ARINC

AVIATION SATELLITE COMMUNICATION SYSTEM

PART 1
AIRCRAFT INSTALLATION PROVISIONS

ARINC CHARACTERISTIC 741P1-7

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FOREWORD

Activities of AERONAUTICAL RADIO, INC. (ARINC)

and the

Purpose of ARINC Characteristics

Aeronautical Radio, Inc. is a corporation in which the United States scheduled airlines are the principal stockholders. Other stockholders include a variety of other air transport companies, aircraft manufacturers and non-U.S. airlines.

Activities of ARINC include the operation of an extensive system of domestic and overseas aeronautical land radio stations, the fulfillment of systems requirements to accomplish ground and airborne compatibility, the allocation and assignment of frequencies to meet those needs, the coordination incident to standard airborne communications and electronics systems and the exchange of technical information. ARINC sponsors the Airlines Electronic Engineering Committee (AEEC), composed of airline technical personnel. The AEEC formulates standards for electronic equipment and systems for the airlines. The establishment of Equipment Characteristics is a principal function of this Committee.

An ARINC Equipment Characteristic is finalized after investigation and coordination with the airlines who have a requirement or anticipate a requirement, with other aircraft operators, with the Military services having similar requirements, and with the equipment manufacturers. It is released as an ARINC Equipment Characteristic only when the interested airline companies are in general agreement. Such a release does not commit any airline or ARINC to purchase equipment so described nor does it establish or indicate recognition of the existence of an operational requirement for such equipment, nor does it constitute endorsement of any manufacturer's product designed or built to meet the Characteristic. An ARINC Characteristic has a twofold purpose, which is:

(1) To indicate to the prospective manufacturers of airline electronic equipment the considered opinion of the airline technical people, coordinated on an industry basis, concerning requisites of new equipment, and

(2) To channel new equipment designs in a direction which can result in the maximum possible standardization of those physical and electrical characteristics which influence interchangeability of equipment without seriously hampering engineering initiative.

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1.0 INTRODUCTION AND DESCRIPTION

1.1 Purpose of this Characteristic

¢-4 This document, Part 1, sets forth the desired characteristics of the Aviation Satellite Communications (SATCOM) System avionics intended for installation in all types of commercial transport and business aircraft. The intent of this document is to provide general and specific guidance on the form factor and pin assignments for the installation of the avionics primarily for airline use. Part 2 describes the desired operational capability of the equipment as configured with the Satellite Data Unit (SDU) to provide data and voice communications, as well as additional standards necessary to ensure interchangeability. Part 3, Circuit Mode Voice and Data Services, describes the standard voice coding algorithm, the Data Interface Unit (DIU) and the Terminal Interface Function Unit (TIFU). Part 4, Specification and Description Language (SDL) contains the SDL Diagrams which show a possible detailed implementation of the system protocols.

¢-5

> STAFF NOTE: Part 5, TDMA System, describes the requirements of an alternative Time Division Multiple Access (TDMA) system that may be used in future satellite systems. Part 5 has been archived in project paper form.

1.2 Relationship of this Document to ARINC Characteristics 597 and 724

¢-4 The Aviation Satellite Communications (SATCOM) System will present standard interfaces to a number of other aircraft systems. These include ACARS (where installed), multi-purpose control and display units (MCDU), Communication Management Units (CMU) (ultimately to be shared with Mode S and VHF Data Links) and passenger telephone coder/encoder and CCS units. Details of the interfaces may be found in Part 3 or subsequent parts of this Characteristic, and in ARINC Characteristic 746, "Cabin Communications System (CCS)".

¢-1 ARINC Characteristics 597 and 597A, "Aircraft Communications Addressing and Reporting System (ACARS)", describe ARINC 404A-packaged airborne ACARS equipment against the background of a fairly detailed system description. ARINC Characteristics 724, 724A and 724B describe ARINC 600-packaged equipment intended to perform essentially the same functions as the ARINC 597/597A equipment in the same framework. ARINC 724/724A equipment will more readily interface with other ARINC "700-Series" equipment on those aircraft on which such equipment is employed. However, all versions of ACARS avionics should interface with the Aviation Satellite Communications system avionics by means of ARINC 429 data buses.

COMMENTARY

> ¢-1 The ARINC 741 Aviation Satellite Communications System avionics design envisages the availability of ACARS avionics on the aircraft to effect certain data collection and distribution functions. Those operators who do not utilize ACARS may employ an appropriately equipped MCDU to perform these functions or a specially designed substitute unit. In practical terms, their most economical solution to the problem may be the use of a "stripped down" ACARS unit.

1.3 Function of Equipment

¢-5 ¢-2 ¢-5 ¢-2 The function of this equipment is the transmission, reception and processing of signals via a satellite providing aeronautical services in the L-band (1525-1660.5 MHz). The system should provide a capability for all aeronautical satellite communications requirements external to the aircraft, including passenger telephone and data services depending on aircraft equipage.

1.4 Airborne Avionics Configurations

¢-2 The general configuration of the satellite avionics and related systems is shown in Attachment 1-1. A more detailed block diagram (including alternate configurations) is shown in Attachment 1-2.

The Satellite Data Unit (SDU) is capable of sending and receiving various data rates. The rate will be dynamically selected by pragmatic assessment of current operating conditions. The signal is transmitted via geostationary satellite transponders to designated supporting earth stations. A detailed functional description of this system configuration is provided in Part 2 of this document.

The airborne system may be capable of transmitting higher data rates and voice communications, but this may necessitate the provisioning of a high gain (i.e., 12 dBic) antenna.

1.5 Unit Description

1.5.1 Satellite Data Unit (SDU)

¢-2 The signal-in-space parameters are determined by the SDU in relation to modulation/demodulation, error correction, coding, interleaving and data rates associated with the communication channel(s). This unit contains circuits for conversion of digital/audio inputs to a baseband or intermediate frequency (IF), if required, and interfaces with the radio frequency unit (RFU). The SDU also interfaces with the ACARS Management Unit (MU) based on ARINC Characteristics 724, 724A and 724B.

1.5.2 Radio Frequency Unit (RFU)

¢-2 The RF unit consists of low power amplifiers, filters, frequency conversion and related components. The RFU operates in a full duplex mode (i.e., simultaneous, transmission and reception of satellite signals). The transmit side uses a power amplifier which accepts a signal from the SDU at either baseband or IF and translates it to the appropriate RF. The receive side uses the output from a low noise amplifier (LNA) and translates signals to baseband or IF for use by the SDU. The RFU should be able to accept the wide range of

1.5.2 Radio Frequency Unit (RFU) (cont'd)

¢-2 signal levels from the LNA depending on configuration and losses.

1.5.3 RF Distribution Units

1.5.3.1 Splitter

The splitter receives medium level RF signals from the RFU and divides the power for distribution to the high power amplifiers (HPA).

1.5.3.2 Combiner

¢-2 The combiner receives medium level RF signals from the low noise amplifiers (LNAs). Note that only one LNA is turned on at a time. The combiner then provides a matching network for distribution of the RF signal from each LNA to the RFU.

1.5.3.3 High Power Relay (HPR)

The HPR is a coax switch for switching output RF power from the HPA to a particular antenna subsystem. The use of the HPR is optional depending on the aircraft configuration.

1.5.4 Diplexer/Low Noise Amplifier (LNA)

¢-2 The diplexer and LNA are combined into one unit for installation. The Diplexer Unit (DU) couples transmit signals from the HPA to the respective antenna (and couples receive signals from the respective antenna to the LNA unit), while preventing transmit-frequency power from degrading the receiver system.

The LNA amplifies the very low level L-band signal from its respective antenna. The LNA also compensates for transmission line losses to the RFU.

1.5.5 High Power Amplifier (HPA)

¢-2 The high power amplifier provides an adequate RF power level, by automatic control, to the antenna in order to maintain the aircraft EIRP within limits. The HPA unit may be located near the respective antenna to assure minimum loss of energy at the RF operating frequency and to avoid excessive thermal dissipation in the HPA unit, or it may be located in the radio equipment rack in certain aircraft.

1.5.6 Low Gain Antenna (LGA)

A low gain (i.e., 0 dBic) antenna may be used to provide communications in case of failure of a main antenna or to provide a means for additional service. Service will be restricted to low data rates when this antenna is employed.

1.5.7 High Gain Antenna (HGA)

¢-2 High gain antennas provide at least 12 dBic gain and are essential for both high data rates and voice services.

1.5.7.1 Dual Side Mounted HGA

A dual side-mounted HGA antenna should be mounted on each side of the aircraft at about 45 degrees from the horizon. The coverage of the main antennas is shown in Attachment 1-8. ¢-1

1.5.7.2 Single Top Mounted HGA

A single top mounted HGA antenna may be used instead of the dual side mounted configuration. Drag may be increased in this application. Either mechanically or electronically steerable antennas may be used.

1.5.8 Keyhole Antennas

A typical installation makes no provision for keyhole antennas to provide coverage in the "Blind Areas" (keyholes) shown in Attachment 1-8. Pins are not presently reserved on the SDU for any such antennas. ¢-4

1.5.9 Antenna Control Unit (ACU)

The antenna control unit (ACU) is used with a mechanically steered antenna to translate antenna beam positioning data and beam position change commands received from the SDU in a standard digital format into the form needed to position the antenna beam correctly. ¢-2

1.5.10 Beam Steering Unit (BSU)

The beam steering unit (BSU) is used with electronically steered antennas to translate antenna position data and beam change commands received from the SDU in a standard digital format into the signals needed to select antenna elements in combinations that result in the beam pointing at the desired satellite.

1.6 System Performance

1.6.1 Transmitter Equipment Performance

The following table provides an indication of the level of service that should be expected from a typical aircraft satellite system, assuming that equipment of nominal performance is utilized. ¢-3

Aircraft EIRP Performance (1)

Voice/Data Service Parameters	Circuit-Mode Voice	Circuit-Mode Data	Packet-Mode Data
RF channel rate	21 kbit/s	10.5 kbit/s	600 bit/s
EIRP per carrier	19.5 dBW(2)	21.0 dBw	7.5 dBW

1.0 INTRODUCTION AND DESCRIPTION (cont'd)

Notes:

(1) These values assume an INMARSAT-II Satellite (satellite G/T = -12.5 dB/K, satellite gain = 158.4 dB) and operation at a satellite elevation angle of 20° or above. Values will differ for other satellites and elevation angles. For example, with spot-beam satellites these figures are expected to be reduced by at least 7 dB.

(2) A 12 dBic aircraft antenna driven from a 40 watt linear HPA per ARINC Characteristic 741, through 2.5 dB of loss, will radiate an EIRP of up to 25.5 dBW, which can support four of these channels.

¢-3 The transmit system is equipped to adjust the EIRP according to commands from the GES. For a single channel system using a Class "C" HPA, the back-off is accomplished entirely in the HPA, while the RFU maintains a constant power level to assure adequate drive to the non-linear HPA. For a multi-channel system using a linear HPA, the back-off is a combination of HPA back-off (collective control of all channel carriers) and RFU output carrier level control on an individual channel basis (to accommodate channels operating at different data rates).

The transmit gain of a High Gain Antenna (HGA) may vary as its beam position is changed while tracking a satellite from an aircraft in motion. To maintain a more constant EIRP as the antenna's beam position is changed, the ACU/BSU outputs the antenna's transmit again for the current beam position on its ARINC 429 bus (in the ACU/BSU status word) to the SDU. The SDU in turn incorporates this gain information into the commanded back-off values it sends via its ARINC 429 bus to the HPA, thereby increasing or decreasing the HPA output (within the maximum and minimum limits of HPA output) to compensate for changes in antenna gain. In a system with a linear HPA this information may be used in setting both the HPA back-off values and the individual channel carrier levels output from the RFU. The antenna shall report its gain in the direction of the satellite with a resolution of 1 dB. The SDU shall make an appropriate
¢-4 HPA adjustment to maintain a given EIRP within ±1 dB when an antenna gain change is reported. The SDU shall also monitor HPA output power when one data channel is active or under other determined signal conditions and make appropriate HPA adjustments to maintain the EIRP within ±1 dB to compensate for drifts in the HPA output power.

The steering control signals should be provided through an ARINC 429 bus from the SDU and should be derived from a signal representing the received signal strength. This is commonly called "closed loop" steering.

The antenna beam steering function should be capable of maintaining the transmitted beam performance with aircraft attitude rates of at least 7.5 degrees per second.

1.6.2 Receiver Equipment Performance

¢-3 The receiver system performance is determined by the characteristics of the antenna sub-system, the LNA/Diplexer, the RFU, the SDU and the interconnecting RF cables. This includes all of the SATCOM equipment's RF systems and circuits from the antenna to the demodulated baseband output. The design parameters of each of these system elements have been described to achieve the following receiver Figure-of-Merit (G/T) values. These are minimum values with a sky temperature of 100°K. For the switched beam (HGA) this example corresponds to the main beam for any pointing angle.

	LGA	HGA
G/T	-26 dB/K	-13 dB/K

Note: In the above examples the LGA G/T is degraded by 1 dB to allow for installation variations.

The above values for G/T should be achieved under the following conditions:

(i) clear sky climatic conditions;

(ii) satellite elevation angles greater than or equal to 5 degrees, within the coverage volume of the aircraft antenna;

(iii) with residual antenna pointing errors (including the effects of errors introduced by the antenna beam steering system); ¢-3

(iv) including the noise contribution of the complete RF subsystem including antenna and low noise amplifier, at a temperature of 290°K;

(v) with the transmitter power amplifier at maximum output level;

(vi) including the loss and noise temperature contribution of a radome, where a radome is fitted.

