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System Description, Installation, and Maintenance Manual

ASPIRE-400

Part Number	Model
90404514-000	ASPIRE 400 HPA
90402651-000	ASPIRE 400 SDU
90402652-000	ASPIRE 400 SCM

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ASPIRE-400

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TRANSMITTAL INFORMATION

TO HOLDERS OF ASPIRE-400 SDIM, ATA NO. 23-15-49 (PUB. NO. D201902000020), ISSUED FOR USE IN SUPPORT OF THE FOLLOWING:

Table TI-1 shows the applicable components.

Table TI-1. Applicable Components

Component PN	Nomenclature
90404514-000	ASPIRE 400 HPA
90402651-000	ASPIRE 400 SDU
90402652-000	ASPIRE 400 SCM

Revision History

This is an INITIAL release of ASPIRE-400 SDIM, ATA NO. 23-15-49.

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ASPIRE-400

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For each revision, write the revision number, revision date, date put in the manual, and your initials in the applicable column.

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ASPIRE-400

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SERVICE BULLETIN LIST

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ASPIRE-400

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ASPIRE-400

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SYSTEM DESCRIPTION, INSTALLATION, AND MAINTENANCE MANUAL
ASPIRE-400

TABLE OF CONTENTS

LIST OF SECTIONS

TABLE OF CONTENTS (Continued)

LIST OF SECTIONS

TABLE OF CONTENTS (Continued)

LIST OF SECTIONS

TABLE OF CONTENTS (Continued)

LIST OF SECTIONS

TABLE OF CONTENTS (Continued)

LIST OF SECTIONS

TABLE OF CONTENTS (Continued)

LIST OF SECTIONS

Title **Page**

TABLE OF CONTENTS (Continued)

LIST OF SECTIONS

TABLE OF CONTENTS (Continued)

LIST OF SECTIONS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

TABLE OF CONTENTS (Continued)

LIST OF TABLES

TABLE OF CONTENTS (Continued)

LIST OF TABLES

Blank Page

INTRODUCTION

1. How to Use This Manual

A. General

(1) This manual provides information about the installation of the Aspire 400 System.

(2) Standard maintenance procedures that technicians must know are not given in this manual.

(3) This publication is written in agreement with the ATA Specification.

(4) Warnings, cautions, and notes in this manual give the data that follows:

(a) A WARNING gives a condition or tells personnel what part of an operation or maintenance procedure, which if not obeyed, can cause injury or death.

(b) CAUTION gives a condition or tells personnel what part of an operation or maintenance procedure, which if not obeyed, can cause damage to the equipment.

(c) A NOTE gives data, not commands. The NOTE helps personnel when they do the related instruction.

(5) Warnings and cautions go before the applicable paragraph or step. Notes follow the applicable paragraph or step.

B. Observance of Manual Instructions:

(1) All personnel must carefully obey all safety, quality, operation, and shop procedures for the unit.

(2) All personnel who operate equipment and do maintenance specified in this manual must know and obey the safety precautions.

C. Symbols

(1) The symbols and special characters are in agreement with IEEE Publication 260 and IEC Publication 27. Special characters in text are spelled out.

(2) The signal mnemonics, unit control designators, and test designators are shown in capital letters.

(3) The signal names followed by an "*" show an active low signal.

(4) The symbols in Figure 1-1 show non-ionizing radiation hazard, ESDS, and moisture sensitive devices.

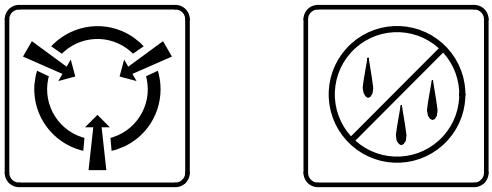

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Figure INTRO-1. Symbols

D. Units of Measure

(1) Measurements, weights, temperatures, dimensions, and other values are expressed in the USMS followed by the appropriate SI metric units in parentheses. Some standard tools or parts such as drills, taps, bolts, nuts, etc. do not have an equivalent.

E. Illustration

(1) Supplemental illustrations use a suffix number to the basic figure number. For example, if Figure 501-5 is used, it signifies that it is an illustration of the item identified by index number 5 in Figure 501.

(2) Illustrations with no specific designation are applicable to all units.

F. Scope

(1) This manual provides detailed information for avionics technicians about the wiring, installation, and setup of every component of the Aspire-400. The installer is responsible for the approval and certification of system components on the aircraft, and for the installation of wiring in the aircraft. This manual includes information for end users about how to operate the Aspire-400. The Aspire-400 connects to the Inmarsat satellite network and provides data and voice services to the aircraft cabin and cockpit. You can install the Aspire-400 with various antennas, and each variation of the system provides a different level of service.

G. Hardware Part Numbers

(1) The SATCOM Products are identified by the hardware part numbers indicated in the Table INTRO-1:

Table INTRO-1. Aspire 400 Component Part Numbers

SATCOM Product	Hardware Part Number
HPA	90404514-XXX
SDU	90402651-XXX
SCM	90402652-XXX

(2) Where:

(a) XXX suffix: Indicates minor variants that do not require substantive re-evaluation (examples include Customer specific part numbers, changes is physical labeling).

(b) A change to form fit or function will be reflected in a new base part number.

(c) Hardware part number controls FPGA firmware and micro-boot software components.

H. Organization

(1) This Manual Includes the following sections:

(a) SECTION 1 - SYSTEM DESCRIPTION

(b) SECTION 2 - SYSTEM OPERATION

(c) SECTION 3 - SYSTEM PRE-CONFIGURATION

(d) SECTION 4 - INSTALLATION

(e) SECTION 5 - SOFTWARE CONFIGURATION

(f) SECTION 6 - MAINTENANCE PRACTICES

(g) SECTION 7 - TROUBLESHOOTING

(h) APPENDIX A

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C. References

(1) Honeywell/Vendor Publications

(a) Related Honeywell publications in this manual are shown in the list that follows:

– Not applicable

(b) Other Publications

– The United States GPO Style Manual (available at http://www.gpo.gov/fdsys/pkg/GPO-STYLEMANUAL-2008/content-detail.html)

- IEEE Std 260.1, Standard Letter Symbols for Units of Measurement (available from the American National Standards Institute at http://www.ansi.org)
- ASME Y14.38, Abbreviations for Use on Drawings and Related Documents (available from the American National Standards Institute at http://www.ansi.org)
- ASME Y14.5, Dimensioning and Tolerancing (available from the American National Standards Institute at http://www.ansi.org)
- ANSI/IEEE Std 91, Graphic Symbols for Logic Functions (available from the American National Standards Institute at http://www.ansi.org)
- CAGE codes and manufacturers' addresses are available at https://cage.dla.mil
- IEEE 315/ANSI Y32.2, Graphic Symbols for Electrical and Electronics Diagrams (available from the American National Standards InstituteInstitute at http://www.ansi.org)

3. Acronyms and Abbreviations (TASK 23-15-49)

A. General

(1) The abbreviations are used in agreement with ASME Y14.38.

(2) Acronyms and non-standard abbreviations used in this publication are as follows:

Table INTRO-2. List of Acronyms and Abbreviations

Term	Full Term
AAC	Aeronautical Administrative Communication
AC	Air Circular
ACARS	Aircraft Communications Addressing and Reporting System
ACD	Aircraft Control Domain
ACMM	abbreviated component maintenance manual
ACO	Aircraft Certification Office
ADC	Analog to Digital Converter
ADGW	Aircraft Datalink GateWay
AEH	Airborne Electronic HW
AES	Aeronautical Earth Station
AG	Aerospace Guidance
AIS	Aircraft Information System
AISD	Aircraft Information Systems Domain
AMBE	Advanced Multiband Excitation
AMD	Advanced Micro Devices

Table INTRO-2. List of Acronyms and Abbreviations (Continued)

Term	Full Term
AMSS	Aeronautical Mobile Satellite Services
ANSI	American National Standards Institute
ANSP	Air Navigation Service Providers
AOC	Aeronautical Operational Control
APC	Aeronautical Passenger Communications
APOL	Aerospace Policy
APU	auxiliary power unit
APUC	auxiliary power unit controller
ARINC	Aeronautical Radio, Incorporated
ASME	American Society of Mechanical Engineers
ASPIRE	Aero Standard Peer Inspection/Review Environment
ATA	Air Transport Association
ATC	Air Traffic Control
ATE	automated test equipment
ATLAS	abbreviated test language for all systems
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Services
AWG	American Wire Gage
BGAN	Broadband Global Area Network
BITE	Built-In Test Equipment
C	Celsius
CAGE	commercial and government entity
CAN-TSO	Canada Transport Canada Civil Aviation
CAN-TSOA	Canada Transport Canada Civil Aviation Authorization
CEH	Complex Electronic Hardware
CEPT-E1	Conference of European Postal and Telecommunication-European 1 (2048 bps, 30-channel PCM)
CFDS	Central Fault and Display System
CFR	Code of Federal Regulation

Table INTRO-2. List of Acronyms and Abbreviations (Continued)

Term	Full Term
CMC	Central Maintenance Computer
CMM	component maintenance manual
CMU	Communications Management Unit
CNS	Communication, Navigation and Surveillance
COE	Center of Excellence
CPU	Central Processing Unit
CRES	corrosion resistant steel
CS	Circuit Switched
CSD	cargo smoke detector
DABC	Dual BGAN Card
DAC	Digital to Analog Converter
DAH	Design Approval Holder
DAL	Design Assurance Level
DHCP	Dynamic Host Control Protocol
DLNA	Diplexer / Low Noise Amplifier
DSP	Digital Signal Processor
DPL	detailed parts list
EASA	European Aviation Safety Agency
ECO	Engineering Change Order
ECU	electronic control unit
EDI	equipment designator index
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMI	Electro-Magnetic Interference
EMS	EMS Technologies
ESDS	electrostatic discharge sensitive
F	Fahrenheit
FANS	Future Air Navigation System
FCC	Federal Communications Commission
FHA	Functional Hazard Assessment

Table INTRO-2. List of Acronyms and Abbreviations (Continued)

Term	Full Term
FPGA	Field Programmable Gate Array
FTM	Functional Test Mode
GPO	Government Printing Office
GDGW	Ground Data Gateway
GES	Ground Earth Station
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GUI	Graphical User Interface
HAS	Hardware Accomplishment Summary
HF	High Frequency
HGA	High Gain Antenna
HLD	HPA / LNA / Diplexer
HPA	High Power Amplifier
HW	Hardware
HAQM	Honeywell Aerospace Quality Manual
IDT	Integrated Design Technology
IP	Internet Protocol
IPDS	Integrated Product Development Support
ISDN	Integrated Service Digital Network
ISEDC	Innovation, Science and Economic Development Canada
ISO	International Standards Organization
IEC	International Electro-technical Commission
IEEE	Institute of Electrical and Electronics Engineers
IPC	illustrated parts catalog
IPL	illustrated parts list
kPa	kilopascal
LRU	line replaceable unit
LODA	Letter of Deviation Authority
MFG	manufacturer

Table INTRO-2. List of Acronyms and Abbreviations (Continued)

Term	Full Term
MTOSS	maintenance task oriented support system
MCDU	Multi-control Display Unit
MCU	Modular Concept Unit
MIDO	Manufacturing Inspection District Office
MOPS	Minimum Operational Performance Standards
MPC	Main Processor Card
MPS	Minimum Performance Standards
NA	Not Applicable
NGSS	Next Generation Satellite Services
NXP	NXP Semiconductors
NHA	next higher assembly
NI	numerical index
No.	number
OHM	overhaul manual
OMM	overhaul maintenance manual
OPR	operation
OPS	operational program software
OEM	Original Equipment Manufacturer
ORT	Owner Requirements Table
PN	part number
Pub.	publication
PAH	Production Approval Holder
PDP	Packet Data Protocol
PDQA	Product Development Quality Assurance
PHAC	Plan for Hardware Aspects of Certification
PIES	Passenger Inflight Entertainment Service
PIESD	Passenger Inflight Entertainment Domain
PPPoE	Point-to-Point Protocol over Ethernet
PS	Packet Switched

Table INTRO-2. List of Acronyms and Abbreviations (Continued)

Term	Full Term
PSAC	Plan for Software Aspects of Certification
PSC	Power Supply Card
PSCP	Project Specific Certification Plan
PSP	Partnership for Safety Plan
PSSA	Preliminary System Safety Assessment
PSU	Power Supply Unit
RAN	Radio Access Network
RF	Radio Frequency
RTCA	Radio Technical Commission for Aeronautics
SAE	Society of Automotive Engineers
SAS	Software Accomplishment Summary
SATCOM	Satellite Communications
SATDATA	Satellite Data
SATVOICE	Satellite Voice
SB	service bulletin
SBB	Swift Broad Band
SBD	Short Burst Data
SCI	Software Configuration Index
SCM	SDU Configuration Module
SCMP	Software Configuration Management Plan
SDIM	System Description and Installation Manual
SDU	Satellite Data Unit
SEU	Single Event Upset
SIP	Serial Interface Protocol
SITA	Société Internationale de Télécommunications Aéronautiques
SOI	Stage of Involvement
SSA	System Safety Assessment
STC	Supplemental Type Certificate
SW	Software

Table INTRO-2. List of Acronyms and Abbreviations (Continued)

Term	Full Term
SI	International System of Units
SPM	standard practices manual
SRU	shop replaceable unit
TCCA	Transport Canada Civil Aviation
TPOS	test programs and operational software
TR	temporary revision
TSDP	technical support and data package
TPA	Transmit Pre-Amplifier
U.S.A.	United States of America
USMS	United States Measurement System
UUT	unit under test
UMTS	Universal Mobile Telecommunications Service
USIM	UMTS Subscriber Identity Module
VoIP	Voice over IP
WACO	Wichita Aircraft Certification Office
XLB	eXtended L-Band

SECTION 1 – SYSTEM DESCRIPTION

1. General Information (TASK 23-15-49)

A. General

(1) The Aspire 400 system provides satellite voice and data interchange using a satellite service in support of the following categories of communications: Air Traffic Service (ATS), Aircraft Operational Control (AOC), Aeronautical Administrative Communication (AAC), and Aeronautical Passenger Communications (APC)

(2) The Aspire 400 provides up to two satellite communication channels. A channel for the following cockpit services: ACARS data (Aircraft Communications Addressing and Reporting System), Cockpit voice, Position Reporting and AIS Electronic Flight Bag services. A second channel for cabin voice and data services.

(3) The Aspire-400 contains three main components, the HPA, the SDU, and the SCM.

(4) The Aspire 400 system consists of three main components, the High Power Amplifier (HPA), the Satellite Data Unit (SDU) and the SDU Configuration Module (SCM).

B. Hardware Part Numbers

(1) At the time of writing of this document, the SATCOM Products were identified by the hardware part numbers indicated in Table 1-1:

Table 1-1. Aspire 400 Component Part Numbers

SATCOM Product	Hardware Part Number
HPA	90404514-XXX
SDU	90402651-XXX
SCM	90402652-XXX

(2) Where:

(a) XXX suffix: Indicates minor variants that do not require substantive re-evaluation (examples include Customer specific part numbers, changes is physical labeling).

(b) A change to form fit or function will be reflected in a new base part number.

(c) Hardware part number controls FPGA firmware and micro-boot software components.

(d) Refer to Figure 1-1 for the system diagram.

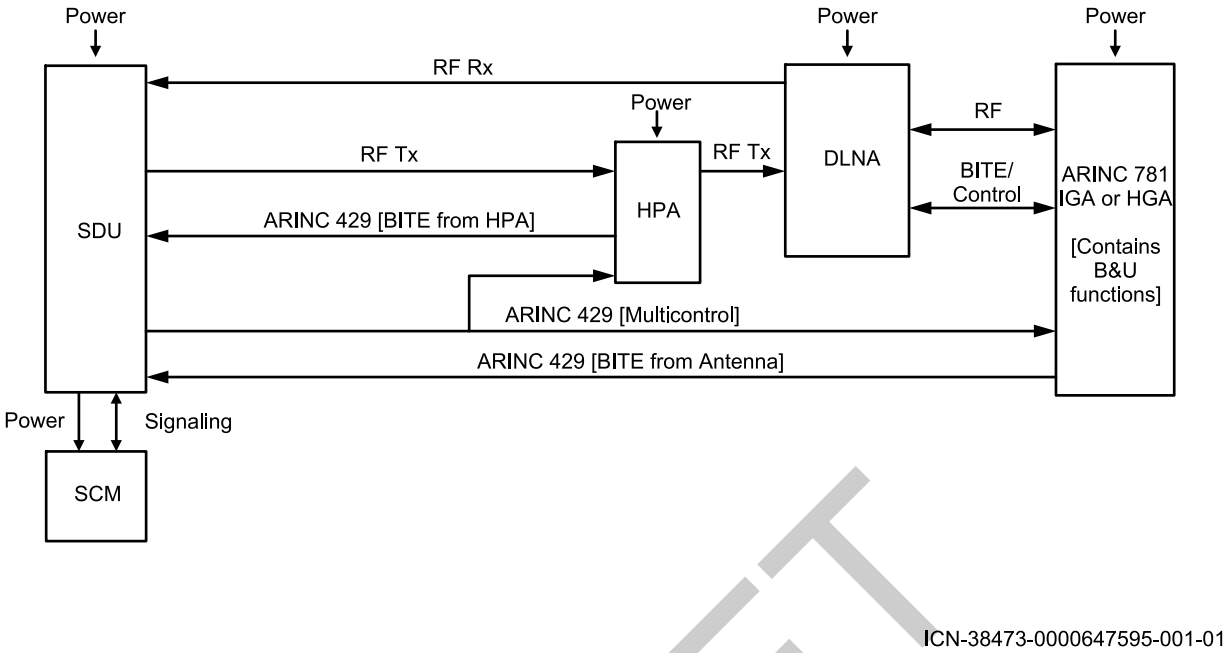

Figure 1-1. Aspire 400 System Diagram

2. HPA Description (TASK 23-15-49)

A. About High Power Amplifier (HPA)

(1) The HPA provides high power amplification of the Transmitted (Tx) RF signal between the Satellite Data Unit and the antenna (via a DLNA). The HPA meets the ARINC 781 [ID4] functional requirements.

(2) Table 1-2 provides the specifications for ASPIRE 400 HPA.

Table 1-2. HPA Component Specifications

Component	Characteristic	Specification
HPA	Part Number	90404514-000
	Length	14.764 inches (375.01 mm) MAX
	Width	2.41 inches (61.2 mm) MAX
	Height	7.88 Inches (200.2 mm) MAX
	Mounting Information	2MCU Tray per ARINC 600
	Weight	9.00 Lbs (4.08 Kg) MAX
	Power Dissipation	240 W MAX
	Power Consumption	280 W MAX
	Operating Voltage	115 VAC
	Cooling	UNIT IS DESIGNED TO OPERATE IN FORWARD O/H CROWN – DRAW THROUGH (MEASURED AT THE BASE) AIR FLOW OF 35.2 KG/HR (77.60 LB/HR) - AMBIENT PRESSURE OF 101.3 KPA (14.696 PSIA) – AIR TEMPERATURE OF 40 C (104 F) INTERNAL FAN USED DURING LOSS OF COOLING CONDITION – FLOW RATE 14.83 CFM AT SEA LEVEL AND ROOM TEMPERATURE – FAN FILTRATION REQUIREMENTS: NONE
	Maintenance	No scheduled Maintenance Required
	Interfaces	J1-A (70X #22 Contacts, 1X Size 1 Coax) J1-B (70X #22 Contacts, 1X Size 1 Coax) J1-C (4X #20 Contacts, 3X #16 Contacts, 4X #12 Contacts, 2X #5 Contacts)
	System Requirements	RTCA/DO-160G

(3) The HPA supports the following functions:

(a) L-band Tx RF Power Amplification

(b) Processor RF Power Management and Diagnostics

(c) Power Supply Secondary Power Generation and Management from Aircraft Primary Mains

(d) Backplane - providing ARINC 600 [ID5] interface.

(4) The L-band Tx Power Amplification provides the primary function RF signal amplification. Control for gain settings and activation is defined by ARINC-429 [ID6] messaging from the SDU. The RF performance, functional health and operational status is continuously monitored and reported via ARINC-429 [ID6] messaging back to the SDU. In addition to enabling the ARINC-429 [ID6] control and response, the processor manages the RF Power Amplification through activation/deactivation current profile sequencing and continuous gain optimization. A high level block diagram is shown in Figure 1-2.

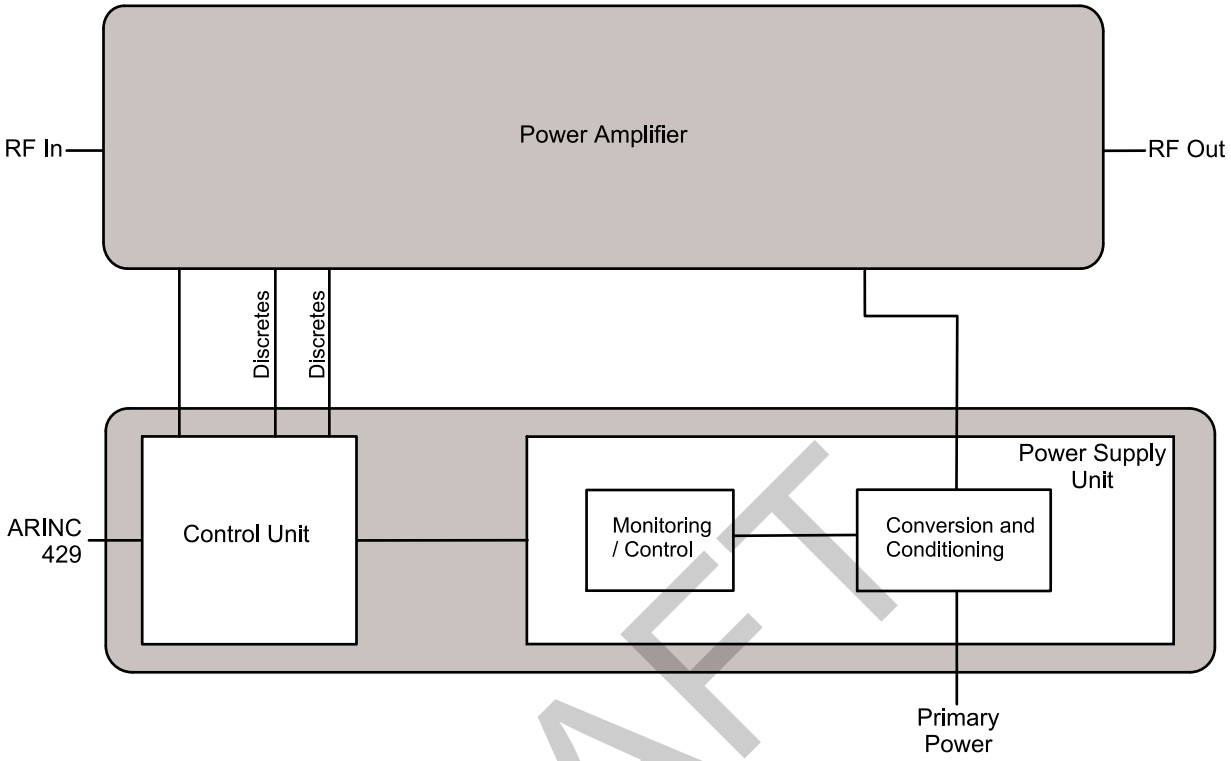

Figure 1-2. High Power Amplifier (HPA) Block diagram

(5) The HPA is designed to support multi-carrier Inmarsat Class 6F and 7F requirements for Aeronautical Mobile Satellite Services (AMSS).

