AEEC

AIRLINES ELECTRONIC ENGINEERING COMMITTEE

To	Air/Ground Communications Systems Subcommittee	**Date**	January 17, 2003
From	Mike Rockwell mdr@arinc.com tel +1 410-266-2996 fax +1 410-266-2047	**Reference**	02-171/SAT-270 ldh

Subject

Draft Circulation
Draft 9 of Supplement 2 to ARINC Characteristic 761: *Second Generation Aviation Satellite Communication System, Aircraft Installation Provisions*

Summary

Supplement 2 provides an interface for an optional Multiple Bearer System (MBS) capability with an optional Complementary SATCOM System (CSS) consisting of a channel-unit LRU with its own antenna subsystem. The MCDU references have been revised to include the Satellite Control/Display Unit (SCDU). The HPA interwiring for pins MP4K and BP11 was revised. Attachment 1-7 LNA/DIP and LDH Form Factor was revised. The system characteristics for Inmarsat Aero-I have been revised to indicate isolation between Low Gain Antenna (LGA) and Global Positioning System (GPS) antennas. Provisions for Aero-I/H+ Air-to-Ground Circuit-Mode Service Selection Codes have been added.

System characteristics for the Globalstar single and multi-channel terminals have been added in Appendix 3.

All provisions pertaining to Iridium have been removed and archived in the summary of changes.

Technical changes to this current draft (Draft 9) appear in ***bold italics***. Material in *italics* represents proposed changes to the gray cover resulting from drafts 1 through 8 of Supplement 2.

Action

Please review Draft 9 and notify Mike Rockwell by **February 19, 2003,** if you have any comments. Draft 9 and comments pertaining to its changes will be reviewed at the next Air/Ground Communications Subcommittee meeting scheduled to be held March 18-19, 2003, in Orlando, Florida.

AERONAUTICAL RADIO, INC
2551 Riva Road
Annapolis, Maryland 21401-7465 USA

DRAFT 9
OF
SUPPLEMENT 2
TO
ARINC CHARACTERISTIC 761

SECOND GENERATION AVIATION SATELLITE COMMUNICATION SYSTEM

AIRCRAFT INSTALLATION PROVISIONS

This draft dated: January 17, 2003

A. PURPOSE OF THIS SUPPLEMENT

This Supplement provides an interface for an optional Multiple Bearer System (MBS) capability with an optional Complementary SATCOM System (CSS) consisting of a channel-unit LRU with its own antenna subsystem. The MCDU references have been revised to include the Satellite Control/Display Unit (SCDU). The HPA interwiring for pins MP4K and BP11 was revised. The system characteristics for Inmarsat Aero-I have been revised to indicate isolation between Low Gain Antenna (LGA) and Global Positioning System (GPS) antennas. Provisions for Aero-I/H+ Air-to-Ground Circuit Mode Service Selection Codes have been added. System characteristics for the Globalstar single and multi-channel terminals have been added. All provisions pertaining to Iridium have been removed and archived in the summary of changes below.

B. ORGANIZATION OF THIS SUPPLEMENT

This Document, printed on goldenrod paper, contains descriptions of changes introduced into Characteristic 761 by this supplement. The material in Supplement 2 is integrated into ARINC Characteristic 761 to form an updated version of the standard.

Changes introduced by Supplement 2 are identified using change bars and are labeled by a "c-2" symbol in the margin.

C. CHANGES TO ARINC CHARACTERISTIC 761 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete tabulation of the changes (additions and deletions) to the Characteristic introduced by this Supplement. Each change is described below, listed by the section number and the title that is employed in this Supplement. In each case a brief description of the change or addition is included. Where deletions occur, the deleted text is included with the description in order to retain a history of previous provisions in the event that they may be utilized in the future.

3.2 Not Used

New title. The previous title was IRIDIUM. The text below was deleted and is retained here for possible future use.

ORIGINAL TEXT FOLLOWS:

3.2 IRIDIUM

The IRIDIUM System, reference Appendix 2, includes a constellation of 66 Low Earth Orbit (LEO) operational satellites, 6-12 spare satellites, a satellite control segment, and a set of gateways. The gateways provide the interface for the bearer traffic (from private data and voice subnetworks, as well as the Public Switched Telephone Network (PSTN)) to gain access to the satellite constellation.

The function of the IRIDIUM avionics equipment is the transmission, reception and processing of signals via a satellite constellation providing aeronautical telephony and packet data services at L-band (1616.0-1626.5 MHz). The system provides a capability for all aeronautical satellite communications requirements external to the aircraft, including flight and cabin crew, as well as passenger, telephone and data services depending on aircraft equipage.

IRIDIUM System supports safety and non-safety packet and telephony services for both air-to-ground and ground-to-air.

ATTACHMENT 1-1 - GENERAL CONFIGURATION OVERVIEW

Changed MCDU to MCDU/SCDU. Added Complementary SATCOM System (CSS).

ATTACHMENT 1-2 - ALTERNATE CONFIGURATIONS

Updated the table.

ATTACHMENT 1-3 - STANDARD INTERWIRING

Changed Function of SDU Pins MP9J and MP9K from "Reserved Unspecified Function Wires" to "Reserved Data Bus from CCS (CEPT E1)" and added references to notes 41 and 60. Changed Function of SDU Pins MP10A and MP10B from "Reserved Unspecified Function Wires" to "Reserved Data Bus to CCS (CEPT E1)" and added references to notes 41 and 60. Revised the HPA interwiring for pins MP4K and BP11.

Changed Function of SDU Pins MP7E/MP7F from "Reserved Steering Inhibit to BSU or TDMA System Tx/Rx Control" to "Reserved Steering Inhibit to BSU". Added LNA/DIP Pin G as "Reserved 28V Hot". Changed LNA/DIP Pin K to "Reserved 28V Ground" and deleted Note 59. Added "Future Spare" to LNA/DIP Pin C Function column. Added LNA/DIP Pin D as Future Spare. Changed HPA/HLD Pins TP3A/TP3B from "Reserved HPA/HLD Mute from Top BSU or SDU/TDMA System Tx/Rx Control" to Reserved HPA/HLD Mute from Top BSU/Future Spare".

ATTACHMENT 1-4 - NOTES APPLICABLE TO STANDARD INTERWIRING

Note 25: Added Satellite Control Display Unit (SCDU).

Note 33: Revised table.

Note 59: Revised note to delete all text except 1st and 2nd sentences.

ORIGINAL TEXT FOLLOWS:

[59] ARINC 741-compatible systems may use SDU pins MP7E/F for steering inhibit of ACU/BSUs by the SDU, and may use HPA/HLD pins TP3A/B for HPA/ HLD muting by an ACU/BSU. (These HPA/HLD mute functions are only utilized in configurations in which a BSU is installed; reference ARINC Characteristic 741, Part 1, Attachments 1-2, 1-3, and 1-4.)

Time Division Multiple Access (TDMA) systems use these SDU and HPA/HLD pins as well as

ATTACHMENT 1-4 - NOTES APPLICABLE TO STANDARD INTERWIRING (cont'd)

LNA/DIP pins K/C for high-speed TDMA control from the SDU to the HPA/HLD and LNA/DIP. TDMA systems require the HPA/HLD to be muted during satellite-to-aircraft time frames, and the LNA to be protected (inactive) during aircraft-to-satellite time frames. The signaling used for these pins is identical to the "HPA Mute" signal specified in ARINC Characteristic 741, Part 1, Attachment 1-4A Note #31 and in the diagram of ARINC Characteristic 741, Part 1, Attachment 1-4A (substituting "TDMA System Tx/Rx Control from SDU" for "HPA Mute Signal from BSU"). The signal sense is reversed for the LNA with respect to the HPA/HLD; the LNA is active when the HPA/HLD is muted, and inactive when the HPA/HLD is not muted. ARINC Characteristic 741 Attachment 1-3 shows the interwiring for its configuration. The TDMA system interwiring is as follows: ARINC 429 "A" Line: SDU MP7E to HPA/HLD TP3A and to LNA/DIP K; ARINC 429 "B" Line: SDU MP7F to HPA/HLD TP3B and to LNA/DIP C.

[60] Added note that these CEPT E1 circuits may be used to interface an optional Multiple Bearer System (MBS) capability with an optional Complementary SATCOM System (CSS) consisting of a channel-unit LRU with its own antenna subsystem. Deleted Iridium from note.

ORIGINAL

ATTACHMENT 1-4A
APM SYSTEM CONFIGURATION

Attachment 1-4A was deleted, but is retained here for possible future use.

ORIGINAL TEXT AND TABLES FOLLOW:

A1.0 APM Configuration Requirements

This section defines the requirements for the SDU APM. The APM, at minimum, contains the following information;

SDU Configuration
System Configuration

The APM programming method, memory map and definition of SDU and System Configuration data is defined in this attachment.

The APM should meet the guidelines detailed in Attachment 3 of ARINC Report 607, "Design Guidance for Avionic Equipment".

A1.1 APM Programming Method

The APM interface allows the SDU to read and write data to the APM. The SDU should provide the interfaces and header format as specified for the APM, in accordance to ARINC Report 607, "Design Guidance for Avionic Equipment".

The programming of the APM consist of a write mode, read mode and a validation mode of operation.

The APM should store static data that is relevant to the operation of the SDU. This data is any data that is persistence from flight to flight on a given aircraft. This data includes Aircraft Identification data that is unique to each aircraft (ICAO 24-bit aircraft address, Airline Code, etc.) and Aircraft Configuration data (SDU Configuration and Vendor User data). Dynamic data (such as current aircraft state) should not be stored in the APM.

A1.1.1 Read Operation

The stored APM data should be read only at power-up as defined in ARINC Report 607, Attachment 3, Section 1.3.1.

Failures of the APM in-flight should not affect the performance of the SDU.

When no valid data is received from the APM, the SDU should indicate an inoperative APM state.

A1.1.2 Write Operation

The write operation performed on the APM should only be allowed as defined in ARINC Report 607, Attachment 3, Section 1.3.2, when the airplane is on the ground.

A1.1.3 Validation

**** TBD ****

A1.2 APM Memory Map

A1.2.1 APM Header Block

The APM Header Block should provide basic identification of the APM and its contents as defined in ARINC Report 607, Attachment 3, Section 4.1.1 and Table 1-1B.

A1.2.2 Aircraft Identification Block

The Aircraft Identification Block should contain parameters that are unique to the aircraft and are necessary to perform satellite communication functions as defined in Table 1-1C.

A1.2.3 SDU Configuration Block

The SDU Configuration Block should contain parameters that are generic to the SDU characteristics. Reference Tables 1-1D and 1-2.

A1.2.4 Vendor User Block

The Vendor User Block should contain parameters that are manufacturer specific. Reference Table 1-1E.

A1.2.5 Integrity Block

The integrity of the APM data should be protected by the host SDU, using a 16-bit Cyclic Redundancy Check (CRC) or equivalent method. Consideration should be given to mirroring the stored APM data for improved integrity and transient protection issues. Reference Table 1-1F.

ORIGINAL

ATTACHMENT 1-4A
APM SYSTEM CONFIGURATION

Table 1-1A APM Memory Map

Address	Category	Size/Format	Contents
00_h	APM Header Block		
20_h	Aircraft Identification Block		
30_h	SDU Configuration Block		
50_h	Vendor User Block		
$F0_h$	Integrity Block		

Table 1-1B APM Header Block

Address	Fields	Size/Format	Contents
00_h	APM Header Length	8 bits/binary	13_h
01_h	APM Header Version	8 bits/binary	Vendor Defined
02_h	APM Capacity	8 bits/binary	02_h Dual Segments
03_h	Vendor ID Code	8 bits/binary	TBD Honeywell/Racal
04_h	Host LRU ID Code	8 bits/binary	TBD Generic 761 SDU
$05\text{-}0F_h$	Host LRU Label	8 bytes/ASCII	"761 SDU" (Generic)
$10\text{-}11_h$	Blocks Installed	2 bytes/binary	TBD
12_h	Integrity Block Style	1 byte/binary	02_h 16 Bit CRC
13_h	8 bit header checksum	8 bits/binary	

Table 1-1C Aircraft Identification Block

Address	Fields	Size/Format	Contents
20_h	Block Length	8 bits/binary	10_h
$21\text{-}23_h$	ICAO 24-bit aircraft address	3 bytes	
$24\text{-}25_h$	Airline Identifier	2 bytes/ASCII	
$26\text{-}28_h$	ICAO Airline Identifier	3 bytes/ASCII	
$29\text{-}2F_h$	Reserved	8 bytes	FF_h

Table 1-1D SDU Configuration Block

Address	Fields	Size/Format	Contents
30_h	Block	8 bits/binary	20_h
31_h	*MCDU/SCDU* Configuration	8 bits/discrete	
32_h	*MCDU/SCDU* Bus Speed	8 bits/discrete	
33_h	CFDS	8 bits/binary	
34_h	Telephony Channel #1 Wiring	8 bits/binary	
35_h	Telephony Channel #2 Wiring	8 bits/binary	
36_h	Cockpit Hookswitch Signaling	8 bits/binary	
37_h	Priority 4 Calls From Cockpit	8 bits/discrete	
38_h	Availability of ICAO 24-bit Aircraft Address from Mode S Transponder	8 bits/discrete	
39_h	ICAO 24-bit Aircraft Address ARINC 429 Bus Speed	8 bits/discrete	
$3A_h$	FMC Connection to SDU	8 bits/binary	
$3B_h$	CMU Configuration	8 bits/binary	
$3C_h$	CMU Bus Speed	8 bits/discrete	
$3D_h$	CPDF Configuration	8 bits/discrete	
$3E_h$	Call Light Activation	8 bits/binary	
$3F_h$	CCS Presence	8 bits/discrete	
40_h	Cockpit Voice Call Light/Chime Option	8 bits/binary	
41_h	HPA/Antenna Configuration	8 bits/discrete	
42_h	SDU Configuration	8 bits/discrete	
43_h	SDU Number	8 bits/binary	
44_h	IRS Configuration	8 bits/binary	
$45\text{-}4F_h$	Reserved	11 bytes	FF_h

ORIGINAL

ATTACHMENT 1-4A
APM SYSTEM CONFIGURATION

Table 1-1E Vendor User Block

Address	Fields	Size/Format	Contents
50	Block Length	8 bits/binary	$A0_h$
$51\text{-}EF_h$	Reserved	159 bytes	

Table 1-1F Integrity Block

Address	Fields	Size/Format	Contents
$F0\text{-}F1_h$	CRC	2 bytes/binary	

Table 1-2 SDU and System Configuration

Address	Configuration Option	Definition MSB 7	6	5	4	3	2	1	LSB 0	Interpretation
31_h	*MCDU/SCDU* Configuration	0	0	0	0	0	x	x	0	*MCDU/SCDU* #1 Installed
		0	0	0	0	0	x	x	1	*MCDU/SCDU* # 1 Not Installed
		0	0	0	0	0	x	0	x	*MCDU/SCDU* #2 Installed
		0	0	0	0	0	x	1	x	*MCDU/SCDU* #2 Not Installed
		0	0	0	0	0	0	x	x	*MCDU/SCDU* #3 Installed
		0	0	0	0	0	1	x	x	*MCDU/SCDU* #3 Not Installed
32_h	*MCDU/SCDU* Bus Speed	0	0	0	0	0	0	0	0	Low Speed Bus
		0	0	0	0	0	0	0	1	High Speed Bus
33_h	CFDS	0	0	0	0	0	0	0	0	Undefined
		0	0	0	0	0	0	0	1	McDonnell-Douglas type CFDS
		0	0	0	0	0	0	1	0	Airbus type CFDS
		0	0	0	0	0	0	1	1	Honeywell CAIMS
		0	0	0	0	0	1	0	0	Boeing type CFDS
		0	0	0	0	0	1	0	1	Undefined
		0	0	0	0	0	1	1	0	Undefined
		0	0	0	0	0	1	1	1	CFDS Not Installed
34_h	Telephony Channel #1 Wiring	0	0	0	0	0	0	0	0	AMS Wired, Cabin Audio Wired
		0	0	0	0	0	0	0	1	AMS Wired, Cabin Audio Not Wired
		0	0	0	0	0	0	1	0	AMS Not Wired, Cabin Audio Wired
		0	0	0	0	0	0	1	1	AMS Not Wired, Cabin Audio Not Wired
35_h	Telephony Channel #2 Wiring	0	0	0	0	0	0	0	0	AMS Wired, Cabin Audio Wired
		0	0	0	0	0	0	0	1	AMS Wired, Cabin Audio Not Wired
		0	0	0	0	0	0	1	0	AMS Not Wired, Cabin Audio Wired
		0	0	0	0	0	0	1	1	AMS Not Wired, Cabin Audio Not Wired
36_h	Cockpit Hookswitch Signaling	0	0	0	0	0	0	0	1	Switched PTT and/or *MCDU/SCDU* Line Select Switch(es)
		0	0	0	0	0	0	0	0	Latched Audio Control Panel SATCOM Mic Switch
37_h	Priority 4 Calls From Cockpit	0	0	0	0	0	0	0	0	Inhibit Priority 4 Calls to/from the Cockpit
		0	0	0	0	0	0	0	1	Allow Priority 4 Calls to/from the Cockpit

ORIGINAL

ATTACHMENT 1-4A
APM SYSTEM CONFIGURATION

Table 1-2 SDU and System Configuration (cont'd)

Address	Configuration Option	Definition MSB 7	6	5	4	3	2	1	LSB 0	Interpretation
38_h	Availability of ICAO 24-bit Aircraft Address from Mode S Transponder	0	0	0	0	0	0	0	0	ICAO 24-bit Aircraft Address (AES ID) is Available from CMU #1 and/or CMU #2 and/or (Reserved) AES ID Input
		0	0	0	0	0	0	0	1	ICAO 24-bit Aircraft Address (AES ID) Not Available from CMU #1 nor CMU #2 nor (Reserved) AES ID Input
39_h	ICAO 24-bit Aircraft Address ARINC 429 Bus Speed	0	0	0	0	0	0	0	0	High Speed Bus
		0	0	0	0	0	0	0	1	Low Speed Bus
$3A_h$	FMC Connection to SDU	0	0	0	0	0	0	0	0	FMC #1 Connected, FMC #2 Connected
		0	0	0	0	0	0	0	1	FMC #1 Connected, FMC #2 Not Connected
		0	0	0	0	0	0	1	0	FMC #1 Not Connected, FMC #2 Connected
		0	0	0	0	0	0	1	1	Neither FMC Connected
$3B_h$	CMU Configuration	0	0	0	0	0	0	0	0	CMU #1 Connected, CMU #2 Connected
		0	0	0	0	0	0	0	1	CMU #1 Connected, CMU #2 NOT Connected
		0	0	0	0	0	0	1	0	CMU #1 Not Connected, CMU #2 Connected
		0	0	0	0	0	0	1	1	Neither CMU Connected
$3C_h$	CMU Bus Speed	0	0	0	0	0	0	0	0	High Speed Bus
		0	0	0	0	0	0	0	1	Low Speed Bus
$3D_h$	CPDF Configuration	0	0	0	0	0	0	0	0	CPDF Installed
		0	0	0	0	0	0	0	1	CPDF Not Installed
$3E_h$	CALL Light Activation	0	0	0	0	0	0	0	0	Call Light On at Call Initiation (for Air/Ground Calls)
		0	0	0	0	0	0	0	1	Call Light On at Call Connection (for Air/Ground Calls)
$3F_h$	CCS Presence	0	0	0	0	0	0	0	0	CCS Installed
		0	0	0	0	0	0	0	1	CCS Not Installed

ORIGINAL

ATTACHMENT 1-4A
APM SYSTEM CONFIGURATION

Table 1-2 SDU and System Configuration (cont'd)

Address	Configuration Option	Definition MSB 7	6	5	4	3	2	1	LSB 0	Interpretation
40_h	Cockpit Voice Call Light/Chime Option	0	0	0	0	0	0	0	0	Spare
		0	0	0	0	0	0	0	1	Steady Lights & Multistroke Chime
		0	0	0	0	0	0	1	0	Flashing Lights & Single Stroke Chime
		0	0	0	0	0	0	1	1	Steady Lights & Single Stroke Chime
41_h	HPA/Antenna Configuration	x	x	x	x	x	x	x	x	***TBD***
42_h	SDU Configuration	0	0	0	0	0	0	0	0	Second SDU Installed
		0	0	0	0	0	0	0	1	Second SDU Not Installed
43_h	SDU Number	0	0	0	0	0	0	0	0	SDU #2
		0	0	0	0	0	0	0	1	SDU #1
44_h	IRS Configuration	0	0	0	0	0	0	0	0	Primary IRS Installed, Secondary IRS installed
		0	0	0	0	0	0	0	1	Primary IRS Installed, Secondary IRS Not Installed
		0	0	0	0	0	0	1	0	Primary IRS Not Installed, Secondary IRS Installed
		0	0	0	0	0	0	1	1	Primary IRS Not Installed, Secondary IRS Not Installed

ATTACHMENT 1-4B - SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION

Revised Table 1-3K HPA/Antenna Subsystem Configuration. Updated Note 3 and added Note 9.

