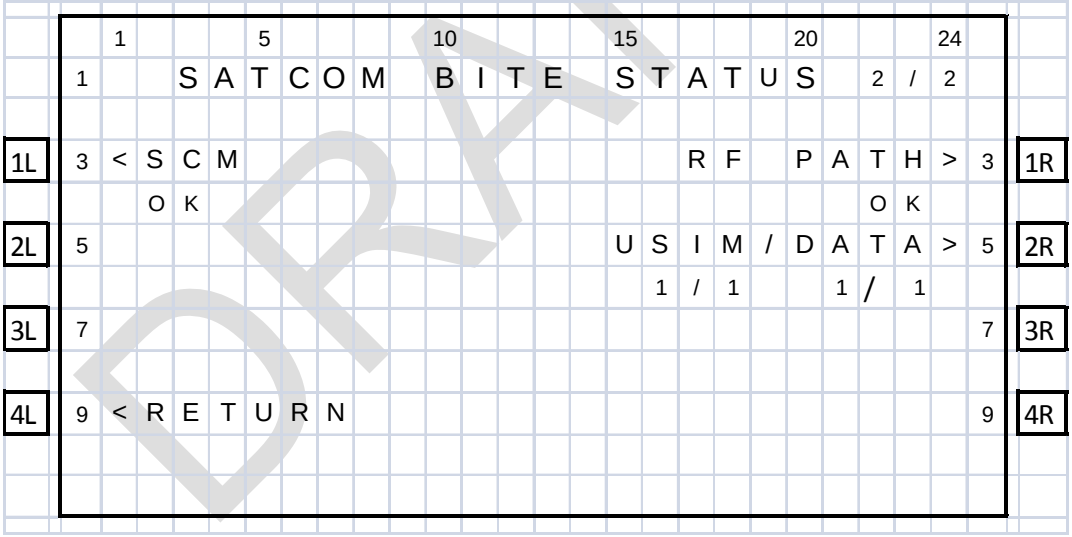

You can view the following information from this screen:

- SDU status on the line below **SDU**
- Overall health of all subsystem components (SCM, DLNA, and HGA) on the line below **SUBSY HLTH**
- Thermal status of the SDU and HGA on the line below **OVERTEMP**
- SCM health on the line below **SCM**
- Peripheral LRU bus status on the line below **SYS BUS**

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- Subsystem bus status on the line below **SUBSY BUS**
- The number of functional channels followed by the number of installed channels on the line below **CHANNELS**
- The number of functioning SBB channels and Classic channels below **CH-SBB CLSC**
- RF path status on the line below **RF PATH**
- USIM and data bus status on the line below **USIM/DATA.**

NOTE: Valid values for status are OK and FAIL. If the status of a subsystem is FAIL, press the button next to the subsystem to view the details.

To view more information about the health of a particular subsystem, press the button next to the name of the subsystem. For more information about the various TCP menu screens, see "Troubleshooting and Fault Isolation" on page 4-8.

3. Channel Status and System Configuration

A. SBB Status

As shown in Figure 2-3, the SBB menu provides information about the status of the SBB service.

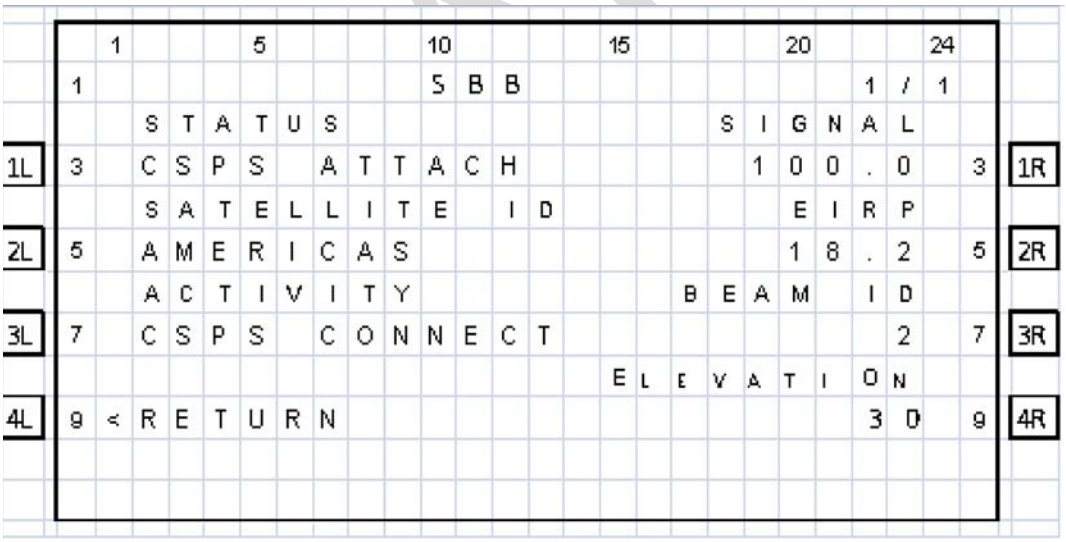

Figure 2-3. SBB Menu

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Table 2-2 describes the information available in the SBB menu.

Table 2-2. SBB Menu

Label	Description
Status	The status of the SBB channel. Possible values are: • HSR NOT READY—high stability oscillator is warming • USIM WARMING—USIM is warming • NOT READY—channel card has not yet started registration, and may be waiting on the Classic card • ATTACHING—satellite identified and attach has begun • CS ATTACH—attach complete, circuit-switch granted • PS ATTACH—attach complete, packet-switch granted • CSPS ATTACH—attach complete, circuit-switch and packet-switch granted • ATTACH-FAIL— attach failed, with the 3GPP cause code • NOT READY—selected satellite does not support SBB • DISABLED—selected SBB service is not configured in the operational mode
Satellite	The selected ocean region.
Activity	The activity status of the SBB service. Possible values are: • CS CONNECT—Circuit Switched services in use • PS CONNECT—Packet Switched services in use • CSPS CONNECT—Circuit Switched services and Packet Switched services in use • NONE —No services in use
Signal	The current signal quality.
EIRP	The EIRP setting of the channel.
Beam ID	The current beam ID for the service.
Elevation	The computed elevation angle for the antenna pointing vector.

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B. Channel Information and Bit Errors

As shown in Figure 2-4, the SATCOM LOG 2 menu provides information about the current channel and the bit error rate.

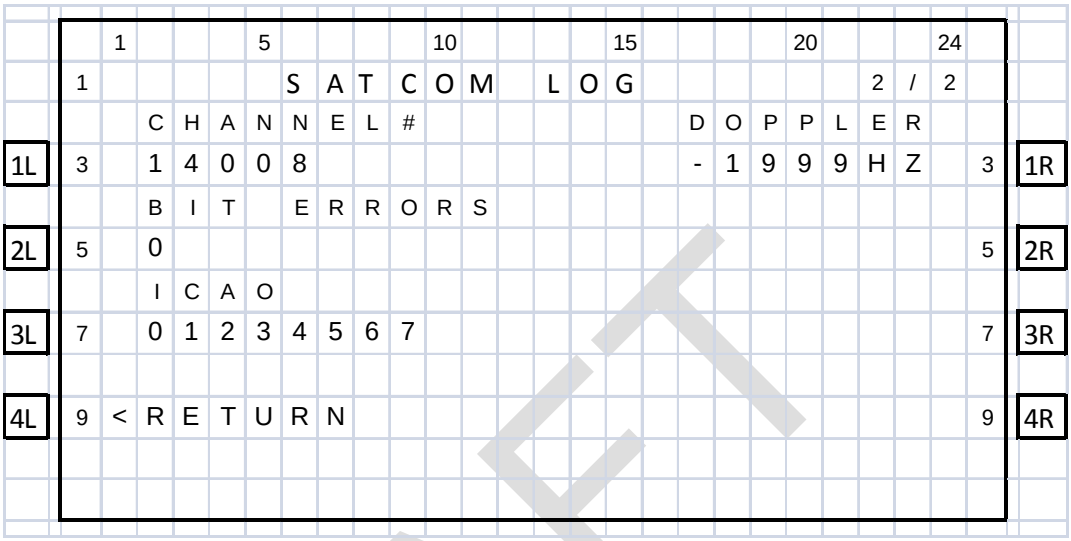

Figure 2-4. SATCOM LOG 2 menu

Table 2-3 describes the information available in the SATCOM LOG 2 menu.

Table 2-3. SATCOM LOG 2 Menu

Label	Description
Channel #	Channel number representation of the P channel, displayed only when the SDU is logged on, otherwise the display is blank.
Bit Errors	The raw bit error rate.
ICAO	The current ICAO address.
Doppler	The doppler correction.

C. System Part Numbers

As shown in Figure 2-5, the SATCOM CONFIG 1 menu provides the hardware part numbers of the SDU and the SCM.

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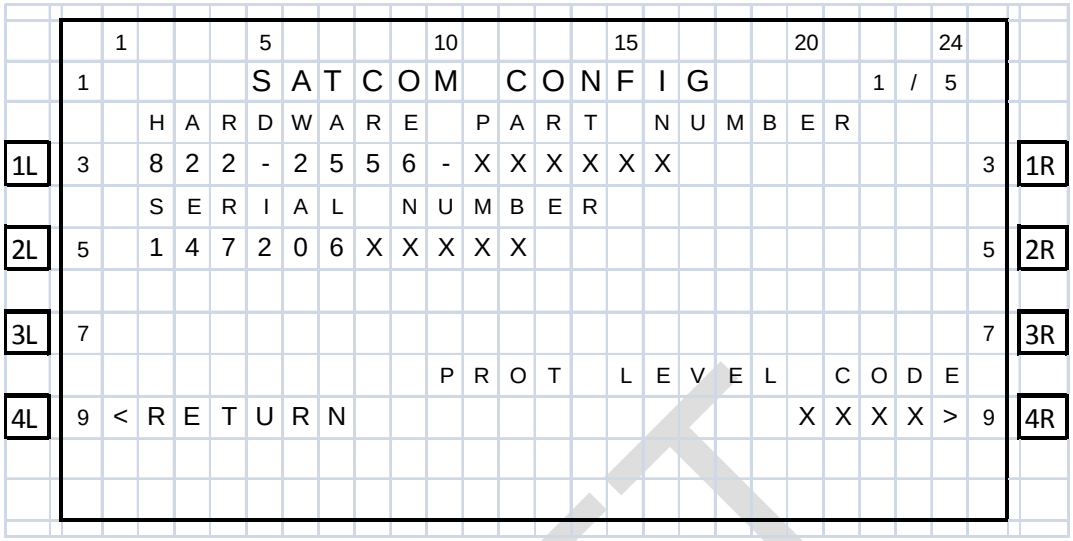

Figure 2-5. SATCOM CONFIG 1 Menu

Table 2-4 describes the information available in the SATCOM CONFIG 1 menu.

Table 2-4. SATCOM CONFIG 1 Menu

Label	Description
Hardware Part Number	Part number of the A781-500 SDU.
Serial Number	Serial number of the A781-500 SDU.
PROT Level Code	This code is displayed if the SATCOM CONFIG menu is accessed from the In-Flight menus. It allows access to the Maintenance Mode TCP menus. Contact RC Product Support for the PROT level code.

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As shown in Figure 2-6, the SATCOM CONFIG 2 menu provides the software part numbers of the equipment in the A781-500 system.

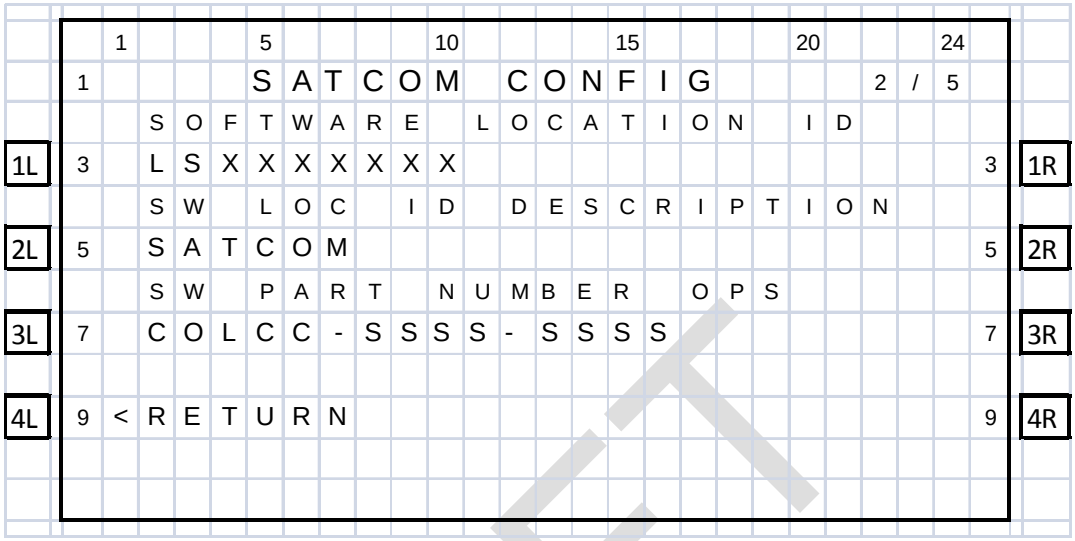

Figure 2-6. SATCOM CONFIG 2 Menu

Table 2-5 describes the information available in the SATCOM CONFIG 2 menu.

Table 2-5. SATCOM CONFIG 2 Menu

Label	Description
Software Location ID	TBD
SW Part Number SDU OPS	Software part number of the operational software in the A781-500 SDU.

As shown in Figure 2-7, the SATCOM CONFIG 3 menu provides the software numbers of the Secure ORT and the User ORT.

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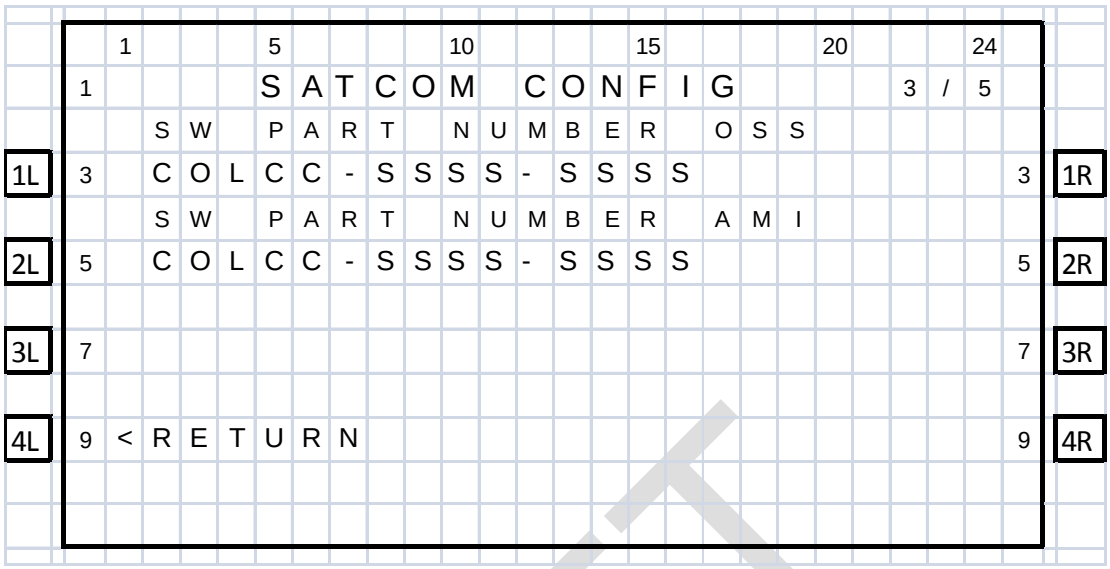

Figure 2-7. SATCOM CONFIG 3 Menu

Table 2-6 describes the information available in the SATCOM CONFIG 3 menu.

Table 2-6. SATCOM CONFIG 3 Menu

Label	Description
SW Part Number OSS	Software part number of the Secure ORT (OSS)
SW Part Number AMI	Software part number of the User ORT (AMI)

As shown in Figure 2-8, the SATCOM CONFIG 4 menu provides the hardware part number and serial number of the antenna in the A781-500 system.

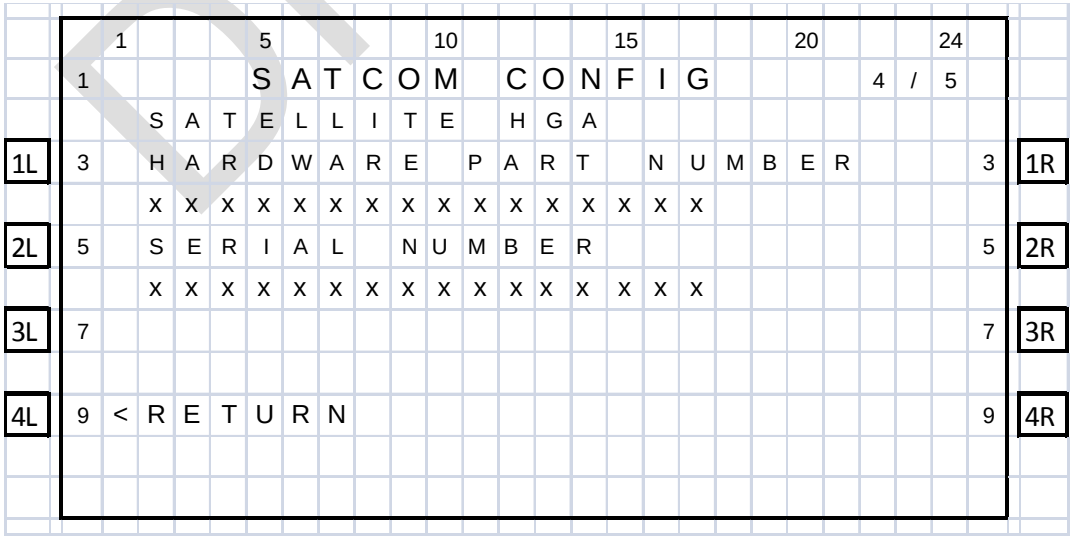

Figure 2-8. SATCOM CONFIG 4 Menu

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Table 2-7 describes the information available in the SATCOM CONFIG 4 menu.