3. SDU System (TASK 23-15-49)

A. Satellite Data Unit

(1) The Aspire 400 Satellite Data Unit (SDU) is the central communications processing and control unit, largely determining the functionality of the complete Aircraft Earth Station. The signal-in-space parameters are determined by the SDU in relation to modulation/ demodulation, error correction, coding, interleaving and data rates associate with the communication channel(s).

(2) The Dual Aeronautical BGAN Card (DABC) provides the Inmarsat modem interface from the vaious voice and data user interfaces to the SATCOM RF interface. Modulation and protocol management are applied as part of this process as well as interface routing. The Dual Aeronautical BGAN Card provides two segregated channels.

B. SDU Functions and Services

(1) The Aspire 400 SDU provides SATVOICE and DATA using the Inmarsat extended L-Band Swift Broadband service in support of the following categories of communications:

(a) Air Traffic Service (ATS),

(b) Aircraft Operational Control (AOC),

(c) Aeronautical Administrative Communication (AAC), and

(d) Aeronautical Passenger Communications (APC).

(2) The Aspire 400 provides up to two Swift Broadband channels:

(a) A Swift Broadband safety channel for the following services:

1 ACARS data (Aircraft Communications Addressing and Reporting System),

2 Voice (two channels - one Circuit Switched Voice (CS) and one Packet Switched Service (PS) using VoIP),

3 Position Reporting.

4 AIS Electronic Flight Bag.

(b) A Swift Broadband non-safety channel is used for the Circuit Switched Voice and Packet Switched Data.

C. Application Mode: Single Channel Aspire 400 ACD/AIS Configuration

(1) The following figures are provided to show the interconnection between the Aspire 400 and other aircraft systems and services.

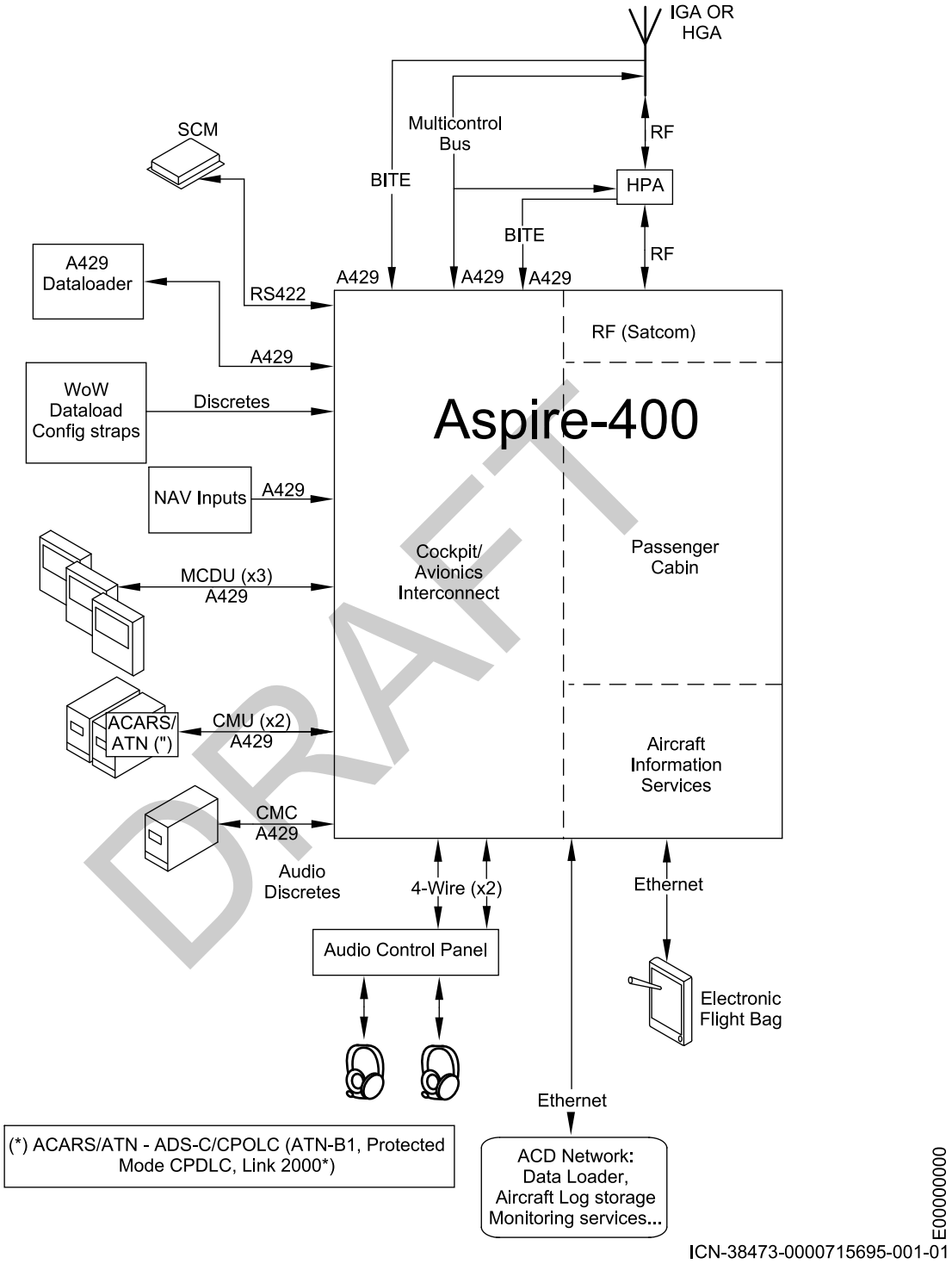

Figure 1-3. Aspire 400 Single Channel

NOTE: The above diagram is a logical representation of the SDU functions and interconnections and does not imply a direct mapping to the physical implementation.

D. Application Mode: Dual Channel Aspire 400 ACD/AIS/PIES Configuration

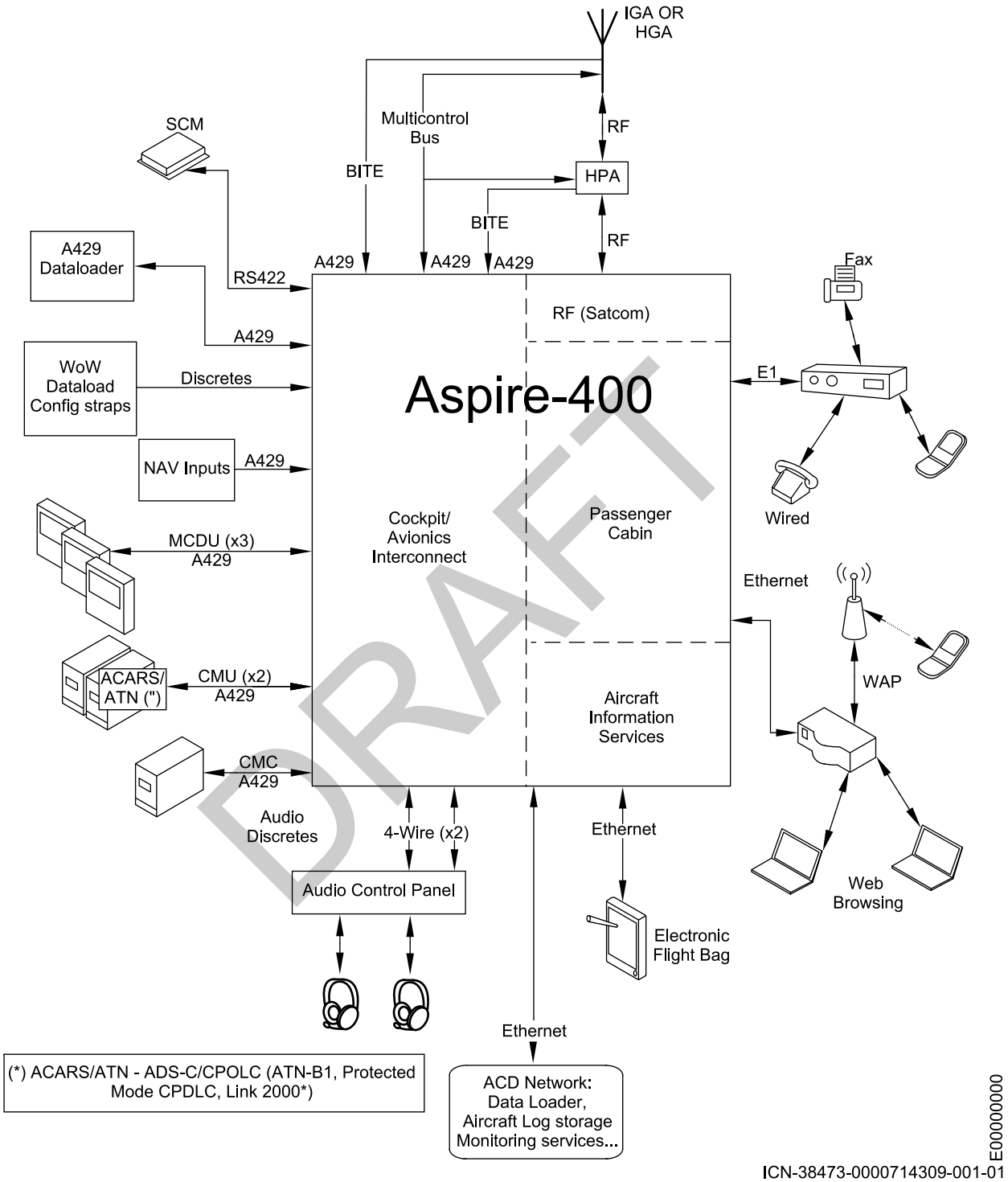

Figure 1-4. Dual Channel Aspire 400

NOTE: Figure 1-4 is a logical representation of the SDU functions and interconnections and does not imply a direct mapping to the physical implementation

E. SDU System Characteristics

(1) Table 1-3 provides the specifications for ASPIRE 400 SDU.

Table 1-3. SDU Component Specifications

Component	Characteristic	Specification
SDU	Part Number	90402651-000
	Length	14.604 Inches (370.94 mm) MAX
	Width	2.41 Inches (61.2 mm) MAX
	Height	7.88 Inches (200.1 mm) MAX
	Mounting Information	2MCU Tray per ARINC 600
	Weight	8.00 Lbs (3.63 Kg) MAX
	Power Dissipation	70 W MAX
	Power Consumption	60 W MAX
	Operating Voltage	115 VAC
	Cooling	UNIT IS DESIGNED TO OPERATE IN FORWARD EBAY, CABIN, AND NON-PRESSURIZED COMPARTMENT. UNIT REQUIRES FORCE AIR COOLING AS FOLLOWS: – AIR FLOW OF 15.4 KG/HR (34.0 LB/HR) – AMBIENT PRESSURE OF 101.3 KPA (14.696 PSI) – AIR TEMPERATURE OF 40 C (104 F). INTERNAL FAN USED DURING LOSS OF COOLING CONDITION: – FLOW RATE MAX 3.98 CFM – FAN FILTRATION REQUIREMENTS: NONE
	Maintenance	No scheduled maintenance Required
	Interfaces	9 PIN D-SUB Receptacle
		RJ45 Connector
	System Requirements	RTCA/DO-160G

4. SCM System (TASK 23-15-49)

A. Aspire 400 SDU Configuration Module (SCM) Architecture

(1) The SCM provides memory for storage of ORT files and licenses, USIMs needed for SBB network access and a Security Smart card that is needed for Safety service

authentication. It assists in the replacement of faulty SDUs as it minimizes SDU configuration steps.

(2) The USIM and Security Smart Card application reside on UICCs (Universal Integrated Circuit Card). Inmarsat has developed the applications and specifies the permissible devices which have the application loaded on them.

(3) The SCM has no Complex Electronic devices. The software can only be loaded in the factory.

B. SCM System Characteristics

(1) Table 1-4 provides the specifications for ASPIRE 400 HPA, SDU and SCM

Table 1-4. SCM Component Specifications

Component	Characteristic	Specification
SCM	Part Number	90402652-000
	Length	4.75 Inches (120.7 mm) MAX
	Width	1.00 Inches (25.4 mm) MAX
	Height	4.00 Inches (101.6 mm) MAX
	Weight	0.50 Lbs (0.23 Kg) MAX
	Power Dissipation	10.7 W MAX
	Power Consumption	16 W MAX
	Operating Voltage	18 VDC MAX
	Cooling	PASSIVELY COOLED AND DOES NOT REQUIRE FORCED AIR. THERE ARE NO INTERNAL COOLING FANS.
	Maintenance	No scheduled maintenance Required
	Interfaces	15 Position D-SUB Plug MALE (TE 5745908-2)
	System Requirements	RTCA/DO-160G

5. Inmarsat Variations (TASK 23-15-49)

A. Scope

(1) Please note all processes described in this plan apply to the development of both classes.

(2) This plan includes schedule information for each of the applications.

(3) These classes are detailed in the Table 1-5 Equipment Class and Subclass Identification:

Table 1-5. Equipment Class and Subclass Identification

Equipment Class Identifier	Description
AES6	AES using a High Gain Antenna (HGA), transceiver (Satellite Data Unit) (SDU), SDU Configuration Module (SCM) and High Power Amplifier (HPA) function), and Diplexer Low Noise Amplifier (DLNA)
Sub-Class 6F	A 6F transceiver is defined as a transceiver unit capable of operating within an AES6 system, which uses a DF diplexer and HGA. It includes the SDU, HPA and the SCM, as shown in Figure 1-1 Block Diagram of an AES6 and its Major components
AES7	AES using an Intermediate Gain Antenna (IGA), transceiver (SDU, SCM and HPA function), and Diplexer Low Noise Amplifier (DLNA)
Sub-class 7F	A 7F transceiver is defined as a transceiver unit capable of operating within an AES7 system, which uses a DF diplexer and IGA. It includes the SDU, HPA and the SCM, as shown in Figure 1-2 Block Diagram of an AES7 and its Major System Components

B. Honeywell SwiftBroadband System Overview

(1) The Inmarsat L-Band (1.5/1.6 GHz) SwiftBroadband Satellite Communications Network consists of:

(a) Aircraft Earth Stations (AESs)

(b) Space segment formed by the Inmarsat-4 geostationary satellites

(c) Inmarsat Ground Network formed by

1 Radio Access Network (RAN)

2 BGAN (Broadband Global Area Network) Core Network

3 GDGW (Ground Datalink Gateway)

4 Safety Voice.

(2) The Basic configuration of the Network in relation to aircraft user terminal functionality is depicted in Figure 1-5:

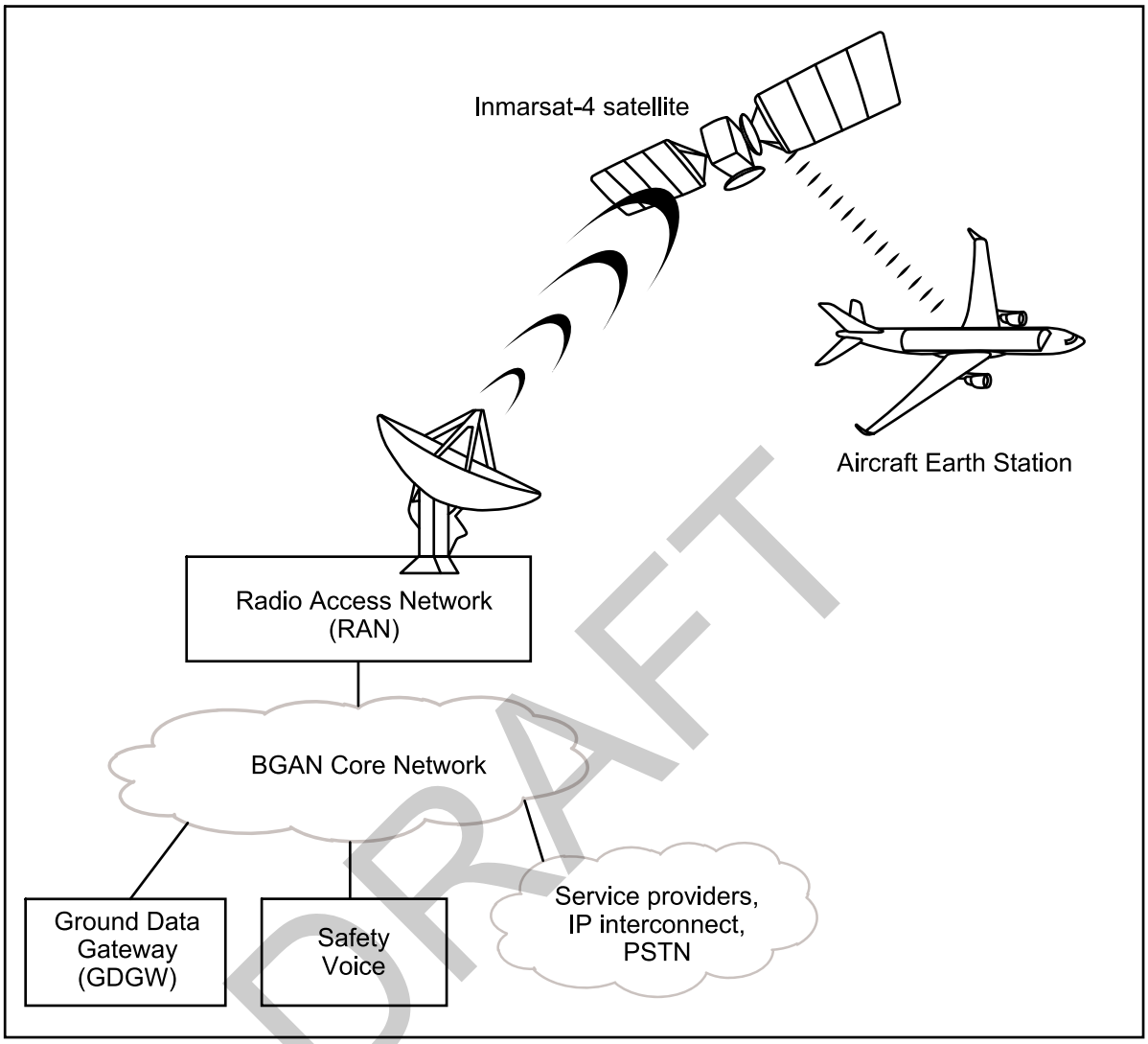

Figure 1-5. Inmarsat Communications Overview

(3) The SATCOM Avionics Suite consists of two L-Band SATCOM systems. The left SATCOM system identified as SDU1 will operate on the Iridium network and the right SATCOM system identified as SDU2 will operate on the Inmarsat network.

(4) Determination of the active and standby system is determined either by the crew or by an Aircraft algorithm outside the SATCOM. The remainder of this document focuses on the Inmarsat portion of the SATCOM avionics suite. The Inmarsat avionics equipment consists of an Aspire 400 Satellite Data Unit (SDU), the Aspire 400 SDU Configuration Module (SCM), and Aspire 400 High Power Amplifier (HPA) installed in the crown area, together forming the 6F transceiver. A Type F DLNA and HGA complete the AES.

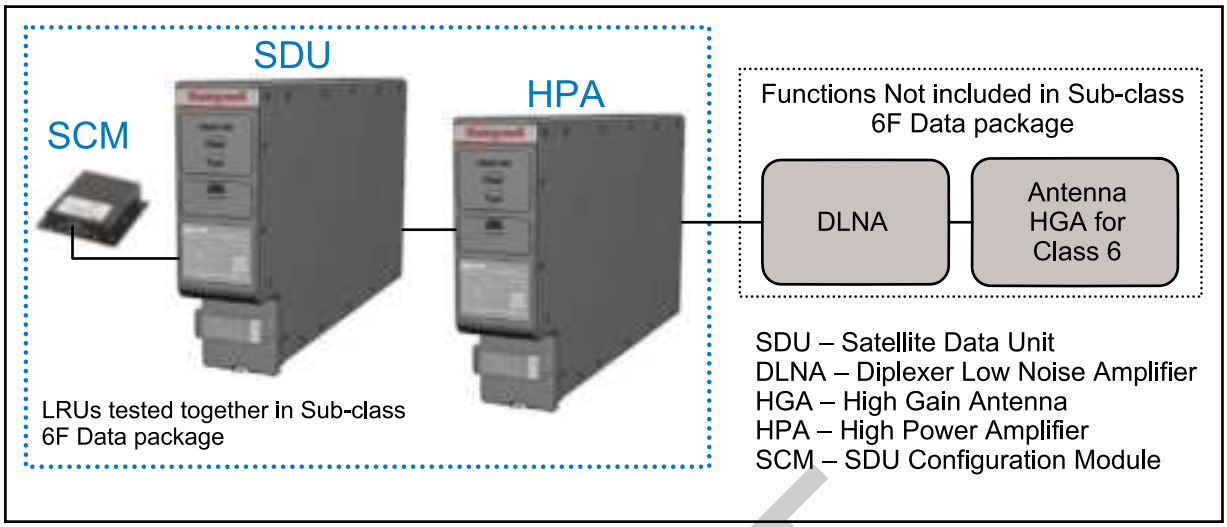

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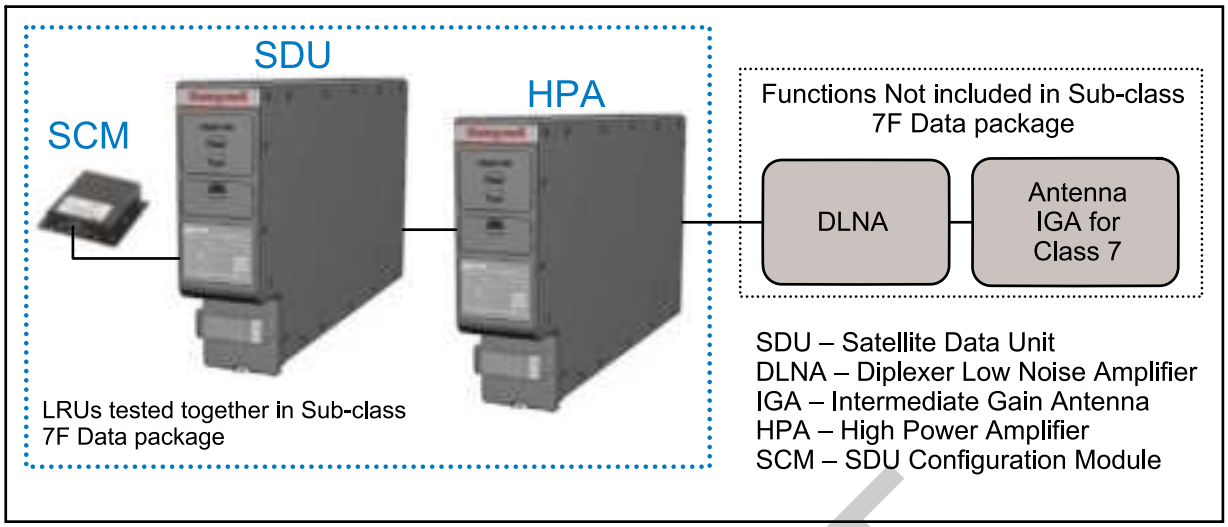
Figure 1-6. AES Class 6 System Configuration Showing 6F Sub-Class



ICN-38473-0000647593-001-01

Figure 1-7. AES Class 7 System Configuration Showing 7F Sub-Class

(5) Note the transmit high power amplifier function, and the RF diplexer function reside in different LRUs.