ATTACHMENT 1-5A1 - 4 OR 8 MCU SDU CONNECTOR REAR VIEW

Revised Index Pin Code.

ATTACHMENT 1-5A3 - 4 OR 8 MCU SDU MIDDLE PLUG CONNECTOR LAYOUT

Revised to correspond to Attachment 1-3.

ATTACHMENT 1-5B2 - 4 or 6 MCU SDU TOP PLUG CONNECTOR LAYOUT

Revised to correspond to Attachment 1-3.

ATTACHMENT 1-5B3 - 4 OR 6 MCU SDU MIDDLE PLUG CONNECTOR LAYOUT

Revised to correspond to Attachment 1-3.

ATTACHMENT 1-6B - 4 OR 6 MCU HPA/HLD MIDDLE PLUG CONNECTOR LAYOUT

Removed note 3 from pin MP4K.

ATTACHMENT 1-7 - LNA/DIP AND LDH FORM FACTORS

Revised Diplexer/LNA Dimension A to allow a common form factor to be used for Aero-H and Aero-I systems. Added mounting pad edge to edge dimension.

ATTACHMENT 2 - ARINC SPECIFICATION 429 LABELS

Added Item 1 and 2 to expand the Label 270 definition to support an SDU with a Multiple Bearer System capability.

Changed Subsystem SAL example from “345” to “173.”

The ARINC 429 Label 172 format was revised to support SDUs with Multiple Bearer System capability. A new note 1 was added and the remaining notes were renumbered. Removed Iridium from the Label 172 example.

ATTACHMENT 3 - EQUIPMENT ENVIRONMENTAL CATEGORIES (EUROCAE ED-14D/RTCA DO-160D)

Attachment was revised to reflect the new RTCA DO-160D/EUROCAE ED-14D requirements. New text was added indicating that more stringent categories may be required by some airframe manufacturers and/or regulatory agencies for some ED-14/DO-160 sections.

APPENDIX 1 - ACRONYMS AND ABBREVIATIONS

Revised.

APPENDIX - 3A - SYSTEM CHARACTERISTICS FOR GLOBALSTAR SINGLE CHANNEL TERMINAL

Added System Characteristics for Globalstar Single Channel Terminal.

APPENDIX - 3B - SYSTEM CHARACTERISTICS FOR GLOBALSTAR MULTI-CHANNEL TERMINAL

Added System Characteristics for Globalstar Multi-Channel Terminal.

ORIGINAL

APPENDIX 2
SYSTEM CHARACTERISTICS FOR IRIDIUM

Appendix 2 was deleted, but is retained here for possible future use.

ORIGINAL TEXT AND TABLES FOLLOW:

A2.1 System Level Specific Description

A2.1.1 EIRP

EIRP = 8.5 dBW maximum, -7.5 dBW minimum, per channel.

A2.1.2 G/T

G/T = -24.8 dB/K

A2.1.3 Number of Channels

The IRIDIUM system puts no constraints on the number of co-located channels. Vendors are expected to produce 1, 2, 4, 8 and 16 channel systems.

A2.1.4 APM/Pin Strapping

***** TBD *****

A2.2 LNA/Diplexer

A2.2.1 VSWR

VSWR for the LNA/Diplexer should be less than or equal to 1.3:1.

A2.2.2 Filter Characteristics

Transmit Port to Antenna Port

Frequency (MHz)	Rejection (dB)
0.0 to 1585.0	>100
1585.0 to 1610.0	>85
1610.0 to 1616.0	decreases
1616.0 to 1626.5	<0.5
1626.5 to 1646.5	increases
1646.5 to 1660.5	>70
1660.5 to 12000.0	>50
12000.0 to 18000.0	>20

Transmit Port to LNA Output Port

Frequency (MHz)	Rejection (dB)
0 to 18000	>10

Antenna Port to Receive Port

Frequency (MHz)	Rejection (dB)
0.0 to 1610.0	>40
1610.0 to 1616.0	decreases
1616.0 to 1626.5	<1.0
1626.5 to 1646.5	decreases
1646.5 to 1656.5	<120
1656.5 to 1660.5	decreases
1660.5 to 18000.0	>50

A2.3 HPA

A2.3.1 VSWR

VSWR for the HPA should be less than or equal to 1.3:1

A2.3.2 Transmit Spectrum Characteristics

A2.3.3 Filter Characteristics

A2.4 Antenna

A2.4.1 Frequency of Operation

A2.4.2 Gain

The Antenna used is a 0 dBic (nominal) gain antenna.

A2.4.3 VSWR

A2.4.4 Coverage

The Antenna shall provides 360 degrees azimuth and +8 to 90 degrees elevation for all operational attitudes of the aircraft.

A2.4.5 Isolation

A2.4.5.1 Physical

A2.4.5.2 Electrical

A2.4.5.3 Intermodulation

APPENDIX 5 - SYSTEM CHARACTERISTICS FOR INMARSAT AERO-I

Revised VSWR to be consistent with ARINC Characteristic 741. Added commentary text indicating that 50 inches of separation between the SATCOM (0 dBi) LGA and GPS antenna will provide 40 dB of isolation. Added Aero-I/H+ Air-to-Ground Circuit-Mode Selection Codes.

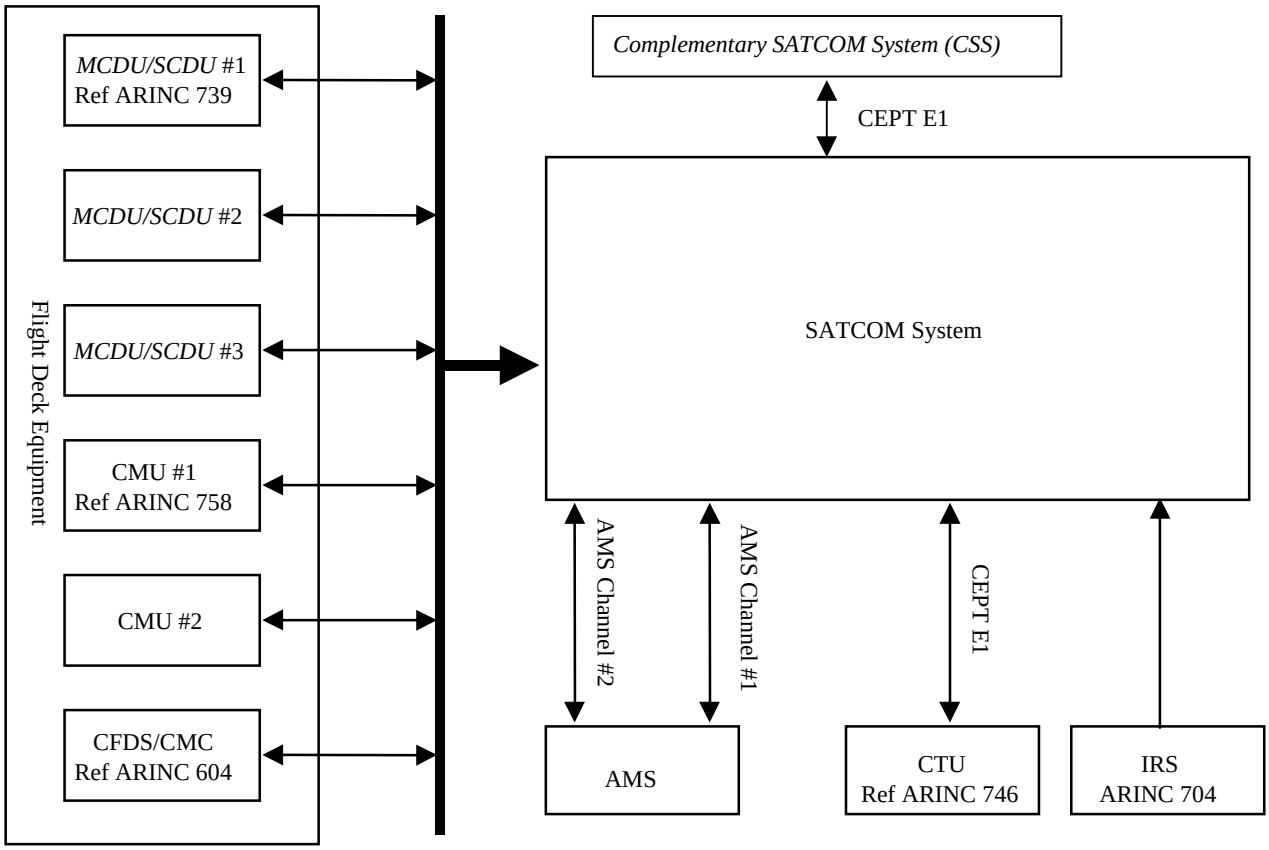
STAFF NOTE: In order to conserve resources, we are not circulating draft "replacement pages." The new draft material proposed to appear in the replacement white pages of the adopted version of the Supplement begins on Page 10 of this draft Supplement.

3.0 SYSTEM DESCRIPTIONS

3.2 Not Used

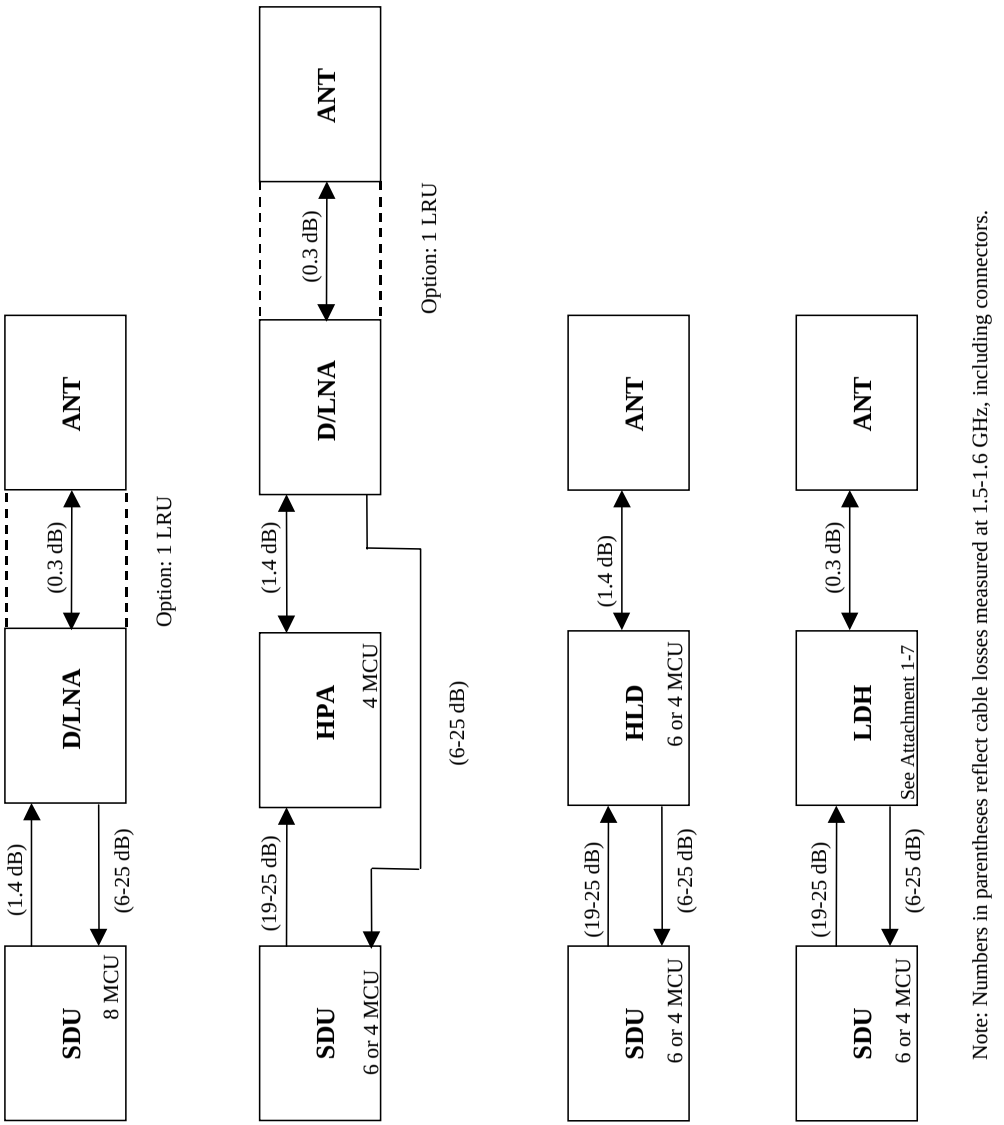
STAFF NOTE: The previous title of this section was IRIDIUM. The material formerly in this section has been preserved as-is (for possible future use) in the change summary for Supplement 2.

ATTACHMENT 1-1
GENERAL CONFIGURATION OVERVIEW



Note: All LRUs external to the SATCOM System are optional.

ATTACHMENT 1-2
ALTERNATE CONFIGURATIONS

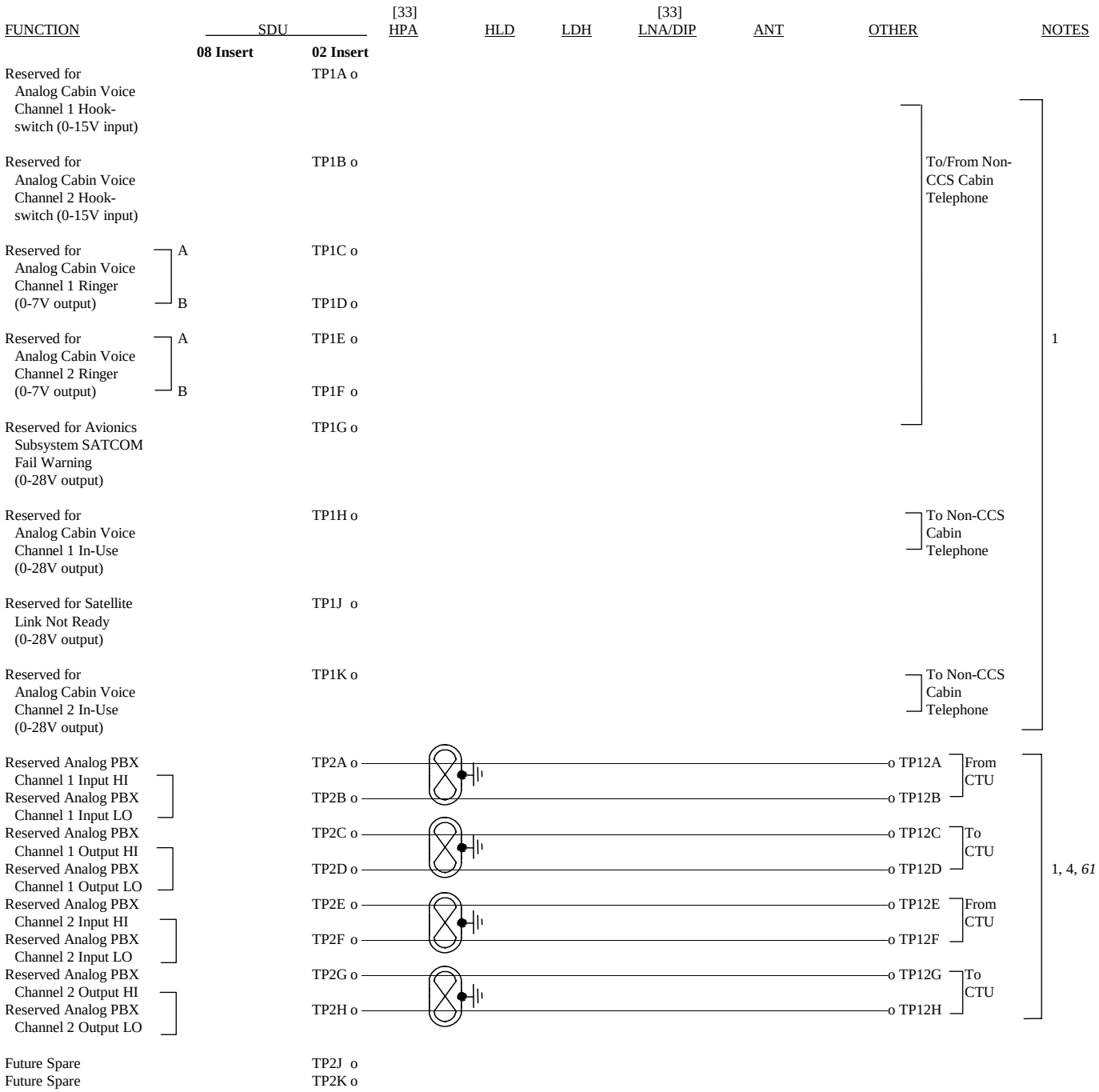


Note: Numbers in parentheses reflect cable losses measured at 1.5-1.6 GHz, including connectors.