(vii) under the operational RF environment; e.g., when the receive antenna is illuminated in its operating bandwidth (29 MHz) by a total RF flux density of -100 dBW/m^2.

For the high data rate system using the high-gain antenna, the thermal contribution of finite losses within the HGA may cause the G/T to be degraded below -13 dB/K even when the HGA gain, LNA noise figure and diplexer plus cable losses are within tolerance.

Antenna performance is expressed in terms of gain. The system noise temperature is achieved in consideration of the RF cable loss factors and the noise figure contributions from the RFU and the LNA/Diplexer.

The receiver system performance provides a bit error rate (BER) of 1x10^{-5} for packet mode data, 1x10^{-3} for circuit mode voice and 1x10^{-5} for circuit mode data.

The steering control signals should be provided through an ARINC 429 bus from the SDU and should be derived from a signal representing the received signal strength. This is commonly called "closed loop" steering. ¢-4

1.0 INTRODUCTION AND DESCRIPTION (cont'd)

1.6.2 Receiver Equipment Performance (cont'd)

¢-4 The antenna beam steering function should be capable of maintaining the received beam performance with aircraft attitude rates of at least 7.5 degrees per second.

1.7 Interchangeability

The ARINC Characteristic 741 Aviation Satellite Communications System comprises two major sub-systems and a number of individual units. System interchangeability, as defined in Section 2.0 of ARINC Report 403, "Guidance for Designers of Airborne Electronic Equipment", is desired by the users for each of the major sub-systems and unit interchangeability, also defined in the above-referenced ARINC Report, is desired for the individual units. The first major sub-system comprises the SDU and the RFU. The second is the antenna sub-system, comprising the antenna itself, the ¢-3 beam steering unit (when used) and the antenna control unit (when used). Interchangeability is also desired for the HPA and the diplexer/LNA Units.

Additional interchangeability standards may be found in Part 2 of this Characteristic. Cabin/cockpit voice and data interfaces to the Cabin Communications System (CCS) and its functional description are given in ARINC Characteristic 746.

COMMENTARY

> Even though the overall satellite system avionics suite comprises sub-systems made up of multiple line replaceable units (LRUs), each LRU must be designed to be autonomous for installation purposes. ¢-1 The airlines will not accept "matched pairs" of units or similar "unbreakable bonds" which necessitate changing more than the LRU whose failure actually causes a sub-system malfunction.

¢-3 1.8 Regulatory Approval

The equipment should meet all applicable FAA and FCC regulatory requirements. This document does not and cannot set forth the specific requirements that such equipment must meet to be assured of approval. Such information must be obtained from the regulatory agencies themselves.

2.0 INTERCHANGABILITY STANDARDS

2.1 Introduction

This Chapter sets forth the specific form factors, mounting provisions, interwiring, input and output interfaces, and power supply characteristics desired for the satellite avionics equipment. These standards should permit the parallel, but independent design of compatible equipment and airframe installations. Refer to ARINC Specification 600 "Air Transport Avionics Equipment Interfaces" (NIC Phase 1) for detailed information on selected form factors, connectors, etc. ARINC 600 standards with respect to weight, racking attachments, front and rear projections and cooling apply.

Manufacturers should note that although this Characteristic does not preclude the use of standards different from those set forth herein, the practical problems of redesigning a standard airframe installation to accommodate a special equipment could very well make the use of that equipment prohibitively expensive for the customer. They should recognize, therefore, the practical advantages of developing equipment in accordance with the standards set forth in this document.

2.2 Form Factors, Connectors and Index Pin Coding

2.2.1 Satellite Data Unit (SDU)

2.2.1.1 SDU Size

The SDU should comply with the dimensional standards in ARINC Specification 600 for the 6 MCU size.

COMMENTARY

c-5 An alternative approach is to combine the 4 MCU RFU and 6 MCU SDU into a single 10 MCU or 6 MCU unit. Either configuration can be implemented with standard ARINC Characteristic 741 interwiring provisions by introducing 2 coax jumpers at the RFU connector (and stowing the connector for the 10 MCU approach). The 10 MCU approach requires replacement of the 4 MCU and 6 MCU trays with a 10 MCU tray.

2.2.1.2 Connectors

c-4 The SDU should be provided with a low insertion force, size 2 shell ARINC 600 service connector (see Attachment 1-5). This connector should accommodate auxiliary interconnections in the top plug (TP) insert, signal interconnections in the middle plug (MP) insert, and coaxial and power interconnections in the bottom plug (BP) insert.

The contact arrangements should be 02 for the top insert, 2 for the middle insert, and 04 for the bottom insert. Index pin code 04 should be used on both the SDU and the aircraft rack connectors.

2.2.1.3 Form Factor

c-2 See Attachment 1-5.

2.2.2 Radio Frequency Unit (RFU)

2.2.2.1 RFU Size

The RFU should comply with the dimensional standards in ARINC Specification 600 for the 4 MCU size.

2.2.2.2 Connectors

The RFU should be provided with a low insertion force, size 2 shell ARINC 600 service connector (See Attachment 1-6). The contact arrangements should be 08 for the top insert, 05 for the middle insert and 04 for the bottom insert. Index pin code 03 should be used on both the RFU and the aircraft rack connectors. c-2

2.2.2.3 Form Factor

See Attachment 1-6. c-2

2.2.2.4 RFU Power Output

When delivering a full output single carrier, the RFU output power should be 15 ±2 dBm as measured at the RFU RF output service connector, MPC1. When delivering multiple carriers, the total RMS output capability should not be less than 15 dBm, and the actual RMS output should not exceed 17 dBm. c-2

2.2.2.5 Harmonics, Discrete, Spurious and Noise

While transmitting an unmodulated, continuous carrier at maximum output power per Section 2.2.2.4 the composite harmonics, discrete, spurious and noise output (including phase noise) at the output of the RFU should fall below the following: c-6

Frequency MHz	Power/4 kHz
0 - 1150	-30 dBc/4 kHz
1150 - 1525	-55 dBc/4 kHz
1525 - 1559	-83 dBc/4 kHz
1559 - 1565	-55 dBc/4 kHz
1565 - 1585	-55 dBc/1 MHz
1585 - 1602	-55 dBc/4 kHz
1602 - 1616	-55 dBc/1 MHz
1616 - 1670	-55 dBc/4 kHz*
1670 - 1675	-55 dBc/1 MHz
1675 - 2000	-55 dBc/4 kHz
2000 - 18000	-30 dBc/4 kHz

* Excluding the carrier frequency ±35 kHz.

The power of any harmonic measured at the RFU output port should be no greater than -30 dBc.

COMMENTARY

(1) The levels are expressed in dB below single carrier level (dBc). For example, -83 dBc is equivalent to a -68 dBm output level with +15 dBm (i.e., 31.6 mW) output power and -55 dBc is equivalent to -40 dBm. c-5

2.2.2.5 Harmonics, Discrete, Suprious and Noise (cont'd)

¢-5 (2) The recommended levels of -30 dBc assume that the HPA gain is reduced by 25 dB in the specified frequency bands when compared to the transmit band gain in the frequency range of 1626.5 to 1660.5 MHz. This will result in a level of -55 dBc at the output of the HPA when driven by the RFU.

2.2.2.6 RFU Linearity

¢-5 When transmitting two carriers each at +12 dBm, third order intermodulation products should be at least 43 dB below each carrier and all other intermodulation products should be at least 45 dB below each carrier.

COMMENTARY

¢-5 This level of performance implies up to 1 dB degradation in the HPA intermodulation output when driven by the RFU.

¢-2

2.2.2.7 Noise Figure

The receive path noise figure for the RFU should not exceed 10 dB under conditions equivalent to a wide-band input signal level of -50 dBm at the RFU input. For conditions equivalent to larger input levels, the noise figure (in dB) may increase in proportion to the signal level (in dBm).

COMMENTARY

¢-2 This RFU noise figure should allow the system installer a maximum loss as specified in Section 2.2.6.4 between the RFU and the LNA. This noise figure and a maximum loss of 25 dB between the RFU and the LNA adds 0.05 dB to the SATCOM receiver noise figure.

ADDITIONAL COMMENTARY

¢-6 Interfering RF energy can exist in frequency bands adjacent to the AES receive band, such as radiation from a mobile system used in Japan operating in the 1513-1525 MHz band. The diplexer rejection specified in Section 2.2.4.3 does not provide specific protection against interference from RF energy in such a closely spaced frequency band. Noise figure which is increased by an Automatic Gain Control (AGC) reacting to interfering RF energy can degrade a desired channel's C/No, thereby causing an apparent degradation of the receiver system performance.

2.2.3 Radio Frequency Distribution Units (RFDU)

RF distribution units (e.g., splitters, combiners and high power relays) suitable for airborne satellite system applications are available in the marketplace at prices considerably lower than would be charged for units if they were built to specific standards in this Characteristic. For this reason dimensional standards are not set forth in this Characteristic.

The connector types described for these units are those preferred. Their use is assumed in the standard interwiring shown in Attachment 1-3 of this Characteristic.

2.2.3.1 Splitter Connectors

The splitter should use TNC type female connectors for both input and output. The connector types described for this unit are those preferred and are called out in the standard interwiring shown in Attachment 1-3 of this Characteristic.

2.2.3.2 Combiner Connectors

The combiner should use TNC type female connectors for both input and output. The connector types described for this unit are those preferred and are called out in the standard interwiring shown in Attachment 1-3 of this Characteristic.

2.2.3.3 High Power Relay (HPR)

The HPR is normally controlled by the Top/Port BSU (see Attachment 1-2). Should this unit fail, the HPR should assume the state in which the HPA is connected to the Starboard BSU and antenna.

2.2.3.3.1 HPR Preferred Connectors

The HPR should use a TNC female connector on the input, a Type N male connector on the starboard (normally closed) output and a Type N female connector on the port (normally open) output. ¢-4

The connector types described for this unit are those preferred and are called out in the standard interwiring shown in Attachment 1-3 of this Characteristic.

2.2.4 Diplexer/LNA

2.2.4.1 Diplexer/LNA VSWR

The Diplexer/LNA Antenna and Transmit (TX) ports' VSWR should be 1.3:1 maximum. The LNA output port (RX) VSWR should be 1.5:1 maximum. ¢-1

Note: In all diplexer performance measurements any unused port should be terminated with its characteristic impedance.

2.2.4.2 Noise Figure/Gain

The Diplexer/LNA noise figure should be less than 1.8 dB at temperatures below 25°. The noise figure may increase with temperature to a maximum of 2.1 dB at the maximum operating temperature (70°). The gain should be between 53 and 60 dB under all operating conditions. ¢-1

2.0 INTERCHANGEABILITY STANDARDS (cont'd)

2.2.4.3 Diplexer/LNA: Antenna Port to LNA Output Port

COMMENTARY

¢-1 The rejection values below do not consider the presence of other L-band systems on board the aircraft. Equipment designers should be aware of the possibility of interference signals from DME, ATC Transponder and Collision Avoidance systems and provide adequate protection.

2.2.4.3.1 Type A - For Protection of GPS Only

COMMENTARY

¢-5 ¢-6 ¢-5 Use of the Type A diplexer/LNA may not provide sufficient interference protection for GLONASS receivers on the same aircraft; but should provide such protection for nearby aircraft as GLONASS moves frequencies below 1610 MHz. Use of the diplexer in Section 2.2.4.3.2 is encouraged.