(6) The external SCM contains the Secure Owner Requirements Table (ORT), the User Owner Requirements Table (ORT), two SwiftBroadband Universal Subscriber Identity Modules (USIMs) and the SBB Security Smartcard.

C. AES Class 6/7 Functions and Services

(1) The Aspire 400 Class 6F/7F Transceiver provides SATVOICE and DATA using the Inmarsat extended L-Band Swift Broadband service in support of the following categories of communications:

(a) Air Traffic Service (ATS),

(b) Aircraft Operational Control (AOC),

(c) Aeronautical Administrative Communication (AAC), and

(d) Aeronautical Passenger Communications (APC).

(2) The Aspire 400 Class 6F/7F Transceiver provides up to two Swift Broadband channels:

(a) A Swift Broadband safety channel for the following services:

(b) ACARS data (Aircraft Communications Addressing and Reporting System),

(c) Voice (two channels – one Circuit Switched Voice (CS) and one Packet Switched Service (PS) using VoIP),

(d) Position Reporting.

(e) AIS Electronic Flight Bag

(f) A Swift Broadband non-safety channel capable of voice and data service.

(g) The Aspire 400 product applicability used for the Class 6F/7F operation is as follows:

– SDU (modem)

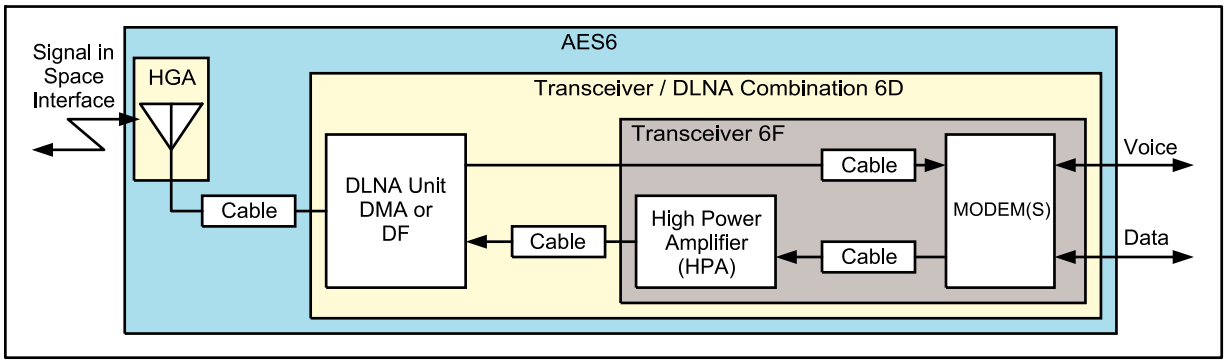
– SCM

– HPA

D. AES sub-class 6F

(1) Due to this application being a sub-class 6F, no DLNA or HGA data will be provided.

NOTE: The modem in Figure 1-8 includes the function of the SDU and the SCM.



ICN-38473-0000647585-001-01

Figure 1-8. Block Diagram of an AES6 and its Major Components

E. AES sub-class 7F

(1) Due to this application being a sub-class 7F, no DLNA or HGA data will be provided.

NOTE: The modem in Figure 1-9 includes the function of the SDU and the SCM.

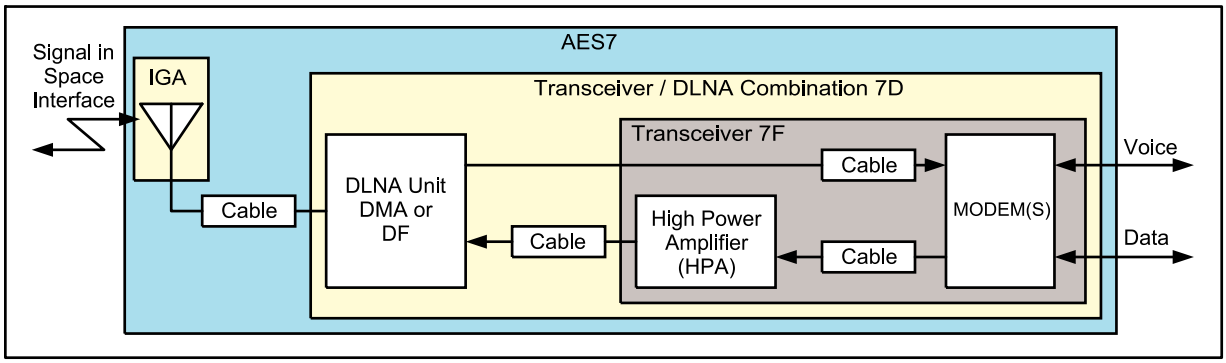


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Figure 1-9. Block Diagram of an AES7 and its Major System Components

F. Commonality Across Classes

(1) The SDU, HPA and SCM are designed to support both classes of operation. The class of operation is determined by SDU configuration settings contained in a Secure Owner Requirement Table (ORT) File.

(2) ORT files are used to identify aircraft specific configurations, and have a unique part number associated with each file created. These files are created and their associated part numbers are created by the air framer or end user using the ORT creation tool.

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SECTION 2 – SYSTEM OPERATION

1. General

A. System Overview

(1) The Aspire 400 SDU/SCM/HPA (Satellite Data Unit/ SDU Configuration Module/ High Power Amplifier) subsystem is part of the Aircraft Earth Station (AES) that facilitates airborne satellite communications using Swift Broadband (SBB) services over the Inmarsat L-Band satellite communications network.

2. Modes of Operations

A. Modes of Operation Transition Path

(1) The modes of operation begins with “Power On” where the OS boots

(2) The SDU begins its configuration and testing based on the ORT loading operational software where the SDU then boots up and begins validation

(a) If the validation fails then the system begins a safe power shut down:

1 Data load command signal will begin a load progress reset

2 SDU configuration or ORT operation software must be fixed.

(3) The SDU will then have the option for several tests and checks:

(a) Maintenance Test Command which places the system in Aircraft Test Mode, once finished, the system returns to SDU Configuration is supported and the application is loaded for the Inmarsat configuration services. The system can now enter Aircraft Test Mode.

(4) At all steps in the process, except for the Aircraft Test Mode, data is sent to be checked against the ORT and is either sent back to the SDU configuration and testing or the process is interrupted and the data load progress is reset.

(5) Figure 2-1 provides an understanding of the modes of operation and the possible transitions between the different modes.

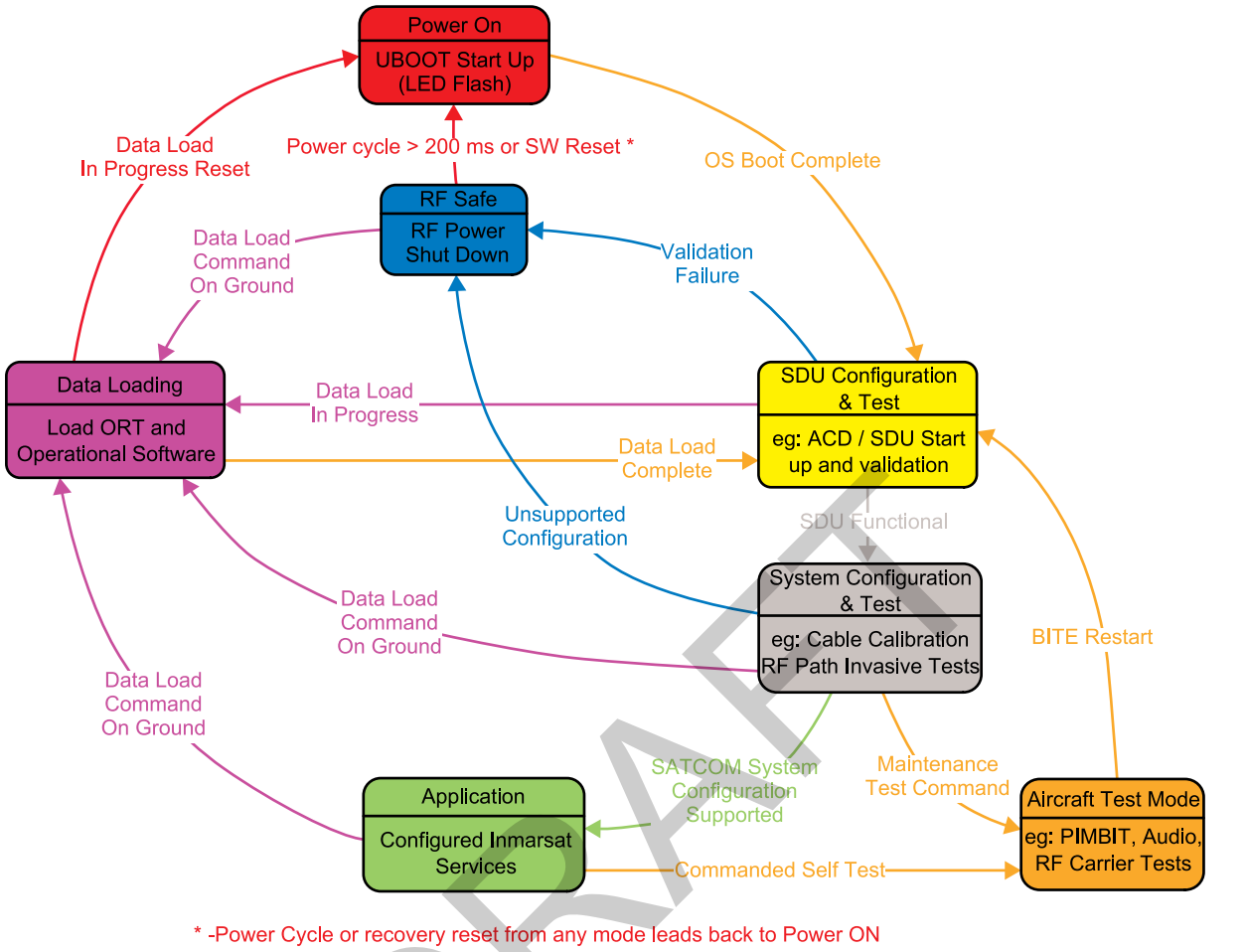

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Figure 2-1. Modes of Operation

B. RF Safe Mode

(1) In RF Safe Mode, the RF output of the system is disabled because a significant system configuration problem has been detected. Safe Mode does permit other interactions with the equipment to allow the condition (e.g. loading a missing ORT) to be remedied. Even once the problem has been remedied, normal operation can only be achieved by a reset where the conditions are no longer present.

(2) The SDU enters RF Safe Mode for any of the following conditions:

(a) SDU configuration missing including missing license keys for any selected ORT features that require a license

(b) SDU configuration incomplete

(c) SDU configuration discrepancy or corruption

(d) SATCOM LRU configuration discrepancy (antenna or PA type mismatch).

(3) Upon entry into RF Safe Mode, the SDU keeps the RF carrier off.

(4) When in Safe Mode, the SDU indicates its inability to provide data and voice services on the following interfaces which are able to be activated:

(a) Pilot control and display

(b) CMU.

(5) In RF Safe Mode, the SDU reports status to the following maintenance interfaces:

(a) Web GUI

(b) CFDS.

(6) In RF Safe Mode, the SDU retains the capability to enter into Data Load Mode and perform maintenance functions necessary to determine the reason for entry into RF Safe Mode.

3. HPA Modes of Operations

A. General

(1) The HPA operates as a means of transmitting RF signal between the SDU and antenna.

(2) The HPA supports the following modes:

(a) L-band Tx RF Power Amplification

(b) Processor RF Power Management and Diagnostics.

4. Tx RF Modes of Operation

A. General

Table 2-1. Tx RF Input/Output

Tx Type	Description		dB(s)
Tx RF Input VSWR	The VSWR looking into the Tx RF interface does not exceed 1.5:1 when measured with respect to a characteristic impedance of 50 ohms anywhere within the L-band Tx frequency range.		N/A
Tx RF Input Dynamic Range	The HPA meets transmit performance requirements for per carrier input levels		+10 dBm to -33 dBm
Tx RF Input Instantaneous Dynamic Range	After system calibration and the setting of the input attenuator value the instantaneous dynamic range of carriers post the input attenuator is 20 dB. Instantaneous per carrier dynamic range accounts for:	Inmarsat System per carrier gain adjustment	10 dB
		Antenna reporting gain range	8 dB
		AES system gain adjustments to overcome gain tolerance	±2 dB
Tx RF Input Damage Level	The HPA meets the transmit performance requirements after exposure to a total average input power of:		+20 dBm
Tx RF Load VSWR Capability	The HPA does not sustain permanent damage if operated continuously at full output into an infinite VSWR load at any phase angle.		
	During steady state operation, the HPA does not exhibit oscillations for any combination of input and output load impedance within the 2:1 VSWR circle.		
	The VSWR looking into the RF output port does not exceed 1.5:1 when measured with respect to a characteristic impedance of 50 ohm anywhere within the L-band Tx frequency range.		
	Under conditions of a single modulated carrier, at rated output power, the measured power with respect to that measured into a matched resistive load when measured into any load within the 2:1 VSWR circle is:		>=0.9 dBr

Table 2-1. Tx RF Input/Output (Continued)

Tx Type	Description		dB(s)
Tx RF Rated Output Power	The HPA is capable of providing 64-QAM maximum carrier-rated average power.	Tx Output port	+42.5 dBm +0.5 dB/-0 dB into a 50Î Ω load
		HPA Output port to Antenna RF port	system loss of 2.5dB
Tx RF Output Dynamic Range	When the PA function is enabled the achievable average power in the presence of 64- QAM modulated carrier(s) ranges from:		+23 dBm to +46 dBm

5. Tx In-band (L-band) Performance

A. Modulation Characteristics

(1) For purposes of the following sections the following definition of Tx carriers apply:

(a) Reference signal generator will be set for the following setup conditions:

(b) Data Source: **PN**

(c) Repeat: **Continuous**

(d) Phase Polarity: **Normal**

(e) Differential Data Encoding: **Off**

(2) The modulation characteristics for the applicable bearer type are shown in Table 2-2 where Channel Bandwidth is the Necessary Bandwidth.

Table 2-2. Modulation Characteristics

Multiplier	Modulation	Roll-Off Factor Root raised cosine	Symbol Rate	Channel Bandwidth	Nominated Bandwidth
0.5	Pi/4 QPSK	0.25	16.8 ksym/s	21 kHz	25 kHz
1.0	Pi/4 QPSK	0.25	33.6 ksym/s	42 kHz	50 kHz
2.0	Pi/4 QPSK	0.25	67.2 ksym/s	84 kHz	100 kHz
4.5	Pi/4 QPSK	0.25	151.2 ksym/s	189 kHz	200 kHz
1.0	16-QAM	0.25	33.6 ksym/s	42 kHz	50 kHz
2.0	16-QAM	0.25	67.2 ksym/s	84 kHz	100 kHz
2.5	16-QAM	0.13	84 ksym/s	94.92 kHz	100 kHz
4.5	16-QAM	0.25	151.2 ksym/s	189 kHz	200 kHz
5.0	16-QAM	0.13	168 ksym/s	189.8 kHz	200 kHz

Table 2-2. Modulation Characteristics (Continued)

Multiplier	Modulation	Roll-Off Factor Root raised cosine	Symbol Rate	Channel Bandwidth	Nominated Bandwidth
2.5	32-QAM	0.13	84 ksym/s	94.92 kHz	100 kHz
5.0	32-QAM	0.13	168 ksym/s	189.8 kHz	200 kHz
2.5	64-QAM	0.13	84 ksym/s	94.92 kHz	100 kHz
5.0	64-QAM	0.13	168 ksym/s	189.8 kHz	200 z

B. Tx Gain

(1) The HPA net Tx gain manufacturing tolerance (unit to unit), Tx Input port to Tx Output port, is 54 dB ± 2 dB under conditions of:

(a) 3 dB input attenuator back-off

(b) PA ON/OFF control in the ON state.

(c) Maximum rated carrier output

(d) Center Tx-band frequency

(e) Room ambient conditions.

(2) While the PA function is held in the disabled state the HPA net Tx gain capability, Tx input port to Tx output port, is < -20 dB under conditions of 0 dB input attenuator back-off.

C. Tx Frequency Response

(1) The Tx-band gain tolerance as assessed from the transmit port input to the transmit port output is less than 1 dB peak to peak under conditions of:

(a) PA function is enabled

(b) Any output level as achieved from a corresponding input level under appropriate input attenuator setting

(c) Constant temperature.

D. Tx Gain Stability

(1) The per unit gain stability for any set level is better than ±1.5 dB due to combined variations in temperature and frequency

(2) The output power stability is within ± 0.5 dB over the burst period excluding the first burst and the preamble/training period of all subsequent bursts under the following conditions:

(a) 50% On/Off carrier duty cycle

(b) Burst period of 20 ms.

(c) Rated output power carrier level

(d) Carrier is modulated by 64-QAM with the permitted characteristics

(e) Constant temperature

(f) Minimum of 1000 bursts.

E. Tx EVM

(1) When conditioned by 2 continuous carriers, each with 64-QAM modulation characteristics yet of independent test sequences and each of 1/2 of the HPA maximum rated average power, the mean squared EVM of the test carrier as measured at the Tx output port is less than 0.002.

F. Tx Spectral Regrowth

(1) For two (2) modulated carriers of the same type but of independent test sequences and each of carrier-rated power, the spectral regrowth as assessed by one of the carriers is simultaneously less than the limits defined by breakpoints for "Case I" and "Case E" as expressed in each corresponding table for the modulation type under the following conditions:

(a) Carrier separation exceeding at least twice that of the assessed spectrum bandwidth

(b) Both carriers are contained to 1626.5 MHz to 1660.5 MHz

(c) Signal source purity better than measurement limits by at least 20 dB

(d) A carrier signal(s) of carrier-rated power and a system applicable modulation

(e) Limit assessment at frequency offset greater than -70 dBc intercept relaxed to -70 dBc

(f) dBe limits expressed in relative power with respect to the carrier power measured in the same bandwidth.

NOTE: Allocation Case I is 2.5 dB more stringent than Inmarsat system specification.

G. Intermodulation Products in the Tx-band

(1) Tx output port referenced two tone IM, or optionally modulated carrier power spectral density in 3 kHz two carrier IM, in the Tx-band of 1626.5 MHz to 1660.5 MHz achieves IM performance of:

(a) Less than -30.5 dBc for 3rd and 5th order IM

(b) Less than -36 dBc for 7th and 9th order IM.

(2) Under conditions of:

(a) Carrier signals of maximum carrier-rated power and a system applicable modulation (optionally)

(b) Carrier separation of at least 200 kHz

(c) Carriers confined to 1626.5 MHz to 1660.5 MHz.

H. Spurious and Noise in the Tx-band

(1) Tx output port referenced spurious and noise in the Tx-band, 1626.5 MHz to 1662.5 MHz, is less than -44.5 dBm/3 kHz outside and offset from the nominated bandwidth by 1500 kHz under conditions of:

(a) A carrier signal of 5 dB less than maximum carrier-rated power and a system applicable modulation

(b) 17 dBi antenna gain

(c) 2.5 dB Tx output to antenna port loss.

(2) Tx output port referenced spurious and noise in the Tx-band, 1626.5 MHz to 1662.5 MHz while the PA is enabled and no carrier input is less than -56.5 dBm/3 kHz.

NOTE: In Normal Operation the PA function will not be directed to disable PA function during periods of burst inactivity.

I. Tx Noise Figure

(1) The noise figure of the transmit path is < 15 dB under conditions of 0 dB input attenuator setting.

6. Out-of-Tx Band Performance

A. Tx Gain

(1) The gain of the PA is reduced by 40 dB minimum for all frequencies 600 MHz or more away from the range 1626.5 MHz to 1660.5 MHz.

B. Spurious Outside of Tx-band when Carrier Present

(1) Under conditions of a carrier signal of carrier rated power and a system applicable modulation the out-of-Tx-band spurious and noise achieves the performance limits derived from the specification limits of RTCA/DO-262D and associated notes in concert with the performance specification behavior of a Type F diplexer.

NOTES:

1 The prescribed selectivity for GNSS-GPS or GNSS-Glonass receivers define performance for both in-band narrow spurious and broadband spurious. If narrow band spurious are present they should not form part of the Broadband noise compliance.

2 Tx in-band spurious 1626.5 MHz to 1660.5 MHz defined elsewhere.

C. Spurious Outside of Tx-band When No Carrier Present

(1) Under conditions of no carriers present at the input and with the PA function enabled the out-of-Tx-band spurious and noise achieves the performance limits derived from the specification limits of RTCA/DO-262D and associated notes in concert with the performance specification behavior of a Type F diplexer.

NOTES:

1 The prescribed selectivity for GNSS-GPS or GNSS-Glonass receivers define performance for both in-band narrow spurious and broadband spurious. If narrow band spurious are present they should not form part of the Broadband noise compliance.

2 Tx in-band spurious is 1626.5 MHz to 1660.5 MHz and 1668.0 MHz defined elsewhere.

D. Intermodulation Products Outside of Tx-band

(1) In the presence of two similarly modulated carriers yet of independent sequences and each at maximum carrier rated power separated by at least 200 kHz and contained to the 1626.5 MHz to 1660.5 MHz Tx-band the achieved network performance at the Antenna Port of a Type F diplexer connected in-line with the Tx output port incurring a net loss of 2.5 dB at midband is no greater than the performance limits as expressed in Table 2-3:

Table 2-3. Performance Limit for Expressed Modulation Type

Sub-Band	IM Order (min)	Frequency (MHz)	IM (dBc)	Test Carriers	Limiting Standard
Below Rx Band	9	0.1 to 1518	-105	CW	DO-210
Rx-band	7	1518 to 1559	-139	CW	DO-210
GPS	5	1575.42 ± 12	-127.8	Modulated	ETSI
Glonass	3	1602 ±5.75	-112.8/500	Modulated	ETSI
1605-1610	3	1605 to 1610	-112.8/500	Modulated	ETSI
Radio Astronomy	3	1610.6 to 1613.8	-112.8/500	Modulated	ETSI
Iridium	3	1616 to 1625.5	-32.3/20	Modulated	V5C3
Tx-band		1626.5 to 1660.5	Defined elsewhere		
Radio Astronomy	3	1660 to 1670	-38.7/3	Modulated	ETSI
Above Tx- band to 1694.5	3	1670 to 1694.5	-32.3/20	Modulated	ETSI
Above Tx- band to 1728.5	5	1694.5 to 1728.5	-56/1000	Modulated	ETSI
Above Tx- band to 1762.5	7	1728.5 to 1762.5	-81/1000	Modulated	ETSI
Above Tx- band to 3400	9	1762.5 to 3400	-81/1000	Modulated	ETSI
Above Tx- band > 3400	9	3400 to 18000	-80	CW	DO-210

NOTES:

1 Modulated carriers must have unique test sequences from each other.

2 On aircraft equipped with Glonass 5th order IM control algorithm limiting carriers no more than 30 MHz of carrier separation may be applied if warranted.

3 Limits of Rx band have equivalence to degradation of G/T.

4 Limits within 2 MHz of Tx-band edges apply only if carriers are not present within 2 MHz of that edge of the Tx-band.

(2) Relief for the specified requirements is permitted if substantiation of Type F Diplexer in excess of the "Assumed System Rejection to Ant port" can be demonstrated.