ATTACHMENT 1-2
ALTERNATE CONFIGURATIONS

LRU	Size MCU	Architecture Type	Airflow Rate kg/hr (40°C)	Heat Dissipation Watts (max)	Shell Size	ARINC 600 Connector Inserts	ARINC 600 Connector Index Pin	RF Connectors
SDU	4	B	22	100	# 2	TP02/MP02/BP04	04	BP Size 5
SDU	4	C	22	100	# 2	TP02/MP02/BP04	04	BP Size 5
SDU	4	D	22	100	# 2	TP02/MP02/BP04	04	BP Size 5
SDU	4	A	22	100	# 2	TP08/MP02/BP04	061	TP Size 1/BP Size 5
SDU	4	B	22	100	# 2	TP08/MP02/BP04	061	TP Size 1/BP Size 5
SDU	4	C	22	100	# 2	TP08/MP02/BP04	061	TP Size 1/BP Size 5
SDU	4	D	22	100	# 2	TP08/MP02/BP04	061	TP Size 1/BP Size 5
SDU	6	B	33	150	# 2	TP02/MP02/BP04	04	BP Size 5
SDU	6	C	33	150	# 2	TP02/MP02/BP04	04	BP Size 5
SDU	6	D	33	150	# 2	TP02/MP02/BP04	04	BP Size 5
SDU	8	A	77	350	# 2	TP08/MP02/BP04	061	TP Size 1/BP Size 5
HPA	4	B	33	150	# 2	TP08/MP05/BP04	08	TP Size 1/MP Size 1
D/LNA		A						
D/LNA		B						
HLD	4	C	33	150	# 2	TP08/MP05/BP04	08	TP Size 1/MP Size 1
HLD	6	C	44	200	# 2	TP08/MP05/BP04	08	TP Size 1/MP Size 1
LDH		D						
ANT (IGA)	*TECOM*	A B						N
ANT (IGA)	*BSC*	A B						TNC
ANT (IGA)	*EMS*	A B						TNC
ANT (IGA)	*OMNIPLESS*	*A B*						*TNC*
ANT (IGA) + D/LNA	*TECOM*	A B						N (TX), TNC (RX)
ANT (IGA)	*DETEXIS*	C						N
ANT (LEO/MEO)	*SENSORS*	B C D						TNC
ANT (LEO/MEO)	*CHELTON*	B C D						TNC
ANT (LEO/MEO)	*BALL*	B C D						TNC

ATTACHMENT 1-3
STANDARD INTERWIRING



ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION	SDU		[33] HPA	HLD	LDH	[33] LNA/DIP	ANT	OTHER	NOTES
	08 Insert	**02 Insert**							
Reserved for Cockpit Voice Unavailable (0-28 V Output)		TP3A o							
Reserved for Cabin Voice Unavailable (0-28V output)		TP3B o							
Reserved for Packet Data Unavailable (0-28V output)		TP3C o							1
Reserved for Packet Data Low Speed Only Available (0-28V output)		TP3D o							
Reserved for SATCOM Inoperable (0-28V output)		TP3E o							
Reserved MFR. Specific		TP3F o							
Reserved MFR. Specific		TP3G o							
Reserved MFR. Specific		TP3H o							***62***
Reserved MFR. Specific		TP3J o							
Reserved MFR. Specific		TP3K o							
APM Power Source	TP6A o	TP4A o							
APM Power Return	TP6B o	TP4B o							
APM Clock Output	TP6C o	TP4C o							
From APM Serial Data Output	TP6D o	TP4D o							
To APM Serial Data Input	TP6E o	TP4E o							
APM Write Enable Output #1	TP6F o	TP4F o							1, 2
APM Write Enable Output #2	TP6G o	TP4G o							
APM Enable #1 Output	TP6H o	TP4H o							
APM Enable #2 Output	TP6J o	TP4J o							
Future Spare		TP4K o							
Reserved Mfr.-Specific		TP5A o							
Reserved Mfr.-Specific		TP5B o							
Reserved Mfr.-Specific		TP5C o							
Reserved Mfr.-Specific		TP5D o							
Reserved Mfr.-Specific		TP5E o							
Reserved Mfr.-Specific		TP5F o							18
Reserved Mfr.-Specific		TP5G o							
Reserved Mfr.-Specific		TP5H o							
Reserved Mfr.-Specific		TP5J o							
Reserved Mfr.-Specific		TP5K o							
Spare 429 Input A		TP6A o							
Spare 429 Input B		TP6B o							
Spare 429 Output A		TP6C o							
Spare 429 Output B		TP6D o							
Reserved Mfr.-Specific		TP6E o							
Reserved Mfr.-Specific		TP6F o							
Reserved Mfr.-Specific		TP6G o							
Reserved Mfr.-Specific		TP6H o							18
Reserved Mfr.-Specific		TP6J o							
Reserved Mfr.-Specific		TP6K o							

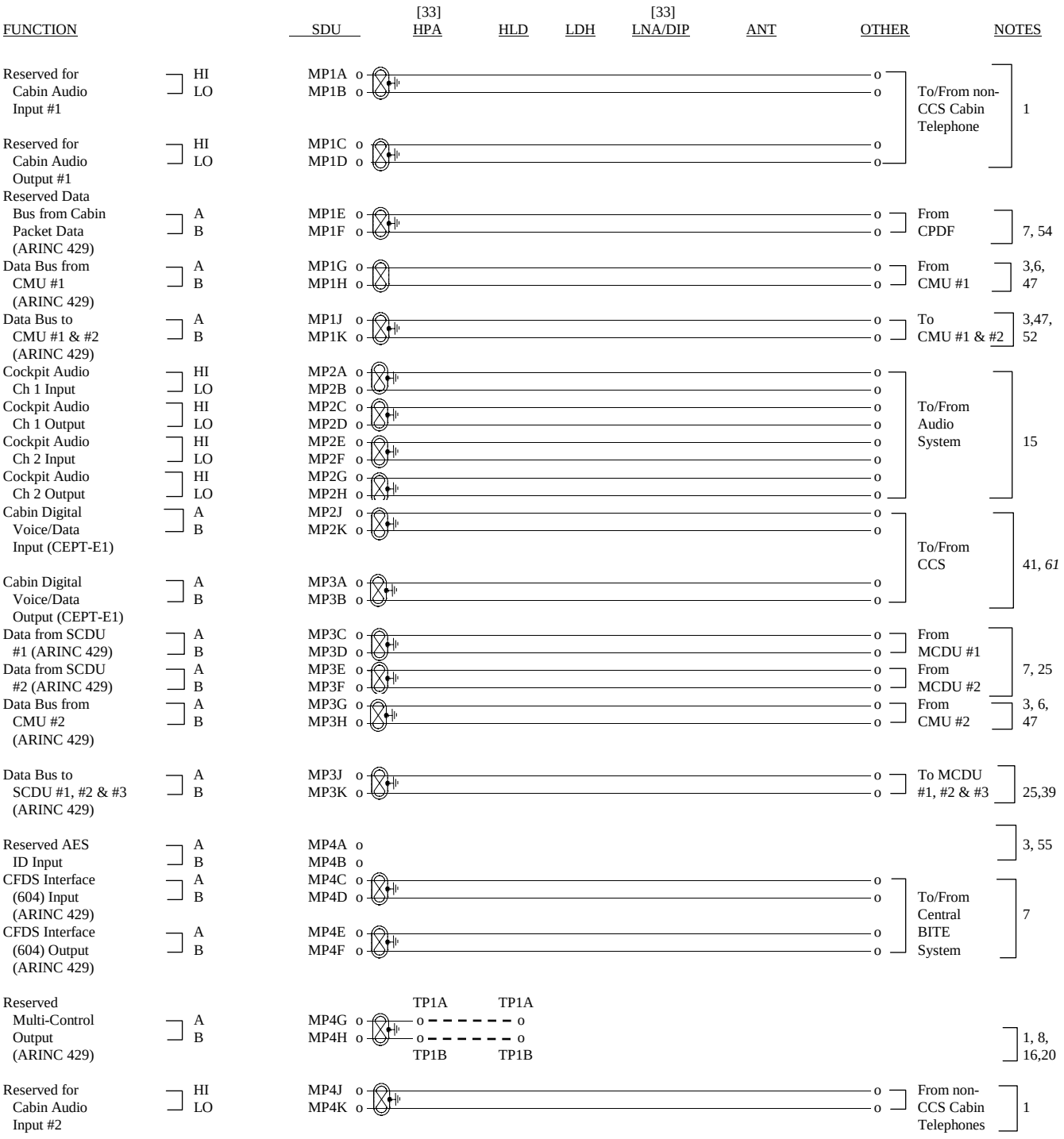
ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION	SDU		[33] HPA	HLD	LDH	[33] LNA/DIP	ANT	OTHER	NOTES
	08 Insert	**02 Insert**							
Reserved Mfr.-Specific		TP7A o							
Reserved Mfr.-Specific		TP7B o							
Reserved Mfr.-Specific		TP7C o							
Reserved Mfr.-Specific		TP7D o							
Reserved Mfr.-Specific		TP7E o							
Reserved Mfr.-Specific		TP7F o							
Reserved Mfr.-Specific		TP7G o							
Reserved Mfr.-Specific		TP7H o							
Reserved Mfr.-Specific		TP7J o							
Reserved Mfr.-Specific		TP7K o							18
Reserved Mfr.-Specific		TP8A o							
Reserved Mfr.-Specific		TP8B o							
Reserved Mfr.-Specific		TP8C o							
Reserved Mfr.-Specific		TP8D o							
Reserved Mfr.-Specific		TP8E o							
Reserved Mfr.-Specific		TP8F o							
Reserved Mfr.-Specific		TP8G o							
Reserved Mfr.-Specific		TP8H o							
Reserved Mfr.-Specific		TP8J o							
Reserved Mfr.-Specific		TP8K o							
Spare Discrete Input (Config. Straps Type)	TP1A o	TP9A o							1
Spare Discrete Input (Config. Straps Type)	TP1B o	TP9B o							
Reserved Mfr.-Specific	TP1C o	TP9C o							
Reserved Mfr.-Specific	TP1D o	TP9D o							
Reserved Mfr.-Specific	TP1E o	TP9E o							
Reserved Mfr.-Specific	TP1F o	TP9F o							
Reserved Mfr.-Specific	TP1G o	TP9G o							18
Reserved Mfr.-Specific	TP1H o	TP9H o							
Reserved Mfr.-Specific	TP1J o	TP9J o							
Reserved Mfr.-Specific	TP1K o	TP9K o							
Strap Option	TP2A o	TP10A o							
Strap Option	TP2B o	TP10B o							
Strap Option	TP2C o	TP10C o							
Strap Option	TP2D o	TP10D o							
Strap Option	TP2E o	TP10E o							
Strap Option	TP2F o	TP10F o							
Strap Option	TP2G o	TP10G o							
Strap Option	TP2H o	TP10H o							
Strap Option	TP2J o	TP10J o							
Strap Option	TP2K o	TP10K o							
Strap Option	TP3A o	TP11A o							
Strap Option	TP3B o	TP11B o							
Strap Option	TP3C o	TP11C o							
Strap Option	TP3D o	TP11D o							
Strap Option	TP3E o	TP11E o							1, 5
Strap Option	TP3F o	TP11F o							
Strap Option	TP3G o	TP11G o							
Strap Option	TP3H o	TP11H o							
Strap Option	TP3J o	TP11J o							
Strap Option	TP3K o	TP11K o							
Strap Option	TP4A o	TP12A o							
Strap Option	TP4B o	TP12B o							
Strap Option	TP4C o	TP12C o							
Strap Option	TP4D o	TP12D o							
Strap Option	TP4E o	TP12E o							
Strap Option	TP4F o	TP12F o							
Strap Option	TP4G o	TP12G o							
Strap Option	TP4H o	TP12H o							
Strap Option	TP4J o	TP12J o							
Strap Option	TP4K o	TP12K o							

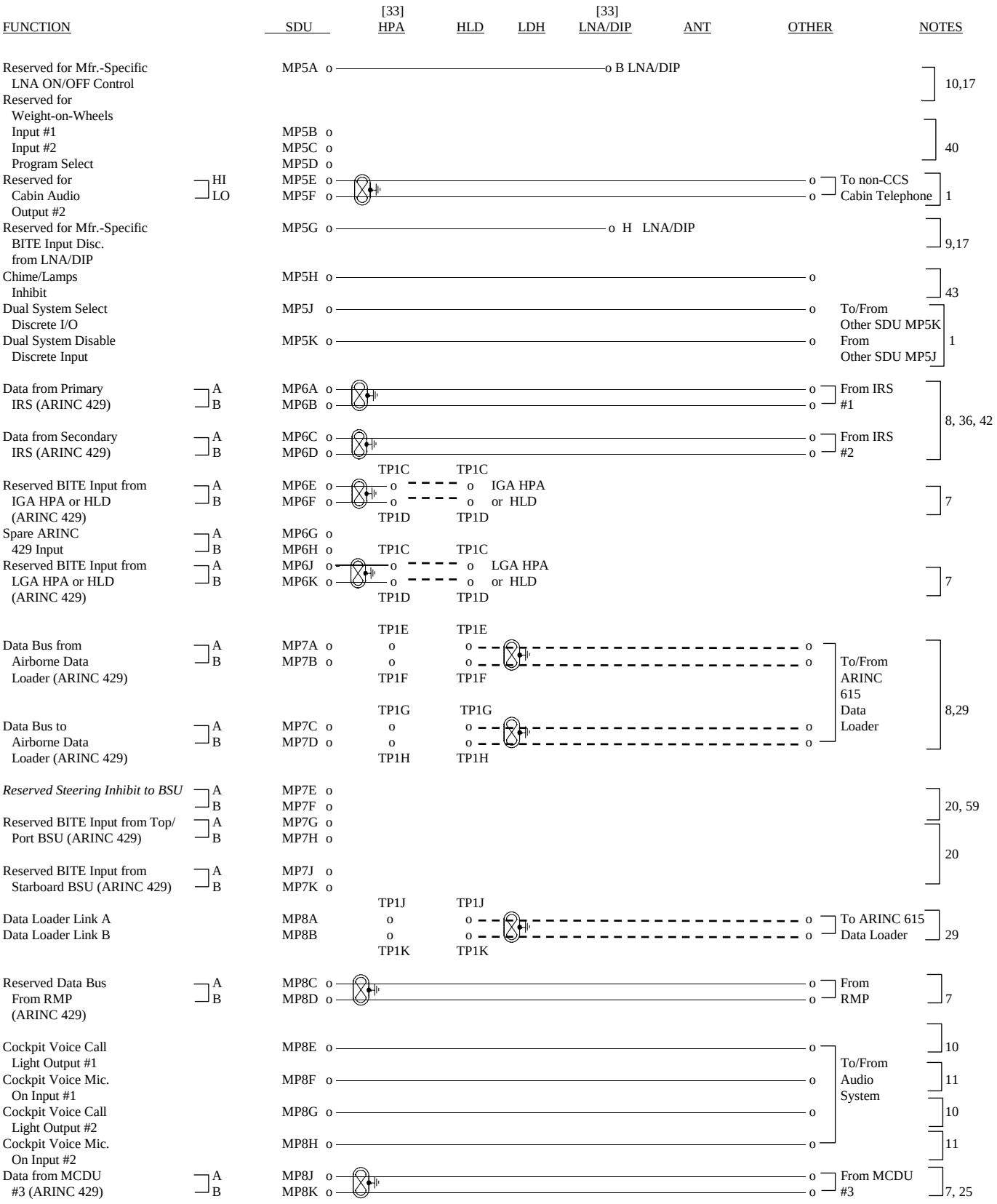
ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION	SDU		[33] HPA	HLD	LDH	[33] LNA/DIP	ANT	OTHER	NOTES
Strap Option	TP5A o	TP13A o							
Strap Option	TP5B o	TP13B o							
Strap Option	TP5C o	TP13C o							
Strap Option	TP5D o	TP13D o							
Strap Option	TP5E o	TP13E o							1, 5
Strap Option	TP5F o	TP13F o							
Strap Option	TP5G o	TP13G o							
Strap Option	TP5H o	TP13H o							
Strap Option	TP5J o	TP13J o							
Strap Option	TP5K o	TP13K o							
Reserved ATE		TP14A o	TP6A o	TP6A o					
Reserved ATE		TP14B o	TP6B o	TP6B o					
Reserved ATE		TP14C o	TP6C o	TP6C o					
Reserved ATE		TP14D o	TP6D o	TP6D o					
Reserved ATE		TP14E o	TP6E o	TP6E o					
Reserved ATE		TP14F o	TP6F o	TP6F o					
Reserved ATE		TP14G o	TP6G o	TP6G o					
Reserved ATE		TP14H o	TP6H o	TP6H o					
Reserved ATE		TP14Jo	TP6J o	TP6J o					
Reserved ATE	TP6K o	TP14K o	TP6K o	TP6K o					
Reserved ATE	TP7A o	TP15A o	TP7A o	TP7A o					
Reserved ATE	TP7B o	TP15B o	TP7B o	TP7B o					
Reserved ATE	TP7C o	TP15C o	TP7C o	TP7C o					
Reserved ATE	TP7D o	TP15D o	TP7D o	TP7D o					
Reserved ATE	TP7E o	TP15E o	TP7E o	TP7E o					
Reserved ATE	TP7F o	TP15F o	TP7F o	TP7F o					
Reserved ATE	TP7G o	TP15G o	TP7G o	TP7G o					
Reserved ATE	TP7H o	TP15H o	TP7H o	TP7H o					
Reserved ATE	TP7J o	TP15Jo	TP7J o	TP7J o					
Reserved ATE	TP7K o	TP15K o	TP7K o	TP7K o					