Table 2-7. SATCOM CONFIG 4 Menu

Label	Description
Hardware Part Number	Hardware part number of the HGA
Serial Number	Serial number of the HGA

As shown in Figure 2-9, the SATCOM CONFIG 5 menu provides the hardware part number and serial number of the SCM.

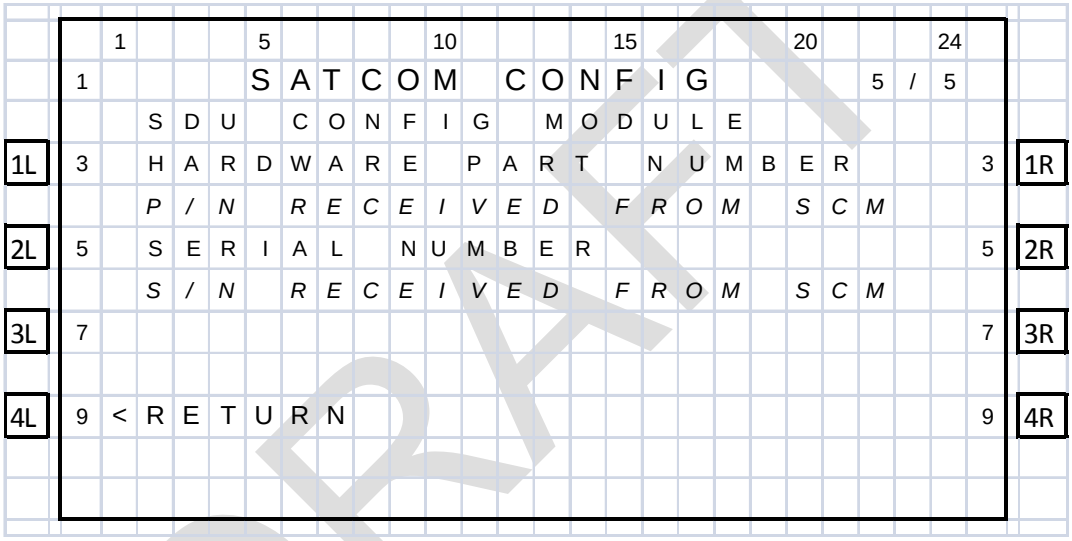

Figure 2-9. SATCOM CONFIG 5 Menu

Table 2-8 describes the information available in the SATCOM CONFIG 5 menu.

Table 2-8. SATCOM CONFIG 5 Menu

Label	Description
Hardware Part Number	Hardware part number of the SCM
Serial Number	Serial number of the SCM

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4. Maintenance Mode

The maintenance menus of the TCP provide the same configuration and BITE information available in In-Flight mode, and provide access to the PIM test, audio configuration, and other options and parameters.

Maintenance mode includes a number of TCP menus, as shown in Figure 2-10.

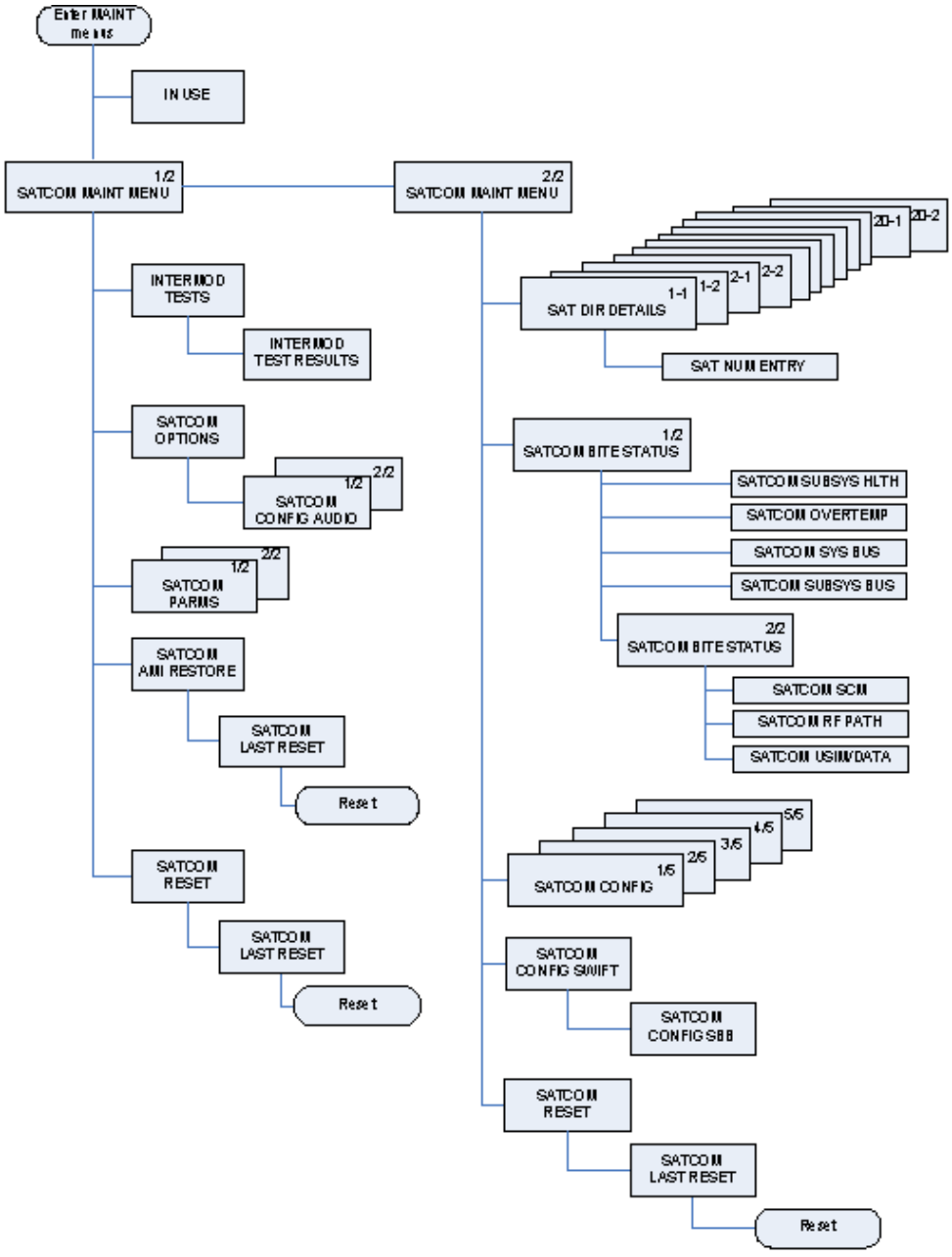

Figure 2-10. Maintenance Mode TCP Menu Structure

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A. Accessing Maintenance Mode

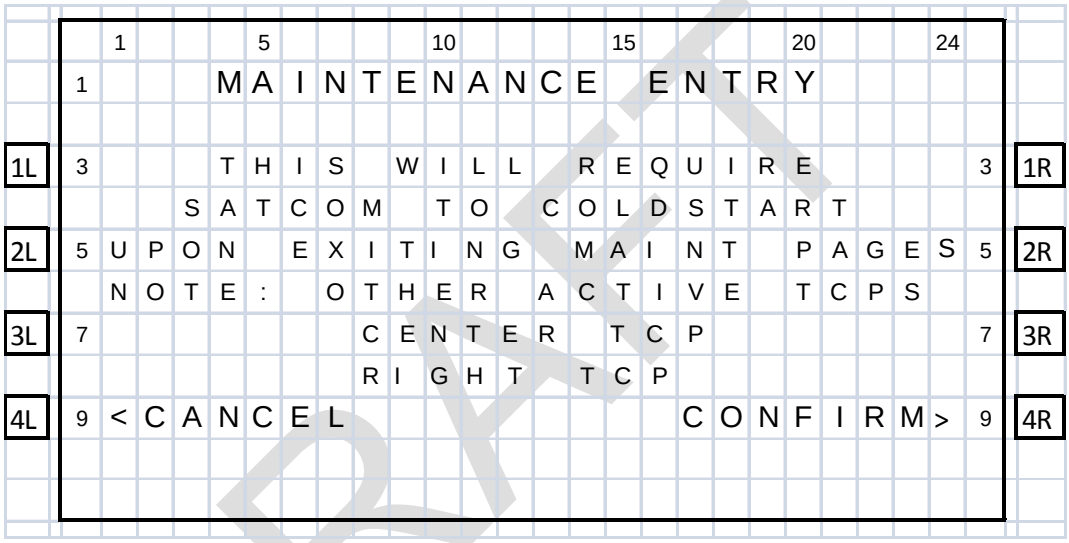
You can only access the TCP maintenance menus when the plane is on the ground and classic services are logged off.

To access the maintenance menus:

1. In the SATCOM CONFIG 1/4 menu, type the protection level code in the scratchpad, and press the button next **PROT LEVEL CODE**.

   NOTE: Contact RC Product Support for the PROT level code.

   The TCP displays the MAINTENANCE ENTRY page.



To enter Maintenance Mode, press the button next to **CONFIRM**.

The SATCOM MAINT MENU appears.

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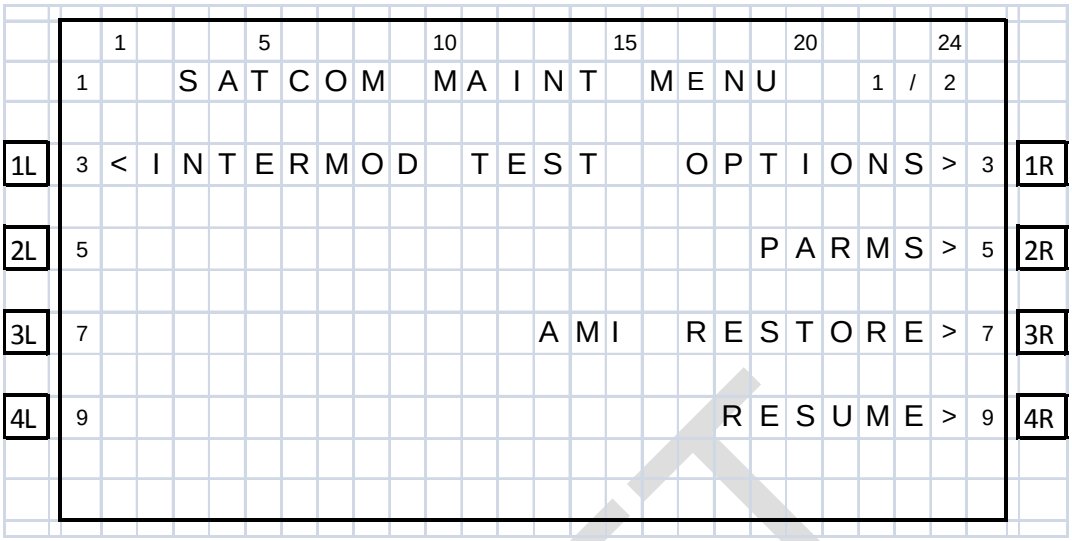

B. Viewing BITE Information

The BITE information available in maintenance mode is the same as the BITE information available in In-Flight mode. For information about the BITE menus, see "Viewing BITE Information" on page 2-14.

C. Starting the Intermod Test

For information and instructions about running the PIM test, see "PIM Test" on page 3-8.

D. Viewing Configuration

The configuration menus available in maintenance mode are the same as the configuration menus in In-Flight mode. For information about these menus, see "System Part Numbers" on page 2-18.

E. Viewing SATCOM Parameters

As shown in Figure 2-11, the SATCOM PARMS menu provides information about logon, fallback, and the channel cards.

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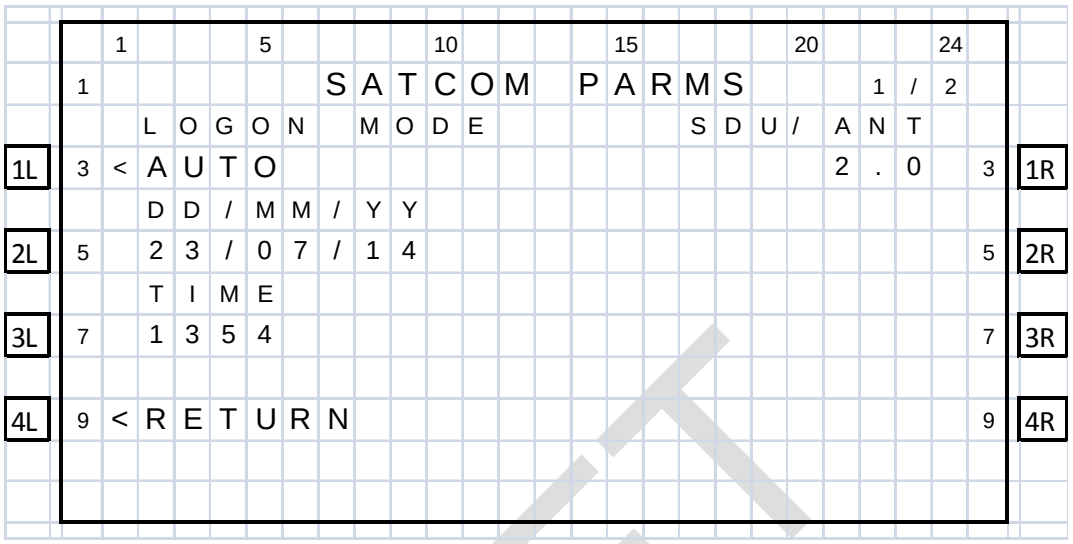

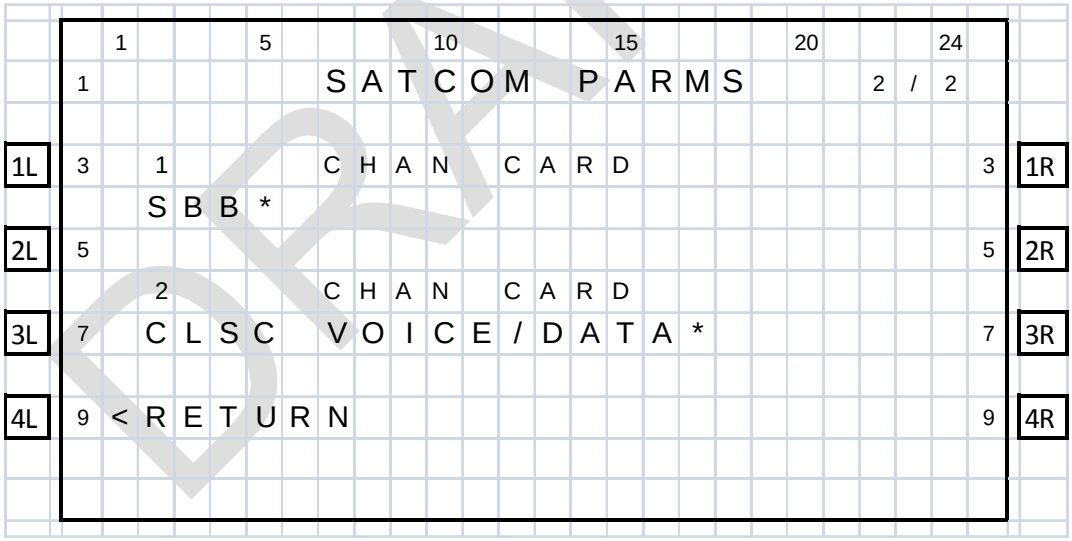

Figure 2-11. SATCOM PARMS

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Table 2-9 describes the information available in the SATCOM PARMS menu.

Table 2-9. SATCOM PARMS Menu

Label	Description
LOGON MODE	AUTO or MANUAL
DD/MM/YY	Current date
TIME	Current time
SDU/ANT	Estimated loss between the SDU and antenna
CHAN CARD1	SBB
CHAN CARD2	CLSCVOICE/DATA

F. Viewing SATCOM Options

As shown in Figure 2-12, the SATCOM OPTIONS menu provides information about audio and phone operation.