E. Harmonics Above the Tx-band (>1670 MHz)

(1) Tx output port referenced harmonics is less than the following limits over the respective frequency range when used with Type F Diplexer and 1.4 dB of coax interconnecting cable shown in Table 2-4:

Table 2-4. Harmonic Frequency Range

Harmonic	dBm/Mhz	Frequency Range
2nd	-19.5 dBm/3 MHz	3253.0 MHz to 3321.0 MHz and 3336.0 MHz to 3350.0 MHz
3rd	-29.5 dBm/3 MHz	4879.5 MHz to 4981.5 MHz and 5004.0 MHz to 5025.0 MHz
4th	-29.5 dBm/3 MHz	6506 MHz to 6642 MHz and 6672.0 MHz to 6700.0 MHz
5th	-29.5 dBm/3 MHz	8132.5 MHz to 8302.5 MHz and 8340.0 MHz to 8375.0 MHz
6th	-40.5 dBm/3 MHz	9759 MHz to 9963 MHz and 10008.0 MHz to 10050.0 MHz

(2) Under conditions of:

(a) A carrier signal of carrier-rated power and a system applicable modulation

7. RF Monitoring and Control

A. Power Amplifier

(1) The design permits the PA function to be enabled/disabled by software control

(2) Any of the following inhibitions hold the PA function as disabled:

(a) Power interruption exceeds the transparency time

(b) Upon power-up and until the first ARINC-429 Label 143 HPA Command Word received with the state of indication of "PA Control" identified as "Carrier ON"

(c) Over-temperature exceeding critical level

(d) Fault conditions of the HPA preclude operation

(e) The HPA is executing a Self Test

(f) The detection of a single event upset that requires reset remedial action

(g) Input Attenuator level has not been defined by ARINC 429 label 143 HPA Command word "PA Backoff"

(h) Control Bus Input is compromised.

(3) The HPA enables the Power Amplifier function if the following conditions exist:

(a) Receipt of ARINC-429 Label 143 HPA Command Word "PA control" set to "Carrier On"

(b) No inhibitions are present holding the PA function as disabled.

(4) The HPA disables the Power Amplifier function if any of the following conditions exist:

(a) Receipt of ARINC-429 Label 143 HPA Command Word "PA control" set to "Carrier Off"

(b) Presence of any inhibitions complying the PA function to be disabled.

(5) The HPA echos the existing condition of "PA Control" of the most recent ARINC-429 label 143 HPA Command word in the ARINC-429 label 143 HPA Status word of the current reporting interval when known else default with "Carrier Off" until assigned otherwise.

(6) While in Normal Operating mode, the HPA achieves full transmit capability within 50 ms of the PA function being enabled. This may occur from commanded capability if no inhibitions prevent it or upon primary power restoration from primary power interrupt if primary power inhibition was the cause of PA deactivation. Allocation accounts for Power Amplifier sequencing to enable drain voltage.

(7) If the PA function is enabled, the HPA achieves its PA function disable state within 50ms of receipt of the ARINC-429 HPA Command word whose state of indication of "PA Control" is "Carrier Off". Allocation accounts for Power Amplifier sequencing to disable drain voltage.

(8) Any transition of the PA function between enabled and disabled states should be recorded to the Event Record log.

B. Input Attenuator

(1) The HPA provides a minimum of 20 dB of input attenuator monotonic adjustment in increments of nominally 1.0 dB.

(2) The design has a persistent means of defining the input attenuators maximum adjustment capability implemented in the design in that is readable by software. Persistent means by hardware or manufacturer reserved memory that cannot be overwritten by application reload. The software reported "PA Backoff Range" is "Input Attenuator Maximum Attenuation Capability" - 16 computed in dBs and expressed in 4-bits. The reportable attenuator maximum attenuation capability is therefore limited to a range of 16(0000) to 31(1111).

(3) The state of indication of "PA Backoff Range" to be reported in ARINC-429 label 143 HPA Status word is the declaration of the input attenuator's maximum adjustment capability implemented in the design.

(4) The cumulative attenuation accuracy should be less than or equal to ±2.0 dB over temperature and frequency.

(5) Software derives the commanded attenuation value from the "PA Backoff" declared in ARINC-429 label 143 HPA Command Word during Normal Operation to set the input attenuator setting except in circumstances of Power Amplifier Management override during the transition period of Power Amplifier Activation/Deactivation.

(6) Any change to the value of "PA Backoff" as declared in ARINC-429 label 143 HPA Command word during Normal Operation state should be recorded in a change of backoff event in the Event Record log.

C. Tx Gain Monitoring

(1) The input detector function and output detector functions are synchronously sampled

(2) The input and output power detectors are used to compute:

(a) "Input Level" reported in ARINC-429 label 357 Aero Power word

(b) "RF Power Input" status reported in ARINC-429 label 350 HPA Maintenance word

(c) "Output Level" reported in ARINC-429 label 357 Aero Power word

(d) "Relative Power" reported in ARINC-429 label 143 HPA Status word

(e) "VSWR" OK/Unknown threshold status reported in ARINC-429 label 350 HPA Maintenance word

(f) "Actual Power Out Status" status reported in label 143 HPA Status word.

(3) "Input Level" and "Output Level" is computed over the non-zero Sample Period prescribed by ARINC-429 label 357 HPA Detector Sample Control word

(4) During the current computing "Input Level" and "Output Level" Sample Period the occurrence of an ARINC-429 label 357 HPA Detector Sample Control word with a different but non-zero Sample Period is held in abeyance until completion of the current Sample Period before becoming effective.

(5) During the current computing "Input Level" and "Output Level" Sample Period the occurrence of an ARINC-429 label 357 HPA Detector Sample Control word with a Sample Period defined as "Period Sync" causes re- initialization of the existing Sample Period upon detection.

(6) "RF Power Input", "Actual Power Out", "VSWR", and "Actual Power Out Status" are computed or assessed over the synchronous reporting interval prescribed by regular scheduling of ARINC-429 labels 143 HPA Status word and label 350 HPA Maintenance word.

D. Input Power Detector Function

(1) The HPA provides a sample of the input power at a point immediately after the input attenuator and prior to the RF Power Amplifier function.

(2) Within the measurement reporting tolerance, the sample of input power is not affected by the enable/disable state of the PA function.

(3) The sample of input power is implemented with a directivity > 20 dB.

(4) The input power detector function that assesses the sample of input power is able to measure signals in a logarithmic response over the input dynamic range with an accuracy of less than ±0.5 dB over level and temperature.

(5) The input power detector function provides broadband (Tx-band) rms power detection with a nominal response time of 1 ms. The input power detector analog to digital conversion oversampling capability should be at least two times that of the detector response time.

(6) The input detector operation and accuracy is independent of the carrier state (ie capable of measuring input power when in the carrier-off state).

(7) The input detection function is active at all times.

(8) Commentary: This detector is used as part of an algorithm that adjusts the input attenuator to compensate for the cable loss between the SDU and the HPA.

(9) For the current ARINC-429 label 357 Aero Power word reporting interval the computed average input level over the interval is reported as "Aero Power In" in accordance to the following:

(a) Only input power samples > -30 dBm are used in computation

(b) Power samples are averaged in dB

(c) Default value of -45 dBm is declared if no input power samples > -30 dBm.

(10) For purposes of conveyance in ARINC-429 label 357 Aero Power word, the computed average input level in dBm over the interval is expressed as a binary number in accordance with the following formulation:

(a) The computed average input level is expressed in dBm to the closest 0.1 dB resolution

(b) The numeric value to be conveyed is "Numeric Value" = ("computed average input level (dBm)" - (-45dBm)) / 0.1 dB

(c) The numeric value is expressed as a 10-bit unsigned binary number.

(11) For the current ARINC-429 label 350 reporting interval the following applies:

(a) If any input power sample is greater than or equal to -30 dBm in the reporting interval then the "RF Power Input" status is reported as "In Range" in ARINC-429 label 350 HPA Maintenance word.

(b) If all of the input power samples are < -30 dBm in the reporting interval then the "RF Power Input" status is reported as "Low Signal" in ARINC-429 label 350 HPA Maintenance word.

(12) For the current ARINC-429 label 143 HPA Status word reporting interval the following applies:

(a) If all input samples are < -30 dBm in the reporting interval then the "Actual Power Out Status" status is reported as "Held Power" in ARINC-429 label 143 HPA Status word.

(b) If the PA function is disabled throughout the reporting interval then the "Actual Power Out Status" status is reported as "Held Power" in ARINC-429 label 143 HPA Status word.

(c) While the PA function is enabled should any input sample be >= - 30 dBm in the reporting interval then the "Actual Power Out Status" status is reported as "Actual Power" in ARINC-429 label 143 HPA Status word.

8. Controller Functions

A. Single Event Upset

(1) The HPA is ruggedized against Single/Multiple Event Upset.

(2) Implementation may employ redundant memory, error correcting hardware memory, software correction encoding or other suitable techniques in any combination thereof. Hardware should select memory types that are proven to be more robust against Single Event Upset (SEU). Non-volatile memory used to retain Event and Fault Logs is not required to be robust to Single Event Upset.

(3) If the processor architecture where the resident application code resides does not include inherent error detection/correction capability then dual application images are retained for Single Event Upset management.

(4) The HPA instigates remedial action on detection of single event corruption to restore the integrity of affected software or firmware.

(5) If remedial action resulting from detection of single event corruption does not compromise the functional operation of the HPA then the event should be recorded to the Event Record log and operation should continue unabated.

(6) If remedial action resulting from the detection of single event corruption does affect the functional operation of the HPA then the HPA does the following: (if able)

(a) Declares the detection as an inhibition cause to the PA function.

(b) Immediately latches the Reset Reason register corresponding to "Single Event Upset".

(c) Forces a software reset.

(7) The HPA continuously monitors the integrity of the software resident area of ROM.

(8) If the integrity of the software area of ROM is detected and confirmed as compromised then the following occurs for as long as the ROM is compromised:

(a) The state of indication of "Internal ROM Integrity" in ARINC-429 label 350 HPA Maintenance word is declared as "ROM Fault"

(b) "Failure Warning" is identified as a ARINC-429 word SSM reportable condition of the HPA

(c) While "Failure Warning" persists as the ARINC-429 word reportable condition for the SSM then the RED LED is illuminated.

(d) Reset Reason register "ROM Fault" detected is latched for use in reset recovery.

NOTE: Confirmed as compromised implies remedial actions were unsuccessful.

(9) If the integrity of the software area of ROM is not compromised then the state of indication of "Internal ROM Integrity" in ARINC-429 label 350 HPA Maintenance word for the current ARINC-429 reporting interval is "No ROM Fault". Accordingly, the Reset Reason register "ROM Fault" remains cleared and the Red Fault LED is not used to annunciate a ROM fault condition.

(10) The HPA continuously monitors the integrity of the operational RAM

(11) If the integrity of operational RAM is detected and confirmed as compromised then the following occurs for as long as the RAM is compromised:

(a) The state of indication of “Internal RAM Integrity” in ARINC-429 label 350 HPA Maintenance word is declared as “RAM Fault”

(b) "Failure Warning" is identified as a ARINC-429 word SSM reportable condition of the HPA

(c) While "Failure Warning" persists as the ARINC-429 word reportable condition for the SSM then the RED LED is illuminated.

(d) Reset Register "RAM Fault" detected should also be latched for use in reset recovery.

(12) If the integrity of operational RAM is not compromised then the state of indication of “Internal RAM Integrity” in ARINC-429 label 350 HPA Maintenance word for the current ARINC-429 reporting interval is “No RAM Fault”. Accordingly, the Reset Reason register "RAM Fault" remains cleared and the Red LED is not used to annunciate a RAM fault condition.

B. Self Test

(1) Functional Test is a SSM annunciation condition of the ARINC-429 reported words and an annunciation pattern condition for the front panel LEDs. SSM = FT denotes that an Off-line self-test is in progress and the HPA is out-of-service. Off- line tests are an integral part of Power-On/Initialization/Reset Recovery and may also be command evoked by ARINC- 429 received words or Maintenance user initiation.

(2) The primary function of RF Power Amplification is suspended during Self- Test thereby enabling invasive tests to be considered however tests dependent on PA function being enabled will not be possible. Awareness and interaction to other AES system components is maintained.

(3) While in "Normal Operation" state the receipt of an ARINC-429 label 143 HPA Command Word whose "Sign/Status Matrix" field is set to "Functional Test" evokes the execution of functional test provided the following conditions are satisfied:

(a) The preceding ARINC-429 label 143 HPA Command word received "Sign/Status Matrix" field was set to "Normal Operation".

(b) The HPA is not actively executing a Off-line self test evoked by ARINC-429 label 143 HPA Command word.

(c) "Functional Test" is identified as a ARINC-429 word SSM reportable condition of the HPA during the execution of Off-line self-test for the following ARINC-429 words:

1 Label 143 HPA Status word

2 Label 350 HPA Maintenance word

3 Label 357 Detector Data word.

(d) While "Functional Test" persists as the ARINC-429 word reportable condition for the SSM then GREEN LED function is temporarily overwritten such that the RED LED and GREEN LED can be illuminated in antiphase, alternating RED then GREEN.

(e) As a minimum Off-line Self-Test should perform the following tests:

1 CRC verification of integrity of application RAM and supporting software modules in RAM

2 CRC verification of integrity of application in ROM

3 The integrity of the power supply function

4 Fault evaluation of Temperature sensors

5 ARINC-429 receive communication integrity

6 Invasive ARINC-429 loopback verification

7 The health of the primary function(s).

NOTE: PA functionality is disable prohibiting RF dependent evaluations and HPA health evaluations.

(f) Off-line self-test should attend to evaluation of all BITE coverage that have corresponding Fault log capabilities. A cycle of Continuous BIT should be considered in achieving the coverage objectives

(g) If at the end of Off-line Self-Test any of the following internal fault conditions persist the HPA is deemed to be in failure:

1 Fault conditions observed in operational RAM

2 Fault conditions observed in software resident ROM

3 Power supply exhibiting secondary power rail voltage faults

4 Power supply current limit exceedance primary or secondary not attributable to RF Input stimulus.

(4) At the completion of functional test the following actions occur:

(a) "Functional Test" is no longer identified as a ARINC-429 word SSM reportable condition of the HPA

(b) If internal faults are confirmed then "Failure Warning" is identified as a ARINC-429 word SSM reportable condition of the HPA for the following ARINC-429 words:

1 Label 143 HPA Status word

2 Label 350 HPA Maintenance word

3 Label 357 Detector Data word.

(c) Results of the test are recorded as an event in the Event Record log

(d) Corresponding test results are indicated in ARINC-429 label 350 HPA Maintenance word

(e) The PA function is restored to its enabled/disabled state before entry to Functional Test execution

(f) The front panel LEDs denote the health status as determined by Self-Test.

(5) If "Failure Warning" was determined as a consequence of execution of Off-line Self Test then identification of "Failure Warning" as a ARINC-429 word SSM reportable condition of the HPA and annunciation by Red LED persists until subsequent re-testing (Continuous BIT or a separate Off-line Self-Test) determines fault conditions attributing to the "Failure Warning" are cleared.

9. ARINC 429 Messaging

A. Message Set Integrity

(1) The HPA does not react to ARINC-429 label 143 HPA Command word if:

(a) The computed parity of the Word is not Odd

(b) The Source Destination ID (SDI) is other than "All Call" or "HPA".

(2) The HPA does not apply parameter information of the ARINC-429 label 143 HPA Command word if:

(a) The SSM identifies Failure Warning (FW) of the LRU of the sourced information

(b) The SSM identifies No Computed Data (NCD) of the sourced information.

(3) If ARINC-429 label 143 HPA Command word is not detected over a sustained period of greater than 1 second then the HPA reacts by:

(a) Identifying "No Computed Data" (Command) as a ARINC-429 word SSM reportable condition of the HPA to be applied to ARINC-429 label 143 HPA Status word.

(b) Recording the occurrence of absence of detection as an event in the Event log.

(c) For as long as the condition persists, "No Command" is declared as the state of indication of "Control Bus Input" of ARINC-429 label 350 HPA Maintenance word for each affected reporting interval.

(d) For as long as the condition persists, flash the HPA RED LED.

(4) On the successive detection of ARINC-429 label 143 HPA Command word in compliance with the expected scheduling the HPA reacts as follows:

(a) No longer identifying "No Computed Data" (Command) as a ARINC-429 word SSM reportable condition of the HPA to be applied to ARINC-429 label 143 HPA Status word until identified otherwise

(b) Recording the occurrence of deassertion to the Event log

(c) Define "Command" as the state of indication of "Control Bus Input" of ARINC-429 label 350 HPA Maintenance word for that and subsequent reporting intervals until asserted otherwise.

(5) If ARINC-429 label 357 HPA Detector Sample Control word is not detected within the greater of 1s or +50% of its expected scheduling from the preceding ARINC-429 label 357 HPA Detector Sample Control word then the HPA reacts by:

(a) Identifying "No Computed Data" (Detector) as a ARINC-429 word reportable SSM condition of the HPA to be applied to ARINC-429 label 357 Aero Power word

(b) Recording the absence of detection as an event in the Event log.

(6) On the successive detection of ARINC-429 label 357 HPA Detector Sample Control word in compliance with the expected scheduling ±50ms the HPA reacts as follows:

(a) No longer identifying "No Computed Data" (Detector) as a ARINC-429 word SSM reportable condition of the HPA to be applied to ARINC-429 label 357 Aero Power word until identified otherwise

(b) Recording the occurrence of deassertion to the Event log.

B. HPA Status Word - ARINC 429 Label 143

(1) The HPA assigns the state of indication of the various Indicators that define the ARINC-429 label 143 HPA Status word format in accordance to the Table 2-5:

Table 2-5. States of Indication Assigned to Indicators by HPA

Indicator	State of Indication of Indicator
Label	Default: 143 Octal
Source Destination ID	Derived from SDI straps or Manufacturing SDI data in memory
PA Backoff Range	Derived from Manufacturing data in memory
PA Control	Defined by states “Carrier On” or “Carrier Off”
HPA Type	Default: “Linear”
Actual Power Out Status	Defined by states “Actual Power” or “Held Power”
Max Avail RMS Power	Default
Actual Peak Power	Defined by the largest forward power sample
Sign Status Matrix	Defined by States: “Failure Warning”, “No Computed Data (Command), “Functional Test”, “Normal Operation”
Parity	Defined by computed Odd parity over word

10. SDU Modes of Operations

A. Power-On Mode

(1) Power-On Mode is entered when power is applied to the SDU and is responsible for:

(a) Booting the ACD application code.

(b) Providing a limited set of BITE tests that can only be performed by boot code.

(2) No other processors are active during this mode.

B. External System Interfaces

(1) This section describes the external hardware interfaces provided by the SDU. The presence of hardware interfaces in this section does not mean that these interfaces are supported by software or that they are functional in every mode of operation.

C. Application Modes

(1) The SDU enters Application Mode upon the successful completion of system configuration and test.

(2) In Application Mode, the SDU provides SBB satellite services based on the ORT configuration.

11. Cockpit Control and Display (MCDU) (TASK 23-15-49)

A. Cockpit Display Types

(1) The SDU equipment software supports concurrent displays connected via the MCDU interfaces activated by ORT.

(2) The Cockpit Control and Display provides synchronized display fields across all displays when the same menu page is selected, except for the scratchpad.

B. Wire Voice Control and Display Functions

(1) This section describes the essential 4-wire voice control and display elements.

(2) The 4-Wire Voice Control and Display.

(a) Allows each display to operate independently from the others.

(b) Permits placing, receiving and termination of safety voice calls on any ORT enabled display.

(c) Ensures independent control and status for each 4-wire interface.

(d) Displays the priority of in-progress calls.

(e) Indicates where detectable if the call termination was normal, abnormal or not completed, in a manner that does not prevent new calls from being initiated or accepted.

NOTE: If both status and pilot action cannot be accommodated, permitting pilot action takes precedence.

(f) Allows the user to modify a pre-set or default priority state and to cycle through the following when placing an air-to-ground call using any ORT enabled display:

From	To
Emergency	High
High	Low

Low	Public
Public	Emergency

C. Satellite Logon Control and Display Functions

(1) The 4-Wire Voice Control and Display provides:

(a) The satellite registration/logon status and control including selection of:

(b) Log off

(c) Auto logon

(d) Constrained logon

(e) Presence of a system failure that makes the SATCOM inoperable.

(2) When the ORT configuration is set for cabin voice calls, the ACD enables/disables cabin voice when a Cabin Calls indication is received from the call-display-and control protocol or the inhibit call discrete is asserted.

D. Dual SATCOM Control and Display Functions

(1) When Configured for Dual Safety SATCOM

(a) The SDU displays the current "SATCOM Select Mode" selected for operation via the Cockpit Control and Display.

NOTE: SATCOM Select Modes are: SDU1, SDU2 or Auto.

(b) The SDU displays if it is currently the Active or Standby SATCOM via the Cockpit Control and Display.

(c) The SDU allows user to set "SATCOM Select Mode" via the Cockpit Control and Display.

E. MCDU Type Cockpit Display Functions

(1) The MCDU type cockpit display pages are rendered by the SDU.

(2) The MCDU type 4-Wire Voice Control and Display permits:

(a) Entry of Air-to-Ground phone numbers via direct entry and via a phonebook facility.

(b) Placing and receiving of 4-wire calls including manual dial;

(c) Direct or Indirect access to other pilot SATCOM display pages.

(3) The MCDU type 4-Wire Voice Control and Display

(a) Displays the Caller identification of incoming calls on schemas that permit it.

(b) Displays the 4-wire Voice Control and Display default priority for non-directory entered numbers is level 2 "High".

(c) Displays is not required to clear a loaded entry on a 4-wire interface.

NOTE: Incorrect entries may be fixed by loading a correct one over top of an existing one.

12. Dual SATCOM Configuration

A. Master Control

(1) There are 2 anticipated mutually exclusive application configurations: Standalone and Dual Safety SATCOM.

(a) Standalone: only one SDU.

(b) Dual Safety SATCOM: 2 SDUs interconnected, but only one can be active and logged onto safety services at any one time.

(2) If the SDU Dual System Disable (DSD) discrete is asserted, the SDU:

(a) Silently Logs off if already logged on.

(b) Disables its RF transmission.

(c) De-asserts its Dual System Select (DSS).

NOTE: This applies for all configurations.

B. Standalone Configuration

(1) In Standalone Configuration, the SDU is always the active SDU, no other SDU is considered.