Antenna Port to LNA Output

¢-5 The rejection from the antenna port to the LNA output port relative to the 1530-1559 MHz passband level should be:

	Frequency (MHz)	Rejection
¢-6	0.0 to 1450.0	> 75 dB
¢-4	1626.5 to 1660.5	> 120 dB
¢-6	1660.5 to 18000.0	> 75 dB

¢-5 **Transmit Port to Antenna Port**

¢-1 The path from the transmit port to the antenna port should have the following characteristics:

	Frequency (MHz)	Rejection
	0.0 to 1530.0	> 80 dB
	1530.0 to 1559.0	> 120 dB
¢-3	1559.0 to 1565.0	> 80 dB
¢-4	1565.0 to 1585.0	> 100 dB
	1585.0 to 1605.0	> 50 dB
¢-6	1605.0 to 1610.0	> 30 dB
	1610.0 to 1626.5	Decreases
	1626.5 to 1660.5	Insertion loss < 0.8 dB
¢-3	1660.5 to 1735.0	Increases
	1735.0 to 12000.0	> 50 dB
¢-3	12000.0 to 18000.0	> 15 dB

¢-5 **Transmit Port to LNA Output Port**

¢-1 The rejection from the transmit port to the LNA output port relative to the passband level from the antenna port to the LNA output port should be as follows:

Frequency (MHz)	Rejection	
0.0 to 1350.0	> 100 dB	
1350.0 to 1530.0	> 80 dB	
1530.0 to 1559.0	> 120 dB	
1559.0 to 1565.0	> 80 dB	¢-2
1565.0 to 1585.0	> 100 dB	¢-4
1585.0 to 1626.5	> 40 dB	¢-2
1626.5 to 1660.5	> 120 dB	
1660.5 to 2000.0	> 80 dB	
2000.0 to 18000.0	> 50 dB	

2.2.4.3.2 Type B - For Protection of GPS, GLONASS and TFTS

COMMENTARY

The following rejections allow simultaneous operation of SATCOMS with GPS, GLONASS and TFTS provided the antenna isolations of Section 2.3.3.13 are achieved and frequency management techniques prevent 3rd and 5th order intermodulation products falling in the GPS, GLONASS and TFTS bands. ¢-5 ¢-7

Antenna Port to LNA Output

The rejection from the antenna port to the LNA output port relative to the 1525-1559 MHz passband level should be:

Frequency (MHz)	Rejection	
0.0 to 1450.0	> 75 dB	
1450.0 to 1525.0	Decreases	
1559.0 to 1626.5	Increases	¢-5
1626.5 to 1660.5	> 120 dB	
1660.5 to 18000.0	> 75 dB	

Transmit Port to Antenna Port

The path from the transmit port to the antenna port should have the following characteristics:

Frequency (MHz)	Rejection	
0.0 to 1525.0	> 80 dB	
1525.0 to 1559.0	> 120 dB	
1559.0 to 1565.0	> 80 dB	
1565.0 to 1585.0	> 100 dB	
1585.0 to 1598.0	> 80 dB	
1598.0 to 1607.0	> 88 dB	
1607.0 to 1610.0	> 85 dB	¢-6
1610.0 to 1626.5	Decreases	
1626.5 to 1660.5	Insertion loss < 0.8 dB	
1660.5 to 1670.0	Increases	
1670.0 to 1675.0	> 70 dB	¢-5
1675.0 to 12000.0	> 50 dB	
12000.0 to 18000.0	> 15 dB	

2.0 INTERCHANGEABILITY STANDARDS (cont'd)

2.2.4.3.2 Type B - For Protection of GPS, GLONASS and TFTS (cont'd)

Transmit Port to LNA Output Port

The rejection from the transmit port to the LNA output port relative to the passband level from the antenna port to the LNA output port should be as follows:

Frequency (MHz)	Rejection
0.0 to 1350.0	> 100 dB
1350.0 to 1525.0	> 80 dB
1525.0 to 1559.0	> 120 dB
1559.0 to 1565.0	> 80 dB
1565.0 to 1585.0	> 100 dB
1585.0 to 1602.0	> 80 dB
1602.0 to 1607.0	> 88 dB
1607.0 to 1616.0	> 85 dB
1616.0 to 1626.5	> 80 dB
1626.5 to 1660.5	> 120 dB
1660.5 to 2000.0	> 80 dB
2000.0 to 18000.0	> 75 dB

2.2.4.4 Reserved

2.2.4.5 LNA Output Power

The output power capability of the LNA should be 10 dBm minimum at the 1 dB gain compression point. This set of parameters establishes the linearity for the receive system and is directly related to its two-tone intermodulation performance.

COMMENTARY

This LNA output should allow the system installer a maximum loss between the LNA and the RFU as described in Section 2.2.6.4.

ADDITIONAL COMMENTARY

Interfering RF energy can exist in frequency bands adjacent to the AES receive band, such as radiation from a mobile system used in Japan operating in the 1513-1525 MHz band. The diplexer rejection specified in Section 2.2.4.3 does not provide specific protection against interference from RF energy in such a closely spaced frequency band. Interfering signals exceeding the output capability of the LNA may cause suppression of desired weak signals and, thereby, cause an apparent degradation of the receiver system performance.

2.2.4.6 Diplexer/LNA Connectors

The Diplexer/LNA should use the following connectors for its RF ports:

Port	Connector Type
Transmit Port (HPA)	N Jack (Female)
Receive Port (RFU)	TNC Jack (Female)
Antenna Port	TNC Jack (Female)

The Diplexer/LNA should use a MIL-C-26482 series 2 type connector for control and power interconnections. It should be identified by the part number MS3470L1210P, or equivalent, which mates with MS3476L1210S on the cable.

2.2.4.7 Diplexer/LNA Form Factors

See Attachment 9A for the form factor of the Diplexer/LNA that provides protection for GPS receivers only. See Attachment 9B for the form factor of the Diplexer/LNA that provides protection for GPS, GLONASS and TFTS receivers.

2.2.4.8 Diplexer/LNA On/Off Control

Provisions are needed to switch the LNA on and off. Note 10 to the Standard Interwiring in Attachment 1-4 of this Characteristic describes the switching signal.

2.2.5 High Power Amplifier (HPA)

The HPA should be consistent with the chart shown below:

Function	HPA Type 1	HPA Type 2
Amplifier Type	Class C	Linear
Unit Size	4 MCU	8 MCU
Max. Heat Dissipation [1]	125 W	250 W
Intermodulation Products		
(3rd Order) [2]	N/A	-25 dBc
(5th Order) [7]	N/A	-25 dBc
(7th Order, Lower band) [8]	N/A	-30 dBc
(7th Order, Lower band) [9]	N/A	-33 dBc
(Greater than 7th, Order, Lower band) [7]	N/A	-35 dBc
(Alternate 6-tone) [10]	N/A	-19 dBc
AM/PM Conversion [3]	N/A	< 2°/dB or < 30°/2 msec
HPA RF Power Output [4]		
0 dB Back-off, Input -12 dBM to -2 dBm	40 W Min., 80 W Max.	40 W Min., 80 W Max.
Back-off Adjustment [6]	At least ≥ 16 dB range in steps of 0.5 dB min. to 1.5 dB max.	
Back-off Stability [5]	± 2 dB	N/A
Gain Stability [5]	N/A	± 2 dB

Notes:

[1] The heat to be dissipated includes any heat produced in the HPA power output control, power supplies and interface electronics. The dissipation should be measured when operated at the maximum duty cycle of operation as specified by the manufacturer.

[2] This performance applies when the HPA is driven by two carriers, with a spacing from 5 kHz to 14 MHz, (e.g., 10 kHz, 100 kHz, 1 MHz and 14 MHz) so as to produce two carriers each at a power

2.0 INTERCHANGEABILITY STANDARDS (cont'd)

¢-7 level of half the rated output power measured at the
HPA output connector. This permits a 10 dB
¢-4 degradation in third order intermodulation products
for the HPA compared to the RFU.

[3] The performance should meet the goal of
¢-2 introducing sufficiently small phase differentials
during gain adjustments to avoid bit transitions in
ABPSK or AQPSK.

[4] 40 watts is the desired minimum power output when
¢-4 the HPA is commanded to deliver maximum RF
power output. All power levels are measured under
unmodulated single carrier conditions. For an
unmodulated single carrier condition of -12 dBm
¢-6 input drive level and operating into a load
impedance of 50 + j0 ohms, 40 W is the expected
¢-4 minimum, with 80 W the maximum power out.

[5] "Stability" includes the effects of temperature, and
¢-2 input frequency.

[6] The HPA may optionally provide an extended
back-off range. The step size and overall accuracy
requirements are relaxed to ± 1 dB for the
¢-5 extended range. SDU command of the extended
range shall be as specified in the 'nominal HPA
Back-off' field of the HPA Command Word in
Attachment 2.

[7] This performance applies when the HPA is driven
by two carriers, with a spacing less than 14 MHz
¢-6 (e.g., 10 kHz, 100 kHz, 1 MHz and 14 MHz), so
as to produce two carriers each at a power level of
¢-7 half the rated output power measured at the HPA
¢-5 output connector.

[8] This performance applies when the HPA is driven
by two carriers, with a spacing from 13.5 MHz to
¢-6 14.5 MHz (e.g., 14 MHz), so as to produce two
carriers each at a power level of half the rated
¢-7 output power measured at the HPA output
¢-5 connector.

[9] This performance applies when the HPA is driven
by two carriers, with a spacing less than 13.5 MHz
¢-6 (e.g., 10 kHz, 100 kHz, 1 MHz and 13 MHz), so
¢-5 as to produce two carriers each at a power level of
¢-7 half the rated output power measured at the HPA
¢-5 output connector.

[10] An alternate method to demonstrate Intermodulation
compliance is to transmit 6 equal, unmodulated
carriers each at a power level of one sixth the rated
¢-7 output power at f, $f+\Delta f$, $f+2\Delta f$, $f+4\Delta f$, $f+5\Delta f$,
$f+6\Delta f$, with Δf ranging from 10 kHz to 1MHz
(e.g., 10 kHz, 100 kHz and 1 MHz). The
intermodulation product produced at $f+3\Delta f$ shall be
less than -19 dBc. This test should be performed
six times in total, with f placed at the high and low
ends of the transmit band.

Additional Notes:

For a Class C HPA, the HPA values define the
output level relative to the maximum capability of ¢-2
the HPA, for an input level of -12 dBm or higher.

For a Linear HPA, the gain range should be at least ¢-4
42 to 58 dB in the transmit band, with a gain
reduction of 25 dB or greater for frequencies above ¢-5
2000 MHz and below 1150 MHz. The range of
input levels shall at least cover -32 to -2 dBm. ¢-7

As indicated in Note 31 to the Standard Interwiring
in Attachment 1-4 of this Characteristic, it must be
possible to mute the HPA and turn it back on when ¢-3
necessary, for example during antenna beam
repositioning. Pins are assigned on the HPA
service connector for the input of a muting signal.

2.2.5.1 Harmonics, Discrete, Spurious and Noise ¢-6

While transmitting an unmodulated, continuous carrier at ¢-1
rated output power, the composite harmonics, discrete, ¢-6
spurious and noise output from the HPA should fall below
the following: ¢-5

Frequency (MHz)	Power
0 - 1525	-55 dBc/4 kHz
1525 - 1559	-83 dBc/4 kHz
1559 - 1565	-55 dBc/4 kHz
1565 - 1585	-55 dBc/1 MHz
1585 - 1598	-55 dBc/4 kHz
1598 - 1610	-55 dBc/1 MHz
1610 - 1670	-55 dBc/4 kHz*
1670 - 1675	-55 dBc/1 MHz
1675 - 18000	-55 dBc/4 kHz

¢-6

* Excluding the carrier frequency ±35 kHz.

COMMENTARY

(1) These levels are expressed in dB below single ¢-5
carrier level (dBc). For example, -83 dBc is
equivalent to a -67 dBW output level with 40 W
(i.e., 16 dBW) output power; and -55 dBc is
equivalent to -39 dBW.

(2) The noise and spurious levels specified in ¢-6
Sections 2.2.2.5 and 2.2.5.1 do not appear to allow
for additional degradation caused by the HPA. The
HPA noise figure specification in Section 2.2.5.2 is
an overriding requirement which restricts the
HPA's noise contribution to such a low level that ¢-5
the resulting degradation to the overall noise level
is negligible. Hence, the same levels can appear in
both Sections. Likewise, discrete spurious signals
which originate prior to the HPA input port are not
further accentuated by the HPA in terms of dBc.

2.2.5.2 Noise Figure ¢-3

The noise figure of the transmitter HPA should not ¢-2
exceed (20 + X) dB, where X dB is the commanded
HPA Back-off Adjustment as defined in Section 2.2.5. ¢-5

¢-3 2.2.5.3 VSWR

The VSWR of the HPA input should be 2.0:1 maximum. The HPA output port VSWR (i.e., the VSWR measured looking into the HPA output port) should not exceed 1.25:1. The HPA should be capable of operating into a load VSWR of 2.0:1 maximum at any phase angle. ¢-2

Note: Under these conditions, the HPA should deliver not less than 32 watts to the load and meet all other performance characteristics. Safety circuitry should be provided to protect the transmitter HPA in the event of an accidental short or an open circuit at its output.

¢-3 2.2.5.4 HPA Connectors

¢-4 The HPA should be provided with a low insertion force, size 2 shell ARINC 600 service connector (see Attachment 1-10). This connector should accommodate signal interconnections and a size 1 coaxial connector in the top plug (TP) insert, signal interconnections and size 1 coaxial connector in the middle plug (MP) insert, and power/coaxial interconnections in the bottom plug (BP) insert. The contact arrangements should be 08 for the top insert, 05 for the middle insert, and 04 for the bottom insert. Index pin code 08 should be used on both Type 1 and Type 2 and the aircraft rack connectors.

¢-3 2.2.5.5 Form Factor

See Attachment 1-10.

2.2.5.6 HPA Muting and Carriers Off Level

¢-5 When the HPA is muted, from maximum rated output power, the HPA RF output level should be at or less than -10 dBW within 1 ms after receiving the mute command (see Attachment 1-4A).

When the HPA is commanded to the "Carrier(s) Off" state (via the HPA Comand word, see Attachment 2), from maximum rated output power, the HPA RF output level should be at or less than -40 dBW.

2.2.6 Coaxial Cable Losses

2.2.6.1 Loss Between RFU and HPA

¢-2 The loss between the RFU and the HPA should fall within the range 19 to 25 dB. This measurement should be taken from the output of the RFU and include the connectors and splitter assembly.

2.2.6.2 Total Loss Between HPA and Antenna

¢-1 The total loss between the HPA and the antenna connector should not exceed 2.5 dB, including the diplexer and any other loss.