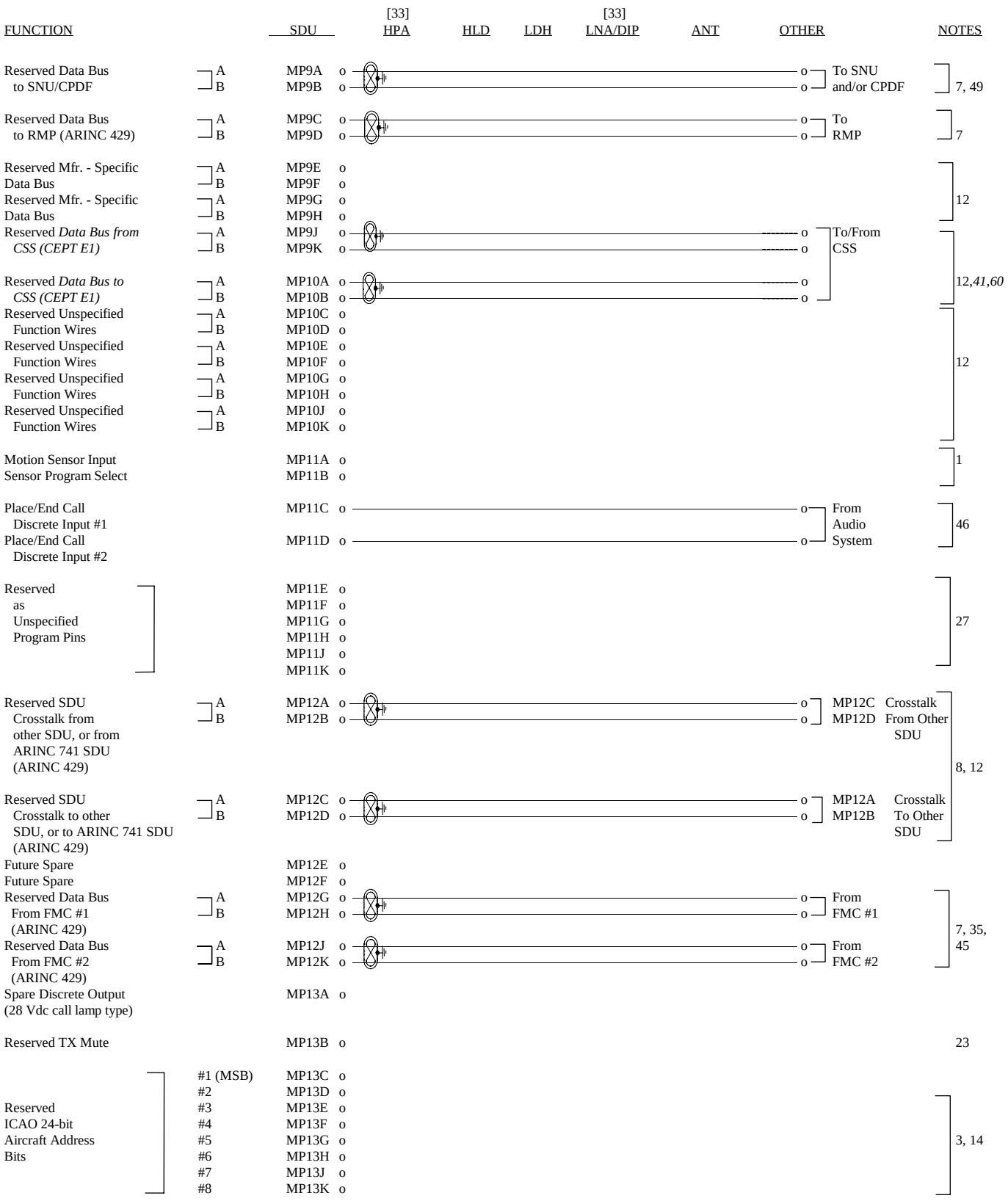
ATTACHMENT 1-3
STANDARD INTERWIRING



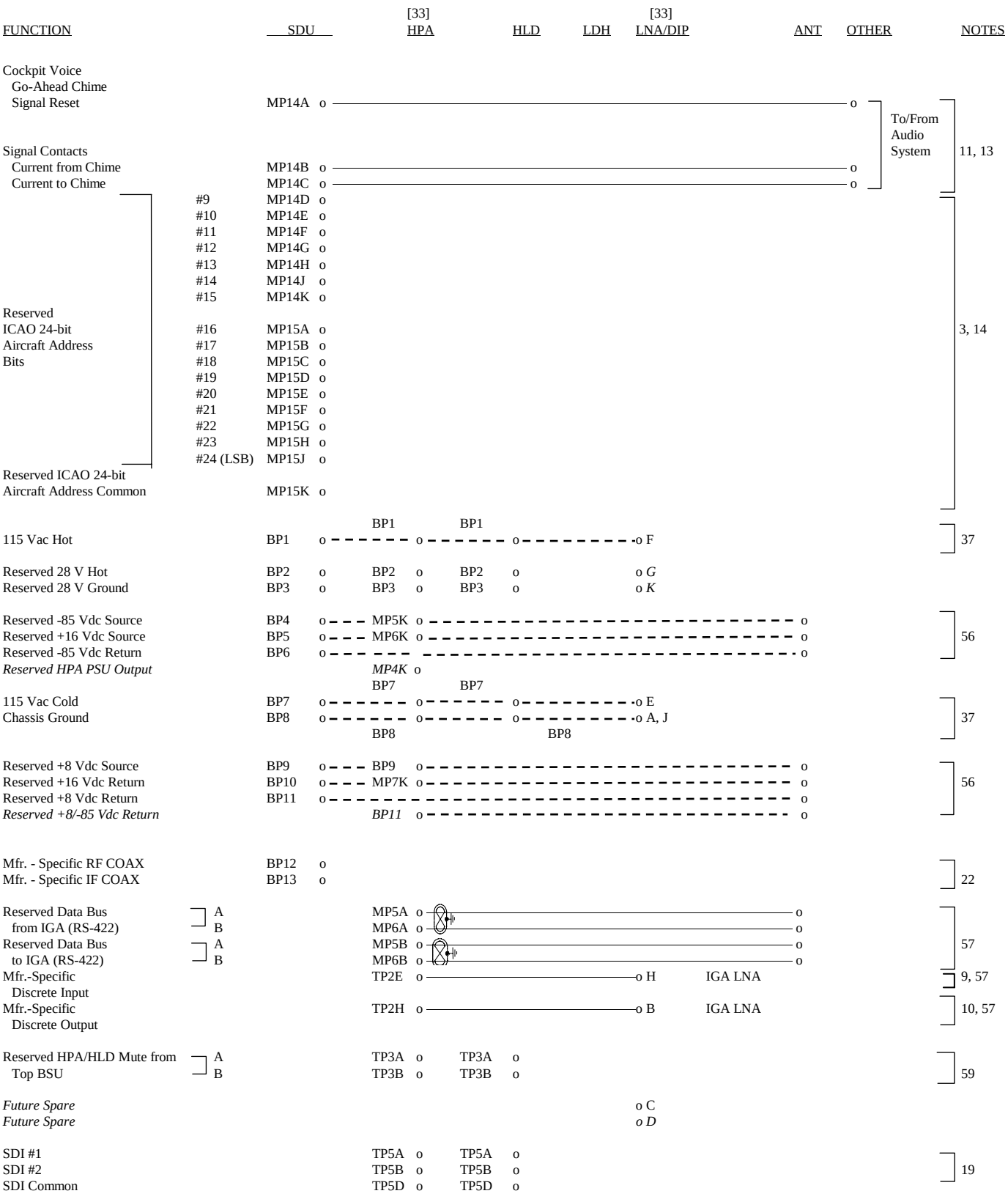
ATTACHMENT 1-3
STANDARD INTERWIRING



ATTACHMENT 1-3
STANDARD INTERWIRING



ATTACHMENT 1-3
STANDARD INTERWIRING



ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

[1] The ARINC 761 SDU standard interwiring is based on the ARINC 741 SDU standard interwiring. Where possible, the ARINC 761 SDU uses the same pinout as the ARINC 741 SDU. The rationale for this is to allow (particularly in pre-wired aircraft) the ARINC 761 SDU to re-use ARINC 741 wiring. However, the ARINC 761 SDU does not support all the ARINC 741 SDU interfaces, and provides interfaces the ARINC 741 SDU does not support. This note is used to identify ARINC 761 SDU pins that are not implemented by all manufacturers.

[2] These pins are provided to allow connection to the Airplane Personality Module (APM) as defined in Attachment 3 of ARINC Report 607 "Design Guidance for Avionic Equipment". The description of the APM programming method, APM Memory Map and APM mission critical data definition are defined in Attachment 1-4A of this characteristic. The SDU may support connections to the APM, the System Configuration pins (see Note 5), or both; but only one method is implemented in any given aircraft installation.

[3] ICAO 24-bit aircraft address.

When in the air the SDU should use the ICAO 24-bit aircraft address held in Non Volatile Memory (NVM) if available. When on the ground the SDU should apply the following paragraphs a. through e.

The SDU should select (in order of decreasing precedence) one of the following means of receiving the ICAO 24-bit aircraft address information. In installations where System Configuration pins are utilized, pin TP10A identifies whether or not the ICAO 24-bit aircraft address is available on an ARINC 429 bus (see Attachment 1-4B).

a. From CMU #1, via the CMU ARINC 429 Low or High speed bus interface pins MP1G/1H using Labels 214 and 216

b. From CMU #2, via the CMU ARINC 429 Low or High speed bus interface pins MP3G/3H using Labels 214 and 216

c. From a source of ICAO 24-bit aircraft address, such as Mode S transponder, on the aircraft via the dedicated ARINC 429 Low or High Speed input ports provided on pins MP4A/4B using Labels 275 and 276

d. From the APM connected to the SDU on pins TP4A to TP4J (for the top plug 02 insert) or on pins TP6A to TP6J (for the top plug 08 insert). See Attachment 1-4A for details

e. From 25 discrete pins made up of 24 pins for the ICAO 24-bit aircraft address and one common pin. See note 14 and Pins MP13C to MP13K and MP14D to MP14K and MP15A to MP15K

The ICAO 24-bit aircraft address should be acquired when the SDU is powered up from the first valid ICAO 24-bit aircraft address received. For an ICAO 24-bit aircraft address to be deemed valid the following must hold: the bus on which the ICAO 24-bit aircraft address is to be received must be active; the octal code must not be 77777777 or 00000000; and both labels needed for an ICAO 24-bit aircraft address must be present. The acquired address should be stored in non-volatile memory, should not be rewritten until the aircraft is on the ground and power is cycled through an on/off power cycle.

COMMENTARY

The Mode S transponder initially, at power up, provides ICAO 24-bit aircraft address values of zero for a short period of time. Until the transponder is removed from 'standby mode' it does not provide an ICAO 24-bit aircraft address with a valid "normal" SSM. After power is first applied to the aircraft avionics the ICAO 24-bit aircraft address from the transponder shows SSM "NCD". Once the bus is deemed to be active, and the ICAO 24-bit aircraft address data it provides has a value other than zero, it is acceptable to use the ICAO 24-bit aircraft address provided from the transponder during these times as long as the SSM is not in the Failure Warning (FW) or Functional Test (FT) condition.

[4] This is an optional two-channel full-duplex analog interface with the Cabin Communications System (CCS) Cabin Telecommunications Unit (CTU), as specified in ARINC Characteristic 746. It is baseband audio, nominally -15 dBm into 600 ohms (0 dBm max), utilizing in-band DTMF signaling. Either this analog interface, or the digital (CEPT E-1) interface, may be used between the SDU and the CTU, but not both simultaneously. Use of either interface is indicated by the presence of signaling on the appropriate wire pairs.

[5] System Configuration pin definition and interpretation details are shown in Attachment 1-4B. The SDU may support connections to the System Configuration pins, the APM (see note 2) or both; but only one method is implemented in any given aircraft installation.

[6] The Communications Management Unit (CMU) or equivalent integrates data communications via the satellite communications system with data communications via other data links on the aircraft. The CMU exchanges data with the SDU at the physical layer on an ARINC 429 data bus, and at the link layer using the bit-oriented file transfer protocol. The CMU utilizes the ISO 8208 subnetwork layer (packet level) protocol, as described in that international standard.

[7] ARINC 429 low speed data bus.

[8] ARINC 429 high speed data bus.

[9] Units functioning normally should annunciate this fact by placing a voltage between +15 Vdc and +36 Vdc relative to airframe dc ground on the connector pins assigned to the LNA/DIP BITE discrete output.

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

Absence of this voltage is interpreted as a fault annunciation. BITE annunciation is not required when the unit has been commanded "off".

[10] The LNA/DIP On/Off control and flightdeck/cockpit Voice Call should provide an internal switch closure to ground. The switch "contact" should be open for (i) off, (ii) no flightdeck/cockpit voice call annunciation, and closed for (i) on, (ii) flightdeck/cockpit voice call annunciation active. The "open" voltage holdoff should be 36 Vdc maximum, the potential across the "closed" switch should be 1 Vdc or less and the current handling capacity should be 500 mA maximum The system configuration as defined in Attachments 1-4A and 1-4B specifies whether the flightdeck/cockpit voice call annunciation is to be steady or flashing. If flashing, the duty cycle should be 50%, and the period should be 0.5 to 1 second.

[11] The SDU should sense the closure of an external switch to dc ground. The resistance to airframe dc ground presented to the SDU connector pins should be 100,000 ohms or more when the external switch is open and 10 ohms or less when the switch is closed. The closed state of the external switches indicates that (i) a flightdeck/cockpit microphone is in use with the SDU, (ii) the Voice Go-Ahead (Chime) output should be reset. In the case of (i), this input can be wired to either the SDU-selected PTT switch, or to an ACP SDU mic transmit key switch suitably latched for the duration of the call as specified by APM system configuration 36_h (see Attachment 1-4A) or by system configuration pin TP13K (see Attachment 1-4B).

[12] These pins are reserved to permit high speed data buses to be used by the avionics manufacturers for interfacing with non-ARINC 761 equipment. Where the functions are unspecified, manufacturers may utilize the interconnect capability as they choose, recognizing the limitations of the twisted-shielded pair medium.

[13] The SDU should close a circuit between pins MP14B and MP14C when the voice go-ahead (chime) output is to be activated such that a current of 1 amp may flow through an external device fed from a 28 Vdc source. The maximum holdoff voltage in the open circuit condition should be 36 Vdc. The minimum hold time (for both the on and off states) should be 250 ms. The system configuration as defined in Attachments 1-4A and 1-4B (pins TP13C and TP13D) specifies whether the chime is to be single or multi-stroke. If multi-stroke, the period should be 0.5 to 1 second.

[14] These pins may optionally be used to encode the ICAO 24-bit aircraft address of the aircraft in which the SDU is installed. Pins assigned to bits that take on the binary "one" state in a given code should be left open circuit. Pins assigned to take on the binary "zero" state in the code should be jumpered to pin MP15K (Address Common) on the airframe side of the connector.

[15] The shields of twisted and shielded pairs of wires used for audio signal transfer should be grounded at the transmitter end only. ARINC Report 412 provides more information on audio system installation and shield grounding. Although interwiring is desired for two flightdeck/cockpit audio channels, the SDU need provide the electronics for only one.

[16] The Multi-Control Output signal is routed to the following LRUs (if installed): HPA, HLD and BSU(s).

[17] For an 02 top plug insert SDU, pin MP5A provides On/Off control of an LGA LNA; for an 08 top plug insert SDU, pin MP5A provides On/Off control of the IGA LNA. Similarly, for an 02 top plug insert SDU, pin MP5G provides BITE feedback for an LGA LNA; while for an 08 top plug insert SDU, pin MP5G provides BITE feedback for the IGA LNA.

[18] Reserved for Manufacturer Specific Function.

[19] In installations configured for an HPA or HLD, Source/Destination Identification should be provided for these LRUs as shown below. Pins that take on the binary "zero" state in a code should be left open circuit. Pins that take on the binary "one" state should be jumpered on the Airframe side of the connector to the pin assigned as "SDI Common".

HPA/HLD SDI Code*		
Interpretation	TP5B (Bit 10)	TP5A (Bit 9)
Reserved	0	0
LGA HPA	0	1
IGA HPA	1	0
Unused	1	1

* ARINC 429

[20] Since stand-alone BSUs are typically not installed as part of ARINC 761 systems, the details of their interconnection to the system are not included herein; reference ARINC Characteristic 741 Part 1.

[21] Reserved for future use.

[22] The characteristic impedance of each coaxial interface should be 50 ohms. The interconnection cabling used depends on the LRUs installed, which is determined by the configuration involved; refer to Attachment 1-2 for details.

[23] The SDU should sense the closure of an external switch to dc ground. The resistance to airframe dc ground presented to the SDU connector pins should be 100,000 ohms or more when the external switch is open, and 10 ohms or less when the switch is closed. The closed state of the switch disables the transmit function of the AES (i.e., mutes the HPA) and the open state enables the transmit function of the AES.

[24] Reserved for future use.

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

[25] This Multi-purpose Control Display Unit (MCDU)/Satellite Control Display Unit (SCDU) interface is used to permit the SDU to be managed by a flightdeck/cockpit control panel. The SDU should be capable of exchanging command and control information using the MCDU protocol standards defined in ARINC Characteristic 739A. Display and control details are manufacturer-specific. Note that no messages for the air-ground link are originated in or routed to the *MCDU/SCDU* over this interface. The details of this interface are manufacturer-specific.

[26] Reserved for future use.

[27] These pins are reserved for possible future use as unspecified program pins whose functions are defined by the avionics suppliers. They are to be left open circuit or wired to pin MP15K, "ICAO 24-bit aircraft address common", as necessary.

[28] Reserved for future use.

[29] Interface details are per ARINC Report 615. Interwiring is only required on those aircraft having an ARINC 615 Airborne Computer High Speed Data Loader installed. Per standard ARINC Specification 429 provisions, one Data Loader ARINC 429 output may drive multiple LRUs, but each LRU drives the Data Loader with an independently wired ARINC 429 bus, with an independent A/B discrete between each LRU and the Data Loader.

[30] These pins are reserved to permit high speed data buses to be used by the avionics manufacturers for interfacing with non-ARINC 761 equipment. Where the functions are unspecified, manufacturers may utilize the interconnect capability as they choose, recognizing the limitations of the twisted-shielded pair medium. In a Type A installation (reference Attachment 1-2) the 8 MCU SDU pins MP9E/F correspond to Data Bus to IGA (RS-422), while pins MP9G/H correspond to Data Bus from IGA (RS-422); these data buses need only be configured to low speed ARINC 429 wiring specifications.

[31] Reserved for future use.

[32] Reserved for future use.

[33] LRU and wire bundles/connectors should be identified via the table provided below:

LRU	Connector Function (Common)	Numeric Code	Wire Bundle
LNA/DIP *and LDH*	Antenna I/O	1	J1
	Rx Output	2	J2
	Tx Input	3	J3
	Power/Signal	4	J4

[34] Reserved for future use.

[35] Details of this interface are not yet defined.

[36] For Location, attitude determination, and computed Doppler correction, the following ARINC 429 Octal labels should be transmitted from the IRS, ADIRS, ADSU, or equivalent.

Label	Parameter
310	Present Position – Latitude
311	Present Position – Longitude
312	Ground Speed
313	Track Angle
314	True Heading
324	Pitch Angle
325	Roll Angle
361	Inertial Altitude

[37] A single SATCOM system (inclusive of avionics and antenna) should be protected by a 115 Vac 7.5 amp circuit breaker having a Type A (short delay) response. When Dual SATCOM systems are installed, the breakers utilized by each system should be the same as for the single system case. The 115 Vac wiring depends on the LRUs installed, which is defined by the configuration involved; refer to Attachment 1-2 for details.

[38] System Configuration Pins definition and interpretation details are shown in Attachment 1-4B.

[39] Reference Attachments 1-4A and 1-4B (pin TP13B) for the definition of the speed (high or low) of this ARINC 429 bus.