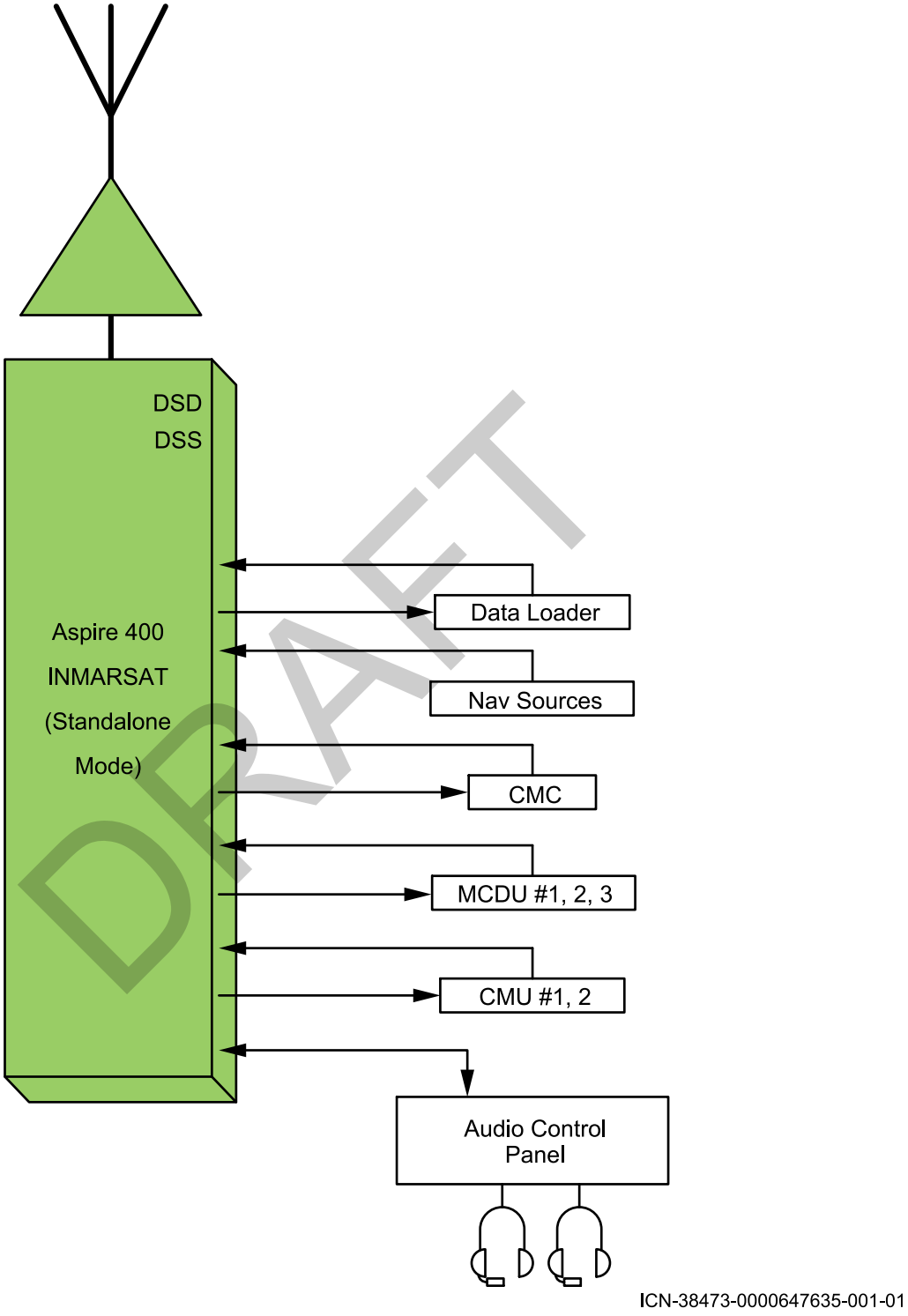


Figure 2-2. Dual SATCOM Standalone Configuration

NOTE: The SDU can be strapped as SDU1 or SDU2.

(2) The SDU enters Standalone Configuration if the ORT is configured for Standalone

(3) When in Standalone Configuration, the ACD asserts its Dual System Select (DSS) discrete.

C. Dual Safety SATCOM (Warm Standby)

(1) When the ORT is configured for Dual Safety SATCOM, the SDU can be in an Active state or a Standby state. The SDU is only allowed to transmit when in the Active state. When in the Standby state, the SDU is not allowed to transmit over the RF interface.

(2) In Dual Safety SATCOM configuration, both SATCOM can provide safety voice and data services. Both have independent RF chains and antennas but only one can be active and logged onto safety services at any one time.

(3) The SDU considers itself "SDU in coverage" when:

(a) The SDU has a valid spot beam map from the spot beams listed on the global beam common channel.

(b) And is in coverage for its current location.

(4) When the SDU does not have a valid spot beam map, the SDU considers itself as "SDU in coverage" when:

(a) SDU can see a satellite that has elevation angle > - 4 degrees.

(5) When ORT configured for Dual Safety SATCOM, on entering the Active state, the SDU:

(a) Asserts its DSS discrete before enabling RF transmission (this will assert the companion SDU DSD discrete).

(b) Enables its RF transmission.

(c) Sets Bit 18 of Label 270 SDU "ACARS" MU/CMU Status Word to "0".

(d) Continues to assert its DSS discrete as long as it is in the Active state.

(6) When ORT configured for Dual Safety SATCOM, on entering the Standby state, the SDU:

(a) Terminates all user services (if any).

(b) Logs off (if logged on).

(c) Disables its RF transmission.

(d) De-asserts its DSS discrete (this will release the other SDU DSD discrete).

(e) Sets Bit 18 of Label 270 SDU "ACARS" MU/CMU Status Word to "1", and continues to de-assert its DSS discrete as long as it is in Standby state.

D. Aircraft Directed Dual Safety SATCOM (Warm Standby)

(1) In Aircraft Directed Dual Safety SATCOM configuration, the SDU powers up in Standby state and waits until it receives directions to go to Active state. Switching decisions are aircraft directed and not determined by the SATCOM systems using the crosstalk bus.

(2) Communication and control of the SDU in an Aircraft Directed Dual Safety SATCOM Configuration are via:

(a) Dual System Disable (DSD)

(b) Dual System Select (DSS)

(c) Labels 272 and 274 on the "Data from MDCU 1, 2 or 3" interfaces.

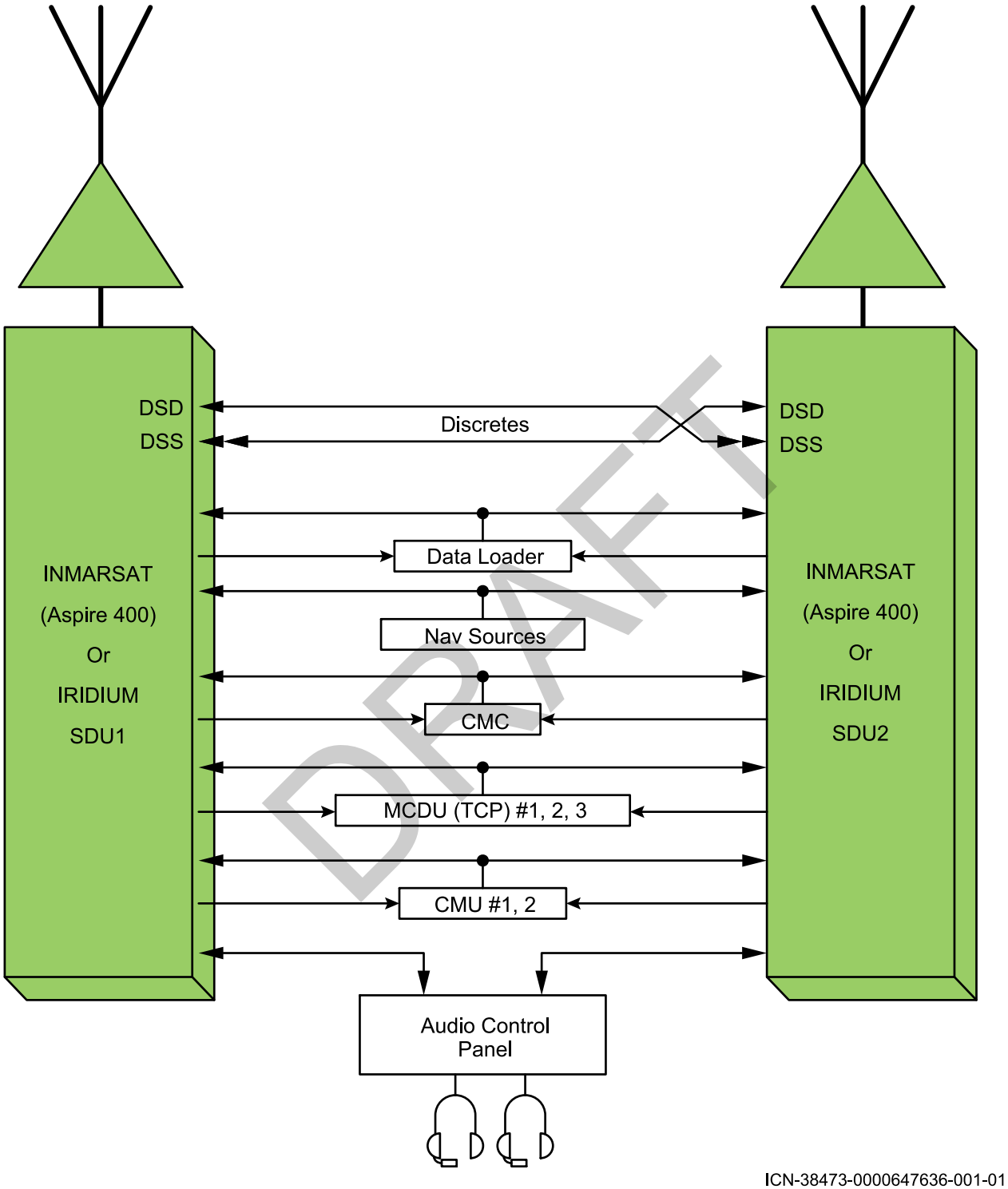


Figure 2-3. Dual SATCOM Dual Configuration

(d) The SDU enters Standby state on start-up and stays in Standby state until commanded to go into Active State via Label 272 from the TCP when the following is true:

1 ORT configured for Aircraft Directed Dual Safety SATCOM.

(e) When all the following are true:

1 ORT configured for Aircraft Directed Dual Safety SATCOM.

2 SSM of Label 272 is set to NO on the selected ARINC 429 MCDU interface for at least 3 consecutives labels.

3 Bits 12-11 (Operational Mode Command) is 01b (SDU1 Active & SDU2 Standby) in Label 272 Operational Mode Command Word that is being used.

(f) The ACD sets the "ACDir Select Mode" to:

1 SDU1 Else

2 SDU2 (Operational Mode Command is set to 10b - SDU2 Active & SDU1 Standby).

NOTE: The priority is to use Label 272 from MCDU 1 when valid, then MCDU 2 when Label 272 is missing/invalid from MCDU 1, then MCDU 3 when Label 272 is missing/invalid from both MCDU 1 & 2.

(g) The ACD keeps the "ACDir Select Mode" unaltered when all the following are true:

1 SSM of Label 272 is set to FT.

2 Bits 12-11 (Operational Mode Command) is 01b (SDU1 Active & SDU2 Standby) or 10b (SDU2 Active & SDU1 Standby) in Label 272 Operational Mode Command Word that is being used.

NOTE: The priority is to use Label 272 from MCDU 1 when valid, then MCDU 2 when Label 272 is missing/invalid from MCDU 1, then MCDU 3 when Label 272 is missing/invalid from both MCDU 1 & 2.

(h) The SDU transitions to Active State, else Standby State, when all the following are true:

1 ORT configured for Aircraft Directed Dual Safety SATCOM.

2 The SDU number (per the strapping) is the same as "ACDir Select Mode".

3 The DSD is not asserted.

(i) Bits 11, 12 and 13 of CFDS Label 362 OCA Fault Summary Word are all set to unavailable (1) when all the following are true:

1 ORT configured for Aircraft Directed Dual Safety SATCOM.

2 The SDU is in Active mode.

(j) That SDU transitions to Standby state when the ORT configured for Aircraft Directed Dual Safety SATCOM.

(k) On entering Active mode, the ACD:

1 Sets the SDU to Auto-Logon.

2 Automatically attempts to establish all ORT enabled services.

(l) When all the ORT is configured for Aircraft Directed Dual Safety SATCOM and the SDU considers itself "SDU in coverage":

1 The SDU sets bit 11 of Label 274 SATCOM OCA Interface Status to:

a 1.

(m) Otherwise set it to

1 0.

(n) When all the ORT is configured for Aircraft Directed Dual Safety SATCOM and the SDU is receiving valid Label 272 from at least one of the TCPs with SSM set to normal (NO) or functional test (FT) for at least 3 consecutives labels:

1 The SDU sets bit 12 of Label 274 SATCOM OCA Interface Status to:

a 1.

2 Otherwise set it to

a 0.

(o) When the ORT is configured for Aircraft Directed Dual Safety SATCOM, either of the following occur:

1 The SDU is logged onto an Inmarsat satellite.

2 The SDU has transitioned to the Standby mode.

(p) The SDU sets bit 13 of Label 274 SATCOM OCA Interface Status to 0 when:

1 ORT configured for Aircraft Directed Dual Safety SATCOM.

2 The SDU has logged off due to a manual command from the pilot.

3 The SDU sets bit 13 of Label 274 SATCOM OCA Interface Status to 1.

E. Electronic Unit Identification and SATCOM Configuration Reports

(1) The SDU can access its own and the SCM configuration information directly.

(2) Configuration information for SATCOM LRU providing antenna and/or the amplification function is retrieved from reports of the LRU containing that function.

(3) The SDU supports reporting partial or collated SATCOM LRU configuration information on multiple interfaces, which may include:

(a) Physical Label on front of SDU

(b) Web GUI

(c) Data Loader

(d) CFDS

(e) MIB

(f) Pilot Displays (MCDU/TCP).

(4) The SDU maintains the following SDU configuration information with the characters limited to the maximum indicated:

(a) SDU Name 11 characters

(b) HW Name 11 characters

(c) SDU Hardware Part Number 15 characters max

(d) SDU Serial Number 15 characters max

(e) Software Part Number(s):

1 SDU Application 15 characters max

2 Secure ORT 15 characters max

3 User ORT 15 characters max.

(f) Software Part Names (designators).

1 SDU Application 15 characters max

2 Secure ORT 15 characters max

3 User ORT 15 characters max.

(5) The SDU maintains configurable MAC addresses for Ethernet ports.

(6) The SDU has the following self-identification data stored electronically:

(a) SDU network identification (including Manufacturers Code).

(b) SDU revision (amendment).

(c) SDU vendor information.

(d) SDU function.

(e) SDU short name.

(f) The TAC code portion of the IMEI.

(g) The SVN portion of the IMEI.

(h) The Serial Number portion of the IMEI.

(7) On startup of the SB safety Voice Service, the ACD retrieves the Channel Card Side A USIM IMSI, and the IMEI from the Safety Channel card.

(8) On startup of the SB safety Voice Service and if Side B is ORT enabled, the ACD retrieves the Channel Card Side B USIM IMSI, and the IMEI from the Channel Card Side B.

(9) The SDU provides configuration reporting for the SATCOM system including the:

(a) SDU

(b) SCM

(c) External Power Amplifier (if present and Configuration reporting supported, as determined by ORT)

(d) Antenna (if configuration reporting supported by Antenna, as determined by ORT and/or antenna signaling).

(10) The SDU retrieves and maintains the following SCM information:

(a) LRU Name 11 characters

(b) Hardware Part Number 15 characters max

(c) Serial Number 15 characters max.

(11) The ACD retrieves and maintains the following configuration information for the antenna with the characters limited to the maximum indicated:

(a) LRU Name 11 characters

(b) Hardware Part Number 15 characters max

(c) Serial Number 15 characters max

(d) Name of SW application 15 characters max

(e) Software Part Number 15 characters max.

(12) When ORT indicates the presence of the HPA, the ACD retrieves and maintains the following configuration information with characters limited to the maximum indicated.

(a) LRU Name 11 characters

(b) Hardware Part Number 15 characters max

(c) Serial Number 15 characters max

(d) Name of SW application 15 characters max

(e) Software Part Number 15 characters max.

(13) The configuration storage and reporting design address the following:

(a) Only displaying information for LRUs that are configured by the ORT to be present.

(b) Distinguishing between the absence of configuration data due to non-support of configuration reporting of the remote LRU and expected but missing data.

1 Dashes have previously been used for expected but unavailable information.

2 It may not always be known by ORT if an LRU supports configuration reporting however it can be inferred if other receive BITE information present but no response is provided to configuration requests.

F. INMARSAT Operational

(1) The 24-bit AES ID (ICAO address) is used as the network addressing mechanism, for both the ACARS and safety voice services.

(2) The ACD provides the following safety services mapped to the indicated planeside interfaces:

(3) **Service Interface**

(a) ACARS ARINC 429 CMU (via Williamsburg V1)

(b) 2 safety voice channels 4-wire1, 4-wire2

(c) Aircraft Position reporting ARINC 429 navigation input data.

(4) When the ATN test feature is enabled, the ACD provides the following Safety Services mapped to the indicated Planeside interfaces:

(a) **Service Interface**

1 ACARS and/or ATN ARINC 429 CMU (via Williamsburg V3)

2 2 safety voice channels 4-wire1, 4-wire2

3 Aircraft Position reporting ARINC 429 navigation input data.

(5) The SDU does not support the following SBB features:

(a) Return carrier activation

(b) Sleep mode

(c) Supplementary services (other than Call waiting, CLIP, CLIR and eMLPP as required for safety SBB voice)

(d) G.711 u-Law

(e) Closed User Group and leased lines

(f) Inmarsat Common MMI

(g) Over the air USIM activation

(h) Point to Point SMS

(i) Cell Broadcast SMS

(j) Manual PLMN selection

(k) GSM USIMs

(l) USIM application toolkit

(m) Non USIM operation (Emergency calls).

G. SBB Bulletin Board and Satellite Table

(1) The SDU keeps an up-to-date satellite table which consists of the information required for the SDU to be able to logon to each satellite.

(2) Each row of the table contains data for one satellite and includes:

(a) Satellite id

(b) Satellite name

(c) Satellite region

(d) Satellite position

(e) SBB PSAB Frequencies.

(3) When there is no valid non-volatile stored ACD copy of the Satellite Table, the ACD synchronizes the ACD stored copy to the values from the ORT Satellite Table on the SCM.

(4) The ACD updates its non-volatile stored copy of the Satellite Table with the System Information Broadcast when new valid information is available.

NOTES:

1 Valid information means that it is syntactically correct as per the satellite table validation criteria.

2 If the System Information Broadcast data received is invalid as per validation criteria for the ORT satellite table, it will be discarded and logged.

(5) If a new satellite is added to the non-volatile stored copy of the Satellite Table based on the System Information Broadcast, the ACD assigns it:

(a) The lowest priority (9)

(b) A name (SAT ID X - where X is the satellite ID number from the System Information Broadcast).

(6) If a SBB capable satellite is removed from the System Information Broadcast, the ACD removes the satellite from its "Broadcast-updated Satellite Table".

(7) The ACD replaces its non-volatile stored copy of the Satellite Table with the SCM ORT Satellite Table when the SCM ORT Satellite Table version differs from the previously SCM sourced ORT Satellite Table.

13. Standard Call Discretes (TASK 23-15-49)

A. Ground to Air - Call Direction

(1) Whenever a 4-wire call is in the following states:

(a) INCOMING

(b) and the ORT indicates standard call discretes, the ACD asserts the chime discrete (set to LOW).

(c) And the ORT indicates standard call discretes, the ACD asserts the associated channel call light discrete (set to LOW).

(d) The ACD:

1 Asserts the associated SATCOM Voice Call bits based on 4-wire interface and priority of the call in SDU to CMU Label 270 (Channel 1/2 Alert bits are 24/25 respectively for P4 calls, Channel 1/2 Call bits are 22/23 respectively for P1/2/3 calls)

2 Asserts SELCAL (bit 14 in SDU to CMU Label 270).

B. Air to Ground - Call Direction

(1) Whenever a 4-wire call is in the following state:

(a) RINGING

(b) And the ORT indicates standard call discretes, the ACD asserts the associated channel call light discrete.

C. Connected and Release

(1) The hold time for a single stroke Cockpit Voice Chime signal is between 250 and 350 ms if both of the following are true:

(a) The ORT indicates standard call discretes

(b) A 4-wire call is in the CONNECTED state, the ACD asserts the associated channel call light output (1 or 2) discrete.

(2) Whenever a 4-wire call is in the following states:

(a) CALL INIT

(b) AVAILABLE

(c) And the ORT indicates standard call discretes, the ACD de-asserts the associated channel call light discrete.

(3) Whenever a 4-wire call is in the following states:

(a) CONNECTED

(b) And the ORT indicates standard call discretes, the ACD asserts in SDU to CMU label 270:

1 Bit 26 if the call is on 4wire 1

2 Bit 27 if the call is on 4wire 2.

(4) Whenever a 4-wire call is released by either:

(a) The ground side OR

(b) The air side, the ACD:

1 De-asserts the associated call light discrete for the channel if the ORT indicates standard call discretes

2 De-asserts the associated SATCOM Voice Communications bit (bit 26 for channel 1, bit 27 for channel 2) in SDU to CMU Label 270.

D. 4-Wire Call Control

(1) Call control inputs are used to place, accept and end calls and to key the Air-to-Ground audio connection. The SDU accepts control inputs from:

(a) Cockpit Voice Mic On Discrete

(b) Call Place/End discrete

(c) Call-display-and-control protocol (e.g. via MCDU).

(2) The SDU supports two modes of call control:

(a) Latched: Bidirectional audio path is present while the call is connected

(b) Push-to-talk call: Air-to-Ground audio only present when call is connected and the Mic is activated.

E. Ground-to-Air Call Decision

NOTE: This figure is descriptive to aid understanding, explicit requirements cover the content.

(1) The ACD routes, rejects, or re-directs to PS the Ground-to-Air CS safety voice calls according to the call decision logic defined by:

(a) BGAN CS routing and preemption

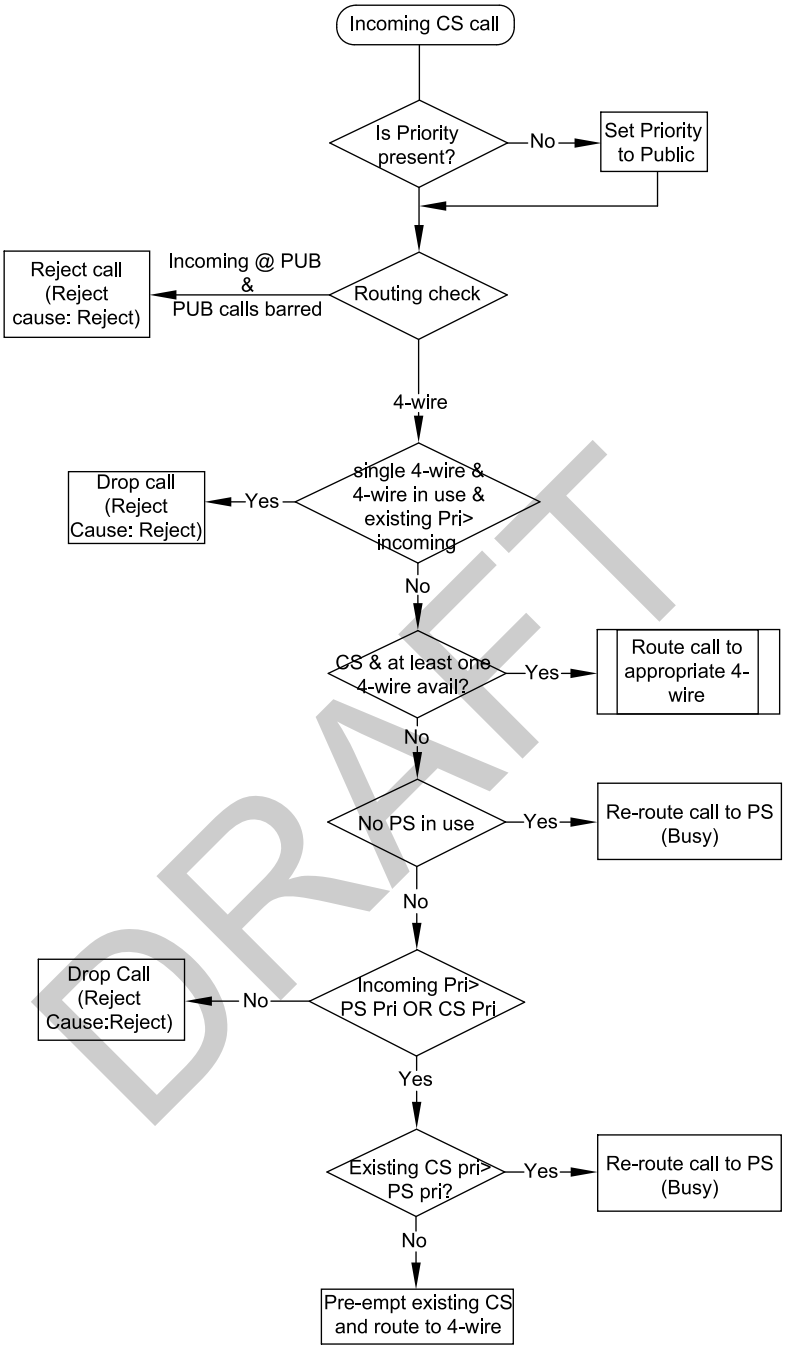
(b) Voice ORT configuration.