COMMENTARY

¢-3 The intent of this Characteristic is to define units which, when installed on an aircraft, should provide SATCOM services in accordance with systems specifications presently being formulated. However, there may be instances where not all of the desired performance can be met in all conditions. It is recognized that imposing more stringent unit characteristics than those described herein may not be cost-effective with the current state of the art. For example, when the effect of the overall voltage standing wave ratio (VSWR) is taken into account between the HPA output port and the antenna, this can decrease the effective HPA output power from the specified 40 W to 32 W (assuming a maximum HPA output port VSWR of 1.25:1 driving an equivalent RF load VSWR of 2.0:1). ¢-3

2.2.6.3 Cable Loss Between Antenna and Diplexer/LNA

The coaxial cable loss between the antenna system and the Diplexer/LNA should not exceed 0.3 dB. ¢-1

2.2.6.4 Loss Between LNA and RFU ¢-2

The total loss between the LNA output and the RFU input should fall within the range 6 to 25 dB, including the ¢-5
cable, combiner, and connectors. ¢-2

COMMENTARY

Interfering RF energy can exist in frequency bands adjacent to the AES receive band, such as radiation from a mobile system used in Japan operating in the 1513-1525 MHz band. The diplexer rejection specified in Section 2.2.4.3 does not provide specific protection against interference from RF energy in such a closely spaced frequency band. Use of a low loss cable may increase the likelihood that strong interfering RF signals may have a degrading effect on the apparent receiver system performance. ¢-6

2.2.6.5 Loss Between SDU and RFU

The loss of the two SDU/RFU coaxial cables shall each be less than or equal to that of 48 inches of RG 58/U. ¢-4

COMMENTARY

Cable loss is specified in this fashion (rather than in dB) because the frequency of operation on these cables is manufacturer dependent, whereas all other cables operate at a specified, known frequency.

2.3 Antenna System Specification

2.3.1 Antenna Coverage Volumes

Two different types of high gain antenna configurations can be utilized; they are defined as follows:

a) Two high gain antennas (HGA) looking abeam and mounted about 45° from the horizon on the side of the aircraft. ¢-

b) A single or dual high gain antenna mounted on top of the fuselage or tail that is electrically or mechanically steerable.

COMMENTARY

> ¢-2 A single low gain hemispherical coverage antenna (LGA) may be used as a back up to the HGA with reduced performance capability.

2.3.1.1 Ideal Antenna Coverage Volume

The antennas should achieve a desired performance over an ideal coverage volume (relative to the aircraft's horizontal line of flight) defined by an elevation range of 5° to 90° and an azimuth range of 360°. The ideal coverage volume should permit communications to be maintained for all normal flight attitudes (e.g., +20°/-5° of pitch, +25°/-25° of roll) except with satellites at low elevation angles to the aircraft.

2.3.1.2 Achieved Antenna Coverage Volume

¢-2 The achieved coverage volume over which all the performance characteristics are satisfied may be less than the ideal antenna coverage volume. See Attachment 1-8 for illustrative information on HGA coverage volumes.

As a minimum, a low gain antenna sub-system should achieve the required performance over at least 85%, and a high gain antenna over at least 75%, of the nominal coverage volume, where the nominal coverage volume is defined as the hemisphere above an aircraft in horizontal flight minus the lowest 5° of elevation.

COMMENTARY

> The foregoing recognizes that with current technology it is very difficult, if not impossible, to design an antenna offering the desired constant gain over a complete hemisphere. In addition, antenna manufacturers should specify the achieved antenna coverage volume for their antennas.

2.3.2 High Gain Antenna (HGA) Receive System

2.3.2.1 Frequency of Operation

¢-5 The receive antenna systems should operate on any frequency within the band 1525-1559 MHz.

2.3.2.2 Polarization

The polarization should be right-handed circular. The definition of CCIR Recommendation 573 applies.

2.3.2.3 Axial Ratio

The axial ratio should be less than 6.0 dB for all steering angles and frequencies of operation.

2.3.2.4 Receive System Figure of Merit (G/T)

¢-1 The receive antenna and diplexer/LNA should perform such that, with a receiver having a noise figure as described in Section 2.2.2.7 connected at the interface at the RFU, overall receive system figure of merit of at least -13 dB/°K is achieved under all conditions (including pointing angle over the receive frequency band) with transmit power up to 60 watts (i.e., 17.8 dBW).

COMMENTARY

> For analysis purposes a sky noise temperature of 100°K should be used. In practice, sky temperature varies over a wide range depending on many factors.

ADDITIONAL COMMENTARY

> ¢-2 The -13 db/K G/T figure of merit should be met at room temperature (i.e., 290°K), for a coverage volume as specified by the antenna manufacturers. At elevated temperatures the G/T may decrease, reducing the coverage volume over which the -13 db/°K figure is met. The converse may be true at low temperatures. For the high data rate system using the high-gain antenna, the thermal contribution of finite losses within the HGA may cause the G/T to be degraded below -13 dB/°K even when the HGA gain, LNA noise figure and diplexer plus cable losses are within tolerance.

2.3.2.5 Steering Angle

The main beam of the antenna should be steerable in accordance with the coverage requirements.

2.3.2.6 Steering Control

¢-4 The antenna receive beam performance requirements should be maintained on a wanted satellite that is within the antenna coverage volume described in Section 2.3.1.1 for aircraft motions that do not cause the aircraft itself to obstruct the beam. The antenna shall point to the commanded direction to within 0.5 dB of its final gain value within [6] seconds from any initial condition.

¢-1 "Open loop" steering, that is beam positioning based on the use of aircraft position data derived from an on-board navigation system, is also permissible but system operation should not be predicated upon it.

¢-4 A current beam is one assigned to optimally point to the chosen satellite for a given aircraft attitude/heading. When the azimuth and/or elevation angles to the satellite change to the extent that the BSU causes one or more phase shifters to change state, the new beam is defined as an adjacent beam.

COMMENTARY

> ¢-1 While the airlines recognize that the functioning of certain antenna types can be enhanced by the use of "open loop" steering, they do not want to have to operate the INS, for example, to conduct a satellite system test. System designers planning to use "open loop" steering, therefore, should ensure that sufficient "closed loop" capability is available to point the beam at the desired satellite for system test purposes and in the absence of failure of the open loop steering information.

2.0 INTERCHANGEABILITY STANDARDS (cont'd)

2.3.2.7 Overload Capability

The receive antenna system should be able to survive in-band power of 0 dBm at the antenna port.

2.3.2.8 Receive Antenna VSWR

The antenna VSWR measured at the single antenna input/output port should be less than 1.5:1 (with respect to a 50 ohm characteristic impedance) for all antenna beam positioning angles over the receive frequency band, see Section 2.3.2.1.

2.3.2.9 Discrimination

The antenna receive subsystem should be able to discriminate in gain against satellites spaced 45° or more in longitude from the wanted satellite (for all aircraft orientations) by at least 13 dB relative to the gain toward the wanted satellite. If practical antenna design considerations prevent this discrimination from being achieved for all flight direction, aircraft orientations, or aircraft positions relative to the satellite, these limitations need to be clearly stated by the antenna manufacturer.

Note: Although adequate discrimination is vital to satellite L-band spectrum reuse, testing of this requirement is not intended to be accomplished on the airframe. Testing on a model or by simulation is acceptable.

2.3.2.10 Phase Discontinuity

The signal phase increments resulting from the minimum achievable beam-steering increments should not exceed:

8 degrees for a minimum of 90% of all combinations of minimum beam-steering increments;

12 degrees for a minimum of 99% of all combinations of minimum beam-steering increments.

This requirement should apply over the entire receive band and minimum antenna coverage volume specified in Section 2.3.1.2.

2.3.3 High Gain Antenna (HGA) Transmit System

The HGA transmit antenna should have a minimum gain of 12 dBic within the achieved antenna coverage volume.

2.3.3.1 Frequency of Operation

The antenna transmit subsystem should operate on any frequency within the band 1626.5-1660.5 MHz.

2.3.3.2 Polarization

The polarization should be right hand circular. The definition of CCIR Recommendation 573 applies.

2.3.3.3 Axial Ratio

The axial ratio should be less than 6.0 dB for all steering angles and frequencies of operation.

2.3.3.4 Steering Angle

The main beam of the antenna transmit subsystem should be steerable as necessary to fulfill coverage requirements.

2.3.3.5 Steering Control

See Section 2.3.2.6.

2.3.3.6 Transmit Antenna VSWR

The antenna VSWR measured at the single antenna input/output port should be less than 1.5:1 (with respect to a 50 ohm characteristic impedance) for all antenna beam pointing angles over the transmit frequency band.

2.3.3.7 Output Power Capability

The antenna system should be able to transmit a continuous single carrier of up to 60 W (i.e., 17.8 dBW). Peak Envelope Power (PEP) may exceed 150 watts due to the presence of multiple carriers.

2.3.3.8 Discrimination

For all antenna steering angles, the antenna should discriminate in antenna gain against satellites spaced 45 degrees or more in longitude from the wanted satellite by at least 13 dB relative to the gain toward the wanted satellite. This should be achieved during all aircraft motions and attitudes encountered under normal operating conditions, as specified in Section 2.3.1. If practical antenna design considerations prevent this discrimination from being achieved for all flight directions, aircraft orientations or aircraft positions relative to the satellite, these limitations need to be clearly stated by the antenna manufacturer.

Note: Testing of this performance is not intended to be accomplished on the airframe. Testing on a model or simulation documentation is acceptable.

2.3.3.9 HGA Connectors and Form Factor

Antennas designed for direct connection to the Diplexer/LNA (as opposed to the BSU) should utilize an N-type female connector. See Attachment 1-11 for connector arrangements and form factors, and Attachments 1-3, 1-4 for interwiring details for the HGA.

2.3.3.10 Beam Steering Unit (BSU)

The beam steering unit (BSU) configuration varies depending on the antenna subsystem design. In some implementations the BSU is included in the RF signal path and should therefore be mounted in close proximity to the antenna (see Attachment 1-12A). In other designs, the BSU is not included in the RF signal path and may be mounted remotely from the antenna (see Attachment 1-12B).

2.3.3.10.1 Beam Steering Unit Connectors

Beam Steering Units intended for installation in the RF signal path should use a TNC type female RF connector for the connection to the Diplexer/LNA (see Attachments

¢-3 1-7A, 1-7B and 1-7C). The number of matched coaxial cables connecting the beam steering unit to the antenna depends on the number of antenna array elements. These types of beam steering units should employ a MIL-C-26482 series 2 type connector (part number MS3470L1626P or equivalent) for the control/power interconnections. This mates with MS3476L16265 on the cable.

¢-4 Beam steering units whose design does not require installation in the direct RF signal path, should be provided with a low insertion force, size 1 shell ARINC 600 service connector for a 2MCU BSU (see Attachment 1-7D). This connector should accommodate auxiliary interconnections in the Top Plug (TP) insert, signal interconnections in the Middle Plug (MP) insert, and coaxial and power connections in the Bottom Plug (BP) insert. Pin assignments should be as shown in Attachment 1-3A. Configuration Index pin code 12 should be used on both the BSU and on the aircraft rack connectors.

2.3.3.10.2 BSU Size and Form Factor

¢-3 See Attachments 1-7A, 1-7B, 1-7C and 1-12B for BSU sizes; the form factor for the 2 MCU BSU is given in Attachment 1-7D.

2.3.3.11 Antenna Control Unit (ACU)

¢-3 The ACU, which is used with mechanically steered antennas, should comply with the dimensional standards in ARINC Specification 404A for the 1 ATR form factor. It should be provided with a connector type DPX2MA26MP40MP34B-00, or equivalent. This mates with a connector type DPX2MA26MS40MS33B-00, or equivalent, on the aircraft rack.

COMMENTARY

> Typical ARINC practice is to describe MIL-C-81659 connectors for ARINC 404A LRUs. In this case however, the insert combination (26/40) is not covered by the MIL spec. We have therefore reverted to a previous practice of quoting one manufacturer's part number "or equivalent".

2.3.3.12 Phase Discontinuity

¢-4 The signal phase increments resulting from the minimum achievable beam-steering increments should not exceed:

> 8 degrees for a minimum of 90% of all combinations of minimum beam-steering increments;
>
> 12 degrees for a minimum of 99% of all combinations of minimum beam-steering increments.

This requirement should apply over the entire transmit band and minimum antenna coverage volume specified in Section 2.3.1.2.

2.3.3.13 L-Band System Physical Isolation

The installation designer should be aware of the need for physical isolation between L-band antennas. Separation resulting in 40 dB or greater of isolation should be provided between the SATCOM antenna and other L-Band antennas at the following frequencies:

1572.0 to 1616.0 MHz	GPS/GLONASS band
1626.5 to 1660.5 MHz	SATCOM band

In addition, separation resulting in 70 dB or greater of isolation should be provided between the SATCOM antenna and the TFTS bottom mounted antenna at the following frequencies: ¢-5

1626.5 to 1660.5 MHz	SATCOM band
1670.0 to 1675.0 MHz	TFTS band

2.3.3.14 Antenna Intermodulation

2.3.3.14.1 Antenna Intermodulation in SATCOM Receive Band

For multicarrier operation, when operating with two unmodulated carriers 4 MHz apart anywhere between 1638.5 and 1660.5 MHz and each one having half the maximum multicarrier average RF power rating of the antenna, the antenna should not generate intermodulation products in the receive band greater than -162 dBW.

Note: For carriers 10 MHz apart, the antenna should not generate intermodulation products in the receive band greater than -164 dBW.