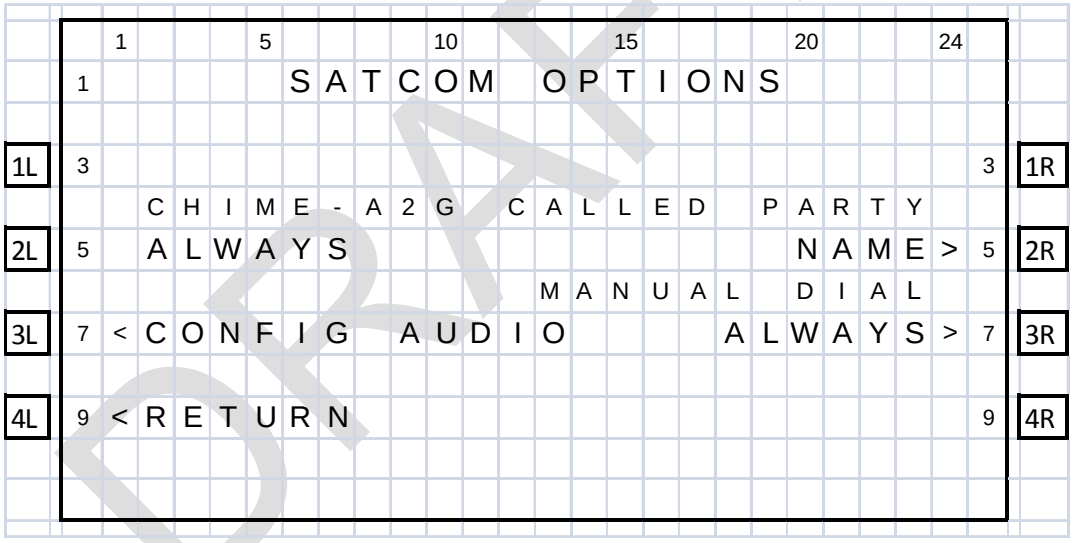

Figure 2-12. SATCOM OPTIONS

Table 2-10 describes the information available in the SATCOM OPTIONS menu.

Table 2-10. SATCOM OPTIONS Menu

Label	Description
CHIME-A2G	Value of the CHIME A2G ORT parameter.
CALLED PARTY	Display mode selection for call placement.
MANUAL DIAL	Current state of the scratchpad number entry control.

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G. Configuring Audio Options

As shown in Figure 2-13 and Figure 2-14, the SATCOM CONFIG AUDIO menu provides information and settings for cockpit phone operation.

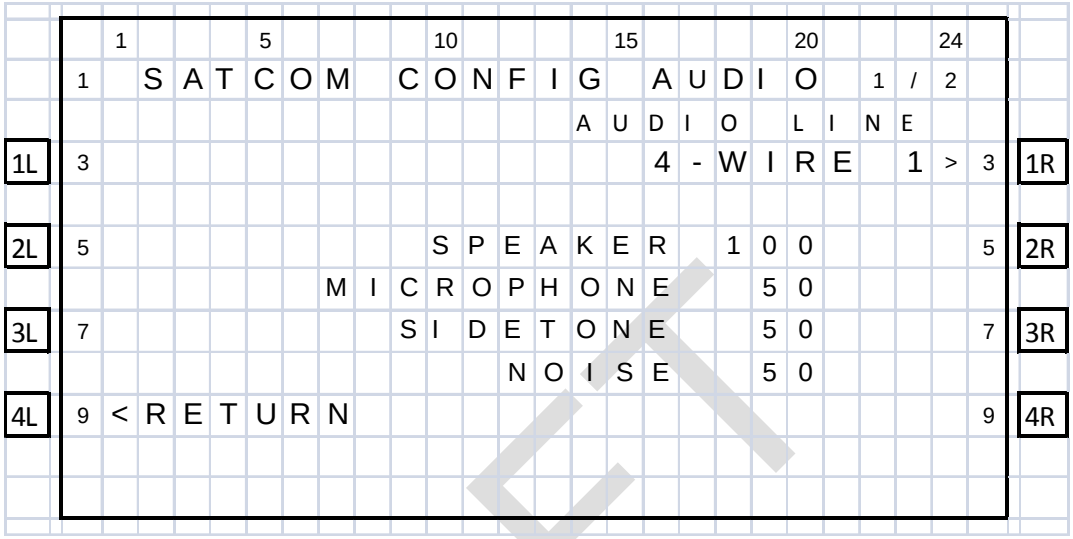

Figure 2-13. CONFIG AUDIO 1/2

Table 2-11 describes the information available in the SATCOM CONFIG AUDIO 1 menu.

Table 2-11. SATCOM CONFIG AUDIO 1 Menu

Label	Description
AUDIO LINE	Switch between four-wire 1 and four-wire 2.
SPEAKER	Headset speaker level—0 to 100.
MICROPHONE	Microphone level—0 to 100.
SIDETONE	Sidetone level—0 to 100.
NOISE	Headset speaker noise level—0 to 100.

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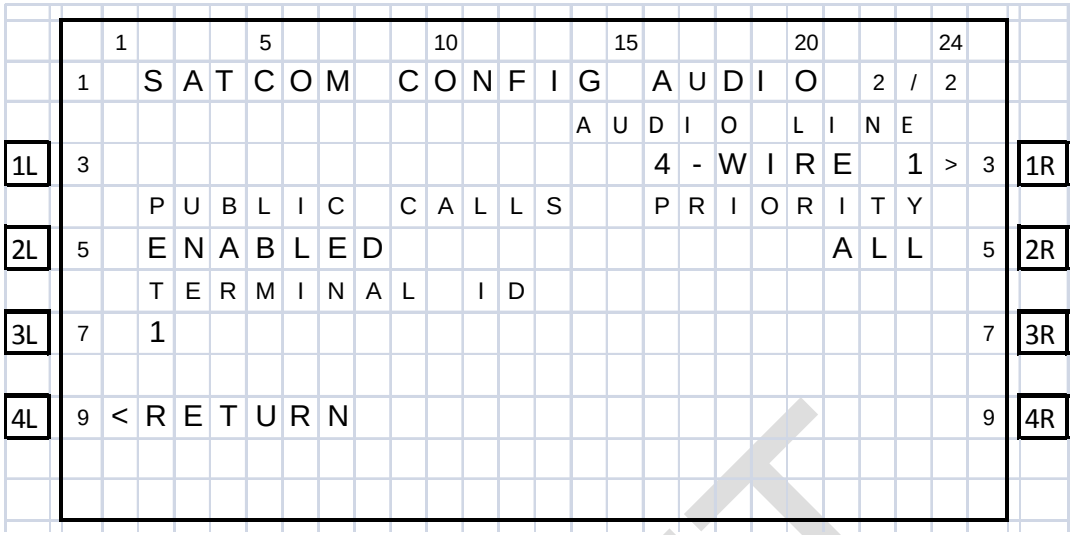

Figure 2-14. CONFIG AUDIO 2/2

Table 2-12 describes the information available in the SATCOM CONFIG AUDIO 2 menu.

Table 2-12. SATCOM CONFIG AUDIO 2 Menu

Label	Description
AUDIO LINE	Switch between four-wire 1 and four-wire 2.
PUBLIC CALLS	Displays the value of the Ground Initiated Public Call Routing ORT parameter. This parameter enables the placing and acceptance of public calls via the analog audio lines.
TERMINAL ID	The terminal ID for the selected audio line interface.
PRIORITY	The priority of calls allowed via the selected audio interface. The possible values are: • COCKPIT • PUBLIC • ALL

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INSTALLATION

This section describes the procedures required to install the A781-500 system (SDU and SCM) on an aircraft, including the following sections:

- Advisories
- Pre-Installation Inspection
- Installation Procedure
- Connection Details
- Owners Requirements Table (ORT)
- Passive Intermodulation (PIM) Test
- Installation and Engineering Drawings

1. Advisories

Before performing any installation procedures, read the safety advisories listed in the Introduction on page INTRO–4 of this manual.

2. Pre-Installation Inspection

Before installing any A781-500 system, conduct a pre-installation inspection of all parts to make sure that no damage occurred during shipping.

A. Unpacking and Inspecting Equipment

- Unpack the A781-500 equipment from the shipping containers.
- Verify that the part number displayed on the shipping box and equipment component matches the model and part number ordered. If components are missing from the shipment, contact the supplier immediately and report the problem.
- Visually inspect the A781-500 equipment for any shipping damage. If any shipping damage has occurred, contact the shipping carrier immediately and report the problem.
- Check the A781-500 equipment connectors for corrosion and damage. If damage is noted, do not apply power to the equipment. Contact the supplier immediately to report the problem.

B. Cabling Notes

Before proceeding with the installation of the A781-500 system, read all cabling notes provided on the Interconnection and Contact Assignment drawings.

3. Installation Procedure

Only authorized technical personnel, trained in general aviation workmanship, that have a basic understanding of SATCOM systems should proceed with the following procedure.
Before performing any installation procedures, read the safety advisories listed in "Safety Advisories" on page INTRO-4 of this manual.

CAUTION: THE A781-500 SYSTEM REQUIRES CONDITIONED AIR PER ARINC781.

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1. Install the SDU in a 6 MCU tray as per ARINC 600. The minimum clearance between the SDU and any other equipment installed above it shall be no less than 0.5 inches (12.7 mm).
2. Install the SCM in any orientation. Refer to Table 1-2 on page 5 for the SCM mounting specification.
   - There are no clearance requirements for the SCM.
3. Connect the SCM to the SDU. The SDU supports one RS-422 interface for interconnect to the SCM.
4. Connect the SDU to the antenna subsystem. The SDU supports ARINC 429 communication to and from the antenna subsystem.
5. Connect the SDU to the TCP(s). The SDU supports three ARINC 429 receive interfaces and one ARINC 429 transmit interface for interconnect to the flight deck TCP(s).

4. Connection Details

A. SDU

The SDU uses two external interface connectors:

- Rear Connector—a low insertion force, size 2 shell receptacle accommodating coaxial and signal interconnections in the top plug insert, Quadrax and signal connections in the middle plug insert, and coaxial and power interconnections in the bottom plug insert. Pin assignments are compliant with ARINC Characteristic 781 with top plug and middle plug deviations as shown in Table 3-1.
- Front Connector—an RJ45 and 9S DSUB connector providing 10BaseT Ethernet interfaces and an RS-232 maintenance interface. Pin assignments are shown in Table 3-2. The front connector is behind a maintenance cover. This connector provides access to maintenance and troubleshooting information when the SDU is not in normal operation.

Table 3-1. SDU Rear Connector Pin Deviations

Pin Number	A781	Deviation
TP01C	ATE pin 3	Data I/O Processor Maintenance GND
TP01D	ATE pin 4	Data I/O Processor Maintenance TXD
TP01E	ATE pin 5	Data I/O Processor Maintenance RXD
TP01F	ATE pin 6	CC1 Processors #1 & #2 Maintenance GND
TP01G	ATE pin 7	CC1 Processor #1 Maintenance TXD
TP01H	ATE pin 8	CC1 Processor #1 Maintenance RXD
TP01J	ATE pin 9	CC1 Processor #2 Maintenance TXD
TP01K	ATE pin 10	CC1 Processor #2 Maintenance RXD
TP02A	ATE pin 11	Shopload
TP02C	ATE pin 13	Voice Processor Maintenance GND
TP02D	ATE pin 14	Voice Processor Maintenance TXD
TP02E	ATE pin 15	Voice Processor Maintenance RXD
TP02F	ATE pin 16	CC2 Processor Maintenance GND

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Table 3-1. SDU Rear Connector Pin Deviations

Pin Number	A781	Deviation
Top Plug Insert Pin Deviations		
TP02G	ATE pin 17	CC2 Processor 2A Maintenance TXD
TP02H	ATE pin 18	CC2 Processor 2A Maintenance RXD
TP02J	ATE pin 19	CC2 Processor 2B Maintenance TXD
TP02K	ATE pin 20	CC2 Processor 2B Maintenance RXD
TP03A	Ethernet	Ethernet speed, 10Base-T
TP03B	Ethernet	Ethernet speed, 10Base-T
TP03C	Empty Cavity	SPARE
TP04A	Ethernet	Ethernet speed, 10Base-T
TP04B	Ethernet	Ethernet speed, 10Base-T
TP04C	Empty Cavity	SPARE
TP05A	Empty Cavity	SPARE
TP05B	Empty Cavity	SPARE
TP05C	Empty Cavity	SPARE
TP06A	Ethernet	Ethernet speed, 10Base-T
TP06B	Ethernet	Ethernet speed, 10Base-T
TP06C	Empty Cavity	SPARE
TP07A	Ethernet	Ethernet speed, 10Base-T
TP07B	Ethernet	Ethernet speed, 10Base-T
TP07C	Empty Cavity	SPARE
Middle Plug Insert Pin Deviations		
MP05F	Spare Discrete	Reserved for future use.
MP07C	Spare Discrete	Flight Deck Data Load

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Figure 3-1 shows the top plug pin deviations outlined in gray.

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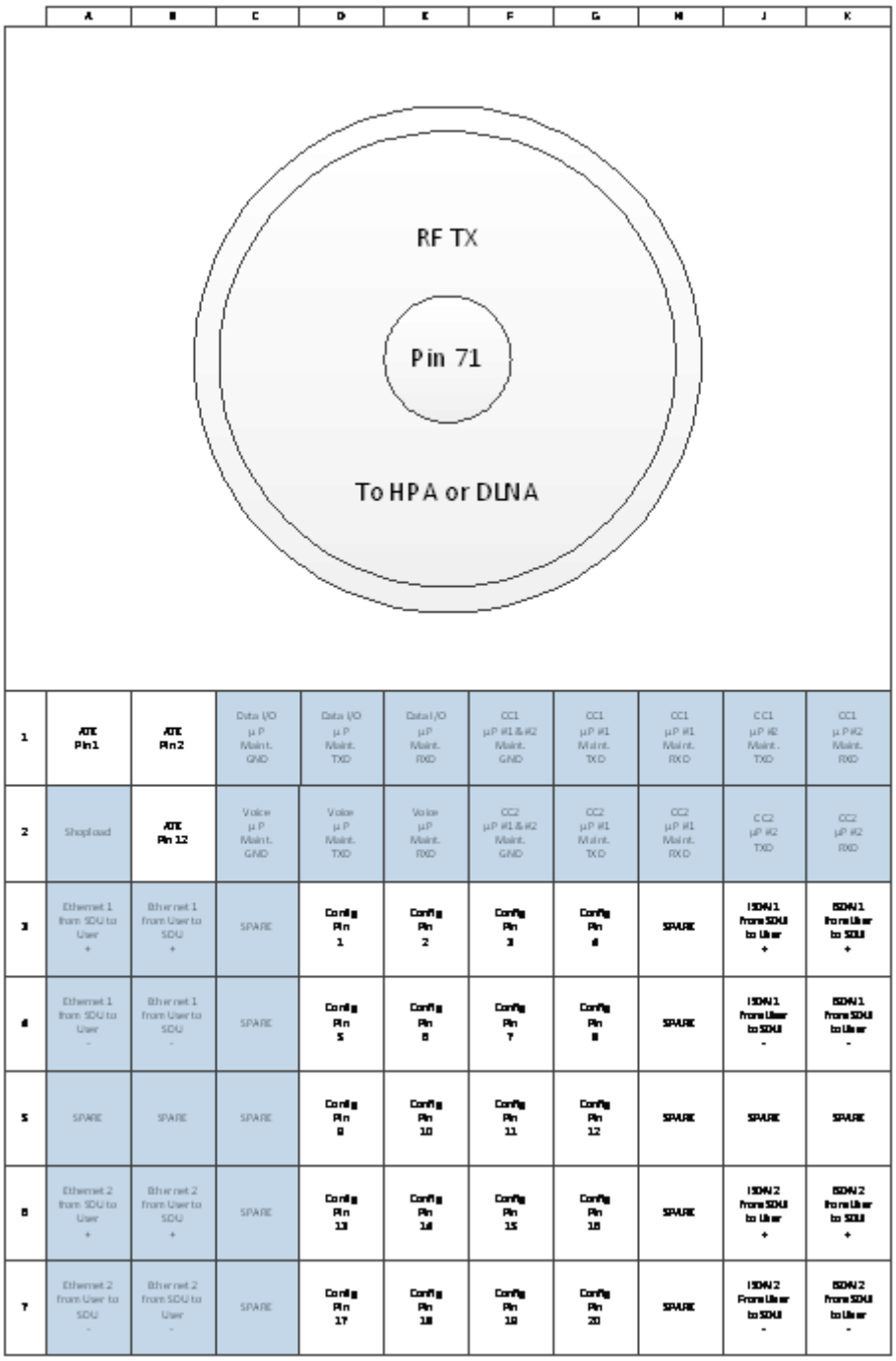

	A	B	C	D	E	F	G	H	J	K
1	ATE Pin1	ATE Pin2	Data I/O µP Maint. GND	Data I/O µP Maint. TXD	Data I/O µP Maint. RXD	CC1 µP #1 & #2 Maint. GND	CC1 µP #1 Maint. TXD	CC1 µP #1 Maint. RXD	CC1 µP #2 Maint. TXD	CC1 µP #2 Maint. RXD
2	Shopload	ATE Pin 12	Voice µP Maint. GND	Voice µP Maint. TXD	Voice µP Maint. RXD	CC2 µP #1 & #2 Maint. GND	CC2 µP #1 Maint. TXD	CC2 µP #1 Maint. RXD	CC2 µP #2 TXD	CC2 µP #2 RXD
3	Ethernet 1 from SDU to User +	Ethernet 1 from User to SDU +	SPARE	Config Pin 1	Config Pin 2	Config Pin 3	Config Pin 4	SPARE	ISDN 1 from SDU to User +	ISDN 1 from User to SDU +
4	Ethernet 1 from SDU to User -	Ethernet 1 from User to SDU -	SPARE	Config Pin 5	Config Pin 6	Config Pin 7	Config Pin 8	SPARE	ISDN 1 from User to SDU -	ISDN 1 from SDU to User -
5	SPARE	SPARE	SPARE	Config Pin 9	Config Pin 10	Config Pin 11	Config Pin 12	SPARE	SPARE	SPARE
6	Ethernet 2 from SDU to User +	Ethernet 2 from User to SDU +	SPARE	Config Pin 13	Config Pin 14	Config Pin 15	Config Pin 16	SPARE	ISDN 2 from SDU to User +	ISDN 2 from User to SDU +
7	Ethernet 2 from User to SDU -	Ethernet 2 from SDU to User -	SPARE	Config Pin 17	Config Pin 18	Config Pin 19	Config Pin 20	SPARE	ISDN 2 From User to SDU -	ISDN 2 from SDU to User -

Figure 3-1. Top Plug Pin Deviations

Figure 3-2 shows the mid plug pin deviations outlined in gray.