(2) The ACD PBX retrieves priority in Ground-to-Air CS calls from:

(a) the eMLPP priority value in the incoming circuit switch message (Report Status) from CC if present else,

(b) set the call priority as Public.

(3) The following figure describes the incoming call decision logic for the PS channel:



ICN-38473-0000647639-001-01

Figure 2-4. (Sheet 1 of 2) Incoming PS Call Decision Logic

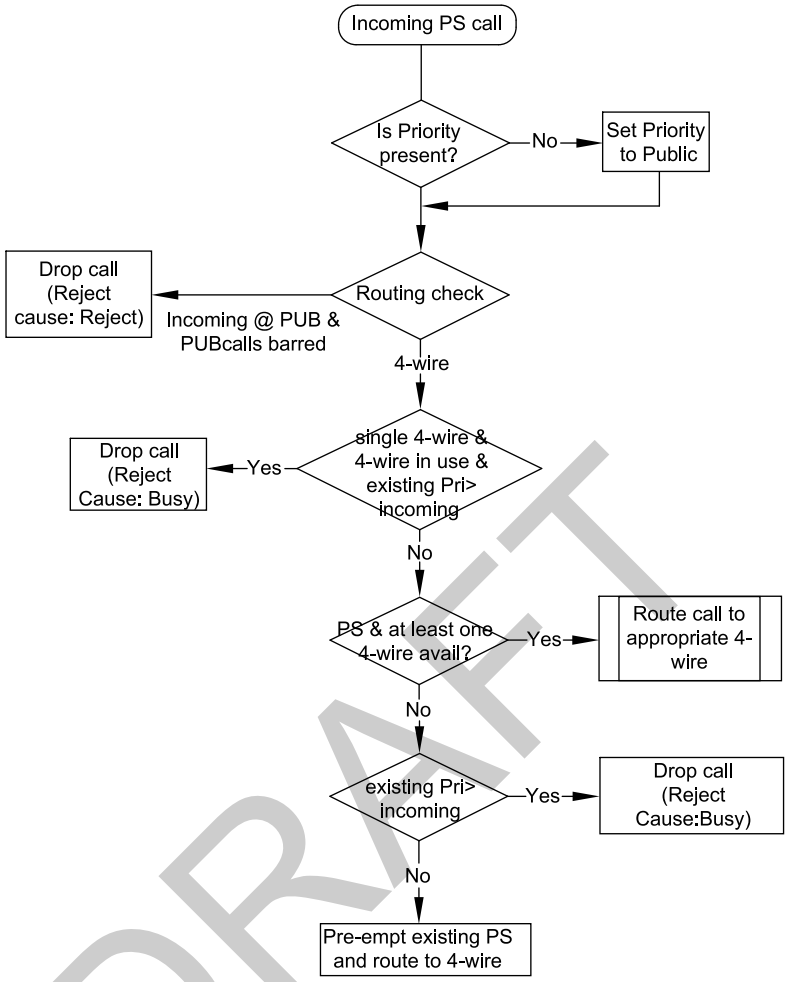


Figure 2-4. (Sheet 2 of 2) Incoming PS Call Decision Logic

NOTE: This figure is descriptive to aid understanding, explicit requirements cover the content.

(4) The ACD routes or rejects an incoming PS safety voice SIP call (SIP:INVITE) according to the call decision logic defined by:

(a) BGAN PS routing and preemption

(b) Voice ORT configuration.

(5) The ACD PBX determines priority in Ground-to-Air VoIP calls from:

(a) the SIP header Resource-priority field for VoIP calls if present, else,

(b) set the call priority as Public.

F. Push-to-Talk (PTT) Cockpit Call Control Mode

(1) The ACD PBX operates in PTT mode when ORT activated.

(2) In PTT mode, the ACD initiates air-to-ground call, based on either of the following:

(a) MAKE CALL command from the call-display-and-control protocol

(b) A transition of the associated Cockpit Voice Mic On discrete if ORT enabled for Preselect.

NOTE: The Call Place/End discrete is not used for placing calls.

(3) If in PTT mode, the ACD PBX accepts a ground-to-air annunciated call (enter CONNECTED state) on any of the following conditions:

(a) ANSWER CALL command received on the call-display-and-control protocol

(b) The first transition of the associated Cockpit Voice Mic On Discrete.

(4) In PTT mode, when a call is CONNECTED, the ACD:

(a) Activates cockpit microphone when the associated Cockpit Voice Mic On discrete is on, and

(b) Mutes the cockpit microphone when the associated Cockpit Voice Mic On discrete is off.

(5) In PTT mode, the ACD initiates an Air Clear (reverting the call state to idle from the airplane side) on any of the following conditions:

(a) END CALL is signaled on the call-display-and-control protocol

(b) The associated Call Place/End Discrete transitions to Call End.

G. Latched Call control mode

(1) The SDU operates in Latched mode when configured by ORT.

(2) In Latched mode, the ACD initiates air-to-ground call, based on either of the following:

(a) A MAKE CALL command from the call-display-and-control protocol.

(b) A transition of the associated Cockpit Voice Mic On discrete if ORT enabled for Preselect.

NOTE: The Call Place/End discrete is not used for placing calls.

(c) In Latched mode, the ACD accepts an annunciated Ground-to-Air call (enter CONNECTED state) on any of the following:

1 ANSWER CALL command received from the Call display and control protocol

2 Associated Cockpit Voice Mic On discrete is in the on state.

(d) In Latched mode, the ACD connects the 4-wire Audio path for the mic:

1 From when the call is connected

2 Until the call is terminated.

NOTE: This applies to Air to Ground and Ground to Air calls.

(e) In Latched mode, the ACD initiates an Air Clear (reverting the call state to idle from the airplane side) on any of the following conditions:

1 END CALL is signaled on the call-display-and-control protocol

2 Associated Cockpit Voice Mic On discrete input is off

3 Call clearing is caused by a Mic switch transition to high.

H. Satellite Facing Voice Handling

(1) The ACD PBX routes Air-to-Ground calls to unused connections in the following order:

(a) The AMBE +2 CS connection

(b) VoIP over PS connection.

(2) Based on ORT configuration, PS or CS Ground-to-Air call requests of public priority is:

(a) Rejected

(b) Routed to the 4-wire interfaces.

NOTE: The ORT configuration settings are mutually exclusive.

(3) The ACD PBX routes Ground-to-Air calls to 4-wire interfaces as follows:

(a) To ORT defined 4-wire default interface if available.

(4) The ACD PBX permits short code (a number <= 6 digits) dialing on both:

(a) The VOIP service

(b) Circuit switched service.

For calls placed on the following ORT enabled interfaces:

(c) 4-wire1

(d) 4-wire2.

(5) If ORT permitted, the ACD PBX permits direct user entry of full international numbers (maximum number of digits = 18 on both):

(a) The VOIP service

(b) Circuit switched service.

(6) For calls placed on any the following ORT enabled interfaces:

(a) 4-wire1, The SDU does not support automatic redial on Air-to-Ground call fail.

(b) 4-wire2, The SDU does not support automatic redial on Air-to-Ground call fail.

I. Safety Circuit Switched (CS) Voice Service

(1) CS call setup messages are sent via the serial control link between them ACD and the Safety Channel Card.

(2) CS voice data are sent via the serial voice link between the ACD and the Safety Channel Card.

(3) The ACD PBX initiates CS Air-to-Ground calls by messaging the following to the safety Channel Card:

(a) The dialed number

(b) ICAO as the calling party number

(c) Priority.

(4) If a new cockpit Air to Ground call is requested during handover, the ACD accepts the call but postpones the call initiation to the ground until:

(a) Safety Logon is achieved at the 1st satellite link Network Logon attempt, then initiate the call once Safety Logon is achieved OR

(b) The pilot terminates the call, then terminate the call OR

(c) Either the 1st satellite link Network or Safety Logon attempt have failed, then reject the call.

(5) If informed by the Channel Card that any of the following activations triggered by the Safety voice CS initiation has failed:

(a) The eMLPP registration,

(b) Call waiting activation the ACD continues to service voice calls.

NOTES:

1 Absence of eMLPP will prevent sending the priority field

2 Absence of call waiting will prevent the new call from being presented to the AES when a call is already in progress.

(6) If an annunciated CS Ground-to-Air call is accepted, the ACD PBX:

(a) Commands the Channel Card to accept the AMBE +2 call set up AND

(b) When established, connects the call through the Serial voice link to the routed 4-wire port.

(7) When a CS Air-to-Ground call is connected, the ACD PBX connects the call through the Serial voice link to the routed 4-wire port.

J. PS (SIP) Voice Service

(1) The ACD PBX implements for PS calls:

(a) A SIP version 2 RFC 3261 User Agent

(b) UDP transport of SIP signaling

(c) A G.729A codec.

(2) The ACD PBX responds to SIP OPTIONS polling from the network.

NOTES:

1 Absence of eMLPP will prevent sending the priority field

2 Absence of call waiting will prevent the new call from being presented to the AES when a call is already in progress.

(3) If an annunciated CS Ground-to-Air call is accepted, the ACD PBX:

(a) Commands the Channel Card to accept the AMBE +2 call set up AND

(b) When established connects the call through the Serial voice link to the routed 4-wire port.

(4) When a CS Air-to-Ground call is connected, the ACD PBX connects the call through the Serial voice link to the routed 4-wire port.

K. Air to Ground Call Set-up

(1) When a new Air-to-Ground SIP call is requested, the ACD PBX:

(a) Commands the safety Channel Card to create a secondary Streaming PDP Content for the RTP voice stream:

1 To ORT specified INMARSAT VoIP APN

2 Linked to the Primary PDP context,

3 With the specified TFT and if successful:

a Activate by sending a SIP:INVITE to the SIP server with

b MSISDN as the calling party.

4 If unsuccessful, terminate the call by:

a Indicating call failure to user

b Commanding the Channel Card to terminate the Secondary context.

NOTE: No Session Description Protocol (SDP) offer is required in the SIP:INVITE message for A2G initiated calls.

(b) The ACD PBX populates the following parameters for voice messaging:

1 ICAO Address

2 UDP port number 5060

3 SIP URI: safety Channel Card IMSI prefixed with SBSAFETY sip:[SBSAFETYimsi]@[sip_domain_name] dialed number: sip:[dialled_number]@[sip_domain_name].

(c) Call priority: SIP call priority as identified in the SIP resource priority field.

L. Call Maintenance and Termination

(1) The ACD PBX responds positively to re-INVITE messages only if there is an active call with matching Call-ID reference.

(2) If a VoIP call is terminated by air side user action, the ACD:

(a) Sends a SIP:BYE

(b) Commands the safety Channel Card to terminate the Secondary context.

(3) If a VoIP call is terminated by ground side SIP:BYE, the ACD:

(a) Commands the safety Channel Card to terminate the Secondary context.

14. Aircraft Information

A. Navigation Information

(1) Navigation information can come from multiple sources on a given aircraft including:

(a) The Hybrid Inertial/GNSS Data source, the GNSS Data source and the Inertial Data source. One or more LRU can be providing the same type of data. ARINC 781-6 indicates that the Hybrid Inertial/GNSS Data solution is the preferred solution followed by the GNSS Data and then the Inertial Data and are given priority accordingly.

(b) Navigation information is shown in Table 2-6:

Table 2-6. Navigation Data

Description	Priority	Labels
Aircraft Position	1	254 Latitude Hybrid
		255 Longitude Hybrid
	2	110 Latitude GNSS
		111 Longitude GNSS
	3	310 Present Position Latitude (INS)
		311 Present Position Longitude (INS)
Ground Speed	1	175 Ground Speed Hybrid
	2	112 Ground Speed GNSS
	3	312 Ground Speed (INS)
True Track	1	137 Track Angle True Hybrid
	2	103 Track Angle True GNSS
	3	313 Track Angle – True (INS)
Aircraft Pitch/Roll	There is no priority, the 1st valid pair received will be used.	324 Pitch Angle (INS)
		325 Roll Angle (INS)
Altitude	1	262 Hybrid Height Above Ellipsoid (HAE)
	2	370 GNSS Height (HAE)
	3	261 Hybrid Altitude MSL
	4	076 GNSS Altitude
	5	361 Inertial Altitude
True Heading	1	132 True Heading Hybrid
	2	314 True Heading (INS)

Table 2-6. Navigation Data (Continued)

Description	Priority	Labels
GNSS Sensor Status	In some instances, these labels will not be available.	273 GNSS sensor status
		101 GNSS HDOP

(2) There are no criteria on selecting a navigation solution when having 2 equal preference valid navigation solutions. Any method of selection is acceptable.

(3) For each navigation solution, the ACD remains with its current label(s) until one of the following occurs:

(a) Label invalid or no longer present.

(b) a higher priority, valid label becomes available on the same or another interface after 5 minutes (±30 seconds hysteresis).

B. RF Power Control

(1) The SDU is designed to interface and control multiple RF configurations. These vary in the following ways:

(a) Standalone or co-packaged HPA

(b) Standalone or co-packaged DLNA

(c) Gain of antenna

(d) Type of antenna

(e) Number of Antenna

(f) Control Interfaces.

(2) The RF configuration items are generally ORT specified, but in some cases, such as type of antenna, they may also be communicated by the Antenna.

(3) The ACD manages the EIRP of each RF carrier to the level associated with the ORT identified terminal class.

(4) Based on ORT settings the ACD determines Antenna Gain by the antenna gain reports.

(5) In a multichannel SDU, the RF power management algorithm:

(a) Maintain the Aircraft EIRPs for established carriers.

(b) Determine the availability of RF power for additional RF carriers.

(c) Maintain the HPA within its operating limits (e.g., to satisfy intermodulation products requirements).

(d) Prioritize the allocation of available RF power to multiple carriers, with regard to the priority of each related service.

(6) The ACD calculates the back-off to send to the HPA considering the following:

(a) EIRP level for the ORT selected class of operation

(b) Installed static losses

(c) Gain performance of the installed antenna

(d) HPA gain.

(7) When the ORT indicates the external power amplifier supports cable calibration, the ACD automatically determines at an unspecified cable loss of between 0 to 18 dB, on a normal ground power on, storing its value in non-volatile memory for use under rapid restart condition.

NOTE: The loss range indicated is at 1.6 GHz, but this does not imply that this 1.6 GHz is used for cable calibration.

(8) When the ORT explicitly provides a cable loss between the SDU and the Power Amplifier the ACD uses this value to set the SDU transmit level.

(9) If there is a loss of gain in the RF path that results in insufficient power to hold all services, the ACD reduces services on the non-safety channel card in order to preserve safety channel card services.

(10) There is no need to log on as a different class when power is below 7 dBi. There is no advantage of partially shutting down services on a channel card as there is no means to save power.

15. SCM Modes of Operations

A. SDU Configuration & Test Mode

(1) The SDU Configuration and Test Mode is entered when ACD Application code begins executing. No User services are available as Application Mode has not yet been selected. The SDU Configuration and Test Mode includes:

(a) ORT and license validation

(b) Configuring the SDU based upon strapping, ORT settings and licenses.

(c) Executing SDU startup and invasive tests.

(d) Transitioning to data load mode if a data load is in progress.

B. SATCOM System Configuration & Test Mode

(1) The SATCOM System Configuration and Test Mode covers the testing of the entire SATCOM including the external PA and antenna functions. Depending on the configuration the LRU that provides the PA function. The SDU enters SATCOM System Configuration and Test Mode on successful completion of SDU Configuration mode activities.

(2) The SATCOM System Configuration and Test Mode includes:

(a) Validating correct communications with external SATCOM LRUs.

(b) Retrieving external SATCOM LRU configuration data.

(c) Validating that the HPA and antenna functions align with the SATCOM LRU configurations indicated in the ORT.

(d) Optionally calculating cable losses (cable calibration).

(e) Optionally executing system invasive tests.

16. Safety Data Services (TASK 23-15-49)

A. Overview

(1) Safety Data services include Air Traffic Services (ATS) and Airline Operational Control (AOC) datalink messages. ACARS data services are supported for SBB safety.

B. AAP Protocol and Supported Services

(1) The ACARS Air-Ground Protocol (AAP) is Inmarsat's bespoke transport layer protocol used for tunneling of ACARS data over SwiftBroadband network. AAP version 2 defined in SDM Volume 3 Chapter 4 and in Iris Precursor System Design Document is to be implemented in the SDU by the Aircraft Data Link Gateway function (ADGW). This gateway:

(a) Requires VPN authentication by the underlying Air Security Gateway function (ASGW) and the related security smart card.

(b) Provides for connection of ACARS services.

(c) Provides Location tracking services.

(d) Provides time-stamping required for the mandatory service performance monitoring at the service provider level.

(e) Provides independent link availability monitoring (keep-alives).

(2) Terminology aligns to the version2 terminology:

(a) ADGW Aircraft Datalink Gateway is equivalent to AAGW ACARS aircraft Gateway.

(3) GDGW Ground Datalink Gateway is equivalent to AGGW ACARS Ground Gateway.

17. Aircraft Information (TASK 23-15-49)

A. Time and Date

(1) The SDU uses Time and Date for:

(a) Timestamping messages to the CFDS

(b) Timestamping log entries

(c) Assessing validity of PIMBIT test frequencies.

(2) On-start up the internal clock is set to a default time and date. Thus, prior to synchronizing to an external source it only represents a time relative to start up.

(3) The SDU also stores snapshots of the Network Date for:

(a) Assessing validity of PIMBIT test frequencies

(b) Checking expiration of temporary license keys.

(4) On start-up, the ACD sets its internal time and date to a default of 2016-01-01, 0 hours, 0 minutes, 0 seconds.

(5) The ACD prohibits timestamping and logs "aging out operations using absolute time and date until the internal time and date has synchronized with either aircraft or network time and date.

(6) The ACD synchronizes its internal time and date to the first source that provides it:

(a) The ORT identified time and date source, OR

(b) Time received from the Inmarsat satellite SBB system information.

(7) Once the ACD has selected a source and synchronized its internal time and date to that source, the ACD continues to synchronize its internal time and date to that source until the next SDU restart.

(8) The ACD distributes its internal time and date to the AP Processor at minimum at startup or when a resynchronization occurs.

(9) The ACD resynchronizes its internal time and date to the selected time and date source when all of the following are true:

(a) The selected time and date has changed

(b) The difference between internal time and date and selected time and date is greater than 10 seconds.

NOTE: Checking for changing (non-static) data is to accommodate lab testing when the time label isn't updating, i.e. labels continuously sent with same time and date.

(c) The ACD updates the Network Time & Date in NVRAM when any of the following occurs:

1 Registration with the network

2 Forced deregistration

3 Channel Card reset

4 Satellite handover

5 Manual logoff.

B. Operational Air/Ground Status

(1) Operational Air/Ground Status is used to prohibit or abort ground maintenance operations when the aircraft is in the air. Examples of applicable ground maintenance operations are:

(a) Execution of full versus rapid POST

(b) Data Loading

(c) Commanded Self-Test

(d) Execution of PIMBIT.

(2) Operational Air/Ground Status is also sent to the High-Power Amplifier (HPA) and antenna.

(3) The ACD sets the air/ground status to on ground when:

(a) No valid Secure ORT is present.

(4) The Operational Air/Ground status is calculated as shown in Table 2-7:

Table 2-7. Operational Air/Ground Status

Source	Status	Setting	Operational Air/Ground Status
Primary **Weight-On-Wheels (WOW)**	Installed, per ORT setting	WOW equates to aircraft on ground, per ORT setting	On-Ground
		WOW doesn't equates to aircraft on ground, per ORT setting	In-Air
	Not configured per ORT setting, or invalid	Use Secondary Source	

Table 2-7. Operational Air/Ground Status (Continued)

Source	Status	Setting	Operational Air/Ground Status
Secondary: **Label 147 Air/Ground Status Label**	Available per ORT setting and Valid	Label 147 Bit 19 is set to 1	On-Ground
		Label 147 Bit 19 is set to 0	In-Air
	Not configured per ORT setting, or invalid	Use Tertiary source	
Tertiary: **Flight Phase**	Available, per ORT setting and Valid	Flight Phase number equates to aircraft on ground, per ORT setting	On-Ground
		Flight Phase number doesn't equates to aircraft on ground, per ORT setting	In-Air
	Not configured per ORT setting, or invalid	Use Quaternary Source	
Quaternary: **Ground Speed**	Valid	Ground Speed <40 KTS	On-Ground
		Ground Speed >=40 KTS	In-Air
	Invalid or Unavailable	On-Ground	

NOTE: In the future, the default when the Ground Speed is invalid or unavailable, i.e. when "all fails", could be defined as an ORT parameter containing the default state.

C. Temperature Profile

(1) In application mode, the SDU maintains a temperature profile histogram in non-volatile memory which is updated every minute.

(2) The temperature profile histogram has contiguous bins of 5˚C (41˚F) width to cover the operating temperature range between -55˚C (-67˚F) and +125˚C (257˚F) with:

(a) all temperature measurements below -55˚C (-67˚F) being captured in the bin for -50 to -55˚C (-58˚F to -67˚F).

(b) all temperature measurements above +125˚C (257˚F) being captured in the bin for +120 to +125˚C (248˚F to 257˚F).

D. AES ID

(1) The SDU configures the Safety Voice and ACARS Data services using the received 24-bit AES ID (ICAO address), obtained from the ORT identified source.

(2) Based on the ORT, the ACD retrieves and set the ICAO from one of:

(a) AES ID Input (Labels 275 & 276)

(b) CMU (Labels 214 & 216) and enable the associated labels on the identified interface.

(3) The first two valid and matching ICAO address labels received after power up on the ground is stored in non-volatile memory and used until the next on-ground power up.

NOTE: If present, the stored ICAO is used after in-air power ups.

(4) The SDU considers any of the following ICAO addresses invalid:

(a) All zeros (0b)

(b) All ones (1b)

(c) ARINC 429 ICAO words with parity errors.

NOTE: The SSM field has intentionally not been included in the validity criteria. Thus, ICAO information can be processed from ARINC 429 labels with SSM other than Normal Operation.