2.3.3.14.2 Antenna Intermodulation Products Which Fall in the GNSS Band ¢-5

For multicarrier operation, when operating two unmodulated carriers anywhere between 1638.5 and 1660.5 MHz, each having half the multicarrier average RF power rating of the SATCOM antenna, the SATCOM antenna should not generate intermodulation products of the 7th order or higher in the GNSS band greater than -115 dBm referenced to the output port of an external 1/4-wave monopole GNSS antenna mounted on a common ground plane with the SATCOM antenna under test. The distance between the antennas should produce isolation of 40 ± 2 dB in the GNSS band (representative of the worst case condition in Section 2.3.5.7). ¢-6 ¢-5 ¢-7 ¢-6

2.3.4 Low Gain Antenna (LGA) Receive System

2.3.4.1 Frequency of Operation

The receive antenna system should operate on any frequency within the band 1525-1559 MHz. ¢-2 ¢-5

2.3.4.2 Polarization

The polarization should be right hand circular. The definition of CCIR Recommendation 573 applies. ¢-2

2.3.4.3 Axial Ratio

¢-2 The axial ratio should be less than 6.0 dB for all frequencies of operation at elevation angles for 45° to 90°, and less than 20 dB at elevation angles from 5° to 45°.

2.3.4.4 Receive System Figure of Merit (G/T)

¢-4 The antenna system (considering the LNA specification) should be such that, with a receiver having noise figure as described in Section 2.2.2.7 connected at the interface at the RFU, an overall receive system figure of merit of at least -26 dB/K is achieved under all conditions (except within 20 [degrees] from the zenith, where it may degrade to -28 dB/K) with power up to 60 watts (i.e., 17.8 dBW); note that the PEP may exceed 150 watts. See COMMENTARY concerning this subject following Section 2.3.1.2.

COMMENTARY

> For analysis purposes the sky noise temperature may be assumed to be 100°K. In practice sky noise temperature varies over a wide range depending on many factors.
>
> Receive System Figure of Merit (G/T) for the 12 dBic antenna (HGA) and the 0 dBic antenna differ by 13 dB (more than the expected 12 dB). This G/T may be obtained with a receive antenna having less than 0 dBic gain.

2.3.4.5 Overload Capability

The receive antenna system should be able to survive in-band power of 0 dBm at the antenna port.

2.3.4.6 Receive Antenna VSWR

¢-2 The antenna VSWR measured at the single antenna input/output port should be less than 1.5:1 (with respect to a 50 ohm characteristic impedance) over the receive frequency band.

2.3.5 Low Gain Antenna (LGA) Transmit System

¢-2 A single LGA should provide at least 0 (but not more than +5) dBic gain over 360° of azimuth and above 5°elevation except within 20° from the zenith, where the gain may be as low as -2 dBic. See Section 2.3.1.2 for additional information relating to the LGA achieved antenna coverage volume.

2.3.5.1 Frequency of Operation

¢-2 The antenna transmit subsystem should operate on any frequency within the band 1626.5-1660.5 MHz.

2.3.5.2 Polarization

The polarization should be right hand circular. The definition of CCIR Recommendation 573 applies.

2.3.5.3 Axial Ratio

The axial ratio should be less than 6.0 dB for all frequencies of operation at elevation angles for 45° to 90°, and less than 20 dB at elevatio angles from 5° to 45°. ¢-3

2.3.5.4 Transmit Antenna VSWR

The antenna VSWR measured at the single antenna input/output port should be less than 1.5:1 (with respect to 50 ohm characteristic impedance) over the transmit frequency band. ¢-2

2.3.5.5 Output Power Capability

The antenna should be able to handle a continuous single carrier of up to 60 W (i.e., 17.8 dBW). The PEP may exceed 150 watts due to the presence of multiple carriers. ¢-4

2.3.5.6 LGA Form Factor ¢-5

See Attachment 1-13 for the appropriate configuration.

2.3.5.7 L-Band System Physical Isolation

The installation designer should be aware of the need for physical isolation between L-band antennas. Separation resulting in 40 dB or greater of isolation should be provided between the SATCOM antenna and other L-Band antennas at the following frequencies: ¢-5

1572.0 to 1616.0 MHz	GPS/GLONASS band
1626.5 to 1660.5 MHz	SATCOM band

In addition, separation resulting in 70 dB or greater of isolation should be provided between the SATCOM antenna and the TFTS bottom mounted antenna at the following frequencies:

1626.5 to 1660.5 MHz	SATCOM band
1670.0 to 1675.0 MHz	TFTS band

2.3.6 Antenna Positioning Data

The SDU should first attempt to receive antenna positioning data on the Primary IRS Input. If the data is invalid or missing, the SDU should next listen to the Secondary IRS Input. If the data are invalid or missing, the SDU will declare in the open loop steering word "NO COMPUTED DATA". The SDU should periodically, at least once every 10 seconds, test the inputs for valid data. When valid data are detected, the search should stop and that data be used, see Attachment 1-4, note 36. ¢-4

2.4 Standard Interwiring

The standard interwiring to be installed for the aeronautical satellite system avionics is set forth in Attachment 1-3 with the applicable notes in Attachment 1-4. This interwiring is designed to provide the degree of interchangeability specified for the system in Section 1.6 of this document. Manufacturers are cautioned not to rely on special wires, cabling or shielding for use with ¢

particular units because they may not exist in a standard installation.

COMMENTARY

Why Standardize Interwiring?

The standardized interwiring is perhaps the heart of all ARINC Characteristics. It is this feature which allows the airline customer to complete his negotiation with the airframe manufacturer so that the latter can proceed with installation engineering and initial fabrication prior to airline commitment on a specific source of equipment. This provides the equipment manufacturer with many valuable months in which to put final "polish" on his equipment in development.

2.5 Power Circuitry

2.5.1 Primary Power Input

¢-2 The aeronautical satellite system should be designed to use 115V 400 Hz single phase AC power. Aircraft power supply characteristics, utilization, equipment design limitations and general guidance material are set forth in ARINC Report No. 413A, "Guidance for Aircraft Electrical Power Utilization and Transient Protection." The primary power input should be protected by circuit breakers of the size described in Attachment 1-4.

2.5.2 Power Control Circuitry

There should be no master on/off power switching within the avionics. Any user desiring on/off control should provide, through the medium of a switching function installed in the airframe, means of interrupting the primary power to the system. It is probable, however, that on/off switching will not be needed in most installations and that power will be wired to the system from the circuit breaker panel.

COMMENTARY

Installation designers should note that a DC supply may be required to parts of the avionics in flight to prevent possible data loss during transient interruptions to the AC supply. The designers of these units are encouraged to use non-volatile memory, however, so that this external DC power is not required.

2.6 System Functions and Signal Characteristics

¢-2 A list of the system functions and signal characteristics required to ensure the desired level of interchangeability for the subsystems comprising the aeronautical satellite system (excluding the SDU-RFU) is set forth in Part 2 of this document.

2.7 Environmental Conditions

¢-4 The avionics should be specified environmentally in terms of the requirements of EUROCAE ED-14 and RTCA Document DO-160C, "Environmental Conditions and Test Procedures for Airborne Equipment". Attachment 3 to this document tabulates the relevant environmental categories. ¢-4

2.8 Cooling

COMMENTARY

Equipment failures in aircraft due to inadequate thermal management have plagued the airlines for many years. Section 3.5 of ARINC Specification 600 contains everything airframe and equipment manufacturers need to know to prevent such problems in the future. They regard this material as "required reading" for all potential suppliers of satellite communication equipment and aircraft installations.

Equipment manufacturers should note that airlines may retrofit satellite equipment into aircraft in which forced air cooling is not available. They should therefore design their equipment such that the thermal interface limits set forth in Section 3.5 of ARINC Specification 600 can be met without such forced cooling air being provided, or persuade their customers to accept the presence of a cooling fan inside the component.

2.8.1 SDU

The SDU should be designed to accept, and airframe manufacturers should configure the installation to provide, forced air cooling as defined in Section 3.5 of ARINC Specification 600. The airflow rate provided to the modem in the aircraft installation should be 33 kg/hr. of 40°C (max.) air, and the pressure drop through the modem should be 5 ±3 mm of water at this rate. The SDU should be designed to dissipate less than 150 W and to expend this pressure drop to maximize the cooling effect. Adherence to the pressure drop standard is necessary to allow interchangeability of the equipment. ¢-2

2.8.2 Radio Frequency Unit (RFU)

The RFU should be designed to accept, and airframe manufacturers should configure the installation to provide, forced air cooling as defined in Section 3.5 of ARINC Specification 600. The airflow rate provided to the RFU in the aircraft installation should be 22 kg/hr. of 40°C (max.) air, and the pressure drop through the RFU should be 5 ±3 mm of water at this rate. The RFU should be designed to dissipate less than 100 W and to expend this pressure drop to maximize the cooling effect. Adherence to the pressure drop standard is necessary to allow interchangeability of the equipment. ¢-3

2.8.3 High Power Amplifier (HPA)

The HPA may require special consideration for cooling. One HPA configuration employs a 4 MCU unit for which a maximum heat dissipation of 125 W is defined. The airflow rate provided to this HPA should be 27.5 kg/hr of 40°C (max.) air and the pressure drop through the HPA ¢-3

2.0 INTERCHANGEABILITY STANDARDS (cont'd)

2.8.3 High Power Amplifier (HPA) (cont'd)

¢-3 should be 5 ±3 mm of water at this rate. Another HPA configuration uses an 8 MCU unit which will need
¢-4 cooling for a maximum of 250 W heat dissipation. The
¢-7 airflow rate for this unit should be 55 kg/hr of 40°C (max.) air and the pressure drop through the unit should
¢-4 be once again, 5 ±3 mm of water. In both cases, the pressure drop should be expended to maximize the cooling effect.

2.8.4 Antenna Control Unit (ACU)

¢-2 The mechanically steered antenna ACU should be designed to accept, and airframe manufacturers should configure the installation to provide, forced air cooling as defined in Section 3.5 of ARINC Characteristic 600. The airflow rate provided to the unit in the aircraft installation should be 44 kg/hr of 40°C (max.) air and the pressure drop through it should be 5 ±3 mm of water at this rate. The ACU should be designed to dissipate less than 200 W of heat and to expend the pressure drop to maximize the cooling effect. Adherence to the pressure drop standard is necessary to allow the desired interchangeability of the equipment.

2.8.5 Beam Steering Unit (BSU)

¢-4 The 2MCU BSU that is rack mounted should be designed to accept, and airframe manufacturers should configure the installation to provide, forced air cooling as defined in Section 3.5 of ARINC Characteristic 600. The airflow rate provided to the 2 MCU BSU should be 11 kg/hr at 40°C (max.) air and the pressure drop through it should be 5 ±3 mm of water at this rate. The 2 MCU BSU should be designed to dissipate less than 50 W of heat and to expend the pressure drop to maximize the cooling effect. Adherence to the pressure drop standard is necessary to allow the desired interchangeability of the equipment.

¢-3 All non-2 MCU BSUs, because they may be mounted in close proximity to the antenna, should be designed to function without forced air cooling.

COMMENTARY

> The non-2 MCU BSU should be able to withstand the high temperatures experienced near the aircraft skin as well as its own heat generation.

2.9 Grounding and Bonding

The attention of equipment and airframe manufacturers is drawn to the guidance material in Section 6 and Appendix 2 of ARINC Specification 404A on the subject of equipment and radio rack grounding and bonding. Particular attention should be given to bonding and grounding requirements of the antenna system especially components mounted outside the airframe.

2.10 System ATE Design ¢-3

2.10.1 General ¢-3

To enable automatic test equipment (ATE) to be used in the bench maintenance of the SDU, those internal circuit functions not available at active interconnection pins and considered by the equipment manufacturer to be needed for automatic test purposes, should be brought to ATE Reserved pins on the upper insert (TP) of the connector (see Attachment 1-3).

2.10.2 Unit Identification ¢-3

The SDU should report its equipment identification code as defined in ARINC Specification 429. The SDU should also provide its software and hardware revision level when requested by a centralized fault display unit on the aircraft or when queried by ATE in the shop.

2.10.3 Built-In Test Equipment (BITE) ¢-3

The SDU described in this Characteristic should contain Built-In Test Equipment (BITE) capable of detecting and annunciating a minimum of 95% of the faults or failures which can occur within the SDU and as many faults as possible associated with the RFU, ACU/BSU, HPA, HPR and the LNA/diplexer.

BITE should operate continuously during flight. Monitoring of the results should be automatic. The BITE should automatically test, detect, isolate and record intermittent and steady state failures. The BITE should display system condition and indicate any faulty LRUs upon activation of the self-test routine. In addition, BITE should display faults which have been detected during in-flight monitoring.

No failure occurring within the BITE subsystem should interfere with the normal operation of the SDU.

COMMENTARY

> Sufficient margins should be used in choosing BITE parameters to preclude nuisance warnings. Discrepancies in SDU operation caused by power bus transients, EMI ground handling, servicing interference, abnormal accelerations or turbulence should not be recorded as faults.
>
> The SDU should be designed to be compatible with a centralized fault display system as described in ARINC Report 604, "Guidance for Design and Use of Built-In Test Equipment (BITE)". The philosophy expressed in ARINC Report 604 is that on-board avionic systems such as SATCOM should provide an interactive, "user friendly", aid to maintenance. The SDU should provide a listing of BITE options in menu format for operator selection. By menu selection, the operator should be capable of

requesting fault status (current and previous), initiating self tests and requesting detailed failure information for diagnostics.