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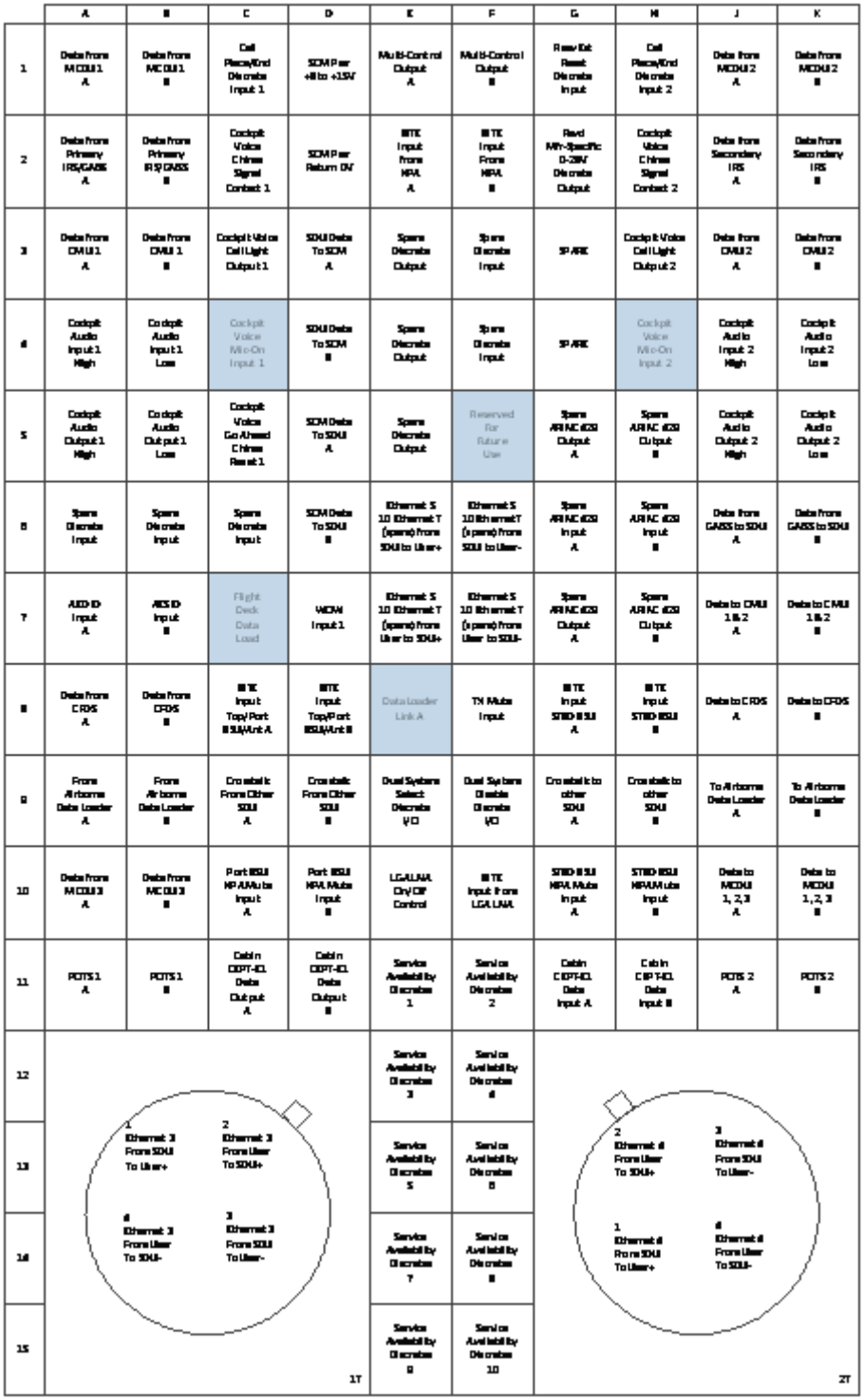

Figure 3-2. Mid Plug Pin Deviations

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Table 3-2. SDU Front Connector DSUB and RJ45 Pin Assignment

9S DSUB Pin Number	Description	RJ45 Pin Number	Description
1	NC	1	RX+
2	TX	2	RX-
3	RX	3	TX+
4	NC	4	NC
5	GND	5	NC
6	NC	6	TX-
7	NC	7	NC
8	NC	8	NC
9	NC		

B. SCM

The SCM uses a 15-pin D-type male connector and locking screws. Pin assignments are compliant with ARINC Characteristic 781 and shown in Table 3-3.

Table 3-3. SCM D-Type Connector Pin Assignment

Pin Number	Description
1	Data to SDU A (RS422)
2	Data to SDU B (RS422)
3	Data from SDU A (RS422)
4	Data from SDU B (RS422)
5	Reserved - RS232 Gnd (used for shop loading)
6	Spare
7	Chassis Ground
8	Power Input +8 V to +15 V
9	Reserved - Enable RS232 (used for shop loading)
10	Reserved - 0 V strap output (used for shop loading)
11	Spare
12	Reserved - RS232 Tx (used for shop loading)
13	Reserved - RS232 Rx (used for shop loading)
14	Spare
15	Power Return 0 V

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5. Owners Requirements Table (ORT)

A. ORT Overview

The A781-500 system includes a secure and user ORT. Secure ORT files must be certified for the aircraft type on which the equipment is installed. Items in user ORT files can be modified by individual customers and may be customized to an individual aircraft.

You can change secure ORT parameters only by uploading an ORT file. To obtain a secure ORT file, contact RC Product Support.

The ORT file is loaded on to the SCM using an ARINC 615A data loader. You can only load ORT data when the aircraft is on the ground and the data load discrete is asserted. When the SDU boots, it compares the ORT file in its memory to that in the SCM. If the ORT files do not match, the SDU loads the file from the SCM into its memory.

Some user ORT parameters can be modified in the SDU ORT. You can reset the SDU ORT to the default values stored in the SCM in the maintenance menus.

To modify the user ORT parameters, use the ORT Application. To obtain the ORT Application, contact RC Product Support.

For more information see the following guides:

- Publication No. D201511000062, A781-500 User ORT User Guide
- Publication No. D201511000064, A781-500 Secure ORT User Guide
- Publication No. D201511000061, A781-500 ORT Application Install Manual.

6. Passive Intermodulation (PIM) Test

This section describes the passive intermodulation test. You must execute the PIM test after installation if the A781-500 SDU operates in SBB mode.

A. Overview

To meet Inmarsat requirements for SBB operation, the A781-500 SDU can test for passive intermodulation effects. The PIM test verifies that the transmit signal from the A781-500 SDU does not degrade or interfere with the receive signals as a result of PIM.

A781-500 SDU can only perform the PIM test when the aircraft is on the ground.

When the A781-500 SDU logs on to the SBB network, the network assigns the terminal two channels for PIM testing. These channels are not used by other terminals so that the A781-500 SDU can transmit the test frequencies without interfering with other satellite communication equipment or the Inmarsat satellite.

B. PIM Requirements

In order to successfully perform the PIM test, the aircraft and the satellite communication system must meet the following requirements:

- The A781-500 SDU must have successfully logged on to a satellite that is visible at the test location within the last 168 hours (7 days).

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- The aircraft has to be outside the hangar and far away from the hangars and towers in order to obtain good results.
- The aircraft must be facing due north in the northern hemisphere, and due south in the southern hemisphere.

C. PIM Test

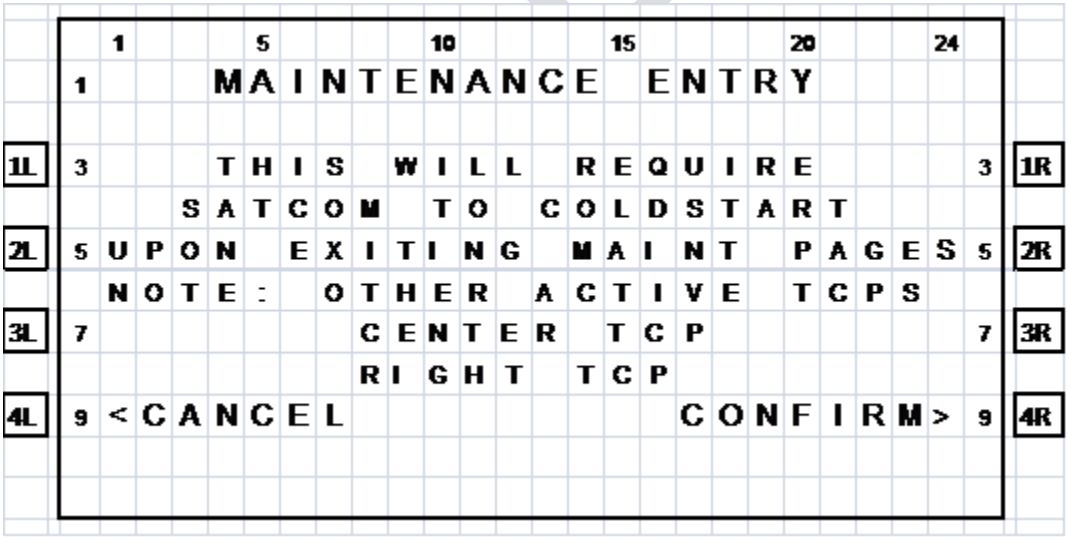
To run the PIM test, you must be in maintenance mode.You can only access the TCP maintenance menus when the plane is on the ground and classic services are logged off.

To start the PIM test:

(a) In the TCP CONFIG 1/5 menu, type the protection level code in the scratchpad, and press the button next to **PROT LEVEL CODE**.

NOTE: Contact RC Product Support for the PROT level code.

The SATCOM Maintenance Entry page appears.



(b) To enter maintenance mode, press the button next to **CONFIRM**.

The MAINTENANCE MENU appears.

(c) To start the PIM test, press the button next to **INTERMOD TEST**.

(d) Press the button next to **RUN** in order to initiate the PIM test.

The PIM test starts. The test takes about 5 minutes.

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D. PIM Test Results

Table 3-4 displays possible PIMBIT status messages. The status messages are displayed on the INTERMOD page.

Table 3-4. PIM Test Conditions

Test Status	Description	Action
READY	Conditions necessary to perform test are present, no test is in progress and no test has been run to completion.	No action required.
IN PROGRESS	Test is in progress.	No action required.
PASS	Test has completed successfully and passed the ORT specified criteria.	No action required.
FAIL	Test has completed but does not meet pass with the ORT specified criteria.	See "PIM Test Overall Status" on page 3-10.
SUSPECT	Test results are suspect (possible causes are: unstable noise, mismatched test frequencies).	Repeat the test.
HSR NOT READY	High stability oscillator is warming.	Wait for the status to change to READY.
NAV DATA UNAVAIL	Test cannot be executed as navigation information is not present.	SDU is in safe mode. Navigation data must be provided in order for the SATCOM system to work, including PIMBIT. Ensure the SDU can receive navigation data. Wait for the status to change to READY and repeat the test.
ANT NOT READY	Test cannot be executed as communication with Antenna has not been established. This could indicate an Antenna or D/LNA fault.	Problem with the antenna. PIMBIT cannot be executed until communication with the antenna is established. Check the cable connections of the SDU and the antenna and check the antenna status. "BITE" on page 4-6. Once the connection has been established, wait for PIMBIT status to change to READY and run PIMBIT.
SDU FAULT	Self test has found internal SDU fault.	Check BITE status. See "BITE" on page 4-6.
TEST FREQ UNAVAIL	No test frequencies less than 168 hours old available for a viable satellite.	Log on to an I-4satellite to obtain test frequencies from the SBB bulletin. Log off, ensure the status changes to READY and run PIMBIT.

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Table 3-4. PIM Test Conditions

Test Status	Description	Action
SAFE MODE	Configuration error detected. Possible causes: • Strapping parity error. • FMPA messages when standalone mode strapped. • Secure ORT parameters are not available.	SATCOM cannot operate until configuration fault is eliminated (see description for possible causes). Once the fault is eliminated, wait for the status to change to READY and run PIMBIT.
NOT ALLOWED IN AIR	Air/Ground status indicates in air. PIMBIT cannot be performed while the aircraft is in the air.	Run PIMBIT when the aircraft is on the ground.

(1) PIM Test Overall Status

At the end of the PIM test, the A781-500 SDU displays the test results on the TCP screen.

The TCP displays the overall PIM status and results for each direction. If the overall status is PASS, the SDU can continue to use SBB services.

If the overall status is FAIL:

- Check the cable connections of the antenna and the SDU.
- Check the direction in which the test failed and verify that the antenna is not blocked in that direction. Refer to "Directional PIM Test Results" on page 3-10.

(2) Directional PIM Test Results

The SDU performs the PIM test with the antenna pointing in different directions and displays the results of the test in each direction. If the overall status of the PIM test is FAIL, you can check the specific directions in which the test failed.

For each direction, the PIM test results provide:

- Overall Status—pass or fail
- The direction coordinates
- The signal degradation—pass level is adjustable in Secure ORT
- Possible interference—interference caused by environmental factors, not the SDU transmit frequencies. Interference indicates that the SDU received a signal in the receive band even when it wasn’t transmitting, therefore an external signal may be interfering with communication in that direction
- Signal and noise levels before and after the test—the SDU uses this information to check for possible interference.

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7. Installation and Engineering Drawings

This section contains the Outline and Installation diagrams, and Interconnection and Contact Assignment drawings for the SDU and SCM.

All foldout pages are odd-numbered and not-backed for print production purposes.

A. Outline and Installation Drawings

The Outline and Installation drawings on Page 3-23 thru Page 3-28 show the physical characteristics of the SDU and SCM, and provide installation data for the system.

B. System Interconnect Drawings

System Interconnect drawings on Page 3-13 thru Page 3-22 show the interconnection details for the SDU and SCM.

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22. SPATIAL MODEL DEFINED BY 90402752_REVB.STP

△20 TAMPER PROOF LABEL.

△19 SOFTWARE LABEL.

△18 CAUTION LABEL: ESD SENSITIVE.

△17 FCC/INDUSTRY CANADA LABEL.

△16 H/W MOD DOT LABEL.

△15 HONEYWELL IDENTIFICATION LABEL INCLUDES:
DESCRIPTION
HARDWARE PART NUMBER AND REVISION
SERIAL NUMBER
DATE OF MANUFACTURE
WEIGHT
CAGE CODE
COUNTRY OF ORIGIN

14. COOLING: BLOW-THROUGH/DRAW-THROUGH PER ARINC 600 LEVEL 1
STANDARD: AIR FLOW AT 50 KG/HR AT 40°C
WITH PRESSURE DROP OF 50±30Pa (5±3MM WATER)

△13 CONNECTOR J1
SEE TABLE 2 FOR CONNECTOR IDENTIFICATION.
ARINC 600 INDEX CODE 81 (5,2,2) BLACK INDICATES RAISED PORTION.

△12 ELECTRICAL BONDING SHALL BE THROUGH CONTACT WITH THE BASE OF UNIT.
DC BONDING RESISTANCE SHALL BE 2.5 MILLIOHMS OR LESS.

11. ELECTRICAL:
INPUT POWER: 115 VAC, 360-800 Hz.
POWER FACTOR: TBD
POWER CONSUMPTION: 425W MAXIMUM AT 115 VAC(360-800Hz).
CURRENT: TBD A MAXIMUM AT 115 VAC, 400 Hz.
POWER DISSIPATION: 220W MAXIMUM AT 115 VAC(360-800Hz).

10. THIS UNIT SHALL BE MOUNTED ONLY IN AN ARINC 600 TRAY WITH A MATCHING
CONNECTOR SCHEME.

△9 INDICATED AREAS ARE FREE FROM PAINT AND PRIMER.

8. FINISH:
METAL TREATMENT: CHEMICAL CONVERSION COATED PER MIL-DTL-5541,
TYPE II, CLASS 3
EXTERIOR FINISH: PRISM POWDER COAT PB134LT (POLYESTER POWDER,
SATIN SANTEX BLACK)APPLIED AND CURED PER MANUFACTURER'S INSTRUCTIONS.

7. MATERIAL:
CHASSIS - ALUMINUM ALLOY 5052-H32, .063 THK PER QQ-A-250/8.

6. ELECTROSTATIC DISCHARGE SENSITIVE (ESD), HANDLE PER IPC-A-610.

△5 ⌖ DENOTES CENTRE OF GRAVITY - LOCATION IS APPROXIMATE.

4. WEIGHT: 25.0 LBS (11.3 KG) MAXIMUM.

△3 DENOTES DIMENSION FROM FRONT PANEL TO REAR PANEL WALL.
DIMENSION DOES NOT INCLUDE SCREW HEAD PROTRUSIONS AND CONNECTOR.