SECTION 3 – SYSTEM PRE-CONFIGURATION

1. Aircraft Information

A. Flight Information

(1) The SDU retrieves the following values from the CFDS when enabled in the ORT:

(a) Flight Phase

(b) Flight Number

(c) Aircraft ID (tail number), and sets the values to not available when CFDS labels are never received.

2. Owner Requirements Table (ORT)

A. Secure ORT

(1) The Secure ORT data file contains settings required for correct operation of Safety Services. This file requires aircraft certification. The Secure ORT may contain other parameter types. Type (1) Secure ORT information is retained in the SCM with a local image resident in the SDU in non-volatile memory.

B. User ORT

(1) Type (4) User ORT information is retained in the SCM with a local image resident in the SDU in non-volatile memory.

(2) Any user modifications to User ORT selections are to the SDU stored copy of User ORT data only and not to the SCM USER ORT copy.

C. License Keys

(1) License keys are installed in the SCM and activate optional SDU features. License keys can be viewed and updated via the appropriate Maintenance Access Levels.

(2) The ACD stores licenses on the SCM.

(3) Each licensed feature that has specific CAN-TSO functionality is associated with a secure ORT item and has no expiry date.

D. Licensing

(1) License keys are installed on the SCM, so that if the SDU is swapped for repair it is not necessary to install new licenses. Each license is uniquely keyed to the individual SCM.

(2) Activating a license feature requires both a valid license to be installed, and the appropriate ORT parameters for that feature to be set. Some features can only have permanent licenses and others support either permanent or time restricted licensing.

(3) The Aspire 400 SDU supports non-expiring licensing of the following ACD controlled features:

(a) Class 6 terminal operation.

(b) Dual Safety SATCOM.

(4) For each of the above, the license is permanent even if constructed with an expiry date.

(5) The Aspire 400 SDU supports permanent and expiring licensing of the following ACD controlled features:

(a) AIS activation

(b) 2nd channel activation (Side B of DABC, provides basic PIES service unless enhanced with additional PIES services).

(6) The Aspire 400 SDU supports permanent and expiring licensing of the following PIES features based on the features being ORT enabled:

(a) PIES HDR

(b) Router Capability.

NOTE: The 2nd channel activation license is also required to activate these features.

(7) The Aspire 400 SDU supports non-expiring licensing of the following ACD controlled features:

(a) Class 7 terminal operation.

E. ORT Parameters

(1) The Aspire 400 uses Secure and User ORT files to configure its operation.

(2) The Aspire 400 ORT files contain the subset of ARINC 781 ORT items that are applicable to the Aspire 400 feature set. ARINC 781 ORT items not covered include:

(a) Items for which only one value is applicable so option selection is not required.

(b) Items that do not apply (e.g. items relating to Classic or Swift 64 operation).

(3) The Aspire 400 ORTs also include additional parameters for the Aspire 400 feature set that are described ARINC 781.

(4) The ARINC 781 ORT items that are not applicable are explicitly listed as scope exclusions.

(5) The following ORT parameters are not supported as they either do not apply to SBB service or the associated function is no longer supported by the SDU or the function is permanently set.

(a) CC Default Mode (A781 Ref A3):

1 Channel card operational mode is always SBB.

(b) SCM (A781 Ref B18):

1 Always Required (Connected).

(c) ISDN 1 (A781 Ref B19):

1 No ISDN port on SDU as repurposed to Ethernet.

(d) ISDN 2 (A781 Ref B20):

1 No ISDN port on SDU as repurposed to Ethernet.

(e) Circuit mode data for ground-to-air calls (A781 Ref E2):

1 Not applicable to SBB Ground-to-Air calls.

(f) Global beam high rate (A781 Ref E3):

1 Not applicable to SBB return channel.

(g) Minimum initial EIRP for Switft64 (A781 Ref E8):

1 Not applicable to SBB.

(6) The ACD ensures that all ACD ORT parameters are assigned to the Secure ORT except for the following User ORT parameters:

(a) SBB Service Provider APN

(b) Cockpit Telephone Directory

(c) Login Policy

(d) Manual Dial Mode.

(7) The AISD ensures that all AISD ORT parameters are assigned to the Secure ORT.

(8) The PIESD ensures that all PIESD ORT parameters are assigned to the Secure ORT.

F. Satellite Table

(1) The ACD ensures the ORT contains the following information for up to 16 satellites:

(a) Satellite identity

(b) Name

(c) Position

(d) Priority

(e) SBB global beam frequencies.

G. SBB Safety Data

(1) The ACD ensures the ORT contains the following parameters for SBB Safety Data configuration:

(a) AAP Position Reporting

(b) APN for the SBB Gateway

(c) DNS Lockup name for the SBB Gateway.

(d) Supported Safety Services for ACARS (CMU using Williamsburg V1 protocol).

(e) SBB Type Approval Code

(f) Aircraft Type.

(g) Location ID

(h) SATCOM 1

1 Not Applicable

2 Applicable.

a Location ID

b Description.

(i) SATCOM 2.

1 Not Applicable

2 Applicable.

a Location ID

b Description.

H. Safety Voice

(1) The ACD ensures the ORT contains the following parameters for SBB Safety Voice configuration:

(a) APN

(b) SIP Domain name.

(2) 4-wire Noise insertion (A781 Ref D6) applied to Classic voice, AMBE +2 codec provides its own specified noise insertion.

I. ACD Voice Configuration

(1) The ACD ensures the ORT contains the following cockpit voice parameters:

(a) G2A Public calls permission

(b) Caller ID:

1 Enable

2 Disable.

(c) 4-wire:

1 Connectivity

2 Preferred routing for Ground-to-Air Calls.

(d) Cockpit headset parameters:

1 Audio level

2 Mic level

3 Side tone level.

(e) Hook switch operation:

1 Latched

2 PTT.

(f) Call Pre-Select.

(g) Call Discretes.

1 Alternate behavior

2 Standard behavior.

(2) There is no requirement to support the following as an ORT configurable item:

(a) Phone number preset (A781 Ref D8) "MAKE CALL" activation by an MCDU to initiate dialing of a number.

(b) Placement of Calls using Place / End Call Discretes (A781 Ref D11) is only necessary if A781 Ref D8 is enabled.

(3) The following ORT parameters are not supported:

(a) Cockpit Air-Ground Call Camp On Timer (A781 Ref D5) has the capability of pre-empting on-going call attendant call at any time, it is not based on a timer.

(b) SDU codec #1 dedication (A781 Ref D1) always services cockpit voice.

(c) Dual SATCOM Voice Channel Mapping.

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SECTION 4 – INSTALLATION

1. Mechanical Installation (TASK 23-15-49)

A. HPA/SDU Installation

(1) The HPA and SDU are 2 MCU form compliant. They are for installation in an equipment rack, in close proximity to each other and with the expectation of external air cooling. RF and control between the SDU and the HPA is supported by dedicated interfaces. Installation cable losses and DLNA losses limits the reach capability to the antenna.

B. SCM Installation

(1) The SCM is mounted using the chassis bonding surface and connected to the SDU using a 15 position D-Sub connector.

C. Design and Construction

(1) Reliability and Maintainability

(a) The components do not require scheduled maintenance to remain operational under normal operating conditions.

NOTE: PIMBIT is not considered scheduled maintenance

(b) The failure rate for loss of SATCOM communication is less than 9.376E-5 per FH.

(c) There is no scheduled maintenance with the exception of INMARSAT required scheduled activities such as PIMBIT.

(d) There is a failure rate of less than 2.5E-6 per FH on all input power bus components that are not protected though short circuit topology.

(e) There is a failure rate of less than 2.5E-8 per FH on each ARINC 429 receive interface resulting in loading of the ARINC 429 bus.

(f) The probability of undetected single event upsets is less than 7.0E-4 per FH

(g) The SDU is ruggedized against Single/Multiple Event Upset.

NOTES: The Implementation can employ any combination of:

1 Redundant memory,

2 Error correcting hardware memory,

3 Software correction encoding or

4 Other suitable techniques.

(h) Recommend selection of memory types proven to be more robust against Single Event Upset (SEU). Non-volatile memory used to retain Event and Fault Logs is not required to be robust to Single Event Upset.

D. Miscellaneous

(1) Warning

(a) The components have a label with a triangular Electrostatic Sensitive Devices caution symbol with bold upper case letters.

NOTE: An acceptable phrasing is found in ATA 300, Chapter 6:

"CAUTION: THIS UNIT IS NOT SUBJECT TO DAMAGE FROM ELECTROSTATIC DISCHARGE AS AN ASSEMBLY. HOWEVER, IT CONTAINS PARTS OR ASSEMBLIES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE."

(b) The SDU and HPA have a label with a triangular Hot Surface Temperature warning symbol with bold upper case letters if any exposed part of the SDU surface exceeds the local ambient temperature by more than 15°C (59°F).

NOTE: An acceptable phrasing is given below:

HOT SURFACES.

DO NOT TOUCH.

(c) The SDU and HPA have a label with a triangular High Voltage caution symbol with bold upper case letters to identify that they contain high voltage components.

NOTE: An acceptable phrasing is:

WARNING

250 V

(d) The SDU has a triangular Field Loadable Software warning label with bold upper case letters.

NOTES:

1 An acceptable phrasing is:
CAUTION: THIS EQUIPMENT REQUIRES FIELD LOADABLE SOFTWARE. ENSURE CORRECT SOFTWARE IS LOADED. REFER TO AMM.

2 The label should be visible when installed in the aircraft, however if sufficient space cannot be found on the front panel then the label may be placed on the top or side of the SDU.

(2) Anti-Tamper Seal

(a) The components have one or more tamper-evident seals as necessary to detect when any cover is removed.

E. Engineering Drawings

(1) For HPA Outline and Installation, refer to Figure 4-1.

(2) For SCM Outline and Installation, refer to Figure 4-2.

(3) For SDU Outline and Installation, refer to Figure 4-3.

NOTES UNLESS SPECIFIED OTHERWISE:

1. DIMENSIONS ARE FOR INSTALLATION PURPOSES ONLY

2. THIS DRAWING SHALL NOT BE USED FOR FABRICATION.

3. CAUTION: THIS UNIT CONTAINS DEVICES SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGE. HANDLE PER THE ESD PROCEDURES OF IPC-A-610

KC-1 4. WEIGHT 9.00 LBS (4.08 KG) MAX.

5 THIS UNIT SHALL BE MOUNTED ONLY IN A 2MCU TRAY PER ARINC 600 WITH MATCHING RADIALL CONNECTOR P/N: NSXN2P22IS0908

6 SEE TABLE 3 FOR ENVIRONMENTAL AND ELECTRICAL CHARACTERISTICS. THE HPA SHALL MEET THE REQUIREMENTS OF RTCA/DO-160G.

7. ELECTRICAL:
NOMINAL INPUT SUPPLY VOLTAGE: 115VAC
KC-2 POWER CONSUMPTION: 280W MAX.
POWER DISSIPATION:240W MAX.
POWER FACTOR: 0.98 MIN LEADING AT 400Hz
CURRENT DRAW: 1A TYP/1.7A MAX AT 115 VAC.

8. APPROXIMATE CENTER OF GRAVITY IS SHOWN BY ⌖

9. MATERIAL (CHASSIS): ALUMINUM ALLOY 6061-T651 PER AMS4027, OR 6061-T651 PER AMS-QQ-A-200/8
(COVER) ALUMINUM ALLOY 5052-H32 PER SAE AMS-QQ-A-250 ASTM B209, SAE AMS-4016

FINISH: CHASSIS/COVER
POWDER COATING, PRISM GRAPHITE LOW GLOSS, PA-0191-LT
CHEMICAL CONVERSION COATING, NO HEXAVALENT CHROMIUM, SurTec650V PER MIL-DTL-5541, TYPE II, CLASS 3

10. N/A

11 PRIMARY AIRFLOW DIRECTION SHOWN. DRAW-THROUGH DIRECTION OPPOSITE.

12. COOLING REQUIREMENTS:
UNIT IS DESIGNED TO OPERATE IN FORWARD O/H CROWN
- DRAW THROUGH (MEASURED AT THE BASE) AIR FLOW OF 35.2 KG/HR (77.60 LB/HR)
- AMBIENT PRESSURE OF 101.3 KPA (14.696 PSIA)
- AIR TEMPERATURE OF 40°C (104°F)
INTERNAL FAN USED DURING LOSS OF COOLING CONDITION
- FLOW RATE 14.83 CFM AT SEA LEVEL AND ROOM TEMPERATURE
- FAN FILTRATION REQUIREMENTS: NONE

13. PRESSURE DROP REQUIREMENTS:
- PRESSURE DROP THRU THE UNIT SHALL BE 50 PA (.20 IN H_2O) +/-30 PA (0.12 H_2O)
- DRAW THROUGH AIR FLOW AT SEA LEVEL WHEN SUPPLIED WITH COOLING AIR AT FLOW RATE of 35.2 KG/HR (77.60 LB/HR)
- AIR TEMPERATURE 40°C (104°F)

14 UPON TSO CERTIFICATION, THE HPA SHALL HAVE THE FOLLOWING MARKING: TSO-C159c (Class/Subclass See IM).

15 THIS AREA FREE OF PAINT

16 ELECTROSTATIC SENSITIVE DEVICE (ESD) LABEL.

17. OVER TEMPERATURE SHUTDOWN THRESHOLD: TBD °C

18 HOT SURFACES WARNING LABEL.

19 FCC APPROVAL LABEL.

20 TAMPERPROOF LABEL.

21 250V WARNING LABEL.

22 SHADED AREA INDICATES EXTENDED PART IN POLARIZING INSERTS

23 ELECTRICAL BONDING SHALL BE THROUGH ARINC 600 CONNECTOR SHELL. BONDING TEST POINT AVAILABLE ON FRONT PANEL. DC BONDING RESISTANCE SHALL BE 2.0 MILLIOHMS OR LESS.

24 N/A

25 ASTERISK INDICATES CATEGORIES THAT ARE EXTENDED.

26 INTERNAL FAN AIRFLOW DIRECTION FOR LOSS OF AIRPLANE COOLING CONDITION

TABLE 1: HPA ASSEMBLY PART NUMBER

PART NUMBER	DESCRIPTION
90404514-000	HPA ASSEMBLY, BLACK LABEL

TABLE 2: HPA ASSEMBLY CONNECTOR IDENTIFICATION 5

REF DESIGNATOR	PART NUMBER	MATING CONNECTOR	REMARKS
J1	HON 50054601 RADIALL NSXF2R22IY0908	RADIALL NSXN2P22IS0908	J1-A TOP INSERT ARRANGEMENT 1C71 (70X #22 CONTACTS, 1X SIZE 1 COAX)
			J1-B MIDDLE INSERT ARRANGEMENT 71C1 (70X #22 CONTACTS, 1X SIZE 1 COAX)
			J1-C BOTTOM INSERT ARRANGEMENT 13C2 (4X #20 CONTACTS, 3X #16 CONTACTS, 4X #12 CONTACTS, 2X #5 CONTACTS)

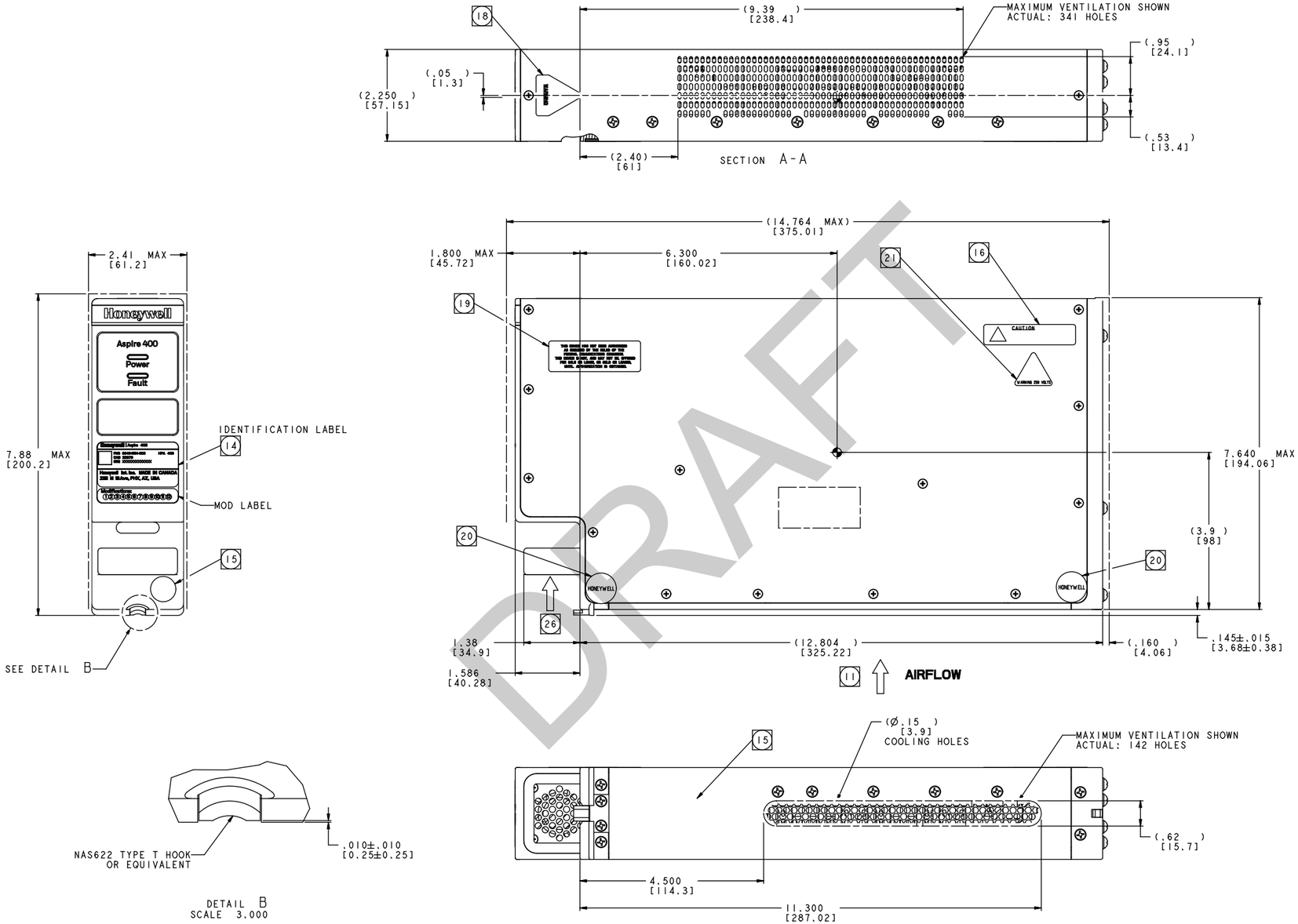
TABLE 3: SYSTEM REQUIREMENTS 6 25

RTCA/DO-1600 SECTION	NAME	CATEGORY
4	TEMPERATURE AND ALTITUDE	F2
4	DECOMPRESSION/OVERPRESSURE	A2
4	LOSS OF COOLING	P
5	TEMPERATURE VARIATION	A
6	HUMIDITY	B
7	OPERATIONAL SHOCKS AND CRASH SAFETY	D,B
8	VIBRATION	S CURVE: B, C R CURVE: B1, C1
9	EXPLOSION PROOFNESS	E
10	WATERPROOFNESS	Y
11	FLUIDS SUSCEPTIBILITY	F
12	SAND AND DUST	S
13	FUNGUS RESISTANCE	F
14	SALT SPRAY	S
15	MAGNETIC EFFECT	Z
16	POWER INPUT	A(WF)HZP1
17	VOLTAGE SPIKE	A*
18	AUDIO FREQUENCY CONDUCTED SUSCEPTIBILITY	R(WF)*
19	INDUCED SIGNAL SUSCEPTIBILITY	ZWX
20	RADIO FREQUENCY SUSCEPTIBILITY (RADIATED AND CONDUCTED)	RR
21	EMISSION OF RADIO FREQUENCY ENERGY	M*
22	LIGHTNING INDUCED TRANSIENT SUSCEPTIBILITY	A3J3L3
23	LIGHTNING DIRECT EFFECTS	XXXX
24	ICING	A
25	ELECTROSTATIC DISCHARGE (ESD)	A
26	FIRE, FLAMMABILITY	C

E90405332-1-G

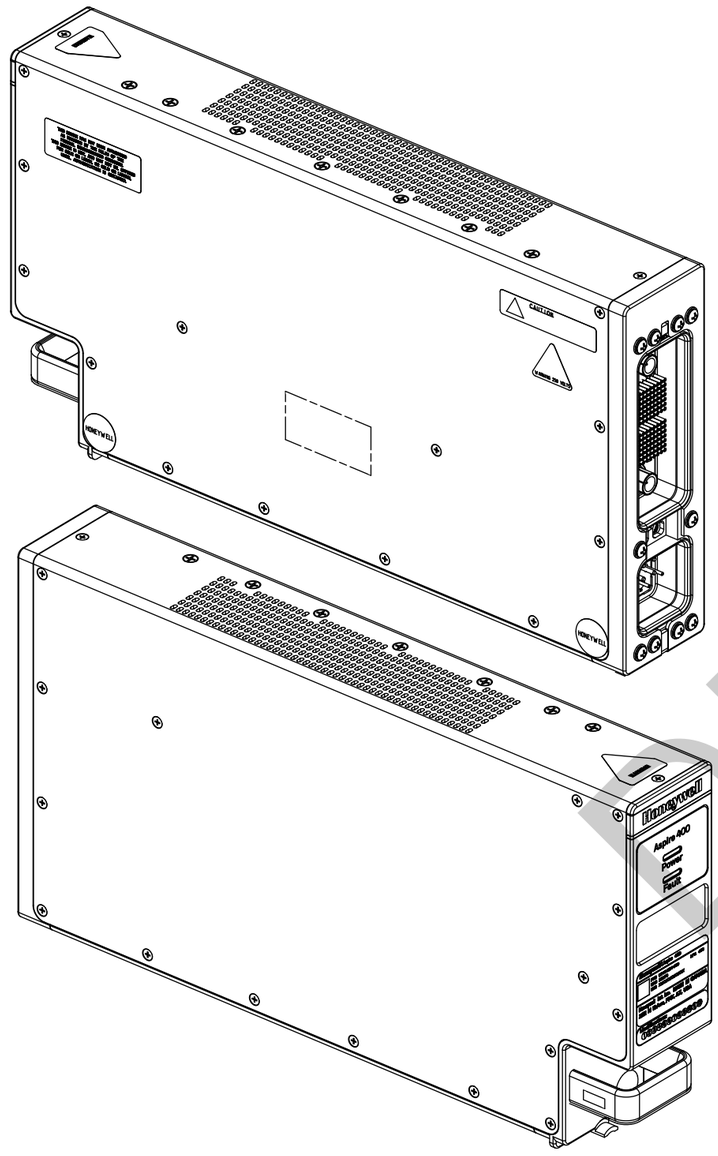
ICN-38473-0000712247-001-01

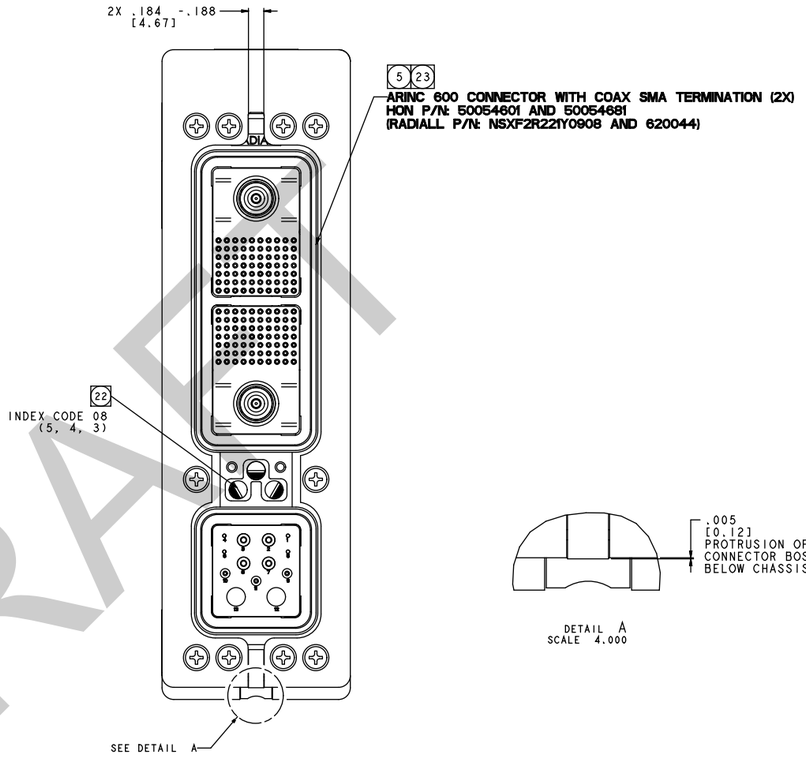
Figure 4-1. (Sheet 1 of 3) HPA Outline and Installation