¢-3 | 2.10.3.1 BITE Display

BITE information should be made available on all applicable data buses for use in the centralized fault display as described in ARINC Report 604. This data will be presented to the maintenance technician on the display contained within that system. As an option, the SDU could also have a System/LRU fault status display on the front panel. This option could be beneficial for local troubleshooting in the electronics equipment bay.

COMMENTARY

Most users desire an alpha-numeric display to present fault information to line maintenance personnel. The desire includes presentation of the information in the form of easily understandable text -- not coded! The airlines do not want the maintenance personnel to be burdened with carrying a library of code translations. The airlines would like to have the fault analysis capability of BITE using the alpha-numeric display equal to or surpassing the capability currently realized with shop Automatic Test Equipment.

¢-3 | 2.10.3.2 Fault Monitor

The results of in-flight or ground operations of BITE should be stored in a non-volatile monitor memory. The size of the memory should be sufficient to retain detected faults during the previous ten flight legs. The data in the monitor memory should include flight leg identification, fault description, and faulty LRU identification

The contents of the monitor memory should be retrievable by BITE operation or by shop maintenance equipment. Refer to ARINC Report 604 for further guidance on fault recording.

ARINC Report 604 also specifies that fault data should be sent to the centralized fault display interface unit on an ARINC 429 data bus at regular intervals. The SDU should output BITE fault data on all applicable Data Buses.

COMMENTARY

The airlines have expressed an interest in having BITE data from as many as 64 previous flight legs available in memory.

A question which must be considered by the equipment designer is, "What is the scope/purpose of BITE"? It appears from the unconfirmed failure data that is available from repair shop operations, that there is merit in considering storage of data which will identify the Shop Replaceable Unit (SRU). BITE should be used to detect and isolate faults to the LRU level.

2.10.3.3 Self-Test Initiation | ¢-3

At the time of equipment turn-on, a power-up self-test should be initiated automatically as described in ARINC Report 604. In addition, the SDU should, where practical, provide self-test capability for troubleshooting and installation verification. The initiation of all test sequences should be possible from the control portion of the centralized fault display system.

As an aid to shop maintenance and local trouble-shooting on the line, a self-test mechanism should be provided on the SDU front panel. The momentary depression of the push button on the front panel of the LRU should initiate a unit/system self-test. The self-test routine should start with an indicator test in which all indicator elements are activated simultaneously. If the self-test routine detects a fault, the "all on" indication should be deactivated leaving the appropriate "fault" indication activated. If no fault is found, the contents of the intermittent fault memory should be reviewed. Only the four most recent flight legs should be considered. If no fault is recorded, the "all on" indication should be deactivated leaving the "normal" indication visible. If an occurrence of a fault on one of the four earlier flight legs is detected, the appropriate "fault" indication should be activated. The activated indications should remain visible until the line maintenance mechanic presses the self-test button a second time or a "time-out" period of approximately ten minutes expires. Selection of four as the number of flight legs, for which intermittent fault memory should be examined for the line maintenance BITE function, was made in the belief that it could be reduced as confidence in the BITE was built up. Manufacturers are urged to make this number easily alterable in their BITE implementation.

2.10.3.4 Monitor Memory Output | ¢-3

The BITE Monitor Memory output should consist of the following:

(a) An output on all low speed ARINC 429 Data Buses to the centralized fault display interface unit, when so requested, as described in ARINC Report 604 using the format described therein.

(b) An output to the display (if provided) located on the SDU, indicating system and LRU status. An English language alpha-numeric display is preferred over LEDs of coded messages.

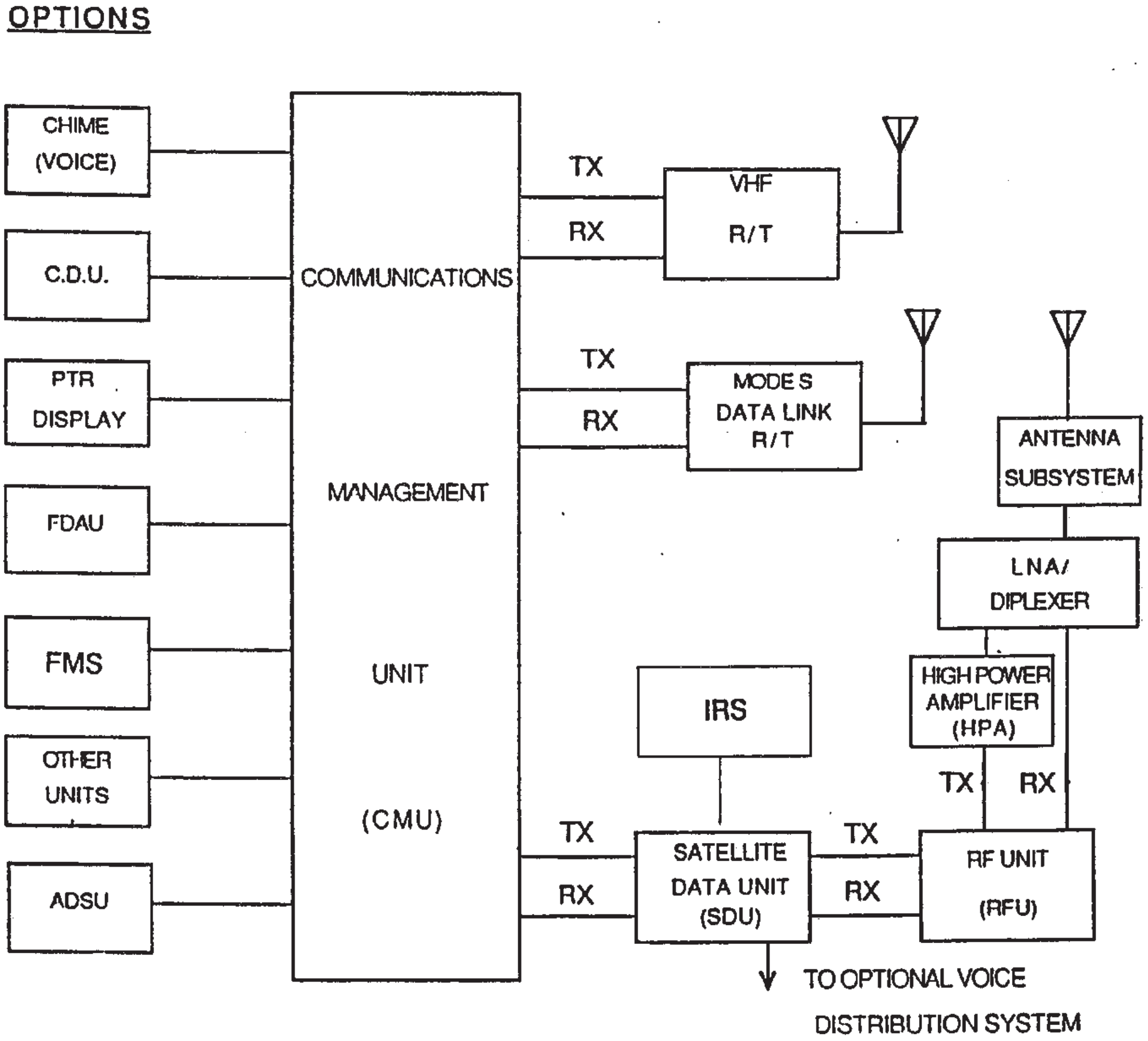
(c) An output of undefined format which should be made available at the ATE reserved pins of the upper connector located on the SDU.

The monitor memory should be capable of being reset in order that stored faults will not be carried over once an LRU replacement or repair has been effected. The reset should be initiated only by shop maintenance.

2.10.3.5 Use of Automatic Test Equipment

c-4 Equipment manufacturers should note that the airlines desire to have maintenance procedures shop verified on automatic test equipment which conforms to ARINC Specification 608, Standard Modular Avionics Repair and Test System. The automatic test equipment is expected to execute software with maintenance procedures written in accordance with ARINC Specification 626, Standard ATLAS Subset for Modular Test and ARINC Specification 627, Programmers Guide for SMART™ Systems using ARINC 626 ATLAS.

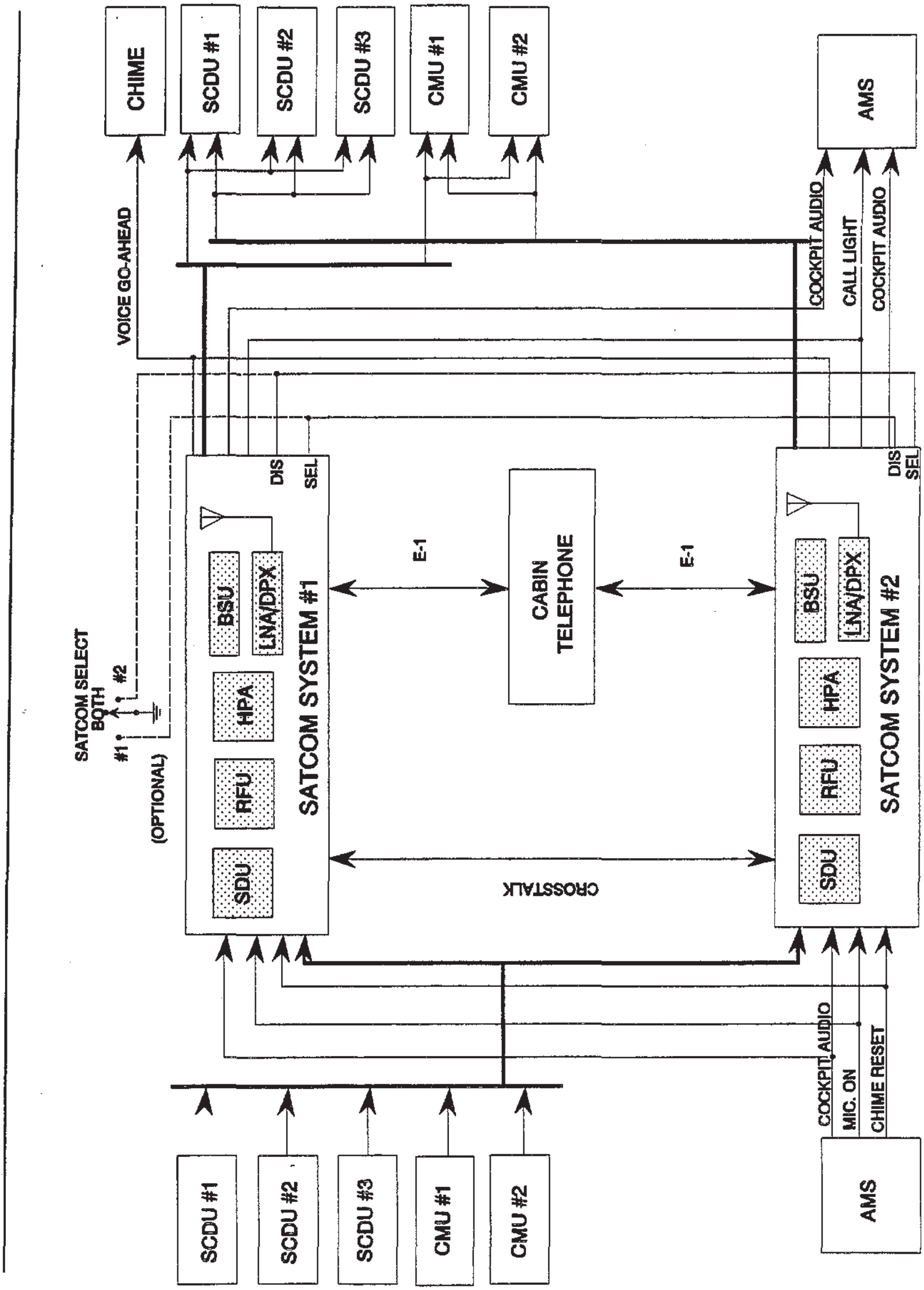
ATTACHMENT 1-1
GENERAL CONFIGURATION OVERVIEW