[40] These discretes are used to enable the SDU to determine whether or not the aircraft is airborne. The inputs should be programmable such that the "true" state may be annunciated by either an airframe dc ground, defined as 0 ±3 Vdc or a resistance to dc ground of less than 1500 ohms at the SDU connector pin MP5B, or an open circuit or voltage. An open circuit is defined as a resistance of 100,000 ohms or more between pin MP5B (or MP5C) and airframe dc ground. The voltage at an input for a "true" indication should be 7 Vdc or more (max 30 Vdc). For this condition, the SDU should present a load of at least 10,000 ohms at each input. Resistance sensing should be based on current flow from the SDU to airframe dc ground.

Programming should be achieved by means of SDU connector pin MP5D. When this pin is open circuit, the "false" state of its associated input should be indicated by the open circuit or voltage condition, and the "true" state by the dc ground condition. When the program pin is connected to MP15K (address common), the "false" state of the associated input should be indicated by the dc ground condition, and the "true" state by the open circuit or voltage condition. In all cases, the "true" state is associated with the aircraft on the ground. These discretes are only wired if equivalent information is not strapped as being available to the SDU on an ARINC 429 input, for example, IRS or the CFDS. Appropriate fail-safe logic (assuming airborne when the air/ground state is unknown, or when multiple

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

ARINC 429 sources contradict each other) should be used in most cases. However, when two or more ARINC 429 sources are wired and no valid data is available (including reception of invalid data), the on-ground state may be assumed in order to enable normal ground maintenance activities independent of other aircraft equipment.

[41] The CEPT-E1 data bus is defined in ITU-T G.703 and G.704. One suitable contender for the twisted shielded cable used for the CEPT E1 buses is Aerospatiale Specification HE24. Other cable types with similar or better characteristics are acceptable. Installation designers are cautioned against the use of twisted shielded cables used presently for ARINC 429 data bus applications as there may be problems in meeting RTCA DO-160 and other specifications in this application.

[42] An SDU may be wired to any two of up to three IRSs. Attachments 1-4A and 1-4B define which IRS pins on the SDU are wired to sources of IRS data.

[43] This discrete input is used to permit the SDU to inhibit SATCOM activation of the chime and call light during takeoff and landing flight phases. If ground-initiated call signaling is still active on the satellite channel when the inhibit is released (i.e., the call has not yet been cleared by the terrestrial party), the chime and light should be activated immediately in the normal fashion.

The input "true" state (i.e., takeoff or landing phase/inhibit chime and lamps) is annunciated by either an airframe dc ground (defined as ±3 Vdc), or a resistance of less than 1500 ohms, between the SDU connector pin and airframe dc ground. The "false" state (i.e., enable chime and lamps) is annunciated by either 7 Vdc or more (maximum 30 Vdc), or an open circuit (a resistance of 100,000 ohms or more), between the SDU connector pin and airframe dc ground.

[44] Reserved for future use.

[45] Messages for the Air/Ground link are not routed over this interface.

[46] The SDU should sense a momentary (typically no less than 100 milliseconds) closure of external switches to dc ground. The resistance to airframe dc ground presented to the SDU connector pins should be 100,000 ohms or more when open, and less than 10 ohms when grounded. The transition from open to ground on the external switches indicates End Call for any ongoing call on the respective channel, or if there is no ongoing call, to indicate Place ATC Call if there is a telephone number in the ATC Call Register.

[47] Reference Attachments 1-4A and 1-4B (pin TP10D) for the definition of the speed (high or low) of these ARINC 429 buses.

[48] Reserved for future use.

[49] This optional port may be used for GES-Specific Data Broadcast (GSDB) data. Such data received from the satellite link is forwarded on this port to a Satellite News Unit (SNU) as specified in ARINC Characteristic 741, Part 1, Attachment 2, for the "GSDB Word sequence - SDU to SNU".

This optional output port may also be used for Cabin Packet-Mode Data (CPD), see Note 54. Both applications may share this port by using unique labels/SALs.

[50] Reserved for future use.

[51] Reserved for future use.

[52] This SDU output may also be wired to the EICAS/ECAM/EDU to permit that unit to monitor the Label 270 word.

[53] Reserved for future use.

[54] These optional ARINC 429 input and output ports may be used to provide packet-mode data services for the Cabin Packet-mode Data Function (CPDF).

[55] Reference Attachments 1-4A and 1-4B (pin TP10F) for the definition of the speed (high or low) of this ARINC 429 bus.

[56] These dc voltage sources are generated either by the 8 MCU SDU or the 4 MCU HPA for use by an IGA. The actual wiring required depends on the LRUs installed, which is determined by the configuration involved; refer to Attachment 1-2 for details. Standard #22 AWG wire is sufficient for these interconnections. Neither the 4 MCU SDU, the 6 MCU SDU, nor the HLD supports these voltages on any pins.

[57] The 4 MCU HPA supports the IGA data buses and LNA/DIP control lines shown as part of a Type B configuration (see Attachment 1-2). These data buses need only be configured to low speed ARINC 429 wiring specifications. The HLD configurations do not require these lines and hence do not implement them; they are all designated as Future Spares for the HLD except for TP2E and TP2H, which are Spare Discrete Input and Spare Discrete Output, respectively.

[58] This RF output port is connected to the D/LNA Tx input port in installations including the HPA; for installations using the HLD, this port is connected directly to the IGA port.

[59] ARINC 741-compatible systems may use SDU pins MP7E/F for steering inhibit of ACU/BSUs by the SDU, and may use HPA/HLD pins TP3A/B for HPA/HLD muting by an ACU/BSU. (These HPA/HLD mute functions are only utilized in configurations in which a BSU is installed; reference ARINC Characteristic 741, Part 1, Attachments 1-2, 1-3, and 1-4.)

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

[60] These CEPT E1 circuits may be used to interface an SDU having optional Multiple Bearer System (MBS) capability with an optional Complementary SATCOM System (CCS) consisting of a channel-unit LRU with its own antenna subsystem. The CSS may be used to add dissimilar SATCOM system capability (e.g., to add Globalstar, ICO, or other capability to an Inmarsat system) for more channels or greater overall SATCOM system availability without the need for a second SDU. This option does not preclude the option of a master/slave or independent second "dual" SATCOM system with its own SDU, with or without cross-talk control and communication on pins MP5J/K and MP12A/B/C/D. Aside from this physical/electrical interface standard, the details of the SDU-CSS interface are manufacturer–specific.

[61] There are a variety of means of interfacing different kinds of facsimile (fax) machines and other circuit-mode data equipment (e.g., personal computers, secure voice terminals) to the SATCOM system, including direct connection to the SDU, or via a DIU or TIFU (either of which can be a physical unit or integrated into the SDU -- reference ARINC Characteristic 741 Part 2 Section 4.4.3 and its subsections, which in turn reference the Inmarsat aeronautical system definition manual modules 1, 2 and 5), or via an ARINC 746 cabin communications system (CCS) cabin telecommunications unit (CTU, which may also involve an intervening cabin distribution system [CDS -- reference ARINC Specification 628]). Options include analog interconnections (utilizing voice-band modems) and direct digital-interconnect data service. The SDU physical interfaces referencing this note (Cabin Digital Voice/Data CEPT-E1 [CTU] and Analog PBX) have the potential to support one or more of these options. Refer to the relevant vendors for specific options and details.

[62] These pins may have various applications, depending on the specific SDU manufacturer. For example, TP3F – TP3J are reserved for a two-wire hybrid fax interface on some SDUs; TP3G – TP3K are reserved for CEPT – E1 signaling on some SDUs. Contact the SDU vendor for specific interface information.

ATTACHMENT 1-4A
APM SYSTEM CONFIGURATION

STAFF NOTE: The incomplete state of the material formerly in this Attachment has been preserved as-is (for possible future use after completion) in the change summary for Supplement 2."

ATTACHMENT 1-4B
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION [1]

Table 1-3 Signal Assignments [8]

08 Insert	02 Insert	Description
[TP2A]	TP10A:	Availability of ICAO 24-bit Aircraft Address (AES ID) from ARINC 429 Ports
[TP2B]	TP10B:	FMC Connection to SDU
[TP2C]	TP10C:	FMC Connection to SDU
[TP2D]	TP10D:	ARINC 429 Bus Speed to/from CMU #1/#2
[TP2E]	TP10E:	CPDF Configuration
[TP2F]	TP10F:	ARINC 429 Bus Speed of AES ID Input
[TP2G]	TP10G:	Reserved for Strap Option
[TP2H]	TP10H:	Reserved for Strap Option
[TP2J]	TP10J:	Reserved for Strap Option
[TP2K]	TP10K:	Call Light Activation
[TP3A]	TP11A:	Strap Parity (Odd); Covering the other 39 Strap Pins
[TP3B]	TP11B:	CCS Presence
[TP3C]	TP11C:	IRS Configuration
[TP3D]	TP11D:	IRS Configuration
[TP3E]	TP11E:	HPA/Antenna Subsystem Configuration
[TP3F]	TP11F:	HPA/Antenna Subsystem Configuration
[TP3G]	TP11G:	HPA/Antenna Subsystem Configuration
[TP3H]	TP11H:	HPA/Antenna Subsystem Configuration
[TP3J]	TP11J:	HPA/Antenna Subsystem Configuration
[TP3K]	TP11K:	HPA/Antenna Subsystem Configuration
[TP4A]	TP12A:	CFDS Type
[TP4B]	TP12B:	CFDS Type
[TP4C]	TP12C:	CFDS Type
[TP4D]	TP12D:	Reserved for Aircraft ID ARINC 429 Input, or PAD for CFDS/SDU Configuration
[TP4E]	TP12E:	SDU Configuration
[TP4F]	TP12F:	SDU Number
[TP4G]	TP12G:	CMU #1 Configuration
[TP4H]	TP12H:	CMU #2 Configuration
[TP4J]	TP12J:	MCDU/SCDU #1 Configuration
[TP4K]	TP12K:	MCDU/SCDU #2 Configuration
[TP5A]	TP13A:	Option Priority 4 Calls to/from Cockpit
[TP5B]	TP13B:	ARINC 429 Bus Speed to MCDU/SCDU #1, #2, #3
[TP5C]	TP13C:	Cockpit Voice Call Light/Chime Options
[TP5D]	TP13D:	Cockpit Voice Call Light/Chime Options
[TP5E]	TP13E:	MCDU/SCDU #3 Configuration
[TP5F]	TP13F:	SDU CODEC 1 Wiring
[TP5G]	TP13G:	SDU CODEC 1 Wiring
[TP5H]	TP13H:	SDU CODEC 2 Wiring
[TP5J]	TP13J:	SDU CODEC 2 Wiring
[TP5K]	TP13K:	Cockpit Hookswitch Signaling Method

ATTACHMENT 1-4B
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION [1]

Table 1-3A Availability of ICAO 24-bit Aircraft Address (AES ID) from ARINC 429 Ports Coding

Pin TP10A/[TP2A]	Interpretation
1	ICAO 24-bit Aircraft Address (AES ID) Not Available from CMU #1 nor CMU #2 nor (reserved) AES ID Input
0	ICAO 24-bit Aircraft Address (AES ID) Is Available from CMU #1 and/or CMU #2 and/or (reserved) AES ID Input

Table 1-3B FMC Connection to SDU Coding

Pin TP10B/ [TP2B]	Pin TP10C/ [TP2C]	Interpretation
0	0	FMC #1 Connected, FMC #2 Connected
0	1	FMC #1 Connected, FMC #2 not Connected
1	0	FMC #1 Not Connected, FMC #2 Connected
1	1	Neither FMC Connected

Table 1-3C ARINC 429 Bus Speed to/from CMU #1/#2 Coding

Pin TP10D/[TP2D]	Interpretation
0	High Speed ARINC 429 bus
1	Low Speed ARINC 429 bus

Table 1-3D Cabin Packet Data Function (CPDF)

Pin TP10E/[TP2E]	Interpretation
0	CPDF Installed
1	CPDF Not Installed

Table 1-3E ARINC 429 Bus Speed of AES ID Input Coding

Pin TP10F/[TP2F]	Interpretation
0	High Speed ARINC 429 bus
1	Low Speed ARINC 429 bus

Table 1-3F Call Light Activation Coding

Pin TP10K/[TP2K]	Interpretation
0	Call Light On at Call Initiation (for Air/Ground Calls)
1	Call Light On at Call Connection(for Air/Ground Calls)

Table 1-3G Strap Parity (Odd)

Pin [2] TP11A/[TP3A]	Interpretation
0	Sum of all other Straps set to 1 is Odd
1	Sum of all other Straps set to 1 is Even

ATTACHMENT 1-4B
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION [1]

Table 1-3H Cabin Communication System (CCS) Coding

Pin TP11B/[TP3B]	Interpretation
0	CCS Installed
1	CCS Not Installed

Table 1-3I Is Skipped Intentionally.

Table 1-3J IRS Configuration Coding

Pins TP11C/ [TP3C]	Pins TP11D/ [TP3D]	Interpretation
0	0	Primary IRS Installed, Secondary IRS Installed
0	1	Primary IRS Installed, Secondary IRS Not Installed
1	0	Primary IRS Not Installed, Secondary IRS Installed
1	1	Primary IRS Not Installed, Secondary IRS Not Installed

ATTACHMENT 1-4B
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION [1]

Table 1-3K HPA/Antenna Subsystem Configuration [3]

[9] Decimal Code	Pins TP11/[TP3] E	F	G	H	J	K	LGA + LNA / DIPLEXER	LGA HPA	TOP / PORT BSU + HGA	STARBOARD BSU + HGA	HGA HPA	HPR	RESERVED FOR FUTURE	*TOP BSU / ACU + IGA*	*DETEXIS IGA*	*EMS IGA*	*BSC IGA*	*OMNIPLESS IGA*	*TECOM IGA*	*SPARE*	*SPARE*	*SPARE*	*SPARE*	*SPARE*	*SPARE*	*SPARE*	RESERVED FOR MFR	
	E	F	G	H	J	K																					
63	1	1	1	1	1	1	*	*																			
62	0	1	1	1	1	1			*		*																
61	1	0	1	1	1	1	*	*	*		*																
60	0	0	1	1	1	1	*	*	*	*	*	*															
59	1	1	0	1	1	1							*														
58	0	1	0	1	1	1							*														
57	1	0	0	1	1	1	*		*		*	*																[6]
56	0	0	0	1	1	1	*	*	*	*		*																[6]
55	1	1	1	0	1	1			*	*	*	*															
30-54	0 *0*	1 *1*	1 *1*	0 *1*	1 *1*	1 *0*							*														
20-29	*1 0*	*0 0*	*1 1*	*1 0*	*1 1*	*0 0*																					*
11-19	*1 1*	*1 1*	*0 0*	*0 1*	*1 0*	*0 0*							*														
10	*0*	*1*	*0*	*1*	*0*	*0*									*												
9	*1*	*0*	*0*	*1*	*0*	*0*	*	*							*												
8	*0*	*0*	*0*	*1*	*0*	*0*										*											
7	*1*	*1*	*1*	*0*	*0*	*0*											*										
6	*0*	*1*	*1*	*0*	*0*	*0*	*	*									*										
5	*1*	*0*	*1*	*0*	*0*	*0*								*													
4	*0*	*0*	*1*	*0*	*0*	*0*	*	*						*													
3	*1*	*1*	*0*	*0*	*0*	*0*												*									
2	*0*	*1*	*0*	*0*	*0*	*0*							*														
1	*1*	*0*	*0*	*0*	*0*	*0*													*								
0	0	0	0	0	0	0																					*

ATTACHMENT 1-4B
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION [1]

Table 1-3L CFDS Type Coding

Pins TP12/[TP4] A	B	C	Interpretation
0	0	0	Undefined
0	0	1	McDonnell-Douglas Type CFDS
0	1	0	Airbus Type CFDS
0	1	1	Honeywell CAIMS
1	0	0	Boeing Type CFDS
1	0	1	Undefined
1	1	0	Undefined
1	1	1	CFDS Not Installed

Table 1-3M SDU Configuration Coding

Pin TP12E/[TP4E]	Interpretation
0	Second SDU Installed
1	Second SDU Not Installed

Table 1-3N SDU Number Coding [4]

Pin TP12F/[TP4F]	Interpretation
0	SDU #2
1	SDU #1

Table 1-3P CMU #1 Installed Coding

Pin TP12G/[TP4G]	Interpretation
0	CMU #1 Installed
1	CMU #1 Not Installed

Table 1-3O Is Skipped Intentionally.

Table 1-3Q CMU #2 Installed Coding

Pin TP12H/[TP4H]	Interpretation
0	CMU #2 Installed
1	CMU #2 Not Installed

Table 1-3R MCDU/SCDU #1 Installed Coding

Pin TP12J/[TP4J]	Interpretation
0	MCDU/SCDU #1 Installed
1	MCDU/SCDU #1 Not Installed

ATTACHMENT 1-4B
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION [1]

Table 1-3S MCDU/SCDU #2 Installed Coding

Pin TP12K/[TP4K]	Interpretation
0	MCDU/SCDU #2 Installed
1	MCDU/SCDU #2 Not Installed

Table 1-3T Priority 4 Calls to /from Cockpit [7]

Pin TP13A/[TP5A]	Interpretation
1	Allow Priority 4 Calls to/from the Cockpit
0	Inhibit Priority 4 Calls to/from the Cockpit

Table 1-3U ARINC 429 Bus Speed to MCDU/SCDU #1, #2, #3

Pin TP13B/[TP5B]	Interpretation
0	Low Speed ARINC 429 bus
1	High Speed ARINC 429 bus

Table 1-3V Cockpit Voice Call Light/Chime Option Coding

Pins [5] TP13C/ [TP5C]	TP13D/ [TP5D]	Interpretation
0	0	Spare
0	1	Steady Lights & Multistroke Chime
1	0	Flashing Lights & Single Stroke Chime
1	1	Steady Lights & Single Stroke Chime

Table 1-3W MCDU/SCDU #3 Installed Coding

Pin TP13E/[TP5E]	Interpretation
0	MCDU/SCDU #3 Installed
1	MCDU/SCDU #3 Not Installed

Table 1-3X SDU CODEC 1 Wiring Coding

Pins TP13F/ [TP5F]	TP13G/ [TP5G]	Interpretation
0	0	AMS Wired, Cabin Audio Wired
0	1	AMS Wired, Cabin Audio Not Wired
1	0	AMS Not Wired, Cabin Audio Wired
1	1	AMS Not Wired, Cabin Audio Not Wired

ATTACHMENT 1-4B
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION [1]

Table 1-3Y SDU CODEC 2 Wiring Coding

Pins		Interpretation
TP13H/ [TP5H]	TP13J/ [TP5J]	
0	0	AMS Wired, Cabin Audio Wired
0	1	AMS Wired, Cabin Audio Not Wired
1	0	AMS Not Wired, Cabin Audio Wired
1	1	AMS Not Wired, Cabin Audio Not Wired

Table 1-3Z Cockpit Hookswitch Signaling Method Coding

Pin TP13K/[TP5K]	Interpretation
1	Switched PTT and/or SCDU Line Select Switch(es)
0	Latched Audio Control Panel SATCOM Mic Switch

[1] Pins assigned to bits that take on the binary "one" state in a given code should be left as open circuits. Pins assigned to take on the binary "zero" state in the code should be jumpered to pin MP15K (Address Common) on the airframe side of the connection.