2. THIS UNIT MEETS THE DIMENSIONAL REQUIREMENTS OF A 6MCU PER
ARINC SPECIFICATION 781.

1. DIMENSIONS AND TOLERANCES IAW Y14.5M-1994.

NOTES, UNLESS OTHERWISE SPECIFIED:

TABLE 1. A781-500 SDU PART NUMBER

PART NUMBER	DESCRIPTION
90402750	ASSY, A781-500 SDU

TABLE 2. A781-500 SDU CONNECTOR IDENTIFICATION △13

REF. DES	PART NUMBER	MATING CONNECTOR	REMARKS
J1	RADIALL 620600891	RADIALL NSXN28577S00	J1-A TOP INSERT ARRANGEMENT 1C71 (70X #22 CONTACTS, 1X SIZE #1 CONTACT)
			J1-B MIDDLE INSERT ARRANGEMENT 118Q2 (118X #22 CONTACTS, 2X SIZE 8 QUADRAX)
			J1-C BOTTOM INSERT ARRANGEMENT 12F5C2 (4X #12 CONTACTS, 1X #16 CONTACTS, 5X SIZE 16 OPTICAL, 2X SIZE 5 COAX)

DEVELOPMENT - Release - 22 Oct 2015 10:50:26 MST - Printed on 04 Nov 2015

Figure 3-3. A781-500 SDU Outline and Installation Drawing, PN 90402752 (Sheet 1 of 3)

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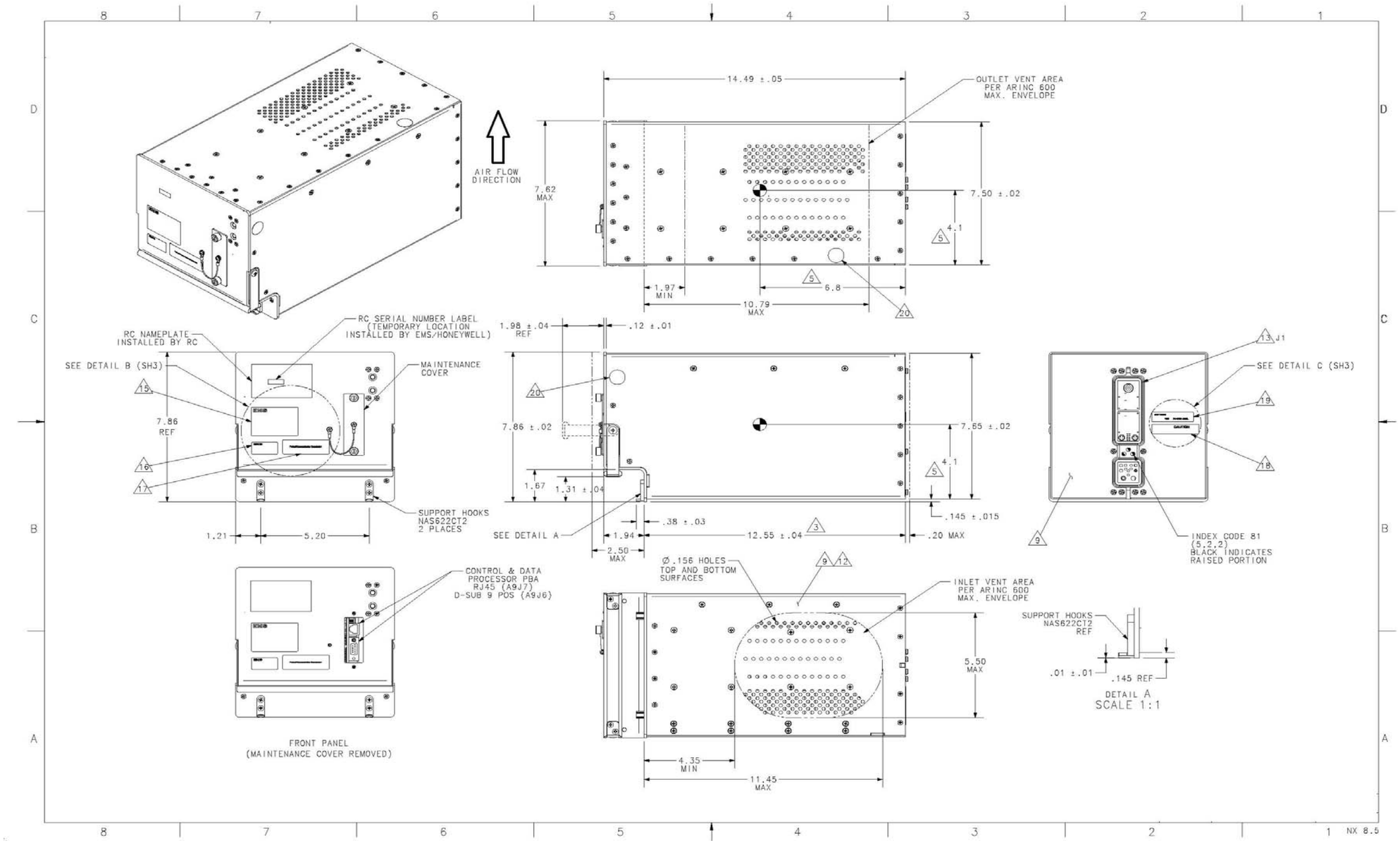

Figure 3-4. A781-500 SDU Outline and Installation Drawing, PN 90402752 (Sheet 2 of 3)

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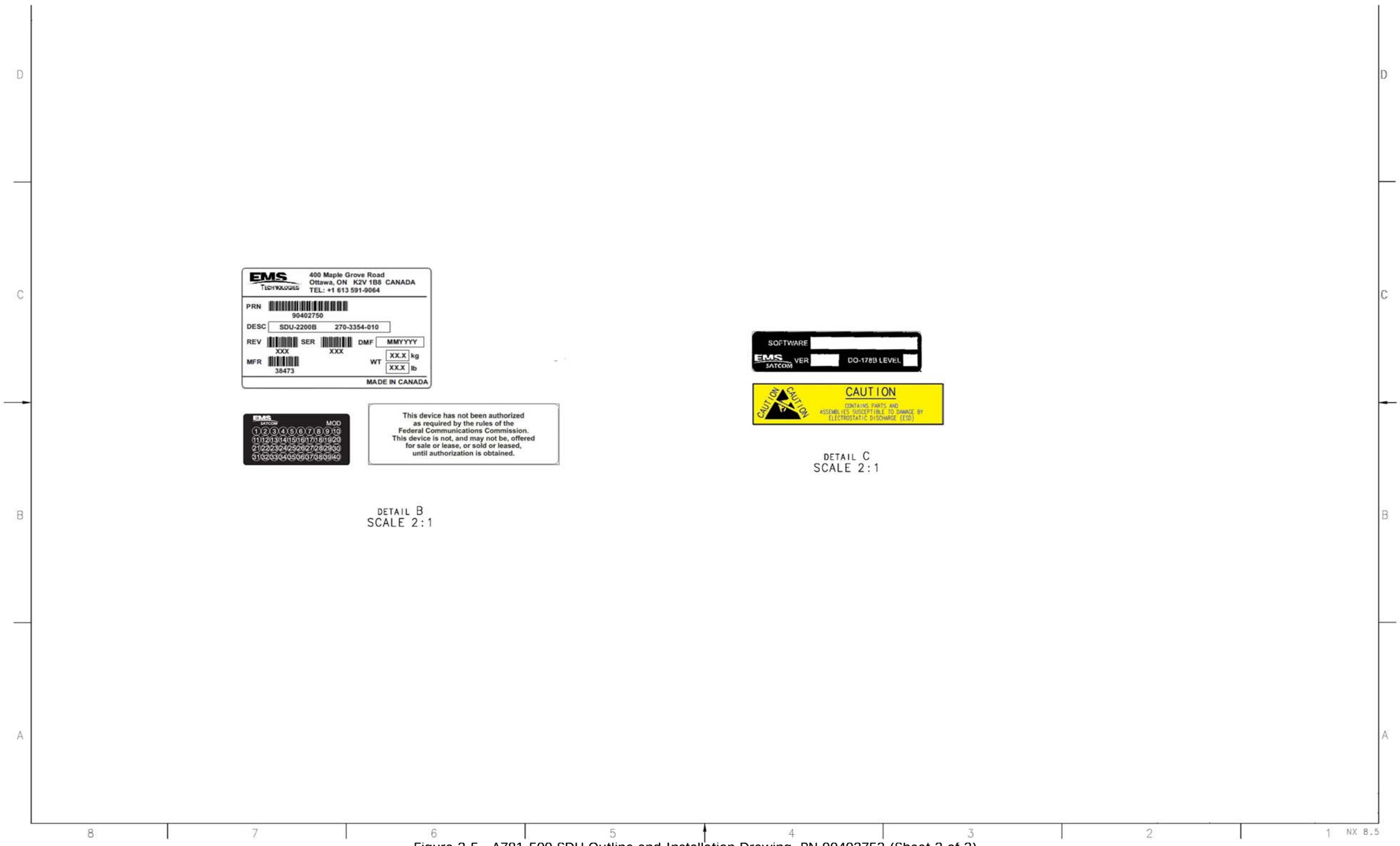

Figure 3-5. A781-500 SDU Outline and Installation Drawing, PN 90402752 (Sheet 3 of 3)

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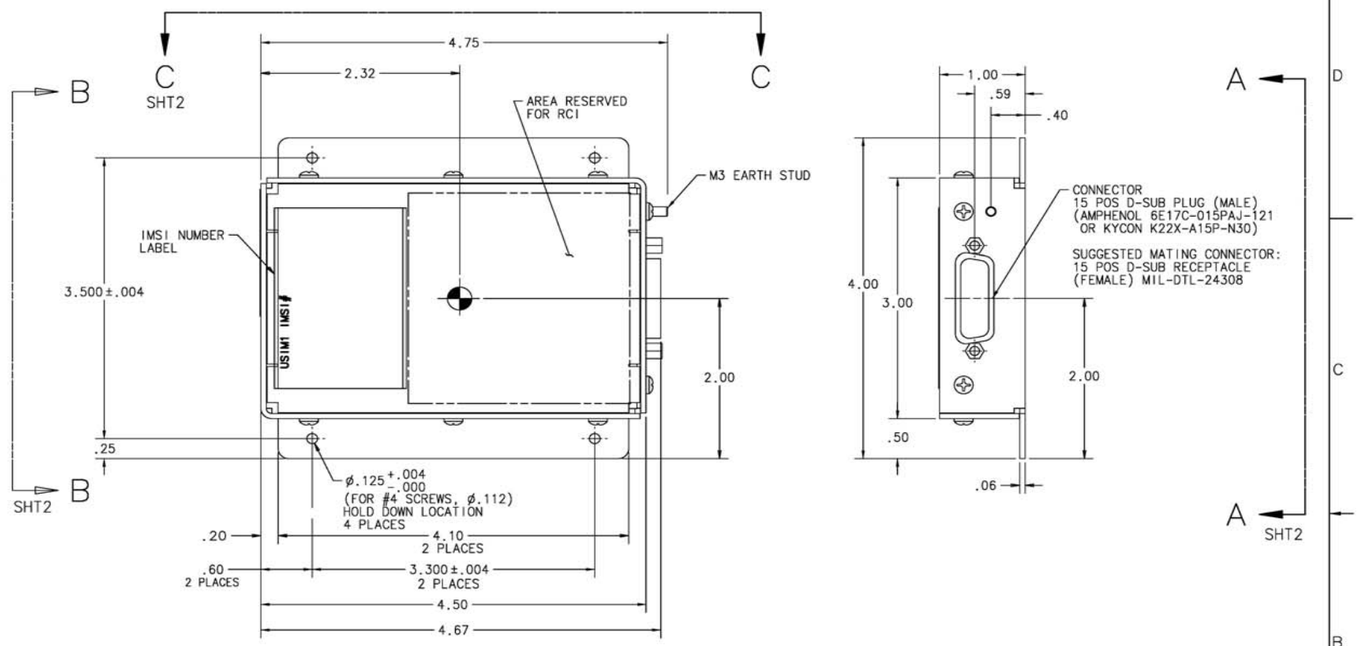
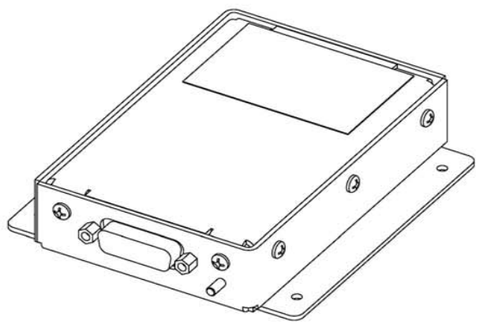
NOTES:

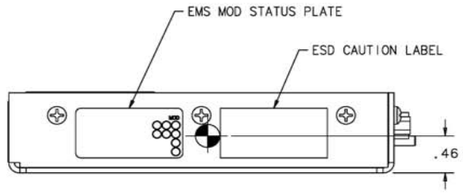
1. THIS UNIT MEETS THE DIMENSIONAL REQUIREMENTS OF ARINC SPECIFICATION 781.
2. MAXIMUM WEIGHT IS .45 kg (1 LB).
3. ⊕ INDICATES APPROXIMATE CENTER OF GRAVITY.
4. TORQUE REQUIREMENTS FOR MOUNTING SCREWS ARE 4.5-6.5 IN-LBS.
5. POWER REQUIREMENT: 12 WATTS MAX, 2.4 WATTS NOM AT 12VDC.
6. FINISH:
   -METAL TREATMENT: CHEMICAL FILM PER MIL-DTL-5541 TYPE II, CLASS 3
   -EXTERIOR FINISH: PRISM POWDER COAT PB134LT (POLYESTER POWDER, SATIN SANTEX BLACK)

TABLE 1: VARIANTS

ASSY PART NUMBER	DESCRIPTION
90404775	UNIT ASSY, A781-500 SCM SINGLE







PRODUCTION - Release - 06 Oct 2015 08:45:53 MST - Printed on 04 Nov 2015

Figure 3-6. A781-500 SCM Outline and Installation Drawing, PN 90404776 (Sheet 1 of 2)

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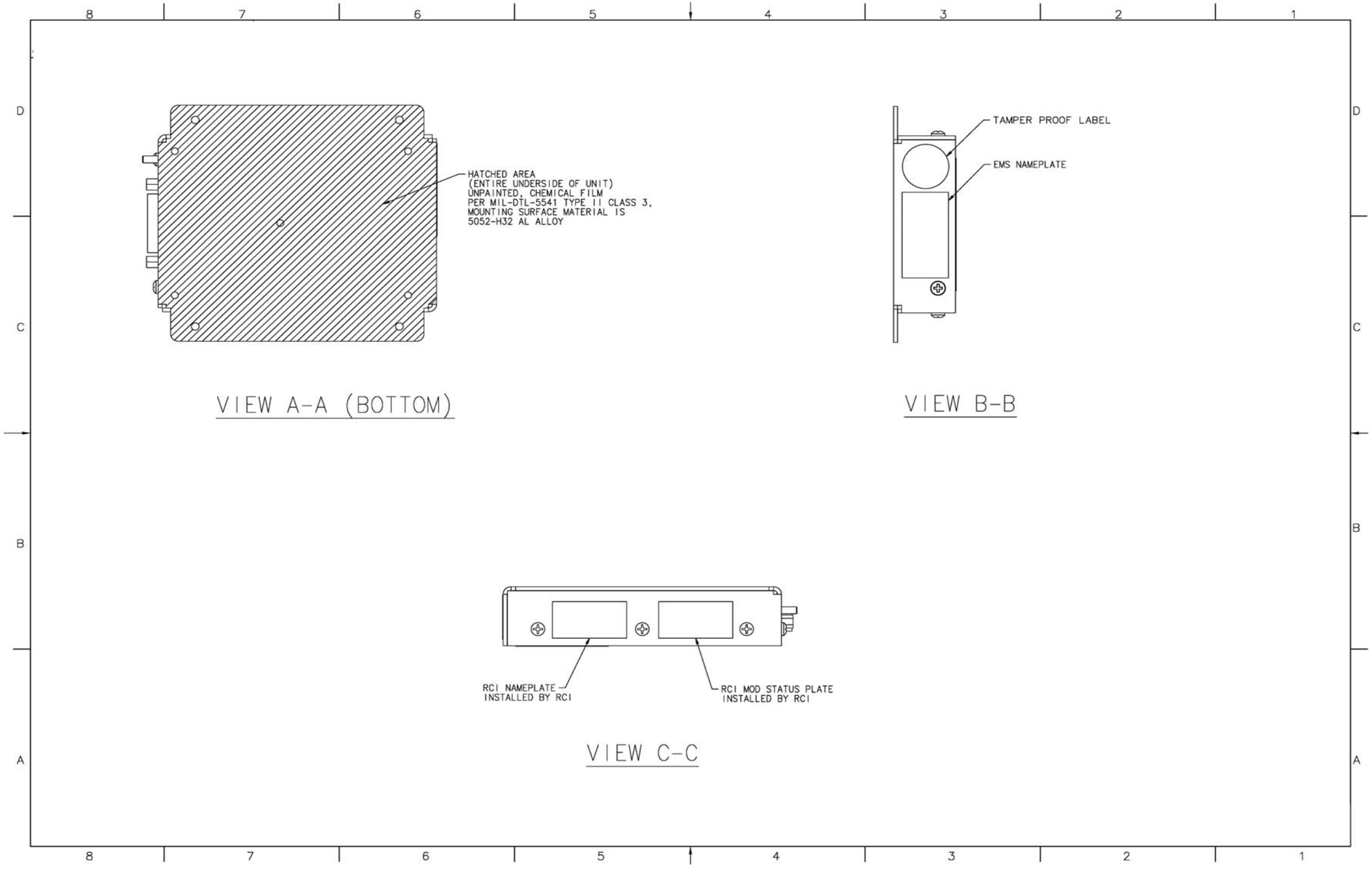

Figure 3-7. A781-500 SCM Outline and Installation Drawing, PN 90404776 (Sheet 2 of 2)

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NOTES:

1. MAX LOSS: 2.0dB TO ANTENNA.
2. RX LOSS: 6-25dB.
3. CABLE BETWEEN SDU AND SCM TO BE LESS THAN 10 METERS. WIRE USED TO ROUTE SCM POWER (SCM PWR) MUST BE 22 AWG MINIMUM.
4. SEE SHEET 2 FOR INTERCONNECTION DIAGRAM.
5. IF THE NUMBER OF OTHER CONFIGURATION PINS IS EVEN, THEN STRAP CONFIGURATION PIN 3 (TP3F) TO SERVICE AVAILABILITY DISCRETE 1 (MP11E).
6. P DENOTES TWISTED PAIR.
7. DENOTES CHASSIS GROUND.
8. EMPTY CAVITY LABEL PER ARINC-781. CONTACTS ARE INSTALLED BUT NO ELECTRICAL CONNECTIONS.