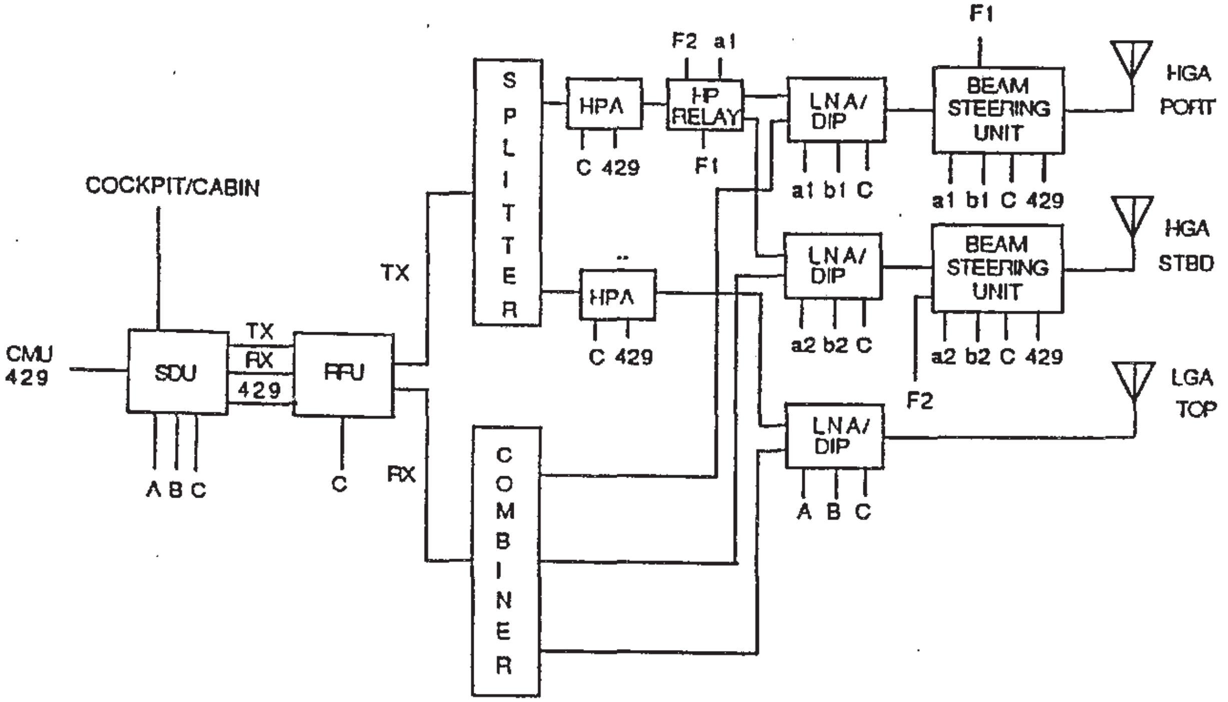
¢-2

ATTACHMENT 1-1A
SAMPLE DUAL SATCOM INSTALLATION

¢-5



ATTACHMENT 1-2
ANTENNA CONFIGURATION



c-3

LEGEND

A/a1/a2 - LNA ON/OFF; a1 is also HP Relay control

B/b1/b2 - LNA BITE
C - 115 VAC
CMU - COMMUNICATIONS MANAGEMENT UNIT
STBD - STARBOARD
429 - ARINC 429 DATA BUS

LNA/DIP - LOW NOISE AMPLIFIER/DIPLEXER
HGA - HIGH GAIN ANTENNA
HPA - HIGH POWER AMPLIFIER
LGA - LOW GAIN ANTENNA
RFU - RADIO FREQUENCY UNIT
SDU - SATELLITE DATA UNIT
F1/F2 HP Relay BITE

Note 1: This block diagram does not necessarily include every interface.

Note 2: See the Antenna Subsystem Control Interface drawing of this configuration (located after the Avionics Block Diagrams within this attachment) for complete details of Beam Steering Unit Interfaces with the SDU, HPA, LNA/DIP, and HP Relay.

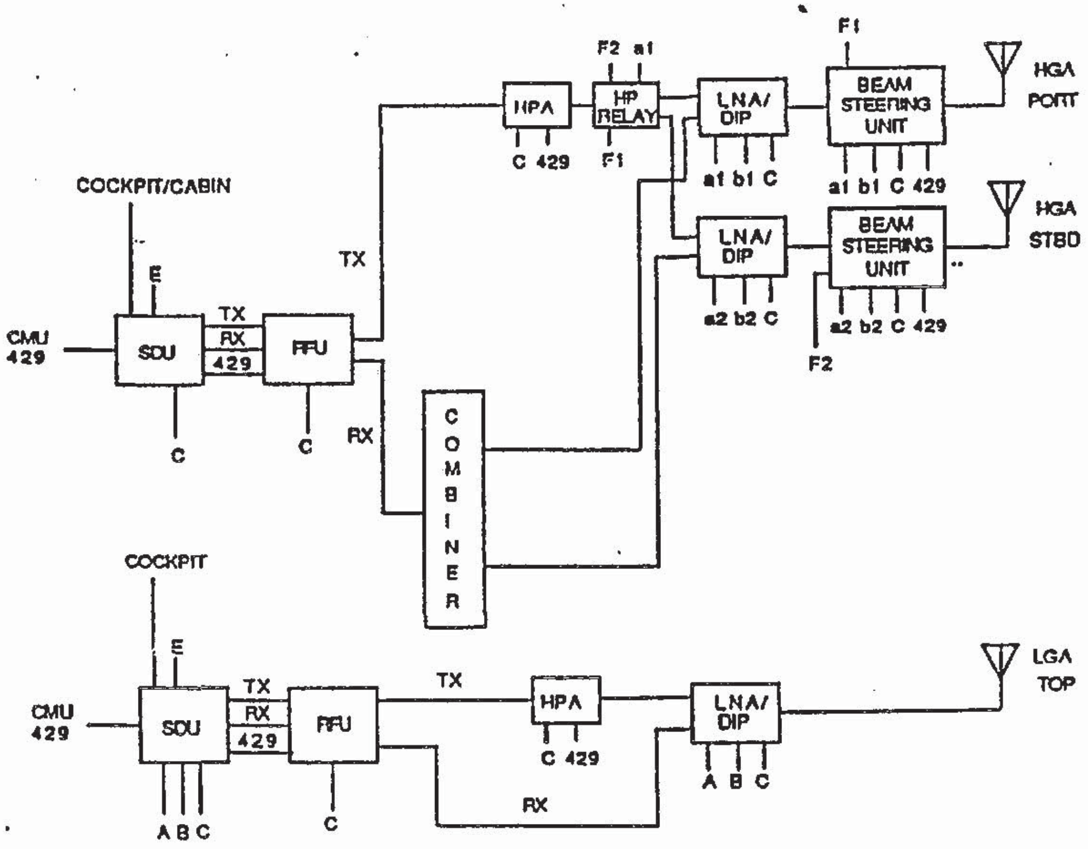
Note 3: The low gain antenna and associated components are optional to this configuration.

Figure 1 - Side Mounted Phased Array Configuration With High Power Relay Option

c-6

ATTACHMENT 1-2 (cont'd)
ANTENNA CONFIGURATION

¢-3



LEGEND

A/a1/a2 - LNA ON/OFF: a1 is also HP Relay Control

B/b1/b2 - LNA BITE
C - 115 VAC
CMU - COMMUNICATIONS MANAGEMENT UNIT
STBD - STARBOARD
429 - ARINC 429 DATA BUS

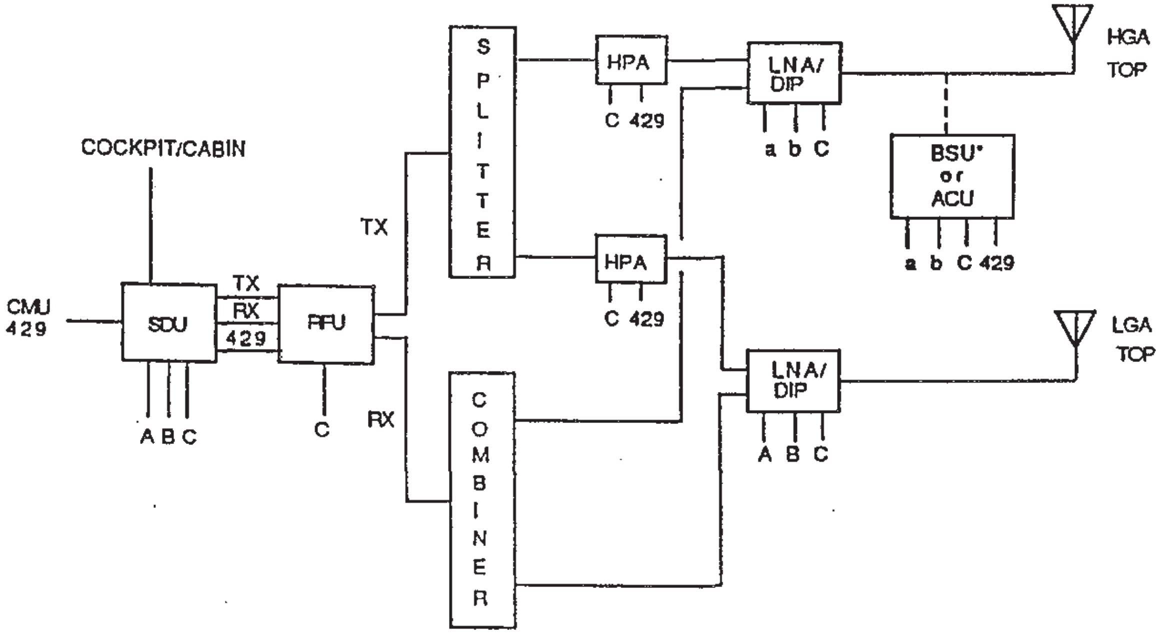
LNA/DIP - LOW NOISE AMPLIFIER/DIPLEXER
HGA - HIGH GAIN ANTENNA
HPA - HIGH POWER AMPLIFIER
LGA - LOW GAIN ANTENNA
RFU - RADIO FREQUENCY UNIT
SDU - SATELLITE DATA UNIT
F1/F2 HP RELAY BITE
E - SDU CROSSTALK

Note 1: This block diagram does not necessarily include every interface.

Note 2: See the Antenna Subsystem Control Interface drawing of this configuration (located after the Avionics Block Diagrams within this attachment) for complete details of Beam Steering Unit Interfaces with the SDU, HPA and LNA/DIP and HP Relay.

Figure 2 - Side Mounted Phased Array Configuration with High Power Relay Option
Dual System: High Gain and Low Gain Antenna

ATTACHMENT 1-2 (cont'd)
ANTENNA CONFIGURATION



¢-3

LEGEND

A/a - LNA ON/OFF

B/b - LNA BITE
C - 115 VAC
CMU - COMMUNICATIONS MANAGEMENT UNIT
429 - ARINC 429 DATA BUS

LNA/DIP - LOW NOISE AMPLIFIER/DIPLEXER
HGA - HIGH GAIN ANTENNA
HPA - HIGH POWER AMPLIFIER
LGA - LOW GAIN ANTENNA
RFU - RADIO FREQUENCY UNIT
SDU - SATELLITE DATA UNIT

* Either a Beam Steering Unit (BSU) or an Antenna Control Unit (ACU) will be required, depending upon the type of top mounted antenna used.

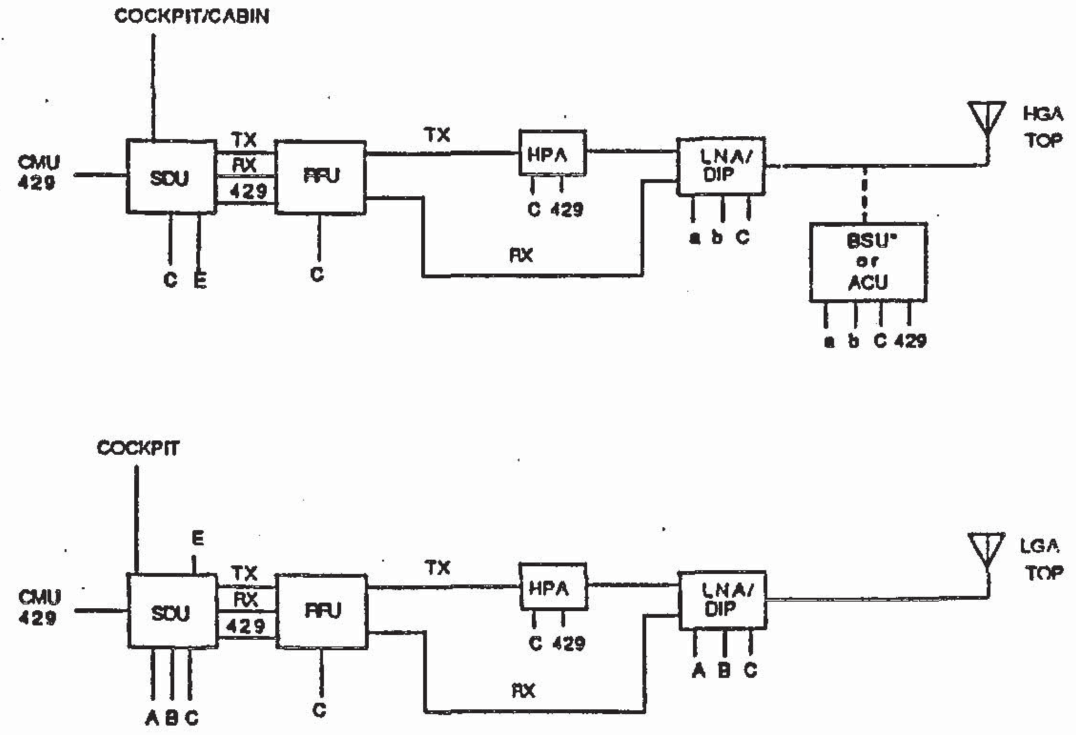
Note 1: This block diagram does not necessarily include every interface.

Note 2: See the Antenna Subsystem Control Interface drawing of this configuration (located after the Avionics Block Diagrams within this attachment) for complete details of ACU/BSU interface with the SDU, HPA and LNA/DIP.