[2] The coverage of the Parity Pin for the 02 insert connector is TP10A through TP10K and TP11B through TP13K (39 pins other than itself). The coverage of the Parity Pin for the 08 insert connector is TP2A through TP2K and TP3B through TP5K. The Parity Pin is programmed to a zero or one to yield an odd number of strap bits set to the one state, including the Parity Pin itself.

[3] *This table is an extension of the one in ARINC 741Characteristic Part 1, Attachment 1-4C, for pins TP11 E-K; any changes to this table should be coordinated with ARINC Characteristic 741. ARINC 761 SDUs make primary assumptions about their antenna subsystem configurations (e.g., presence or absence of IGA HPA, D/LNA, HLD and LDH) from their basic system configurations as shown in Attachment 1-2; SDU pins TP11/[TP3] E-K provide the detailed antenna subsystem configuration information. Decimal codes 4 and 5 cover IGAs with a standard ACU/BSU interface (reference ARINC Characteristic 741 Part 1, including Attachments 1 and 2). For the more typical configurations where the IGA's ACU/BSU functions are integrated into another LRU (e.g., SDU or HPA), the specific antenna type must be identified. Pseudo-dual IGA + LGA configurations (as for those defined for HGA + LGA in ARINC Characteristic 741 Part 1, Attachment 1-2 Figure 3) are signified with "LGA" LRUs.* Other configurations are possible and may be added at a later date.

[4] The state of this strap is "Don't Care" for a single SDU configuration.

[5] The steady vs. flashing light option applies to the call annunciation phase only. The light remains on (steady) for the duration of the call after the acknowledgement of the annunciation with either the STEADY or FLASHING option.

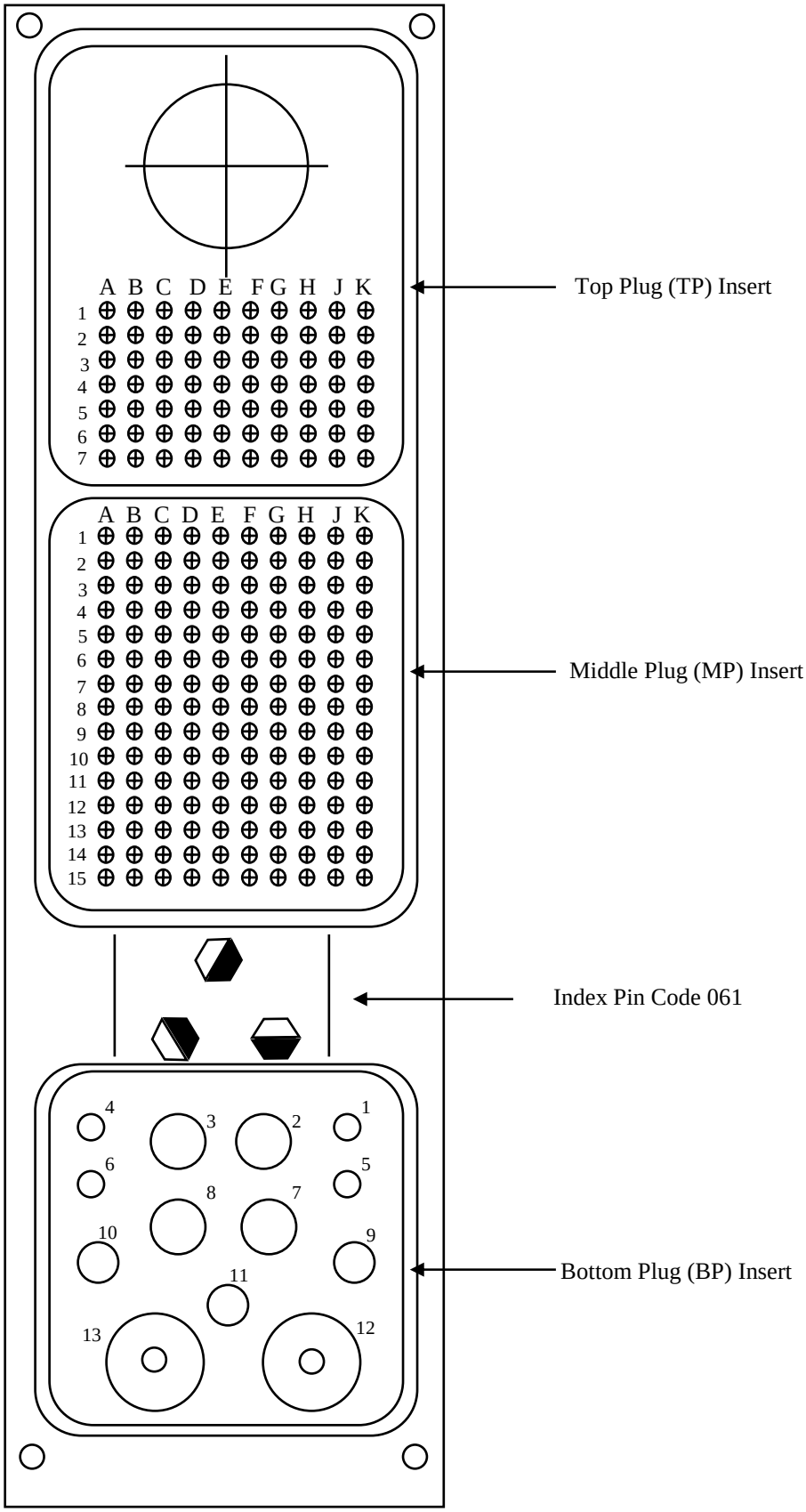
[6] Interwiring and operation is TBD.

[7] The following apply for the case of this pin wired to the 0 state: Priority 4 calls are not allowed to or from the cockpit AMS. ORT item "i" (Allowance and Routing of ground-initiated Public Correspondence/Priority 4 calls--reference ARINC Characteristic 741 Part 2 Section 4.5.2.3) cannot be allowed to specify the cockpit AMS. (If Priority 4 calls are Allowed by item "i", they are to be routed to the CCS or cabin analog phones). All cockpit AMS-initiated calls are to be processed at Priority 3 or higher. Additionally, ORT item "g" (Codec Dedication) cannot be allowed to specify Cabin dedication.

[8] System Configuration pins associated with the 02 top plug insert of the SDU correspond exactly to those specified in ARINC Characteristic 741, Part 1, for the SDU. Those System Configuration pins associated with the 08 top plug insert of the SDU (possessing a type 5 RF coaxial connector as well as interconnection pins) are bracketed to denote clearly their new pin number assignments.

[9] For referencing convenience, the decimal equivalent is given for the binary coding shown for pins E – K, treating pin E as the LSB and pin K as the MSB.

ATTACHMENT 1-5A1
4 OR 8 MCU SDU CONNECTOR REAR VIEW



ATTACHMENT 1-5A3
4 OR 8 MCU SDU MIDDLE PLUG CONNECTOR LAYOUT

	A	B	C	D	E	F	G	H	J	K
1	Reserved Cabin #1 Audio Input Hi	Reserved Cabin #1 Audio Input Lo	Reserved Cabin #1 Audio Output Hi	Reserved Cabin #1 Audio Output Lo	Reserved Data From CPDF A	Reserved Data From CPDF B	From CMU #1 429 A	From CMU #1 429 B	To CMU #1 & #2 429 A	To CMU #1 & #2 429 B
2	Cockpit Audio Input #1 Hi	Cockpit Audio Input #1 Lo	Cockpit Audio Output #1 Hi	Cockpit Audio Output #1 Lo	Cockpit Audio Input #2 Hi	Cockpit Audio Input #2 Lo	Cockpit Audio Output #2 Hi	Cockpit Audio Output #2 Lo	Cabin Dig Voice/ Data Input CEPT-E1 A	Cabin Dig Voice/ Data Input CEPT-E1 B
3	Cabin Digital Voice/Data Output CEPT-E1 A	Cabin Digital Voice/Data Output CEPT-E1 B	Data From SCDU #1 A	Data From SCDU #1 B	Data From SCDU #2 A	Data From SCDU #2 B	Data From CMU #2 A	Data From CMU #2 B	Data To SCDU #1, #2, & #3 A	Data To SCDU #1, #2, #3 B
4	Reserved AES ID Input A	Reserved AES ID Input B	From CFDS A	From CFDS B	To CFDS A	To CFDS B	Multi Control Output A	Multi Control Output B	Reserved Cabin #2 Audio Input Hi	Reserved Cabin #2 Audio Input Lo
5	LGA LNA On/Off Control	Reserved For Weight On Wheels Input #1	Input #2	Program Select	Reserved Cabin #2 Audio Output Hi	Reserved Cabin #2 Audio Output Lo	BITE Input Disc From LGA LNA	Chime/ Lamps Inhibit	Dual System Select Discrete I/O	Dual System Disable Discrete I/O
6	Data From Primary IRS A	Data From Primary IRS B	Data From Secondary IRS A	Data From Secondary IRS B	BITE Input From IGA HPA A	BITE Input From IGA HPA B	Spare 429 Input A	Spare 429 Input B	BITE Input From LGA HPA A	BITE Input From LGA HPA B
7	From Airborne Data Loader A	From Airborne Data Loader B	To Airborne Data Loader A	To Airborne Data Loader B	Reserved Steer. Inh to BSU A	Reserved Steer. Inh to BSU B	Reserved BITE Input From Top BSU A	Reserved BITE Input From Top BSU B	Reserved BITE Input From Starboard BSU (ARINC 429)	Reserved BITE Input From Starboard BSU (ARINC 429)
8	Data Loader Link A	Data Loader Link B	Reserved Data From RMP A	Reserved Data From RMP B	CP Voice Call Light Output #1	CP Voice Mic On Input #2	CP Voice Call Light Output #2	CP Voice Mic On Input #2	Data From SCDU #3 A	Data From SCDU #3 B
9	Reserved Data To SNU/CPDF A	Reserved Data To SNU/CPDF B	Reserved Data To RMP A	Reserved Data To RMP B	*Unspec* *Function* *A*	*Unspec* *Function* *B*	*Unspec* *Function* *A*	*Unspec* *Function* *B*	*Reserved* *Data Bus* *From* *CSS CEPT E1* *A*	*Reserved* *Data Bus* *From* *CSS CEPT E1* *B*
10	*Reserved* *Data Bus* *to* *CSS CEPT E1* *A*	*Reserved* *Data Bus* *to* *CSS CEPT E1* *B*	Unspec Function A	Unspec Function B	Unspec Function A	Unspec Function B	Unspec Function A	Unspec Function B	Unspec Function A	Unspec Function B
11	From Motion Sensor #1	Motion Sensor #1 Program Select	Call Place/End Discrete Input #1	Call Place/End Discrete Input #2	Reserved Unspec Program	Reserved Unspec Program	Reserved Unspec Program	Reserved Unspec Program	Reserved Unspec Program	Reserved Unspec Program
12	Reserved Crosstalk From Other SDU A	Reserved Crosstalk From Other SDU B	Reserved Crosstalk To Other SDU A	Reserved Crosstalk To Other SDU B	○	○	Reserved Data From FMC #1 A	Reserved Data From FMC #1 B	Reserved Data From FMC #2 A	Reserved Data From FMC #2 B
13	Spare Discrete Output 28 Vdc Call Lamp Type	Reserved TX Mute	ICAO Aircraft Address Bit #1 (MSB)	ICAO Aircraft Address Bit #2	ICAO Aircraft Address Bit #3	ICAO Aircraft Address Bit #4	ICAO Aircraft Address Bit #5	ICAO Aircraft Address Bit #6	ICAO Aircraft Address Bit #7	ICAO Aircraft Address Bit #8
14	CP Voice Chime Reset #1	CP Voice Chime Signal Contact 1	CP Voice Chime Signal Contact 2	ICAO Aircraft Address Bit #9	ICAO Aircraft Address Bit #10	ICAO Aircraft Address Bit #11	ICAO Aircraft Address Bit #12	ICAO Aircraft Address Bit #13	ICAO Aircraft Address Bit #14	ICAO Aircraft Address Bit #15
15	ICAO Aircraft Address Bit #16	ICAO Aircraft Address Bit #17	ICAO Aircraft Address Bit #18	ICAO Aircraft Address Bit #19	ICAO Aircraft Address Bit #20	ICAO Aircraft Address Bit #21	ICAO Aircraft Address Bit #22	ICAO Aircraft Address Bit #23	ICAO Aircraft Address Bit #24 (LSB)	ICAO Aircraft Address Common

ATTACHMENT l-5B2
4 or 6 MCU SDU TOP PLUG CONNECTOR LAYOUT

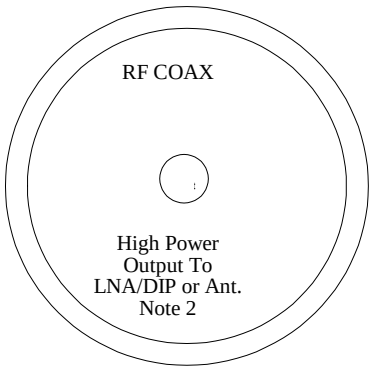
	A	B	C	D	E	F	G	H	J	K
1	0-15 V Discrete Input	0-15 V Discrete Input	0-7 V Discrete Output	0-7 V Discrete Output	0-7 V Discrete Output	0-7 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output
2	Reserved Analog PBX Channel 1 Input Hi	Reserved Analog PBX Channel 1 Input Lo	Reserved Analog PBX Channel 1 Output Hi	Reserved Analog PBX Channel 1 Output Lo	Reserved Analog PBX Channel 2 Input Hi	Reserved Analog PBX Channel 2 Input Lo	Reserved Analog PBX Channel 2 Output Hi	Reserved Analog PBX Channel 2 Output Lo	O	O
3	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	*Reserved MFR. Specific*	*Reserved MFR. Specific*	*Reserved MFR. Specific*	*Reserved MFR. Specific*	*Reserved MFR. Specific*
4	APM Power Source	APM Power Return	APM Clock	Serial Data Bus From APM	Serial Data Bus To APM	APM Write Enable #1	APM Write Enable #2	APM Enable #1 Output	APM Enable #2 Output	O
5	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific
6	Spare 429 Input	Spare 429 Input	Spare 429 Output	Spare 429 Output	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific
7	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific
8	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific
9	Spare Discrete Input Config. Strap Type	Spare Discrete Input Config. Strap Type	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific	Reserved Manufacturer Specific
10	Option Avail. of ICAO 24-bit Aircraft Address	Option FMC Config.	Option FMC Config.	Option CMU #1/#2 Bus Speed	Option CPDF Presence	Option AES ID 429 Input Bus Speed	Reserved for Strap Option	Reserved for Strap Option	Reserved for Strap Option	Option Call Light Activation
11	Option Strap Parity (Odd)	Option CCS Presence	Option IRS Config.	Option IRS Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.
12	Option CFDS Type	Option CFDS Type	Option CFDS Type	Reserved A/C ID or CFDS/SDU Config.	Option SDU Config.	Option SDU Number	Option CMU #1 Config.	Option CMU #2 Config.	Option MCDU/ SCDU #1 Config	Option MCDU/ SCDU #2 Config.
13	Option Priority 4 Calls To/From Cockpit	Option MCDU/ SCDU Bus Speed	Option Light/ Chime Code	Option Light/ Chime Code	Option MCDU/ SCDU #3 Config.	SDU CODEC 1 Wiring	SDU CODEC 1 Wiring	SDU CODEC 2 Wiring	SDU CODEC 2 Wiring	Cockpit Signaling Method
14	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE
15	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE

ATTACHMENT 1-5B3
4 or 6 MCU SDU MIDDLE PLUG CONNECTOR LAYOUT

	A	B	C	D	E	F	G	H	J	K
1	Reserved Cabin #1 Audio Input Hi	Reserved Cabin #1 Audio Input Lo	Reserved Cabin #1 Audio Output Hi	Reserved Cabin #1 Audio Output Lo	Reserved Data From CPDF A	Reserved Data From CPDF B	From CMU #1 429 A	From CMU #1 429 B	TO CMU #1 & #2 429 A	TO CMU #1 & #2 429 B
2	Cockpit Audio Input #1 Hi	Cockpit Audio Input #1 Lo	Cockpit Audio Output #1 Hi	Cockpit Audio Output #1 Lo	Cockpit Audio Input #2 Hi	Cockpit Audio Input #2 Lo	Cockpit Audio Output #2 Hi	Cockpit Audio Output #2 Lo	Cabin Dig Voice/ Data Input CEPT-E1 A	Cabin Dig Voice/ Data Input CEPT-E1 B
3	Cabin Digital Voice/Data Output CEPT-E1 A	Cabin Digital Voice/Data Output CEPT-E1 B	Data From SCDU #1 A	Data From SCDU #1 B	Data From SCDU #2 A	Data From SCDU #2 B	Data From CMU #2 A	Data From CMU #2 B	Data To SCDU #1, #2, & #3 A	Data To SCDU #1, #2, #3 B
4	Reserved AES ID Input A	Reserved AES ID Input B	From CFDS A	From CFDS B	To CFDS A	To CFDS B	Multi Control Output A	Multi Control Output B	Reserved Cabin #2 Audio Input Hi	Reserved Cabin #2 Audio Input Lo
5	LGA LNA On/Off Control	Reserved For Weight On Wheels Input #1	Input #2	Program Select	Reserved Cabin #2 Audio Output Hi	Reserved Cabin #2 Audio Output Lo	BITE Input Disc From LGA LNA	Chime/ Lamps Inhibit	Dual System Select Discrete I/O	Dual System Disable Discrete I/O
6	Data From Primary IRS A	Data From Primary IRS B	Data From Secondary IRS A	Data From Secondary IRS B	BITE Input From IGA HPA A	BITE Input From IGA HPA B	Spare 429 Input A	Spare 429 Input B	BITE Input From LGA HPA A	BITE Input From LGA HPA B
7	From Airborne Data Loader A	From Airborne Data Loader B	To Airborne Data Loader A	To Airborne Data Loader B	Reserved Steer. Inh to BSU or TDMA Sys. Tx/Rx Ctrl A	Reserved Steer. Inh to BSU or TDMA Sys. Tx/Rx Ctrl B	Reserved BITE Input From Top BSU A	Reserved BITE Input From Top BSU B	Reserved BITE Input From Starboard BSU (ARINC 429)	Reserved BITE Input From Starboard BSU (ARINC 429)
8	Data Loader Link A	Data Loader Link B	Reserved Data From RMP A	Reserved Data From RMP B	CP Voice Call Light Output #1	CP Voice Mic On Input #2	CP Voice Call Light Output #2	CP Voice Mic On Input #2	Data From SCDU #3 A	Data From SCDU #3 B
9	Reserved Data To SNU/CPDF A	Reserved Data To SNU/CPDF B	Reserved Data To RMP A	Reserved Data To RMP B	Unspec Function A	Unspec Function B	Unspec Function A	Unspec Function B	*Reserved Data Bus From CSS CEPT E1 A*	*Reserved Data Bus From CSS CEPT E1 B*
10	*Reserved Data Bus To CSS CEPT E1 A*	*Reserved Data Bus To CSS CEPT E1 B*	Unspec Function A	Unspec Function B	Unspec Function A	Unspec Function B	Unspec Function A	Unspec Function B	Unspec Function A	Unspec Function B
11	From Motion Sensor #1	Motion Sensor #1 Program Select	Call Place/End Discrete Input #1	Call Place/End Discrete Input #2	Reserved Unspec Program	Reserved Unspec Program	Reserved Unspec Program	Reserved Unspec Program	Reserved Unspec Program	Reserved Unspec Program
12	Reserved Crosstalk From Other SDU A	Reserved Crosstalk From Other SDU B	Reserved Crosstalk To Other SDU A	Reserved Crosstalk To Other SDU B	O	O	Reserved Data From FMC #1 A	Reserved Data From FMC #1 B	Reserved Data From FMC #2 A	Reserved Data From FMC #2 B
13	Spare Discrete Output 28 Vdc Call Lamp Type	Reserved TX Mute	ICAO Aircraft Address Bit #1 (MSB)	ICAO Aircraft Address Bit #2	ICAO Aircraft Address Bit #3	ICAO Aircraft Address Bit #4	ICAO Aircraft Address Bit #5	ICAO Aircraft Address Bit #6	ICAO Aircraft Address Bit #7	ICAO Aircraft Address Bit #8
14	CP Voice Chime Reset #1	CP Voice Chime Signal Contact 1	CP Voice Chime Signal Contact 2	ICAO Aircraft Address Bit #9	ICAO Aircraft Address Bit #10	ICAO Aircraft Address Bit #11	ICAO Aircraft Address Bit #12	ICAO Aircraft Address Bit #13	ICAO Aircraft Address Bit #14	ICAO Aircraft Address Bit #15
15	ICAO Aircraft Address Bit #16	ICAO Aircraft Address Bit #17	ICAO Aircraft Address Bit #18	ICAO Aircraft Address Bit #19	ICAO Aircraft Address Bit #20	ICAO Aircraft Address Bit #21	ICAO Aircraft Address Bit #22	ICAO Aircraft Address Bit #23	ICAO Aircraft Address Bit #24 (LSB)	ICAO Aircraft Address Common