Figure 3-8. A781-500 System Interconnect Drawing, PN 90402748 (Sheet 1 of 3)

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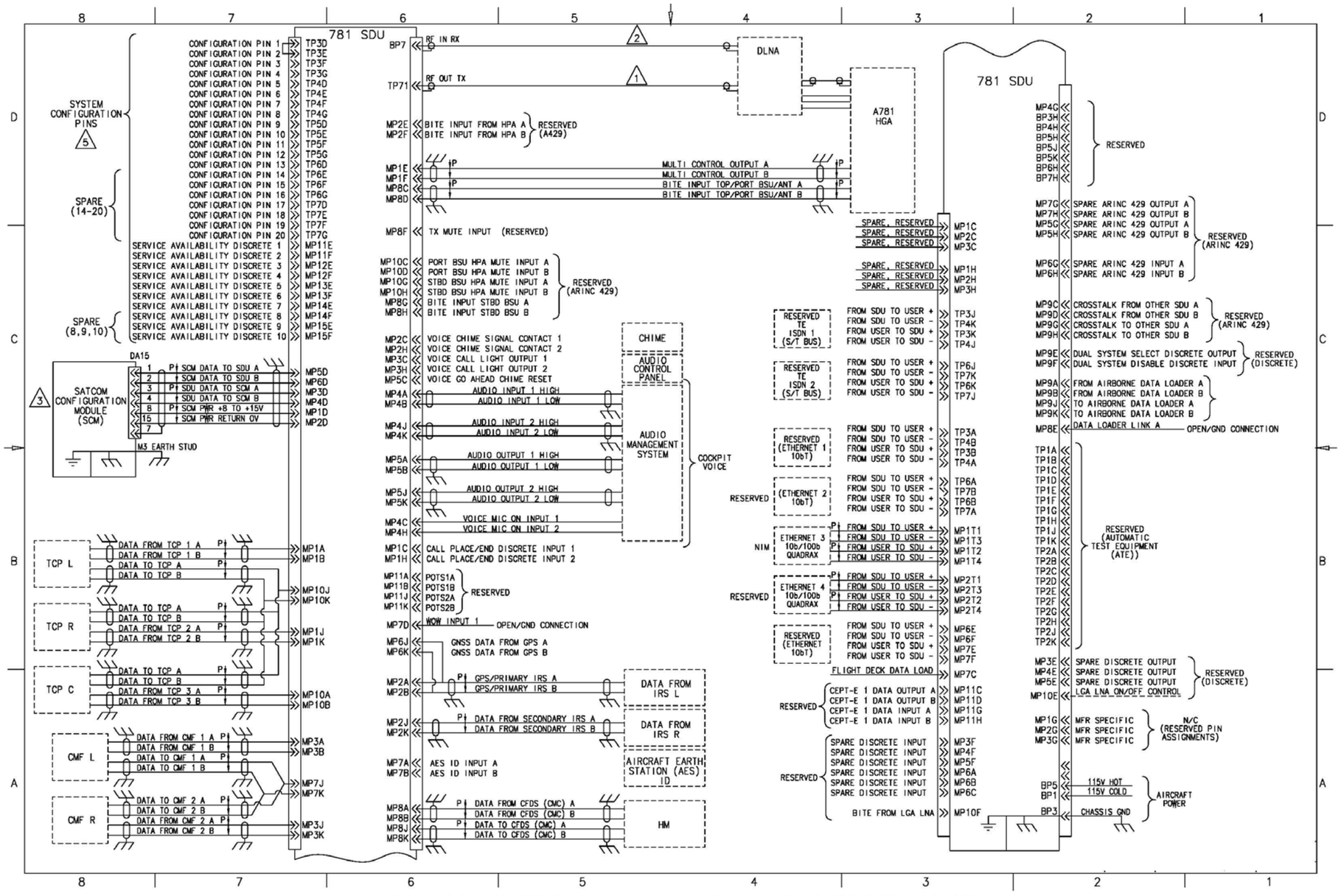

Figure 3-9. A781-500 System Interconnect Drawing, PN 90402748 (Sheet 2 of 3)

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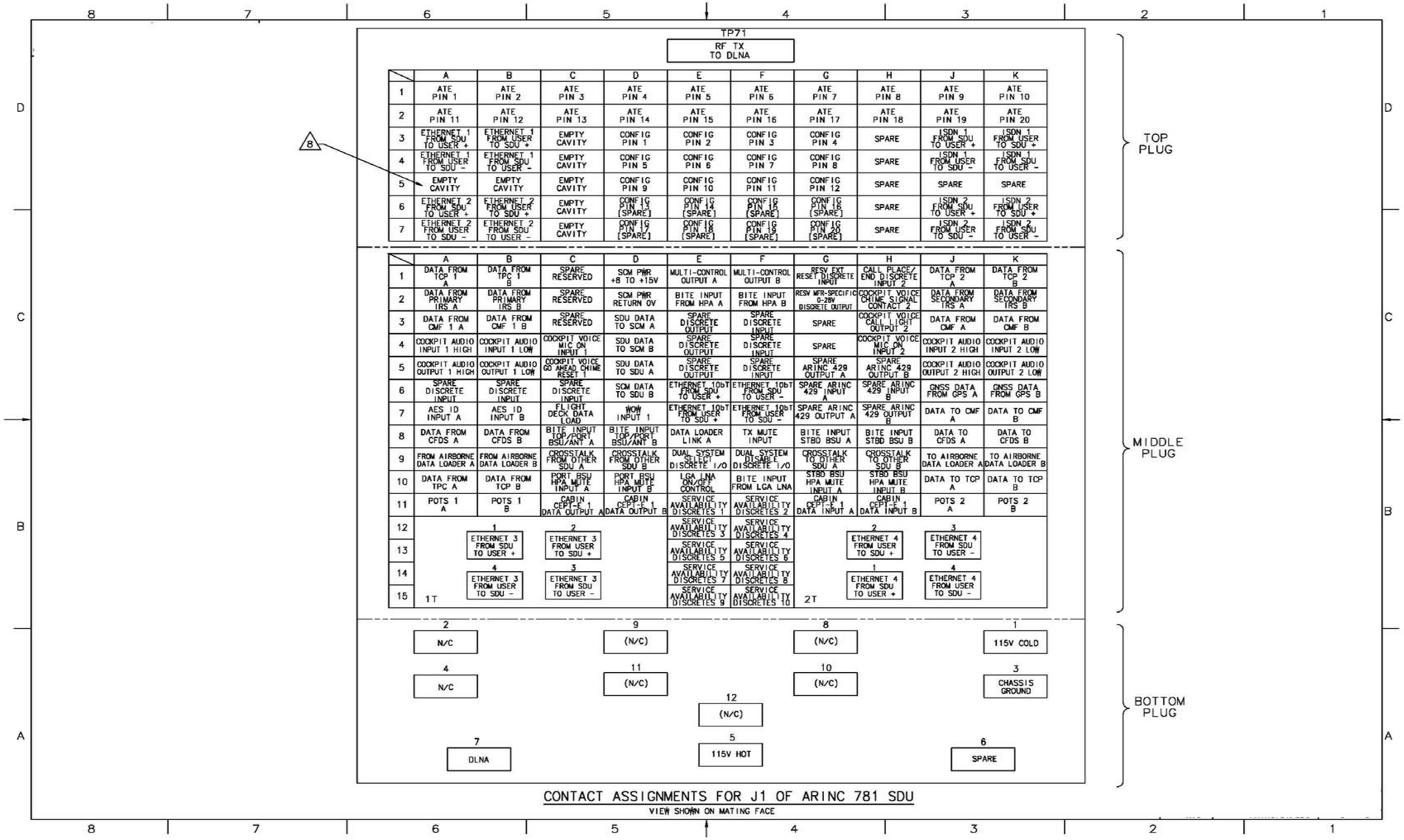

Figure 3-10. A781-500 System Interconnect Drawing, PN 90402748 (Sheet 3 of 3)

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TESTING AND FAULT ISOLATION

This section provides test procedures to determine the operational readiness of SDU units.

All of the tests are to be performed when the SDU is installed on an aircraft and connected to a TCP.

There are no operational test procedures defined for the SCM. SCM health is determined by accessing the SDU BITE information.

If the A781-500 equipment passes all tests in this section but does not function according to the installation requirements, the fault may be with equipment or wiring outside the A781-500 system.

This section includes:

- Operational and Diagnostic Testing
- Troubleshooting and Fault Isolation
- Adjustment/Alignment Procedures
- Modification History.

NOTE: Depending on the version of software installed, the MPU menus described may differ from those shown as examples in this manual.

1. Operational and Diagnostic Testing

This section includes the following sections:

- General
- Test and Fault Isolation Equipment Requirements
- SDU Maintenance Port Utility
- Operational and Diagnostic Test Procedures.

A. General

The A781-500 system requires testing for one of the following reasons:

- To verify the operational readiness of the system after installation on an aircraft
- To verify that a fault exists and produce system reports for troubleshooting purposes
- To verify the operational readiness of repaired LRUs after re-installation on an aircraft.

This section includes test and fault isolation procedures for the A781-500 system. All test and load procedures require the A781-500 SDU MPU, which is accessed by connecting to the maintenance port of the SDU.

B. Test and Fault Isolation Equipment Requirements

Table 4-1 lists the equipment required to access the SDU Maintenance Port Utility and perform operational and diagnostic testing on the SDU.

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Table 4-1 List of Required Test Equipment

Item	Equipment	Specification	Quantity
Computer	Standard	PC running VT-100 terminal emulator, such as Hyper Terminal and equipped with an RS-232 port.	1
VT-100 terminal emulation program	HyperTerminal©, ProComm Plus©, or equivalent	Serial communication program using an RS-232 port	1
Cable	RS-232 cable	Maximum length 25 feet	1
Allen key	Standard	3/32 inch Allen key to fit a hex screw with a 4/40 inch head.	1

C. SDU Maintenance Port Utility

This section describes the SDU MPU and provides the connection and cabling details required to access and use the program.

(1) Connecting to the MPU

The MautoPU provides a system interface for fault isolation and diagnostic procedures.

To use the SDU MPU:

(a) Using a 3/32 Allen key, remove the maintenance port cover.

(b) Connect an RS-232 and VT-100 terminal (computer operating a terminal emulation program) to the RS-232 maintenance port interface of the SDU.

The maintenance port on the front panel of the SDU provides a direct connection to the MPU using a DB9 connector.

Figure 4-1 provides cabling details for the SDU maintenance port.

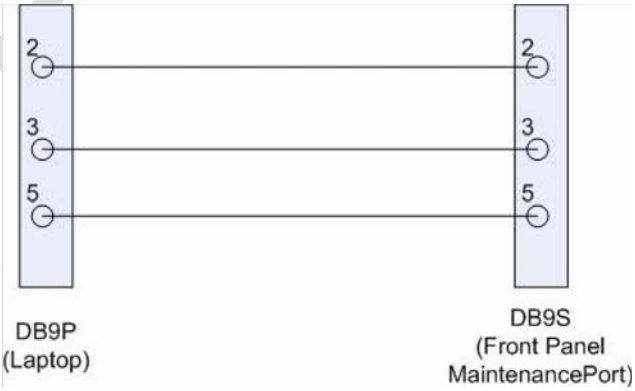

Figure 4-1. Maintenance Cable

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(a) Interface Requirements

A standard VT-100 compatible terminal running an emulator program (such as HyperTerminal, ProComm Plus, or similar) provides the user interface to the SDU MPU. The RS-232 terminal connection settings for SDU maintenance ports are listed in Table 4-2.

Table 4-2 Maintenance Port Connection Settings

Parameter	Setting
Character Format	ASCII
Baud Rate	19200 bps
No. of bits	8
Parity	None
Stop bits	1
Flow Control	None

(2) Using the SDU MPU

This section describes the basic procedures for using and navigating the SDU MPU.

NOTE: There are various levels of access to the MPU. Each level is protected by a different password. This section describes the MPU functions available using the Level 1 password.

(a) Entering Passwords

You can enter the password any time after the SDU boots.

- To access Level 1 functions, type **menu**.

NOTE: The password does not appear on the screen when you type it.

(b) Navigating the SDU MPU

- To scroll through the available menus, press CTRL+N.
- To go to the previous menu, press CTRL+O.
- To refresh the menu screen or exit from a Reports Menu, press ESC.

(c) Selecting Menu Items

- To enable test or data entry functions, press the letter associated with the menu items.

(d) Selecting Reports

The reports available through the MPU enable users to view information about the configuration and status of the SDU. This information is used to troubleshoot the communication system on the aircraft.

To access reports:

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1 In the MPU, press EQUAL SIGN (=).

A list of reports appears. Active reports show as toggled on. Inactive reports show as toggled off.

2 To activate a report, type the report number, and then press ENTER.

NOTE: Multiple reports can be activated at the same time; type and enter each report number separately.

3 To turn off individual, active reports, type the report number you want to toggle off, and then press ENTER.

4 To turn off all active reports, press EQUAL SIGN (=), and then press X.

(3) Menu Item Descriptions

This section provides a brief description of the Level 1, MPU menu items used for test and fault isolation procedures.

In active SDUs, menu screens display the firmware version.

NOTE: Depending on the version of software installed and the system configuration, the menu and reports available to users may differ slightly from the reports described in this document.

(a) Menu 1

Table 4-3 shows an example Menu 1 screen display.Table 4-3 describes the items available in Menu 1.

Table 4-3 Menu 1 Item Descriptions

Menu Item	Description
Y: explain error status	Reports error status when failure LED is illuminated. Displays OK if no error exists.
F: print equipment stats	Prints a list of the current equipment statistics, including temperature, number of power-ups, hours of operation, time since power-up, and processor usage.

(b) Menu 2

Table 4-4 describes the items available in Menu 2.

Table 4-4 Menu 2 Item Descriptions

Menu Item	Description
L: re-enter logon password	Permits a user to enter a new access level password without having to reboot the SDU.
Z: reset A781 SDU	Enables a complete, soft reset of the SDU; once reset, the menu access password must be re-entered.

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Table 4-4 Menu 2 Item Descriptions (Continued)

Menu Item	Description
V: get firmware versions	Displays the kernel and application software versions for the Control Processor, Data I/O Processor, Channel Cards.
C: query loss of cooling mode	Indicates if loss of cooling mode is active or inactive.

(c) Menu 3

Table 4-5 describes the items available in Menu 3.

Table 4-5 Menu 3 Item Descriptions

Menu Item	Description
F: list call log	Lists Classic call logs for the following events: • Successful Aero Log-on • Air-to-ground calls accepted by the SDU • Ground-to-air calls accepted by the SDU Lists SBB call logs for the following events: • Attachment or modification of attachment, including change of beam ID • Creation or deletion of primary or secondary contexts
O: list DIO ORT	Lists of ORT items destined for the Data Processor in human readable form.
Y: verify CP ORT	Verifies if file name of the internal copies of the Secure and User ORT are valid or corrupted.
G: clear call log	Clears the call log after a confirmation.
H: list SCM/CP ORT	Lists ORT settings and how they were configured (either by default or through the maintenance port, or via SCM ORT files). “Set by maintenance port” indicates that the ORT parameter is set by the maintenance port.

D. Operational and Diagnostic Test Procedures

You can perform all test procedures presented in this section to test the total operational status of the A781-500 system. You can conduct these operational tests for all equipment returned to service after repair.

The procedures assume that the technical personnel are familiar with the test equipment used and can operate the equipment to produce the required inputs and obtain the required results (indications). Refer to the detailed operating procedures and descriptions of the SDU MPU included in this section.

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CAUTION: ONLY AUTHORIZED TECHNICAL PERSONNEL WHO ARE TRAINED IN GENERAL AVIA1.57 TION WORKMANSHIP AND HAVE A BASIC UNDERSTANDING OF SATCOM SYSTEMS SHOULD PERFORM THE OPERATIONAL AND DIAGNOSTIC TEST PROCEDURES IN THIS MANUAL.

CAUTION: CHANGES TO DEFAULT VALUES FOR SOME MENU FUNCTIONS MAY SERIOUSLY DEGRADE SYSTEM OPERATION.

NOTE: This manual describes the basic MPU functions, menus, and reports required for the testing and fault isolation procedures presented in this section. Consult RC Product Support before entering any unfamiliar menu selections not described in this manual.

NOTE: Using a terminal emulation program, open a log file and save all test results for future reference and test records.