E90405332-2-G
ICN-38473-0000712248-001-01

Figure 4-1. (Sheet 2 of 3) HPA Outline and Installation





E90405332-3-G

ICN-38473-0000712249-001-01

Figure 4-1. (Sheet 3 of 3) HPA Outline and Installation

NOTES, UNLESS OTHERWISE SPECIFIED:

1. DIMENSIONS ARE FOR INSTALLATION PURPOSES ONLY.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5-2009.
3. DIMENSIONS ARE IN INCHES [MILLIMETERS]. MILLIMETERS ARE FOR REFERENCE ONLY.
4. TOLERANCES: .XX: ±.01[±0.25], .XXX: ±.005 [±0.13], ANGLES: ±30'.
5. THIS DRAWING SHALL NOT BE USED FOR FABRICATION.
6. CAUTION: THIS UNIT CONTAINS DEVICES SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGE. PROTECT ASSEMBLY PER ANSI/ESD S20.20.
7. WEIGHT: .50 LB (.23 KG) MAX.
8. SEE TABLE 1 FOR ENVIRONMENTAL AND ELECTRICAL CHARACTERISTICS. THE SCM SHALL MEET THE REQUIREMENTS OF RTCA/DO-160G.
9. POWER DISSIPATION IS 10.7 WATTS MAXIMUM. CURRENT TAKEN BY SCM AT 12VDC IS .89 AMPS MAXIMUM.
10. APPROXIMATE CENTER OF GRAVITY INDICATED BY ⊕.
11. MATERIAL: ALUMINUM ALLOY (5052-H32) PER AMS4016. FINISH: POWDER COATING, PRISM, PA-0191-LT, GRAPHITE TEXTURE, LOW GLOSS OVER CHEMICAL CONVERSION COATING AS PER MIL-DTL-5541, TYPE II, CLASS 3.
12. NOMINAL INPUT POWER IS 9.8V TO 18VDC.
13. CONNECTOR: 15 POSITION D-SUB PLUG MALE (TE 5745908-2). SUGGESTED MATING CONNECTOR: 15 POSITION D-SUB RECEPTACLE (TE 205205-2).
14. COOLING REQUIREMENTS: SCM IS PASSIVELY COOLED AND DOES NOT REQUIRE FORCED AIR. THERE ARE NO INTERNAL COOLING FANS.
15. THIS AREA FREE OF PAINT.
16. HONEYWELL LOGO LABEL.
17. UNIT IDENTIFICATION LABEL.
18. MOD LABEL.
19. USIM NUMBER LABEL.
20. CAUTION LABEL.
21. COUNTRY OF ORIGIN LABEL.
22. THIS SURFACE SHALL BE FREE OF PAINT.
23. ASTERISK INDICATES CATEGORIES THAT ARE EXTENDED.

TABLE 1: SYSTEM REQUIREMENTS (8)

DO-160G	
SECTION	CATEGORY
4) TEMPERATURE AND ALTITUDE	A2* (23)
5) TEMPERATURE VARIATION	A
6) HUMIDITY	B
7) OPERATIONAL SHOCKS AND CRASH SAFETY	B, D
8) VIBRATION	S, CURVE B
9) EXPLOSION PROOFNESS	E
10) WATERPROOFNESS	Y
11) FLUIDS SUSCEPTIBILITY	F
12) SAND AND DUST	S
13) FUNGUS RESISTANCE	F
14) SALT SPRAY	S
15) MAGNETIC EFFECT	Z
16) POWER INPUT	X
17) VOLTAGE SPIKE	X
18) AUDIO FREQUENCY CONDUCTED SUSCEPTIBILITY - POWER INPUTS	X
19) INDUCED SIGNAL SUSCEPTIBILITY	ZWX* (23)
20) RADIO FREQUENCY SUSCEPTIBILITY (RADIATED AND CONDUCTED)	RR
21) EMISSION OF RADIO FREQUENCY ENERGY	M* (23)
22) LIGHTNING INDUCED TRANSIENT SUSCEPTIBILITY	A3J3L3, B2H2L2
23) LIGHTNING DIRECT EFFECTS	X
24) ICING	X
25) ELECTROSTATIC DISCHARGE (ESD)	A
26) FIRE, FLAMMABILITY	C

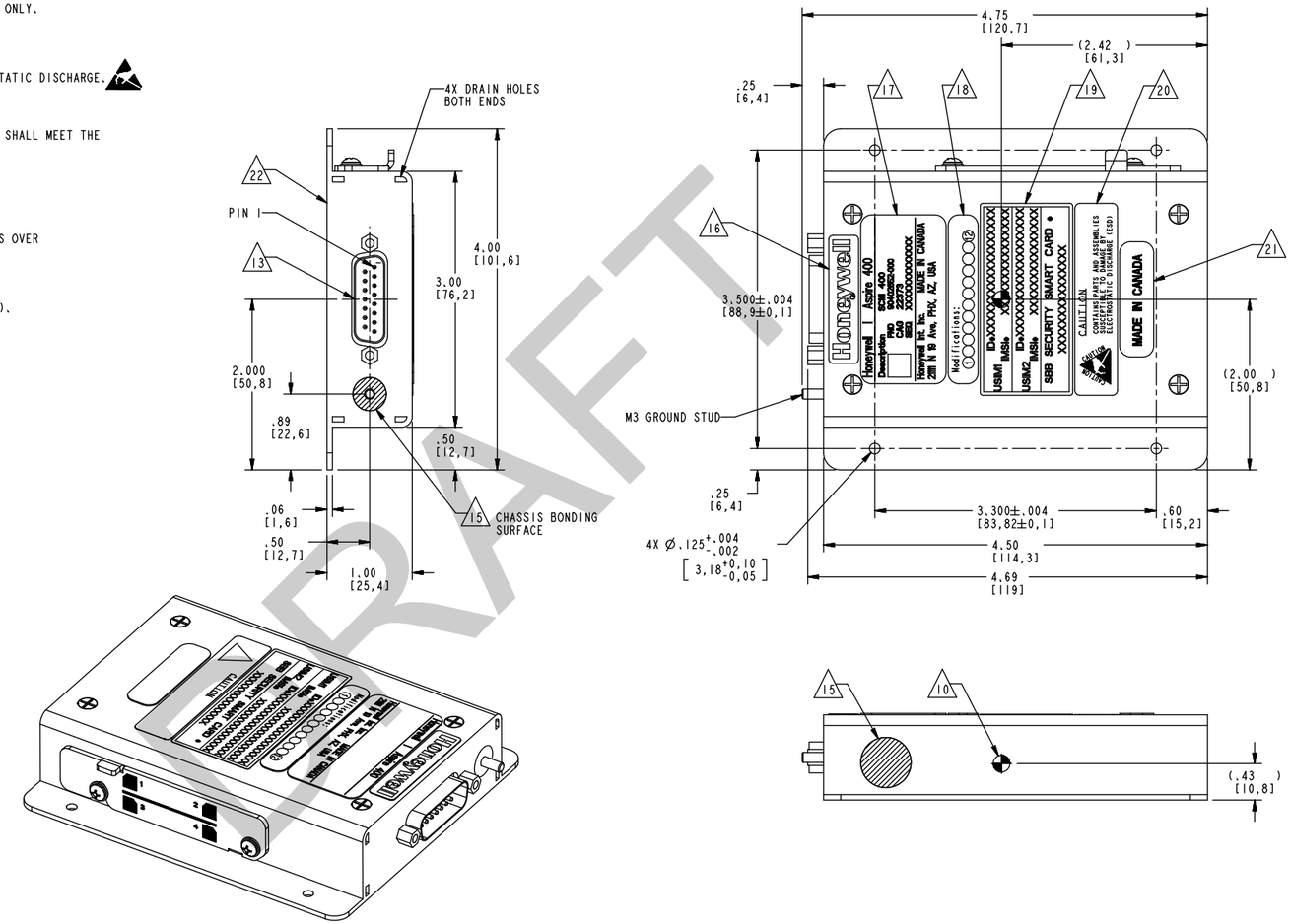


Figure 4-2. SCM Outline and Installation

E90405333-1-A

ICN-38473-0000712250-001-01

NOTES, UNLESS SPECIFIED OTHERWISE:

1. DIMENSIONS ARE FOR INSTALLATION PURPOSES ONLY .
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5-2009 .
3. DIMENSIONS ARE IN INCHES (MILLIMETERS). MILLIMETERS ARE FOR REFERENCE ONLY.
4. TOLERANCES: .XX: ±.01 .XXX: ±.005 [XX: ±0.25 .X: ±0.25 .XX: ±0.13], ANGLES: ±30' .
5. THIS DRAWING SHALL NOT BE USED FOR FABRICATION.
6. CAUTION: THIS UNIT CONTAINS DEVICES SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGE. HANDLE PER THE ESD PROCEDURES OF ANSI/ESD S20.20.
7. THIS UNIT MEETS THE APPLICABLE REQUIREMENTS OF ARINC 600 FOR A SIZE 2 MODULAR CONCEPT UNIT (2MCU).
8. WEIGHT: 8.00 LB (3.63 KG) MAX.
9. THIS UNIT SHALL BE MOUNTED ONLY IN A 2MCU TRAY PER ARINC 600 WITH MATING CONNECTOR, RADIALL PN NSXN2B577S0081 OR EQUIVALENT.
10. ENVIRONMENTAL TESTING PER RTCA/DO-160G. SEE TABLE 1 FOR ENVIRONMENTAL AND ELECTRICAL CHARACTERISTICS.
11. POWER DISSIPATION: 70.0 WATTS, MAXIMUM.
12. APPROXIMATE CENTRE OF GRAVITY IS SHOWN BY ⌖.
13. REFERENCE MATERIAL (CHASSIS): ALUMINUM ALLOY 6061-T651 PER AMS4027 OR 6061-T6511 PER AMS-QQ-A-200/8.
    REFERENCE FINISH (CHASSIS): POWDER COAT GRAPHITE TEXTURE LOW GLOSS PA-0191-LT OVER CHEMICAL CONVERSION COATING PER MIL-DTL-5541, TYPE II, CLASS 3.
14. NOMINAL INPUT POWER IS 115VAC. POWER FACTOR OF 0.984 AT 60 WATTS, 400 Hz @100 VAC. CURRENT: 0.7A TYPICAL AT 115 VAC @400 Hz.
    OVERTEMPERATURE SHUTDOWN THRESHOLD: TBD °C.
15. MAINTENANCE CONNECTORS
    * 9 PIN D-SUB, RECEPTACLE
    * RJ45 CONNECTOR
16. REFERENCE PRESSURE DROP REQUIREMENTS:
    PRESSURE DROP THROUGH THE UNIT SHALL BE 50 ±30 PA (.2 ± .12 inH_2O) AT SEA LEVEL WHEN SUPPLIED WITH COOLING AIR AT FLOW RATE OF 15.4 KG/HR (.57 LB/MIN) AT 40° C (104° F).
17. REFERENCE COOLING REQUIREMENTS:
    UNIT IS DESIGNED TO OPERATE IN FORWARD EBAY, CABIN, AND NON-PRESSURIZED COMPARTMENT. UNIT REQUIRES FORCE AIR COOLING, AS FOLLOWS:
    * AIR FLOW OF 15.4 KG/HR (34.0 LB/HR)
    * AMBIENT PRESSURE OF 101.3 KPA (14.696 PSI)
    * AIR TEMPERATURE OF 40° C (104° F).
    INTERNAL FAN USED DURING LOSS OF COOLING CONDITION:
    * FLOW RATE MAX 3.98 CFM
    * FAN FILTRATION REQUIREMENTS: NONE
18. THIS AREA FREE OF PAINT.
19. CONNECTOR KEYING INDEX CODE IS 81 (KEY POSITIONS: 5, 2, 2). SHADED AREA INDICATES EXTENDED PART IN POLARIZING INSERTS.
20. BLOW-THROUGH DIRECTION SHOWN. DRAW-THROUGH DIRECTION OPPOSITE.
21. ASTERISK INDICATES CATEGORIES THAT ARE EXTENDED.
22. UPON TSO CERTIFICATION, THE SDU SHALL HAVE THE FOLLOWING MARKING:
    TSO-C159c (Class/Subclass See IM).

TABLE 1: SYSTEM REQUIREMENTS 10

RTCA/DO-160G SECTION	NAME	CATEGORY
4	TEMPERATURE AND ALTITUDE	A2* 21
4	LOSS OF COOLING	Z (505 MINUTES)
5	TEMPERATURE VARIATION	A
6	HUMIDITY	B
7	OPERATIONAL SHOCKS AND CRASH SAFETY	D, B
8	VIBRATION	S: CURVE B
9	EXPLOSION PROOFNESS	E
10	WATERPROOFNESS	Y
11	FLUIDS SUSCEPTIBILITY	F
12	SAND AND DUST	S
13	FUNGUS RESISTANCE	F
14	SALT SPRAY	S
15	MAGNETIC EFFECT	Z
16	POWER INPUT	A (WF) HZPI
17	VOLTAGE SPIKE	A* 21
18	AUDIO FREQUENCY CONDUCTED SUSCEPTIBILITY	R (WF)* 21
19	INDUCED SIGNAL SUSCEPTIBILITY	ZWX* 21
20	RADIO FREQUENCY SUSCEPTIBILITY (RADIATED AND CONDUCTED)	RR
21	EMISSION OF RADIO FREQUENCY ENERGY	M* 21
22	LIGHTNING INDUCED TRANSIENT SUSCEPTIBILITY	A3J3L3 B2H2L2
23	LIGHTNING DIRECT EFFECTS	XXXX
24	ICING	X
25	ELECTROSTATIC DISCHARGE (ESD)	A
26	FIRE, FLAMMABILITY	C

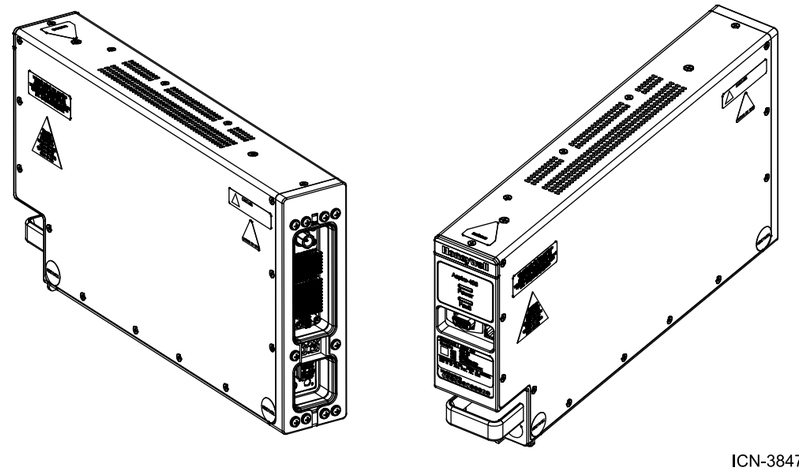


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Figure 4-3. (Sheet 1 of 2) SDU Outline and Installation

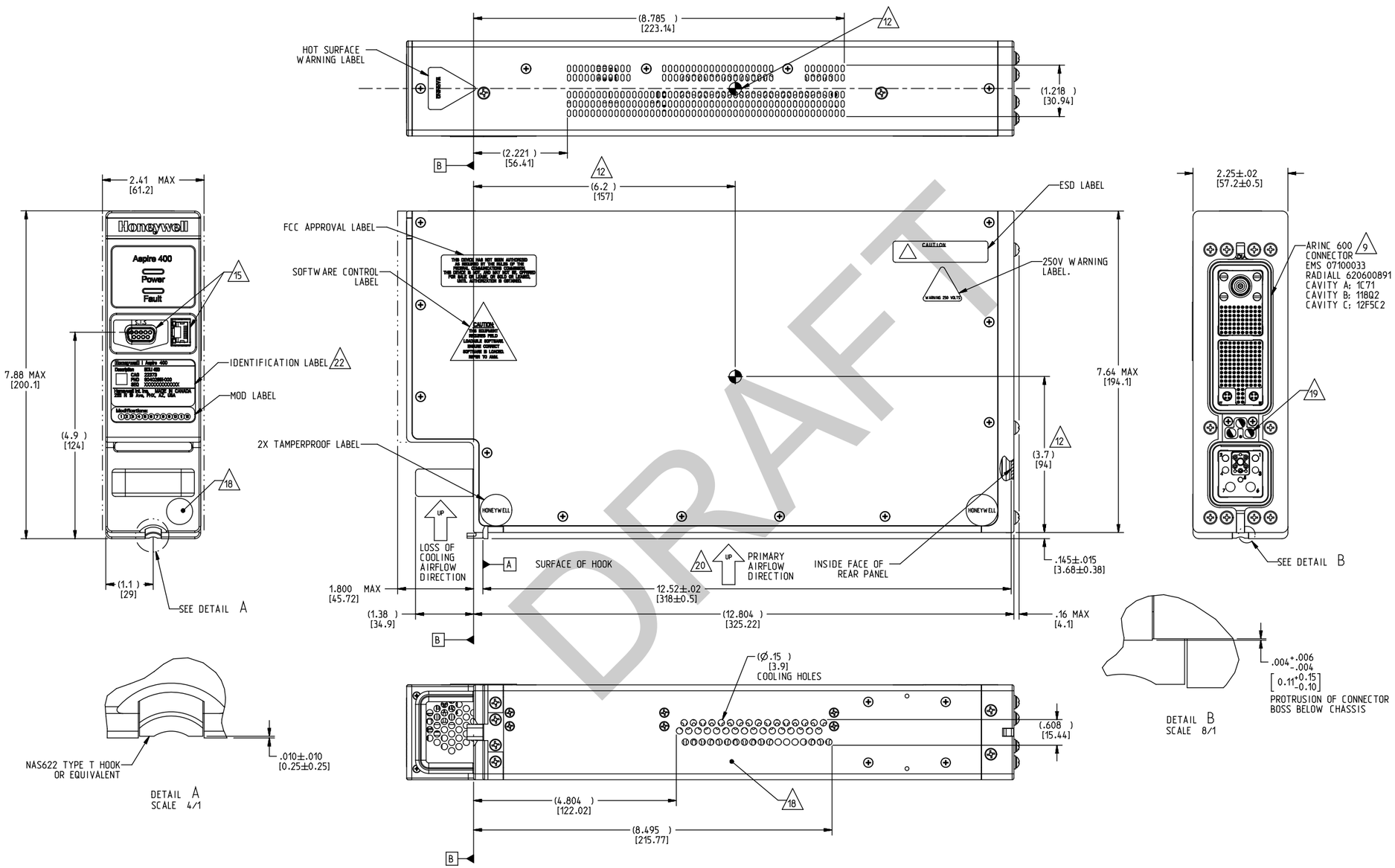

Figure 4-3. (Sheet 2 of 2) SDU Outline and Installation

2. Electrical Installation (TASK 23-15-49)

A. General

(1) The Electrical System for the Aspire-400 consists of three main components, the HPA, SCM and SDU, with the SDU acting as a central hub for the other two.

B. HPA Installation

(1) Power Requirements

(a) The HPA system runs on 115 VAC with a maximum power consumption of 280 W and has a maximum power dissipation of 240 W.

(2) Interfaces

(a) J1-A (70X #22 Contacts, 1X Size 1 Coax)

(b) J1-B (70X #22 Contacts, 1X Size 1 Coax)

(c) J1-C (4X #20 Contacts, 3X #16 Contacts, 4X #12 Contacts, 2X #5 Contact).

C. SCM Installation

(1) Power Requirements

(a) The SCM system runs on 18 VDC with a maximum power consumption of 16 W and has a maximum power dissipation of 10.7 W.

(2) Interfaces

(a) 15 Position D-SUB Plug MALE (TE 5745908-2).

D. SDU Installation

(1) Power Requirements

(a) The SDU system runs on 115 VAC with a maximum power consumption of 60 W and has a maximum power dissipation of 70 W.

(2) Interfaces

(a) 9 PIN D-SUB Receptacle

(b) RJ45 Connector.

3. Physical Connectors

A. SDU Rear Panel Receptacle

(1) The SDU has a low insertion force, size 2 shell ARINC 600 receptacle with an index pin arrangement of 081.

NOTE: The connector Index Pin Coding and Connector Specification are defined in ARINC 600 Attachments 18 and 19 respectively.

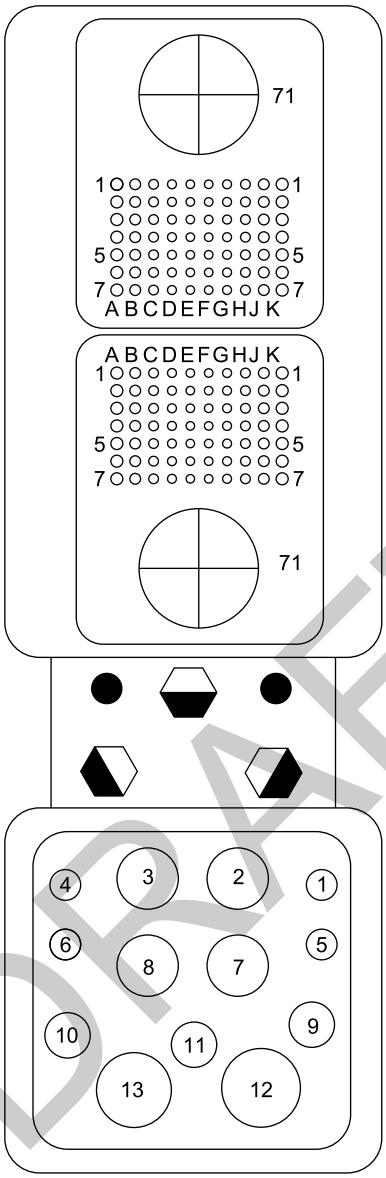

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Figure 4-4. ARINC 600 Receptacle with Index Pin Coding