ATTACHMENT 1-6B
4 or 6 MCU HPA/HLD MIDDLE PLUG CONNECTOR LAYOUT

	A	B	C	D	E	F	G	H	J	K
1	○	○	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○	○	○
4	○	○	○	○	○	○	○	○	○	○
5	Note 1	Note 1	○	○	○	○	○	○	○	Note 3
6	Note 1	Note 1	○	○	○	○	○	○	○	Note 3
7	○	○	○	○	○	○	○	○	○	Note 3



MPC1

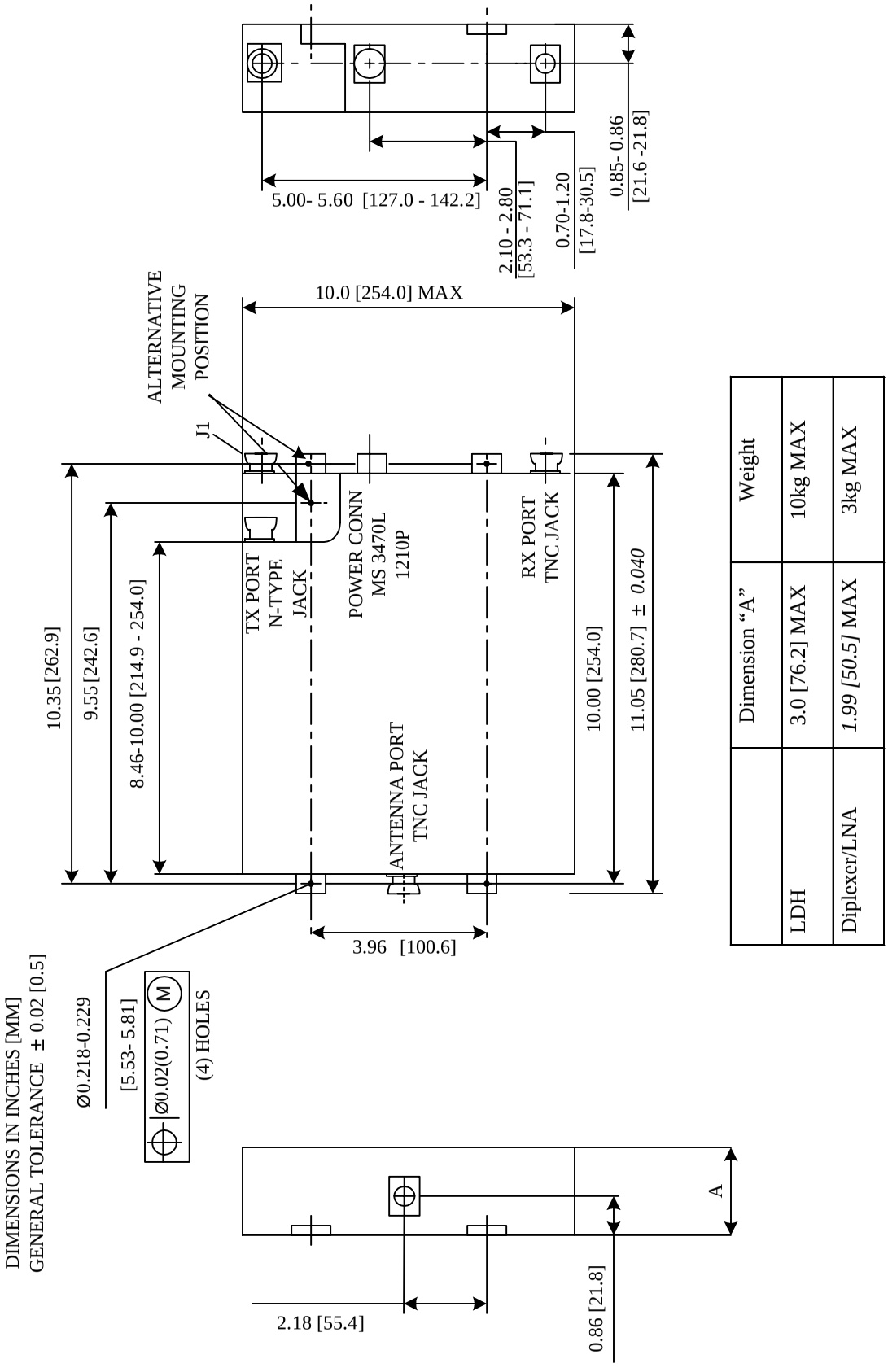
Notes:

[1] The definition of these pins for both the HPA and the HLD is given in Attachment 1-4, Note 57.

[2] The definition of this connector for both the HPA and the HLD is given in Attachment 1-4, Note 58.

[3] The definition of these pins for both the HPA and the HLD is given in Attachment 1-4, Note 56.

ATTACHMENT 1-7
LNA/DIP AND LDH FORM FACTORS



	Dimension "A"	Weight
LDH	3.0 [76.2] MAX	10kg MAX
Diplexer/LNA	*1.99 [50.5]* MAX	3kg MAX

ATTACHMENT 2
ARINC SPECIFICATION 429 LABELS

ARINC Specification *429* Labels contained in ARINC Characteristic 741 Part 1, Attachment 2 and Appendix 1 as well as ARINC Characteristic 741 Part 2, Sections 4.7, 4.8, 4.9, and 4.10, as applicable, apply unless otherwise noted below.

Items that do not apply for ARINC Characteristic 761 (e.g., RFU) are simply ignored (but *precluded* from different use, in order to maintain compatibility with ARINC Characteristic 741).

1. *Label 270:*

   For an SDU with Multi-Bearer System (MBS) capability as described in Item 2 below, the various fault and no-service bits in the Label 270 word (reference ARINC Characteristic 741 Part 2 Section 4.7.3.1, SDU to ACARS MU/CMU Status word) are interpreted as meaning the logical AND of the respective fault/no-service status of all of the supported bearer systems – i.e., the fault/no-service state is not indicated if at least one bearer system is OK with respect to the fault/no-service condition. The following bits in the Label 270 word, thus have the following amplified definitions (where N represents the number of bearer systems supported by the SDU):

   11 Data link via MU/CMU Not Available via bearer system 1 AND Not Available via bearer system 2…AND Not Available via bearer system N.

   13 SATCOM Voice Unavailable via bearer system 1 AND Unavailable via bearer system 2…AND Unvailable via bearer system N.

   17 SATCOM Not Logged-On via bearer system 1 AND Not Logged-On via bearer system 2…AND Not Logged-On via bearer system N.

   20 SATCOM Cockpit Fault via bearer system 1 AND via bearer system 2…AND via bearer system N.

   21 SATCOM Cockpit Voice Fault via bearer system 1 AND via bearer system 2…AND via bearer system N.

2. *For multiple bearer system (MBS)-capable SDUs and CMUs, the Williamsburg protocol "Destination Code" is used by the CMU to select which bearer system is to be used for each downlink Williamsburg file, and by the SDU to indicate which bearer system was used for each uplink file, on a file-by-file basis. The [C]MU is informed as to the real-time air/ground connectivity status of each possible bearer system (as one of the criteria for selecting a bearer system for a downlink file) by the appropriate Join/Leave event messages (see Label 172 Note 1). The SDU-relevant Destination Code definitions are as follows (reference ARINC Specification 429 P3 Attachment 11A and ARINC Specification 619 Attachment 3 Table 3-1):*

Binary	*Hex*	*Bearer System*
00001011	*0B*	*Inmarsat*
00001100	*0C*	*Spare*
00001101	*0D*	*ICO*
00001110	*0E*	*Globalstar*
01010011	*53 (ASCII "S")*	*Satellite link (generic)*
01010001	*51 (ASCII "Q")*	*[SDU #1/Left]*
01010010	*52 (ASCII "R")*	*[SDU #2/Right]*

Note: Character Destination codes Q and R have no role in the MBS protocol, and are included here only for completeness in listing all SDU-relevant codes. Codes Q and R are only used when the SDU transmits/receives onboard messages as an ACARS end system.

The CMU indicates its support of the Satcom MBS protocol in its Label 172 word transmissions to the SDU, as specified in ARINC Characteristic 758 Section 5.3.3.3 and Attachment 6 Table 6-15. If the [C]MU does not support MBS, the SDU can assume that the [C]MU is merely ARINC 741 compatible (i.e., the [C]MU will ignore bits 17-29 in the SDU's Label 172 words, as well as any Join/Leave Event messages other than Label 271), and thus the SDU (as well as the CMU) must use Destination character code "S" for downlinks and "M" for uplinks, and must use the Label 271 Join/Leave Event message (for Data-3), regardless of which bearer system service the SDU is providing at the time. All SDUs must also be capable of responding to character Destination code "S" from any [C]MU, meaning that the particular type of satellite downlink is not specified.

COMMENTARY

In this manner, non-MBS-compatible [C]MUs can interoperate with any type of SDU, and non-MBS-capable SDUs can interoperate with any type of [C]MU. Maximum usage of multi-bearer systems is assured when the CMU and SDU are both MBS-compatible, but even a non-MSB compatible [C]MU can still reap benefits from an MBS-capable SDU (e.g., greater availability of at least one air-ground link).

ATTACHMENT 2
ARINC SPECIFICATION 429 LABELS

Label 172 – Subsystem Identifier Word

32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
P	SSM		Satellite System Type													Subsystem SAL								Octal Label							
																173								172							
X	X	X	0	0	0	0	0	0	0	0	0	0	*0*	0	*1*	*1*	*1*	*0*	*1*	*1*	*1*	*1*	*0*	0	1	0	1	1	1	1	0

Bit	Description	Coding	Note
1	Label 172	0	
2	.	1	
3	.	1	
4	.	1	
5	.	1	
6	.	0	
7	.	1	
8	Label 172	0	
9	SAL (e.g. *173*)	*0*	
10	.	*1*	
11	.	*1*	
12	.	*1*	
13	.	*1*	
14	.	*0*	
15	.	*1*	
16	SAL	*1*	
17	Inmarsat Aero *H/H+/I/L* (“S”)	*1*	*2*
18	*Spare*	0	
19	*Spare*	*0*	*2*
20	Globalstar (“G”)	0	*2*
21	ICO (“C”)	0	*2*
22	Spare	0	*3*
23	Spare	0	*3*
24	Spare	0	*3*
25	Spare	0	*3*
26	Spare	0	*3*
27	Spare	0	*3*
28	Spare	0	*3*
29	Spare	0	3
30	SSM	X	*4*
31	SSM	X	*4*
32	Parity	X	

Notes:

[1] The SDU should transmit a Label 172 Subsystem Identifier at a rate of once per second on its output bus to the ACARS [C]MU. This word should contain the SAL of the SDU in bits 9 through 16. This data may subsequently be used by the ACARS [C]MU to facilitate subsystem LRU identification without specific interwiring definitions.

Satellite *bearer* system type is indicated in bits 17-29. *[Dynamic air/ground connectivity is indicated by one or more Join/Leave message types – e.g., reference ARINC Characteristic 741 Part 2, Section 4.7.3.3 for Label 271 for Inmarsat systems.]* In the example *above, Inmarsat Aero* is the only satellite service *supported*. If no bit is set to indicate the *satellite system type, then the [C]MU should assume it is Inmarsat Aero-H or Aero-L (with specific Aero service unspecified).* The [C]MU does not need to distinguish between *Inmarsat* Aero-L, *Aero-H, Aero*-I and Aero-H+ *except for possibly the cost per kilobit, which may be one of the CMU routing criteria; the current Aero service is indicated in the Join/*Leave *message]*. It *is* possible for *an SDU* to support more than one satellite type, simultaneously; *this is referred to as a Multi-Bearer System (MBS).* Therefore, more than one satellite type may be indicated, if applicable.

[2] The character shown after each satellite service provider is transmitted in the Media Advisory message, as described in ARINC Specification 620, Section 5.3.51.

[3] This example illustrates the coding for the Subsystem Identifier Word. All spare bits are set to binary 0.

[4] SSM per ARINC Specification 429.

ATTACHMENT 3
EQUIPMENT ENVIRONMENTAL CATEGORIES
(EUROCAE ED-14D/RTCA DO-160D)

The following RTCA DO-160/EUROCAE ED-14 environmental test categories apply to the design of the ARINC 761 Second Generation Aviation Satellite Communication System. The list is purely an example based on DO-160D/EUROCAE ED-14D. Manufacturers are advised that they must refer to the correct version of DO-160/EUROCAE ED-14.

More stringent categories may be required by some airframe manufacturers and/or regulatory agencies for some ED-14/DO-160 sections (e.g., induced lightning [Section 22]), particularly for essential-level certifications.

Environment Description	*ED-14D* *DO-160D* Section	Rack Mounted	Internal Airframe Mounted	External Airframe Mounted
Temperature/Altitude	4.0	A1 [3]	A2 [3]	F2
Temperature Variation	5.0	B	B	A
Humidity	6.0	A	A	C
Shock/Crash Safety	7.0	*B*	*B*	*B*
Vibration	8.0	*S2B2*	*S2C*	*S2C*
Explosion	9.0	X	X	X
Waterproofness	10.0	X	X	S
Fluids	11.0	X	X	F (de-ice)
Sand and Dust	12.0	X	X	D
Fungus	13.0	X	X	F
Salt Spray	14.0	X	X	S
Magnetic Effect	15.0	A	A	A
Power Input	16.0	E	E	E
Voltage Spike	17.0	A	A	A
Audio Susceptibility	18.0	E	E	E
Induced Signal	19.0	A	A	A
RF Susceptibility	20.0	*RRR*	*RRR*	*YYX [6]*
Emission of RF	21.0	*L*	L	L
Induced Lightning	22.0	A2XX	*A3XX*	XXE3
Direct Lightning	23.0	X	X	1A 1B 2A [5] [2]
Icing	24.0	X	X	A [4]
ESD	*25.0*	*A*	*A*	*X*

Notes:

[1] Unused.

[2] The lightning test category will be dictated by the placement of the antenna on the aircraft and the recommendations from the airframe manufacturer. Antennas over six inches in height above the fuselage should be tested in a Zone 1 lightning category.

[3] Decompression test is the maximum operating altitude of the aircraft.

[4] This requirement can be satisfied by load analysis.

[5] Test category dependent on the zone where the antenna is to be installed.