Refer to the Outline and Installation diagrams (Figure 3-1 to Figure 3-6) and the Interconnection and Contact Assignment drawings (Figure 3-7 to Figure 3-9) for additional information.

(1) Test Setup Procedure

The test setup procedure is presented in Table 4-6.

Table 4-6 Test Setup Procedure

Step	Action
1.0	Make sure that the SDU is powered down and disconnected from the power source.
2.0	Using a 3/32 Allen key, remove the maintenance port cover.
3.0	Connect a maintenance cable to the SDU front-panel maintenance port connector.
4.0	Connect the other end of the cable to the serial port of the computer.
5.0	Open a log file to capture all test data. A log file is a text capture of the ASCII traffic between the computer attached to the maintenance port and the SDU.
6.0	Follow the procedures in "Installation and Operational Verification Tests" on page 4-6.

(2) Installation and Operational Verification Tests

To verify that the A781-500 system is ready for operation, use the following procedures:

- Power-On Test
- BITE

(a) Power-On Test

To complete the power-on test, follow the steps in Table 4-7.

Table 4-7 Power-On Test Procedure

Step	Action
1.0	Follow the test setup procedure in Table 4-6 on page 6.
2.0	Power-on the SDU.

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Table 4-7 Power-On Test Procedure (Continued)

Step	Action
3.0	Check the status of the front panel LEDs. Verify that the green LED flashes for 60 seconds and then turns off. Verify that the red LED is not illuminated. For more information about the LED signals, refer to "LEDs" on page 1-9.
4.0	Follow the BITE test procedure in "BITE" on page 4-7.

(b) BITE

If equipment connected to the A781-500 system provides wrong information or does not provide a signal to the A781-500 SDU, the SDU cannot function properly.

The SATCOM BITE menu provides information about the results from BITE for various parts of the A781-500 system.

To check the BITE status, follow the steps in Table 4-8.

Table 4-8 Power-On Test Procedure

Step	Action
1.0	Using the TCP, navigate to the SATCOM BITE page. See "Viewing BITE Information" on page 2-15.
2.0	Confirm that the following report a status of OK: • SDU • Sub System Health • SCM • SYS BUS • Sub System BUS • RF Path
3.0	If BITE fails the SDU or SCM, remove the component from service and return it to RC—see "Maintenance and Repair" on page 5-1. Return the UUT along with a hardcopy printout of the recorded (captured) log file of the test results. Indicate the date of the test and the serial number of the UUT on the test documentation.
4.0	If BITE fails a component other than the A781-500 SDU or SCM, verify the operation of that component and test the satellite communication system again. See "Troubleshooting and Fault Isolation" on page 4-8
5.0	If the Unit Under Test (UUT) **PASSED** the test, the unit is ready for service.
6.0	Follow the procedures in "Post Test" on page 4-7.

(3) Post Test

When testing is completed, follow the steps in Table 4-9.

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Table 4-9 Post Test Procedure

Step	Action
1.0	Save the log file of the test results (or data) for future reference.
2.0	Remove power from the SDU that was tested and from all other test equipment.
3.0	Disconnect test equipment from the SDU.
4.0	Replace the maintenance-port connector cover (if it was removed during the test setup).

2. Troubleshooting and Fault Isolation

This section provides troubleshooting procedures for A781-500 systems.

Troubleshooting procedures require data obtained using the TCP. For specific instructions on how to access and use the TCP, refer to "Operating the MCDU" on page 2-2.

NOTE: All of the TCP menus discussed in this section are accessed from the SATCOM BITE menu.

A. Subsystem Health

The SATCOM SUBSY HLTH menu provides the BITE status of subsystem components.

To check the subsystem health, on the SATCOM BITE menu, press the button next to **SUBSY HLTH**.

Figure 4-2 illustrates the SATCOM SUBSY HLTH menu.

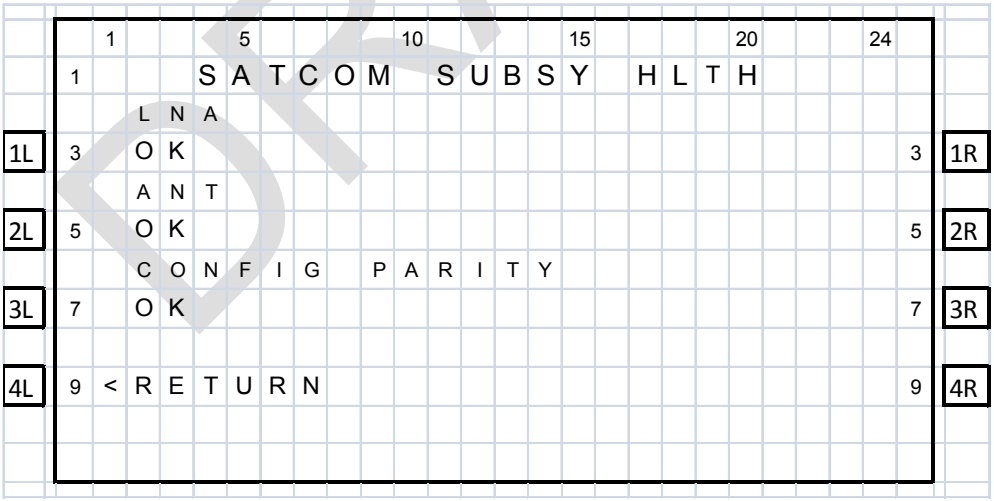

Figure 4-2. SATCOM Subsystem Health Menu

Table 4-10 describes the information available on the SATCOM SUBSY HLTH menu.

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Table 4-10 SATCOM Subsystem Health Menu

Label	Description	Action
LNA	Reports the status of the LNA as OK, NO DATA (if golden label 350 from the antenna is missing or HGA is disconnected), TEST, or FAULT. The LNA status matches the HDA status.	If the status is NO DATA, check the bus connections from the Antenna and check the speed of bus. If the status is FAULT, test or troubleshoot the LNA equipment.
ANT	Reports the status of the HGA as OK, FAULT, TEST, or NO DATA.	If the status is FAULT, test or troubleshoot the HGA equipment. If the status is NO DATA check the ARINC 429 bus from the Antenna.
FMPA	Reports the status of the FMPA as OK, FAULT, NO DATA, or NONE. If there is no FMPA configured, the reported status is NONE.	If the status is FAULT, return the FMPA to RC, the equipment supplier. If the status is NO DATA check the cable to the FMPA.
CONFIG PARITY	Reports the status of the rear connector configuration parity as OK (parity is odd) or FAULT (parity is not odd). This status can be different from the setting of Bit 25 in Label 350 to the CMC, which is also set if the secure ORT is missing or invalid.	If the status is FAULT, check strapping—a non-supported configuration may be strapped.

B. SATCOM System Bus

The SATCOM SYSTEM BUS menu provides information about the bus status of equipment outside the A781-500 system. SATCOM services are not available if the equipment does not operate or communicate properly.

To check the bus status, on the SATCOM BITE menu, press the button next to **SYS BUS**.

Figure 4-3 illustrates the SATCOM System Bus menu.

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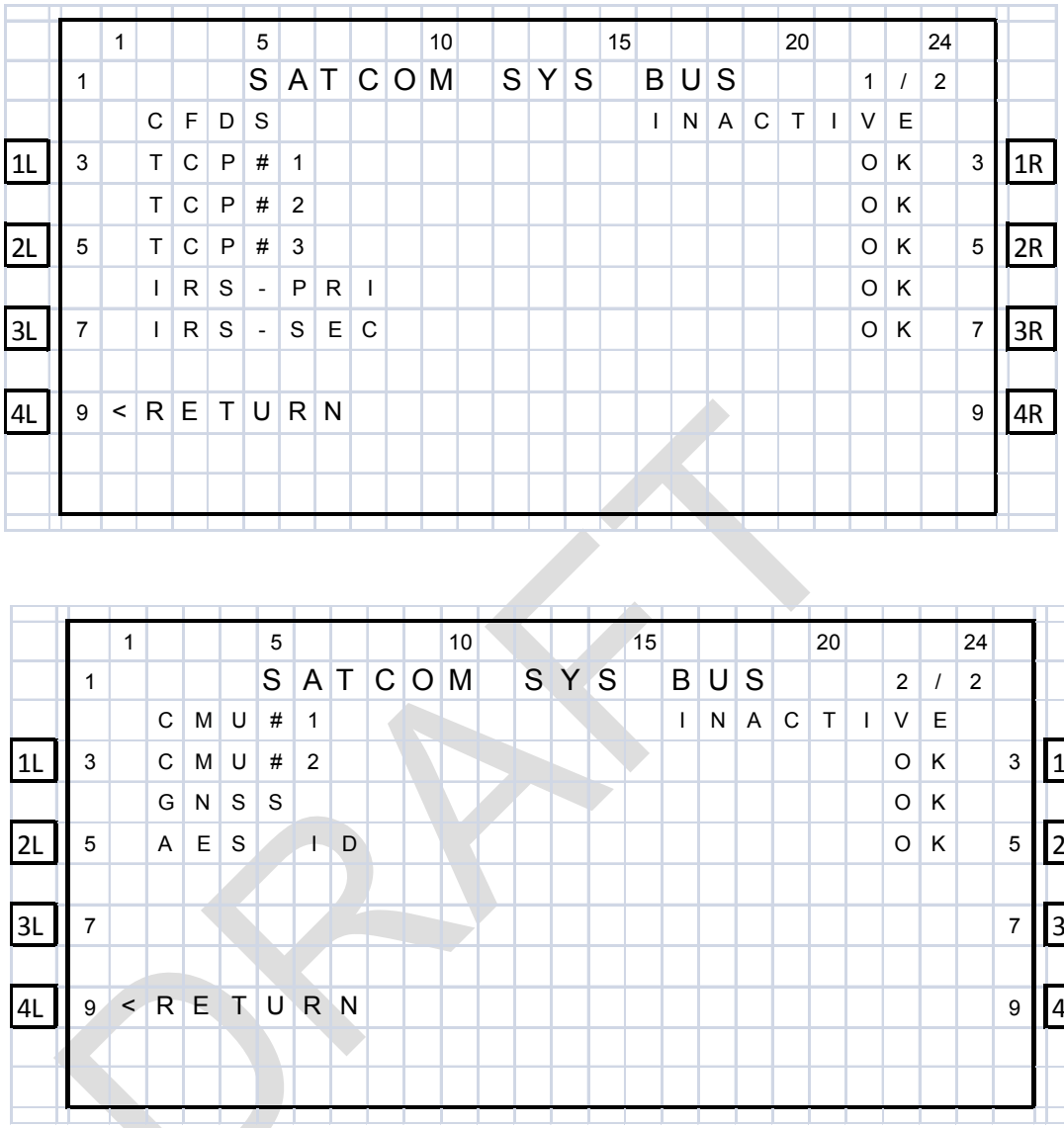

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Figure 4-3. SATCOM System Bus Menu

Table 4-11 describes the information available on the SATCOM SYS BUS menu.

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Table 4-11 Bus Status Indicators

Bus	Status			
	INACTIVE	NO DATA	NONE	OK
CFDS	No labels of correct speed on bus.	The expected Golden label (227) is not present.	The bus is not installed.	The expected Golden label is present and the bus is active at the correct speed.
CFDS	The A781-500 does not support or receive input from the CFDS. Therefore the status will always be NONE.			
TCP	No labels of correct speed on bus.	The expected Golden label (377) is not present.	The secure ORT parameter indicates the bus is not installed.	The expected Golden label is present and the bus is active at the correct speed.
IRS - PRI	No labels of correct speed on bus.	The expected Golden label (310) is not present, i.e. Label 310 or Label 254, depending on ORT selection.	N/A (Primary IRS always present on this aircraft.)	The expected Golden label is present and the bus is active at the correct speed.
IRS - SEC	No labels of correct speed on bus.	The expected Golden label (310) is not present.	The IRS2Type secure ORT parameter specifies whether it is connected or not connected.	The expected Golden label is present and the bus is active at the correct speed.
GNSS	No labels of correct speed on bus.	The expected Golden label (110) is not present.	The secure ORT parameter indicates the bus is not installed.	The expected Golden label is present and the bus is active at the correct speed.
AES ID	No labels of correct speed on bus.	The expected Golden label (275) is not present.	The secure ORT parameter indicates the bus is not installed.	The expected Golden label is present and the bus is active at the correct speed.
CMU	No labels of correct speed on bus.	The expected Golden label (270) is not present.	The secure ORT parameter indicates the bus is not installed.	The expected Golden label is present and the bus is active at the correct speed.

C. Thermal Status

As shown in Figure 4-4, the SATCOM OVERTEMP menu reports the thermal status of system components.

To check the thermal status, on the SATCOM BITE menu, press the button next to **OVERTEMP**.

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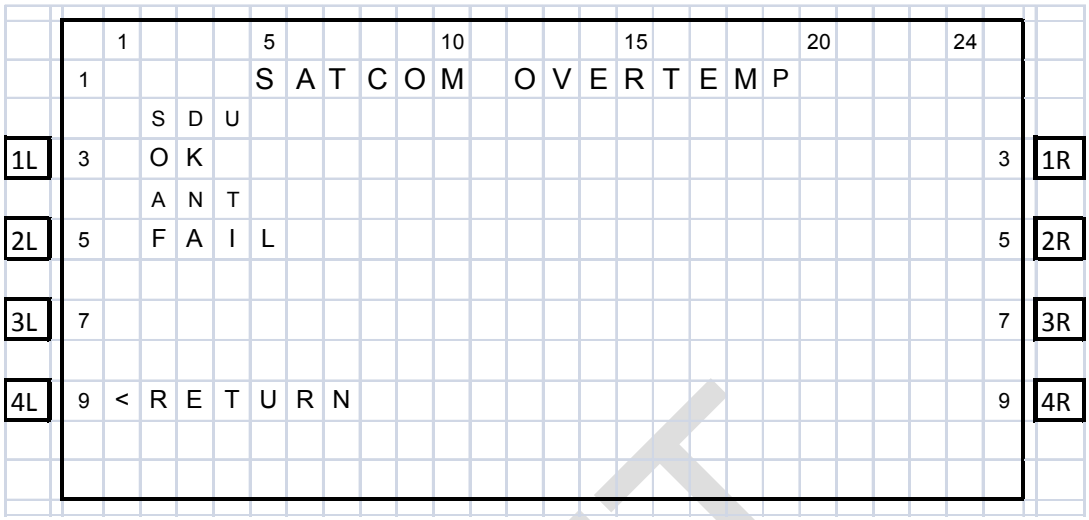

Figure 4-4. SATCOM Overtemp Menu

Table 4-12 describes the information available on the SATCOM OVERTEMP menu.

Table 4-12 SATCOM OVERTEMP Menu

Label	Description	Action
SDU	Reports the SDU thermal status as OK or FAIL.	If the status is FAIL, check the fan operation and temperature at the location of the equipment.
HGA	Reports the HGA thermal status as OK, NO DATA, or FAIL.	If the status is FAIL, check the fan operation and temperature at the location of the equipment. If the status is NO DATA, check data bus connection.
FMPA	Reports the FMPA thermal status as OK, NO DATA, or FAIL.	If the status is FAIL, check the fan operation and temperature at the location of the equipment.

D. SCM Health

As shown in Figure 4-5, the SATCOM SCM menu reports the status of the communication buses to the SCM and the status of the secure and user configuration tables.

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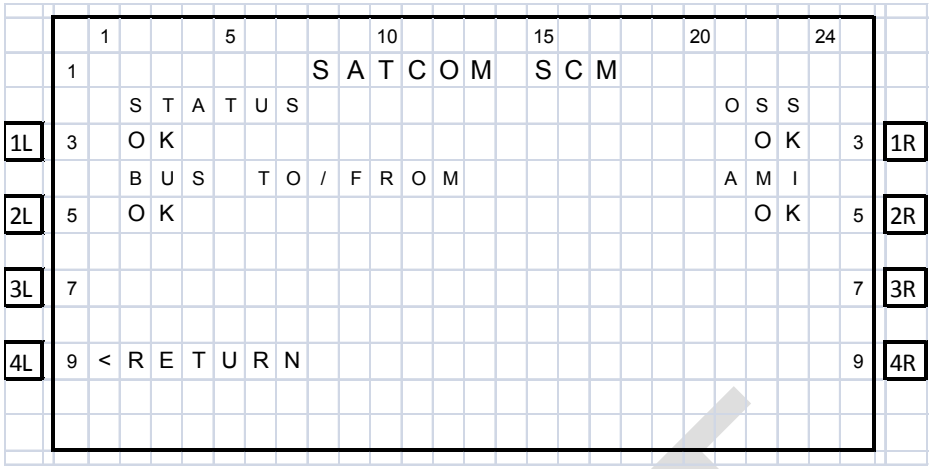

Figure 4-5. SATCOM SCM Menu

Table 4-13 describes the information available on the SATCOM SCM menu.

Table 4-13 SATCOM SCM Menu

Label	Description	Action
STATUS	Reports the SCM status as OK or FAIL.	If the status is FAIL, return the SCM to RC the equipment supplier.
BUS TO/FROM	Reports the status of the bus to the SCM as OK or FAIL.	If the status is FAIL, check the connections to the SCM.
OSS	Reports the status of the Secure ORT as one of the following: NOT LOADED – No ORT in SCM memory. OK – Secure ORT is valid. INVALID – The Secure ORT is corrupted or otherwise invalid and must be reloaded.	If the status is INVALID or NOT LOADED, load a SECURE ORT file.
AMI	Reports the status of the User ORT as one of the following: NOT LOADED – No ORT in SCM memory. OK – User ORT is valid. INVALID – The User ORT is corrupted or otherwise invalid and must be reloaded.	If the status is INVALID or NOT LOADED, load a USER ORT file.

E. Subsystem Bus Status

As shown in Figure 4-6, the SATCOM SUBSY BUS menu reports the status of all subsystem buses that provide communication between the components of the system.

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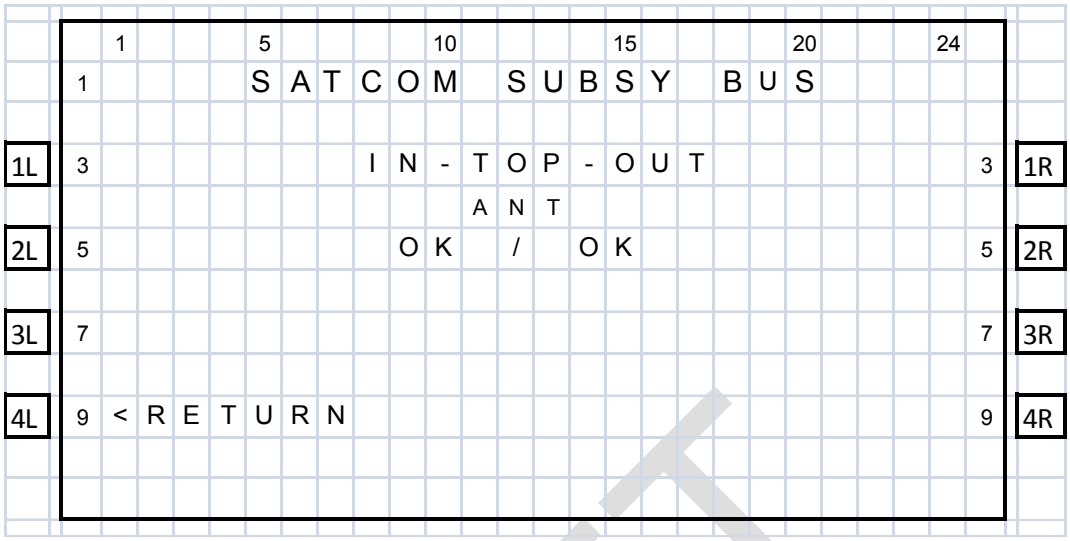

Figure 4-6. SATCOM Subsystem Bus Menu

Table 4-14 describes the information available on the SATCOM SUBSY BUS menu. Fields are left blank if the equipment is not included in the installation.

NOTE: Input and output are with respect to the SDU.

Table 4-14 SATCOM SUBSY BUS Menu

Label	Description	Action
ANT	Reports the status of the input and output buses for the antenna as OK, NO DATA, or FAIL.	If status is NO DATA, label 350 is missing—check the bus connections. If status is FAIL, check antenna bus status.

F. RF Path Status

As shown in Figure 4-7, the SATCOM RF PATH menu reports the status of the RF paths.

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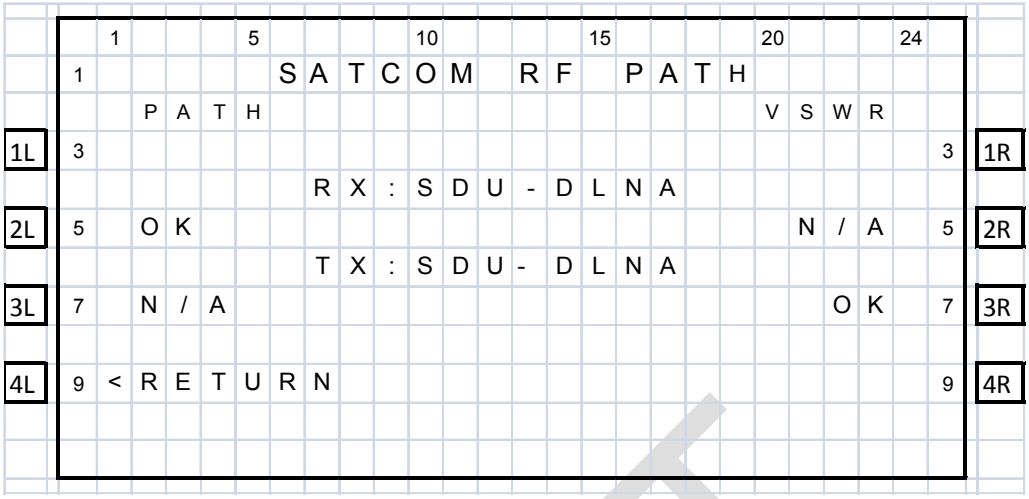

Figure 4-7. SATCOM RF Path Menu

Table 4-15 describes the information available on the SATCOM RF PATH menu.

Table 4-15 SATCOM RF PATH Menu

Label	Description
RX:DLNA-SDU	Reports the status of the RF path from the DLNA to the SDU as OK or FAULT. If the status is FAULT, check Rx RF cabling between the SDU and the antenna.
TX:SDU-ANT	Reports the status of VSWR activity on the SDU-Antenna RF path as OK or FAULT. If the status is FAULT, check Tx RF cabling between the SDU and the antenna.

G. USIM and Data Bus Status

As shown in Figure 4-8, the SATCOM USIM/DATA menu reports the status of the USIMs and data buses of the system.

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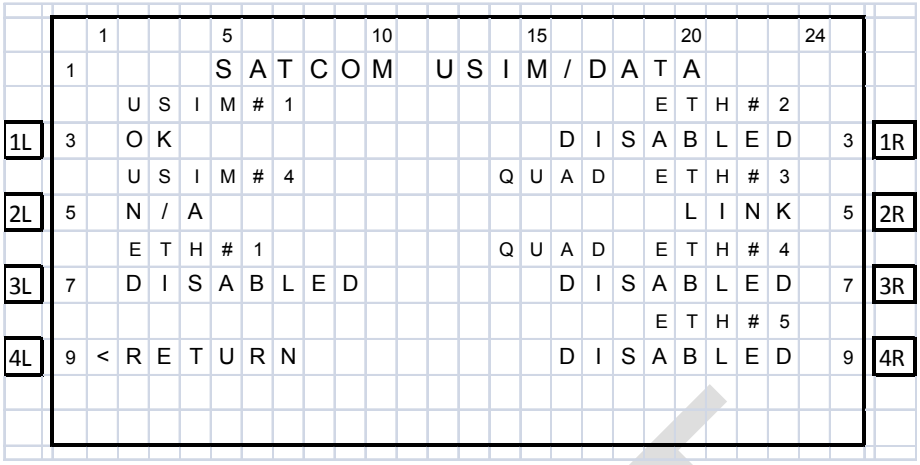

Figure 4-8. SATCOM USIM/DATA Menu

Table 4-16 describes the information available on the USIM/Data menu.

Table 4-16 SATCOM USIM/DATA Menu

Label	Description
USIM#1	Reports the status of USIM#1 bus as OK, WARMING, SBB LOG, FAULT, or N/A if channel card 1 is not in SBB mode. If status is FAULT, check that SIM card is not damaged and is properly inserted. Power cycle after checking.
USIM#2	Reports the status of USIM#2 bus as N/A. If status is FAULT, check that SIM card is not damaged and is properly inserted. Power cycle after checking.
USIM#3	Reports the status of USIM#3 bus as N/A. If status is FAULT, check that SIM card is not damaged and is properly inserted. Power cycle after checking.
USIM#4	Reports the status of USIM#4 bus as N/A. If status is FAULT, check that SIM card is not damaged and is properly inserted. Power cycle after checking.
ETH#1	Reports the status of ETH#1 bus as DISABLED, LINK, or NO LINK.
ETH#2	Reports the status of ETH#2 bus as DISABLED, LINK, or NO LINK.
QUAD ETH#3	Reports the status of QUAD ETH#3 bus as DISABLED, LINK, or NO LINK.
QUAD ETH#4	Reports the status of QUAD ETH#4 bus as DISABLED, LINK, or NO LINK.
ETH#5	Reports the status of ETH#5 bus as DISABLED, LINK, or NO LINK.
NOTE: Only Ethernet 3 is fully supported. Ethernet 1, 2, and 5 are not supported and Ethernet 4 is only used for application data loading.	

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H. ORT

The A781-500 system may not function properly if the ORT parameters do not match the installed system.

(1) ORT Use and Storage

The ARINC 781 system includes a secure and user ORT. Secure ORT files must be certified for the aircraft type on which the equipment is installed. Items in user ORT files can be modified by individual customers and may be customized to an individual aircraft.

You can change secure ORT parameters only by uploading an ORT file. To obtain an ORT file, contact RC Product Support.

The load procedure loads an ORT file to the SCM using an ARINC 615A data loader. You can only load ORT data when the aircraft is on the ground and the data load discrete is asserted. When the SDU boots, it compares the ORT file in its memory to that in the SCM. If the ORT files do not match, the SDU loads the file from the SCM into its memory.

Some user ORT parameters can be modified in the SDU ORT. You can reset the SDU ORT to the default values stored in the SCM in the maintenance menus.

(2) Checking the ORT

You can check the content of the ORT file through the maintenance port menus. "SDU Maintenance Port Utility" on page 4-2 provides information about accessing the maintenance port menus.

NOTE: The ORT includes many parameters that affect internal operations. These parameters are not meaningful for technicians troubleshooting the satellite communication system.

To check the ORT:

(a) In the maintenance port menus, navigate to menu 3.

(b) To list the ORT, press **H**.
The list of ORT parameters appears. The list is about eight pages long.
Some ORT parameters displayed are system defaults that cannot be modified through the Secure and User ORT files.

(c) Compare the ORT parameters to the system installed in the aircraft.

I. Contact Product Support

When the troubleshooting procedures do not find a fault and the A781-500 system does not function properly, contact RC Product Support.

RC Product Support may ask you to capture and send them system specific logs and reports.

To access logs:

(1) In the maintenance port menus, navigate to Menu 3.

(2) Turn on the text capture feature of the terminal emulator on your computer.
In HyperTerminal, click **Transfer**, and then click **Capture Text**.

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(3) To view the call log, in Menu 3, press **F**.

(4) Turn off the text capture feature of the terminal emulator and send the captured file to RC Product Support.

To access reports:

(1) Turn on the text capture feature of the terminal emulator on your computer. In HyperTerminal, click **Transfer**, and then click **Capture Text**.

(2) In the maintenance port menus, press EQUAL SIGN (**=**). A list of reports appears.

(3) To activate a report, type the number next to the report description, and then press ENTER.

NOTE: RC Product Support will specify the required reports, and may ask you to operate the A781-500 equipment while the reports gather information.

(4) To stop a report, press EQUAL SIGN (**=**), then type the number of the report, and then press ENTER.

NOTE: To stop all reports, press **X**.

(5) Turn off the text capture feature of the terminal emulator and send the captured file to RC Product Support.

3. Adjustment/Alignment Procedures

There are no adjustment/alignment procedures required for the A781-500 system.

4. Modification History

The A781-500 system currently has no history of modifications.

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MAINTENANCE AND REPAIR

This section provides maintenance and repair information for the A781-500 system, including the following sections:

- Maintenance
- Repair
- Instructions for Continued Airworthiness
- Visual Inspection and Check

1. Maintenance

The A781-500 system does not require routine maintenance.

2. Repair

If functional problems occur, the SDU BITE identifies the faulty LRU.

As per continued airworthiness instructions, if an SDU or SCM is inoperative, use the Standard Practices Chapter of the Aircraft Maintenance Manual to:

- Remove the unit
- Secure cables and wiring
- Collar applicable switches and circuit breakers, and placard them as “inoperative”.

Before flight, revise the equipment list and weight and balance data as applicable, and record the removal of the unit in the log book. Refer to section 91.213 of the FAR or the aircraft’s minimum equipment list (MEL).

All repairs must be performed at the RC equipment supplier factory.

3. Instructions for Continued Airworthiness

Periodic inspections of the mechanical and electrical interfaces of the A781-500 system components to the aircraft should be completed as defined by the governing airworthiness body’s Instructions for Continued Airworthiness (ICA) for the installation (for example, Transport Canada, the FAA, the EASA).

Installation of the ARINC 781 SATCOM Avionics System on an aircraft by Supplemental Type Certificate (STC) obligates the aircraft operator to include the maintenance information supplied by this manual in the operator’s Aircraft Maintenance manual and the operator’s Aircraft Scheduled Maintenance Program.

This section provides the special instructions and maintenance requirements for continued airworthiness of the A781-500 system.

A. Airworthiness Limitations

When applicable, the Airworthiness Limitations section is FAA-approved, and specifies maintenance required under Title 14 Code of Federal Regulations (CFR) Part 43.16 and 14 CFR 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

This section must be added to the Airplane Maintenance Manuals. The information contained herein supplements the Airplane Maintenance Manuals only in those areas covered by the

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A781-500 system installation. For limitations and procedures not contained in this supplement, consult the basic Airplane Maintenance Manuals.

The inspections and airworthiness limitations specified in this section are FAA approved. This section specifies the inspections and other maintenance required under sections 433.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

B. Electrical and Mechanical Inspection and Check

Periodic inspections of the mechanical and electrical interfaces of the A781 system components to the aircraft should be completed as defined by the governing airworthiness body (for example, Transport Canada, the FAA, the EASA).

C. Instructions for Continued Airworthiness

The following paragraphs describe all maintenance requirements and instructions for continued airworthiness of the A781-500 system:

1. This manual contains maintenance information for the and SCM, including system description, system operation, installation, test, and fault isolation.
2. Add the following information to the illustrated parts catalog for the aircraft:
   - All part numbers referred to in this manual
   - All LRUs referred to in this manual.
3. Add all wiring diagram information contained in this manual to the aircraft operator’s appropriate aircraft Wiring Diagram Manuals.
4. No additional or routine maintenance is required for the on-condition SDU or SCM.
5. If an SDU or SCM is inoperative, follow the instructions listed in "Repair" on page 5-1.
6. Return all units to the RC equipment supplier factory for repair. Refer to "Appendix A: Return Material Authorization" on page A-1 for detailed removal information and procedures.
7. Install repaired units on the aircraft in accordance with the installation instructions provided in this manual.
8. Make sure that all repaired units are operating before approving them for return to service, using the operational verification tests and procedures provided in this manual.
9. Enter the approval for return to service in the logbook, as required by section 43.9 of the FAR.
10. Add the following scheduled maintenance tasks to the aircraft operator’s appropriate aircraft maintenance program:
    (a) Recommended periodic scheduled servicing tasks: None required.
    (b) Recommended periodic inspections: as per the aircraft inspection and maintenance schedule.
    (c) Recommended periodic scheduled preventative maintenance tests (tests to determine system condition and/or latent failures): None required.

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4. Visual Inspection and Check

Perform the following procedures to inspect the SDU and SCM after installation of the units onto the aircraft.

Follow all approved safety standards and practices during the inspection.

1. Disconnect all circuit breakers to the SDU and SCM and associated systems.

CAUTION: FAILURE TO DISCONNECT CIRCUIT BREAKERS CAN LEAD TO INJURY TO THE OPERATOR AND DAMAGE TO THE EQUIPMENT.

2. Examine the connection for loose, damaged, or missing hardware.
3. Examine cables and connections. Contact RC Product Support to gauge the severity of the damage if you find:
    - Corrosion
    - Chafing
    - Wear
    - Damage.
4. Tighten any loose connectors to the manufacturer's recommended value.

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APPENDIX A: RETURN MATERIAL AUTHORIZATION

To return equipment to RC for repair, this RMA procedure must be followed. Failure to comply with this procedure may result in shipping delays and additional charges.

1. Warranty Returns

Equipment that qualifies for warranty repair can be returned to RC for repair or replacement at their discretion. The customer shall pay the shipping costs to RC and RC will pay the shipping costs to return the repaired/replaced unit to the customer.

2. Non-Warranty Returns

Equipment that fails to work properly because of improper or negligent use, abuse, shipping damage, or any other condition can still be returned to RC for repair or replacement at their discretion. The customer will be notified of the cost to repair or replace the unit before invoicing for the repair or replacement. The customer shall pay for the shipping costs to and from RC.

3. Repackaging Requirements

ARINC 781 SDU or SCM components must be returned to RC in approved shipping containers. Failure to do so may invalidate the warranty.

If SDU or SCM shipping containers are unavailable, they can be ordered from RC when requesting the RMA number.

4. RMA Procedure

If it is determined that equipment must be returned to RC for repair or overhaul, follow the RMA procedure below.

1. Have the following information ready before calling RC Product Support:

- Model (e.g., A781-500 SDU)
- Unit part number (e.g., 90402750, 90404775)
- Serial number
- Description of failure
- Aircraft tail number, serial number, and aircraft model number

2. An RC Product Support specialist will attempt to resolve the problem by telephone. If equipment must be returned to RC, the Product Support Specialist will authorize the R&O Coordinator to issue an RMA number.
3. Pack the equipment in the original shipping container or a container approved by RC.
4. Write the RMA number on the outside of the shipping container and on all shipping documents, enclose a copy in the box, and send your prepaid shipment to RC.

   [RC to complete]
5. Fax or email the details of the shipment to the R&O Coordinator, including the following information: Shipment date, carrier name, and the waybill number.

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6. The processing of LRU returns is limited to standard business hours from 8:30 am to 5:00 pm EST. For general inquires and status requests, contact the R&O department directly:

   Phone: [RC to complete]
   Email: [RC to complete]
   Fax: [RC to complete]

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