[6] *The third category character of the Section 20 specification refers to the pulse-modulated radiated susceptibility test. There is no specific separate pulse test required for the "Y" category level (other than the square wave modulation test, which is already specified in the second category character), hence the "X" (i.e., not tested) for the third character.*

APPENDIX 1
ACRONYMS AND ABBREVIATIONS

A/C	Aircraft
ac	alternating current
ACARS	Aircraft Communications Addressing and Reporting System
ACP	Audio Control Panel
ADIRS	Air Data Inertial Reference System
ADSU	Automatic Dependent Surveillance Unit
AEEC	Airlines Electronic Engineering Committee
AES	Aircraft Earth Station
AMCP	Aeronautical Mobile Communications Panel
AMS	Audio Management System
ANT	Antenna
AOC	Aeronautical Operational Control
APM	Airplane Personality Module
ARINC	Aeronautical Radio Inc
ATC	Air Traffic Control
ATE	Automatic Test Equipment
ATLAS	Abbreviated Test Language for All Systems
ATS	Air Traffic Services
BITE	Built In Test Equipment
BP	Bottom Plug
BSU	Beam Steering Unit
C	Centigrade
CAIMS	Centralized Airplane Information Management System
CCS	Cabin Communications System
CDU	Control Display Unit
CEPT	European Postal and Telecommunications Conference
CFDS	Centralized Fault Display System
CMC	Central Maintenance Computer
CMU	Communications Management Unit
CODEC	Coder/Decoder
CPD	Cabin Packet Data
CPDF	Cabin Packet-mode Data Function
CRC	Cyclic Redundancy Check
CSS	*Complementary SATCOM System*
CTU	Cabin Telecommunications Unit
dB/K	Decibel per Kelvin
dB	Decibel
dBi	Decibel relative to isotropic
dBic	Decibel relative to isotropic, circular polarization
dBm	Decibel relative to one milliwatt
dBW	Decibel relative to one watt
dc	direct current
DIP	Diplexer
D/LNA	Diplexer/Low Noise Amplifier
DTMF	Dual Tone Multi-Frequency
ECAM	Electronic Centralized Aircraft Monitoring
EDU	Electronic Display Unit
EICAS	Engine Indication and Crew Alerting System
EIRP	Effective Isotropic Radiated Power
EUROCAE	European Organisation for Civil Aviation Equipment
FAA	Federal Aviation Administration
FMC	Flight Management Computer
FPLMTS	Future Public Land Mobile Telecommunications System
FT	Functional Test
FW	Failure Warning
GES	Ground Earth Station
G/T	Gain/Temperature
GHz	Gigahertz (10^9 Hz)
GLONASS	Global Navigation Satellite System
GPS	Global Positioning System
GSDB	GES-Specific Data Broadcast
HLD	High Power Amplifier/Low Noise Amplifier/Diplexer
HPA	High Power Amplifier
Hz	hertz
ICAO	International Civil Aviation Organization
ID	Identification
IF	Intermediate Frequency

APPENDIX 1
ACRONYMS AND ABBREVIATIONS

IGA	Intermediate Gain Antenna
INS	Inertial Navigation System
IRS	Inertial Reference System
ISO	International Organisation for Standardisation
ITU	International Telecommunication Union
kg/hr	kilogram per hour
kHz	kilohertz (10^3 Hz)
LDH	Low Noise Amplifier / Diplexer / High Power Amplifier
LEO	Low Earth Orbit
LGA	Low Gain Antenna
LNA	Low Noise Amplifier
LRU	Line Replaceable Unit
LSB	Least Significant Bit
mA	milliampere
MASPS	Minimum Aviation System Performance Standards
MBS	*Multiple Bearer System*
MCDU	Multi-Purpose Control and Display Unit
MCU	Modular Concept Unit
MEO	Medium Earth Orbit
MHz	Megahertz (10^6 Hz)
MOPS	Minimum Operational Performance Standards
ms	millisecond
MSB	Most Significant Bit
MP	Middle Plug
NCD	No Computed Data
NVM	Non Volatile Memory
ORT	Owner Requirements Table
PBX	Private Branch Exchange
PLMN	Public Land Mobile Network
PSDN	Packet Switched Data Network
PSTN	Public Switched Telephone Network
PSU	Power Supply Unit
PTT	Push-to-Talk
RF	Radio Frequency
RMP	Radio Management Panel
Rx	Receive
SAL	System Address Label
SAN	Satellite Access Node
SARPs	Standards and Recommended Practices
SATCOM	Satellite Communications
SCDU	Satellite Control/Display Unit
SDI	Source/Destination Identifier
SDU	Satellite Data Unit
SMART	Standard Modular Avionics Repair and Test System
SMS	Short Message Service
SNU	Satellite News Unit
SSM	Sign/Status Matrix
TP	Top Plug
Tx	Transmit
V	volts
Vac	Volts alternating current
Vdc	Volts direct current
VSWR	Voltage Standing Wave Ratio
W	watts

APPENDIX 2
NOT USED

STAFF NOTE: The previous title of this Appendix was System Characteristics for IRIDIUM. The material formerly in this Appendix has been preserved as-is (for possible future use) in the change summary of Supplement 2.

APPENDIX 3A
SYSTEM CHARACTERISTICS FOR THE GLOBALSTAR SINGLE CHANNEL TERMINAL

A3.1 System Level Specific Description

A3.1.1 EIRP

EIRP = 7 dBW maximum

A3.1.2 G/T

G/T ≤ -23 dB/K

A3.1.3 Number of Channels

One

A.3.1.4 APM/Pin Strapping

**** TBD ****

A3.2 LNA/Diplexer

A3.2.1 VSWR

LNA Output VSWR ≤ 2:1

A.3.2.2 Filter Characteristics

There is no diplexer because there are separate antennas for transmit and receive.

A3.3 HPA

A3.3.1 VSWR

VSWR ≤ 2:1

A3.3.2 Transmit Spectrum Characteristics

Conforms with 47 CFR Part 25 and ETSI EN301 473.

A3.3.3 Filter Characteristics

Ensures compliance with RTCA DO-262.

A3.4 Antenna

COMMENTARY

The antenna is one of two types. The first type consists of two elements: Globalstar receive antenna (+Filter/LNA) and Globalstar transmit antenna.

The second type of antenna consists of four elements: Globalstar receive antenna (+Filter/LNA), Globalstar transmit antenna #1, Globalstar transmit antenna #2 (used when more than one terminal is onboard), plus its own GPS antenna (+Filter/LNA).

A3.4.1 Frequency of Operation

Transmit: 1616.0 to 1621.35 MHz
Receive: 2483.5 to 2500 MHz

A3.4.2 Gain

Transmit: > 3 dBic (LHCP) at boresight

< 5 dBic (LHCP) at boresight

> -5 dBic (LHCP) Zero to 80 degrees off boresight

< -2 dBi (Total) 90 degrees off boresight.

Receive: > 3 dBic (LHCP) at boresight*

> -5 dBic (LHCP) Zero to 80 degrees off boresight

**For the passive antenna element without LNA (LNA gain approximately 27 dB).*

A3.4.3 VSWR

VSWR ≤ 2:1

A.3.4.4 Coverage

The antenna provides hemispheric coverage with nominally 10-degree minimum elevation to satellite.

A3.4.5 Isolation

TX Band (Passive): > 25 dB

TX Band (with LNA): > 50 dB

RX Band (Passive): > 25 dB

A3.4.5.1 Physical

**** TBD ****

A3.4.5.2 Electrical

Two Element Antenna:

RX Port Power: 3.3 to 3.8 Vdc, 40 mA max.

Four Element Antenna:

RX Port Power: 3.3 to 5.0 Vdc, 40 mA max.

GPS Port Power: 4.0 to 5.0 Vdc, 40 mA max.

A3.4.5.3 Intermodulation

Ensures compliance with RTCA DO-262.

APPENDIX 3B
SYSTEM CHARACTERISTICS FOR THE GLOBALSTAR SINGLE CHANNEL TERMINAL

A3.1 System Level Specific Description

A3.1.1 EIRP

EIRP = 14 dBW maximum

A3.1.2 G/T

G/T ≤ -23 dB/K

A3.1.3 Number of Channels

One Carrier, up to 16 Channels

A.3.1.4 APM/Pin Strapping

**** TBD ****

A3.2 LNA/Diplexer

A3.2.1 VSWR

LNA Output VSWR ≤ 2:1

A.3.2.2 Filter Characteristics

There is no diplexer because there are separate antennas for transmit and receive.

A3.3 HPA

A3.3.1 VSWR

VSWR ≤ 2:1

A3.3.2 Transmit Spectrum Characteristics

Conforms with 47 CFR Part 25 and ETSI EN 301 473.

A3.3.3 Filter Characteristics

Ensures compliance with RTCA DO-262.

A3.4 Antenna

COMMENTARY

The antenna unit consists of four elements: Globalstar receive antenna (+Filter/LNA), Globalstar transmit antenna #1, Globalstar transmit antenna #2 (used when more than one terminal is onboard), plus its own GPS antenna(+Filter/LNA).

A3.4.1 Frequency of Operation

Transmit: 1616.0 to 1621.35 MHz
Receive: 2483.5 to 2500 MHz

A3.4.2 Gain

Transmit: > 3 dBic (LHCP) at boresight

< 5 dBic (LHCP) at boresight

> -5 dBic (LHCP) Zero to 80 degrees off boresight

< -2 dBi (Total) 90 degrees off boresight.

Receive: > 3 dBic (LHCP) at boresight

> -5 dBic (LHCP) Zero to 80 degrees off boresight

**For the passive antenna element without LNA (LNA gain approximately 27 dB).*

A3.4.3 VSWR

VSWR ≤ 2:1

A.3.4.4 Coverage

The antenna provides hemispheric coverage with nominally 10-degree minimum elevation to satellite.

A3.4.5 Isolation

TX Band (Passive): > 25 dB

TX Band (with LNA): > 50 dB

RX Band (Passive): > 25 dB

A3.4.5.1 Physical

**** TBD ****

A3.4.5.2 Electrical

RX Port Power: 3.3 to 5.0 Vdc, 40 mA max.

GPS Port Power: 4.0 to 5.0 Vdc, 40 mA max.

A3.4.5.3 Intermodulation

Ensures compliance with RTCA DO-262.

APPENDIX 5
SYSTEM CHARACTERISTICS FOR INMARSAT AERO-I

A5.1 System Level Specific Description

A5.1.1 EIRP

EIRP	Type Service
13.5 dBW	Safety Voice and Safety Data Simultaneously
13.0 dBW	Non-Safety Voice and Safety Data Simultaneously
12.5 dBW	Safety Voice
12.0 dBW	Non-Safety Voice

A5.1.2 G/T

-19 dB/K

A5.1.3 Number of Channels

Typically 3 or 4 Voice and 1 Data Channel

A5.1.4 APM/Pin Strapping

A5.2 LNA/Diplexer

A5.2.1 VSWR

Output: *1.5:1 maximum*
Input: 1.3:1 maximum

A5.2.2 Filter Characteristics

Transmit Port to Antenna Port:

Frequency (MHz)	Rejection (dB)
0.0 to 1525.0	>80
1525.0 to 1559.0	>120
1559.0 to 1585.0	>100
1585.0 to 1605.0	>88
1605.0 to 1610.0	>62
1610.0 to 1614.0	>40
1614.0 to 1626.5	Decreases
1626.5 to 1631.5	Insertion loss <2.3
1631.5 to 1660.5	Insertion loss <0.8
1660.5 to 1735.0	Increases
1735.0 to 12000.0	>50
12000.0 to 18000.0	>15

COMMENTARY

The ICAO SARPS and RTCA MOPS are expected to require the use of the modified type A Diplexer/LNA for those AESs that are installed in aircraft that will operate in environments requiring GPS/GLONASS navigational positioning data.

The frequencies between 1626.5 and 1631.5 MHz are not expected to be used.

Transmit Port to LNA Output Port

Frequency (MHz)	Rejection (dB)
0.0 to 1350.0	> 100
1350.0 to 1530.0	> 80
1530.0 to 1559.0	> 120
1559.0 to 1565.0	> 80
1565.0 to 1585.0	> 100
1585.0 to 1626.5	> 40
1626.5 to 1660.5	> 120
1660.5 to 2000.0	> 80
2000.0 to 18000.0	> 50

Antenna Port to LNA Output

Frequency (MHz)	Rejection (dB)
0.0 to 1450.0	> 75
1626.5 to 1660.5	> 120
1660.5 to 18000.0	> 75

A5.3 HPA

A5.3.1 VSWR

Input: 1.5:1 (2.0:1 maximum)
Output: 1.3:1 maximum

A5.3.2 Transmit Spectrum Characteristics

For a linear HPA, the gain range should be at least 42 to 58 dB in the transmit band, with a gain reduction of 25 dB or greater for frequencies above 2000 MHz and below 1150 MHz.

A5.4 HLD

A5.4.1 VSWR

Input: 1.5:1 (2.0:1 maximum)
Output: 1.3:1 maximum

A5.4.2 Transmit Spectrum Characteristics

For a linear HLD, the gain range should be at least 42 to 58 dB in the transmit band, with a gain reduction of 25 dB or greater for frequencies above 2000 MHz and below 1150 MHz.

A5.4.3 Spectrum Characteristics

The filter characteristics of the HLD is such that the spectrum mask at the antenna port is:

Maximum Harmonic, Discrete Spurious and Noise Density Levels	
Frequency (MHz)	EIRP (density)
below 1525.0	-135 dBc/ 4 kHz
1525.0 to 1559.0	-203 dBc/ 4 kHz
1559.0 to 1585.0	-155 dBc/ MHz
1585.0 to 1605.0	-143 dBc/ MHz
1605.0 to 1610.0	-117 dBc/ MHz
1610.0 to 1614.0	-95 dBc/ MHz
1614.0 to 1660.0	-55 dBc/ 4 kHz[1]
1660.0 to 1670.0	-55 dBc/ 20 kHz[1]
1670.0 to 1735.0	-55 dBc/ 4 kHz
1735.0 to 12000.0	-105 dBc/ 4 kHz
12000.0 to 18000.0	-70 dBc/ 4 kHz

APPENDIX 5
SYSTEM CHARACTERISTICS FOR INMARSAT AERO-I

Note 1: Within the transmit band, excluding the frequency band within ± 35 kHz of the carrier.

COMMENTARY

With an integrated HPA and LNA/Diplexer, a transmission spectrum at the output of this LRU is what should be specified.

A5.5 Cable Losses

The maximum value of the cable losses are:

SDU to D/LNA	1.4 dB
HPA to D/LNA	1.4 dB
HLD to Antenna	1.4 dB

A5.5.1 SDU-to-HPA/HLD

19 to 25 dB

A5.5.2 HPA-to-Antenna

Less than 2.5 dB

A5.5.3 SDU-to-Antenna (Without HPA)

Less than 2.5 dB

A5.5.4 Antenna-to-LNA/Diplexer:

Less than 0.3 dB

A5.5.5 LNA/Diplexer-to-SDU

6 to 25 dB

A5.5.6 HLD-to-SDU

6 to 25 dB

A5.6 Antenna

A5.6.1 Frequency of Operation

Receive:	1530.0	to	1559.0 MHz
Transmit:	1626.5	to	1660.5 MHz

A5.6.2 Gain

6 dBic minimum

A5.6.3 VSWR

1.5:1

A5.6.4 Coverage 85%

A5.6.5 Isolation

A5.6.5.1 Physical

The physical isolation should be at least 100 inches.

COMMENTARY

Prime consideration should be given to providing as much separation as possible between SATCOM and GNSS (GPS/GLONASS) antennas. The electrical isolation specified in the previous characteristic for SATCOM (ARINC 741) is 40 dB, which provides protection for GNSS against intermodulation products from two 20 watt carriers generating 7th order products in the GNSS band. Inmarsat nominally provides frequency management to prevent 3rd or 5th order products from being generated in the GNSS band, and there is an algorithm in the AES to check for this also.

Examples of measured electrical isolation vs. physical separation of SATCOM High Gain (12 dBi) and GPS antennas mounted on top of the aircraft are shown below. It should be noted that these levels of isolation were for the worst case where the beam of the HGA was steered toward the GPS Antenna.

Aircraft	*Separation*	*Isolation*
B-777	*970 inches*	*52 dB Top HGA to GPS*
B-767	*400 inches*	*46 dB Top HGA to GPS*

From the above it can be concluded that 200 inches provides 40 dB of isolation for a High Gain Antenna (cutting the distance in half reduces the isolation by 6 dB). For systems with lower power and antennas with less gain the distance could be reduced further, e.g., Inmarsat Aero-I with a 20 watt HPA and a 6 dBi antenna could achieve isolation sufficient to protect GPS with 100 inches of separation.

Using the same rationale used above it can be concluded that 50 inches of separation between the SATCOM (0 dBi) LGA and GPS antenna will provide 40 dB of isolation.

On-aircraft measurements have also shown that interfering inband signals (intermodulation products from SATCOM) received at the GPS antenna that are on the order of -105 dBm can degrade the GPS C/N by approximately 6 dB. Signals at -116 dBm produced no degradation.

The legacy of 40 dB isolation from ARINC Characteristic 741 stems from the anticipated levels of intermodulation products from a high gain antenna, and the amount of isolation required to keep the level received at the GPS antenna below -115 dBm.

A5.6.5.2 Electrical

The electrical isolation should be 40 dB between the IGA and GNSS antenna with the IGA steered toward the GNSS antenna.

A5.6.5.3 Intermodulation

Discrete 7th and higher order products should not cause a power level greater than -115 dBm in the antenna port of the quarter wave monopole GNSS antenna, with 40 dB isolation between the IGA and GNSS antennas.

APPENDIX 5
SYSTEM CHARACTERISTICS FOR INMARSAT AERO-I

A5.7 Aero-I/H+ Air-to-Ground Circuit-Mode Service Selection Codes

A5.7.1 Background

Reference ARINC Characteristic 741, Part 2, Section 4.4.5.1, and Inmarsat Aero SDM Module 5 Part 1 and Module 5, Part 2, Section 3.4.2.4.

ARINC Characteristic 741 describes Aero-H operation with a high-gain antenna (HGA), utilizing 9600 bps baseband coding on 21,000 bps C-channels. This appendix describes Aero-I operation with an intermediate-gain antenna (IGA), utilizing 4800 bps baseband coding on 8400 bps C-channels. A third variant, Aero-H+, is an HGA-based system which contains both 8400 and 21,000 bps C-channel capabilities (including spot-beam capability).

The full-rate terminal interface function (FR-TIF) in the 9600 bps codec used with Aero-H/H+ automatically selects the appropriate circuit-mode service (voice, fax or data) using signal analysis techniques to detect the presence or absence of fax and data in-band signaling. However, the half-rate TIF (HR-TIF) in the 4800 bps codec used with Aero-I/H+ requires the user to specify the desired circuit-mode service, e.g., with a dialing prefix code. It may also be desirable in some instances to use a dialing prefix code to force an Aero-H+ system into the 9600 bps codec mode. [An Aero-H+ system normally defaults to the 4800 bps codec mode whenever possible, i.e., as long as the GES being used for the call (log-on or transit) supports the 8400 bps C-channel.]

ARINC Characteristic 741, Part 2, Section 4.4.5.1 describes air-to-ground call procedures for Aero-H, including the use of the international access code (IAC) "00" (dialed just before the country code). Inmarsat SDM Module 5 Part 2 recommends the use of non-standard variations of the IAC in the dialed number to select the desired initial circuit-mode service. The SDU may thus examine the dialed number and notify its TIF of the selected service. The TIF may then activate the appropriate encoder interface functions and set the mode of the encoder/decoder. In cases where fax or data mode is selected, the local TIF also instigates a mode change of the remote TIF, since the initial mode of operation of the remote TIF is voice. Once the local (airside) TIF has been configured, the SDU must replace any non-00 prefix code in the dialed number with the standard IAC (00) before transmitting the complete phone number to the GES.

APPENDIX 5
SYSTEM CHARACTERISTICS FOR INMARSAT AERO-I

A5.7.2 Prefix Code Definitions

Prefix Code	*Selected Circuit-Mode Service / Channel Rate*	
	IGA Installed	*HGA Installed (Notes 1 & 2)*
00	*Voice / 8400 bps*	*Voice / 8400 OR Voice, fax and data / 21,000*
01	*Fax / 8400 bps*	*Fax / 8400 OR Voice, fax and data / 21,000*
02	*Data / 8400 bps*	*Data / 8400 OR Voice, fax and data / 21,000*
96	*N/A (Note 3)*	*Voice, fax and data / 21,000*

Notes:

1. *When a 21,000 bps C-channel is used with an HGA, the prefix code is effectively ignored, and is simply replaced with '00' in the SU transmission to the GES.*

2. *The SDU will normally use the 8400 bps C-channel unless the GES being used for the call (log-on or transit) does not support that rate (as determined from the GES capabilities information in the System Table), or unless the '96' prefix is used to force the 9600 bps codec (21,000 bps C-channel) mode.*

3. *If the "96' prefix is dialed when an IGA is installed, the call should be rejected.*