Note: 3: The low gain antenna and associated components are optional to this configuration. ¢-6

Figure 3 - Top Mounted Antenna Configuration

ATTACHMENT 1-2 (cont'd)
ANTENNA CONFIGURATION



C-3

LEGEND

A/a - LNA ON/OFF

B/b - LNA BITE
C - 115 VAC
CMU - COMMUNICATIONS MANAGEMENT UNIT
E - SDU CROSSTALK
429 - ARINC 429 DATA BUS

LNA/DIP - LOW NOISE AMPLIFIER/DIPLEXER
HGA - HIGH GAIN ANTENNA
HPA - HIGH POWER AMPLIFIER
LGA - LOW GAIN ANTENNA
RFU - RADIO FREQUENCY UNIT
SDU - SATELLITE DATA UNIT

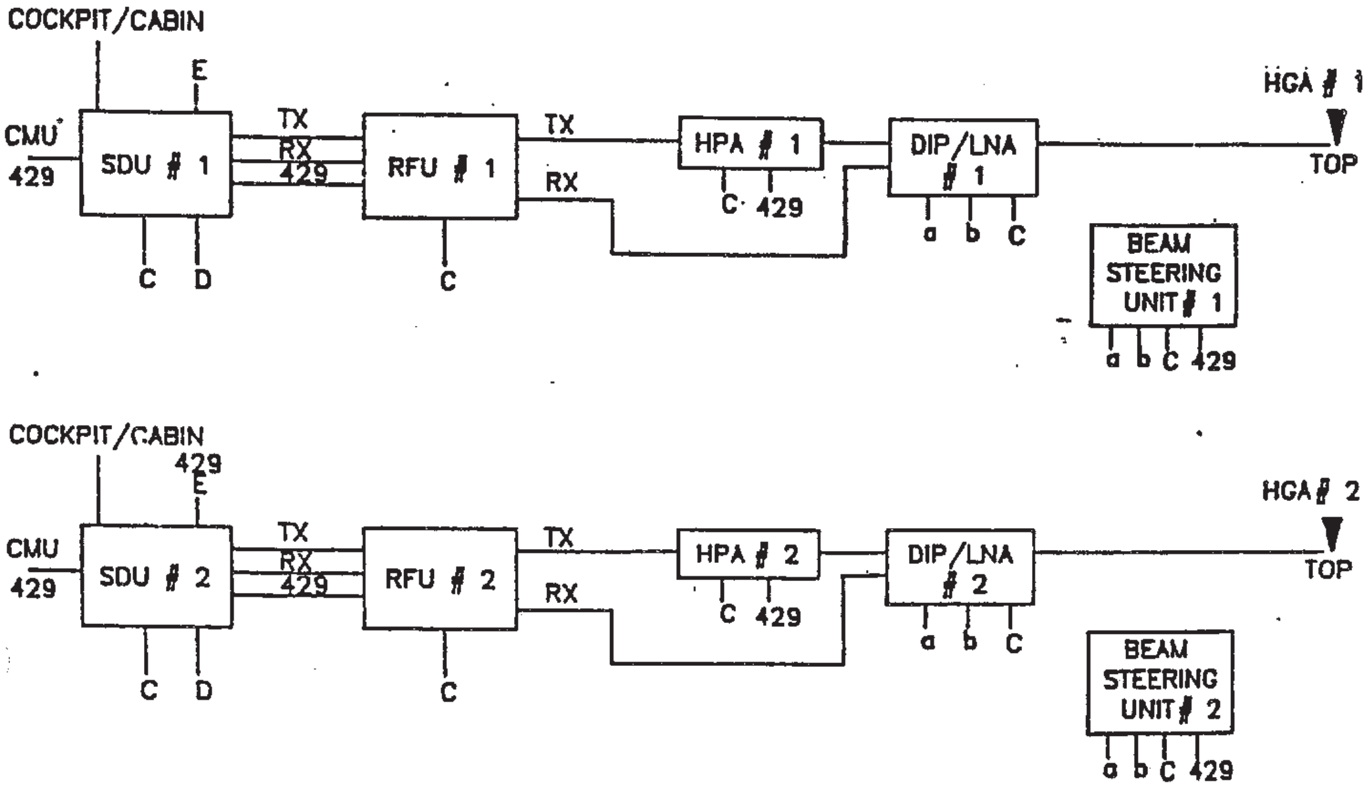
* Either a Beam Steering Unit (BSU) or an Antenna Control Unit (ACU) will be required, depending upon the type of top mounted antenna used.

Note 1: This block diagram does not necessarily include every interface.

Note 2: See the Antenna Subsystem Control Interface drawing of this configuration (located after the Avionics Block Diagrams within this attachment) for complete details of ACU/BSU interfaces with the SDU, HPA and LNA/DIP.

Figure 4 - Top Mounted Configuration
Dual System: High Gain and Low Gain

ATTACHMENT 1-2 (cont'd)
ANTENNA CONFIGURATION



c-3

a - LNA ON/OFF
b - LNA BITE
C - 115 VAC
D - BITE/CONTROL
E - CROSSTALK TO 2nd SDU
429 - ARINC 429 DATA BUS

LNA/DIP - LOW NOISE AMPLIFIER/DIPLEXER
HGA - HIGH GAIN ANTENNA
HPA - HIGH POWER AMPLIFIER
LGA - LOW GAIN ANTENNA
RFU - RADIO FREQUENCY UNIT
SDU - SATELLITE DATA UNIT

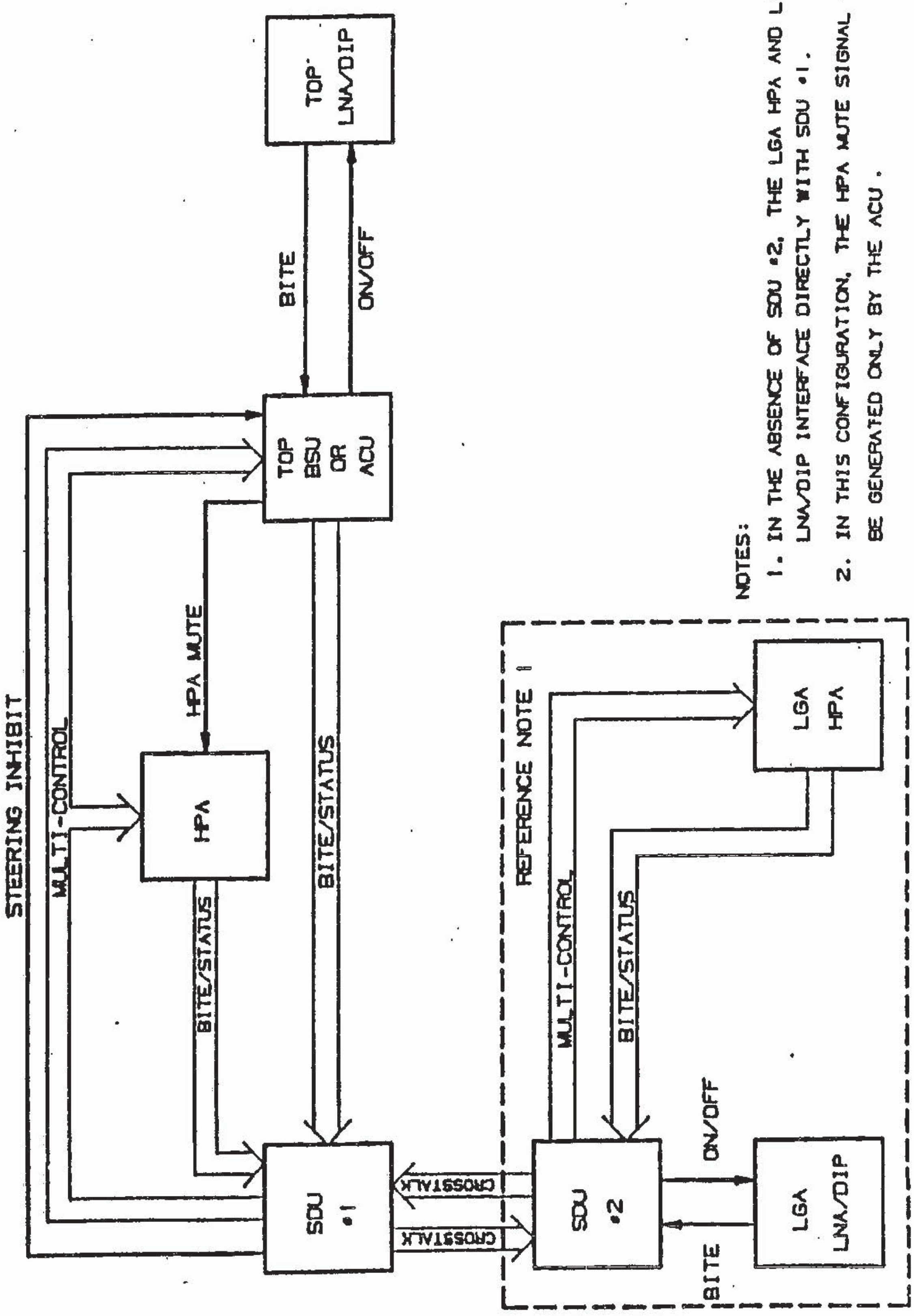
Note 1: This block diagram does not necessarily include every interface.

Note 2: See the Antenna Subsystem Control Interface drawing of this configuration (located after the Avionics Block Diagrams within this attachment) for complete details of ACU/BSU interface with the SDU, HPA and LNA/DIP.

**Figure 5 - Top Mounted Array Configuration
Dual High Gain Antenna System**

ATTACHMENT 1-2 (cont'd)
ANTENNA CONFIGURATION

c-2

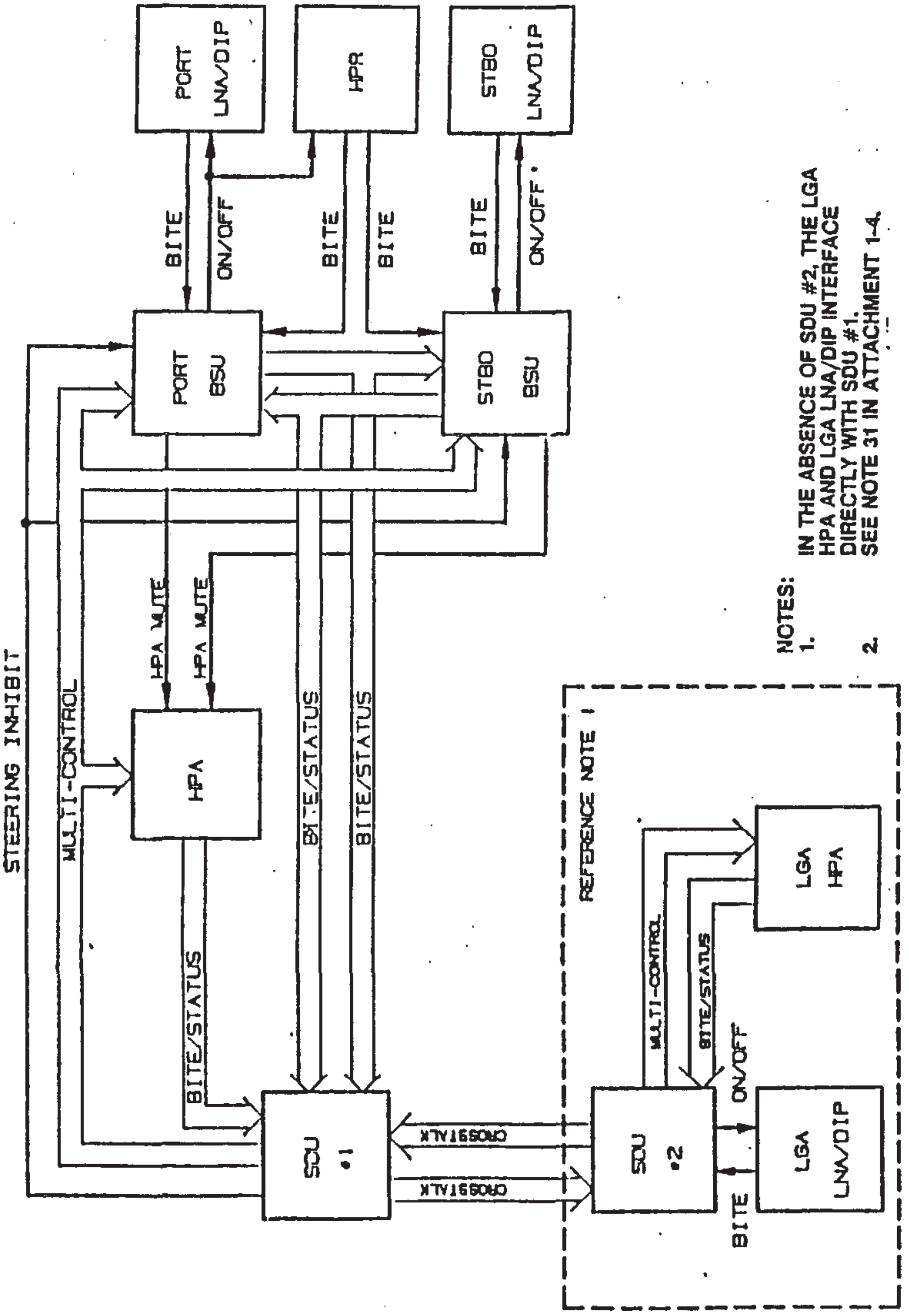


NOTES:

1. IN THE ABSENCE OF SDU #2, THE LGA HPA AND LGA LNA/DIP INTERFACE DIRECTLY WITH SDU #1.
2. IN THIS CONFIGURATION, THE HPA MUTE SIGNAL WILL BE GENERATED ONLY BY THE ACU.

Figure 6 - Antenna Subsystem Control Interfaces (RF Excluded)
Top Mounted Antenna Configuration

ATTACHMENT 1-2 (cont'd)
ANTENNA CONFIGURATION



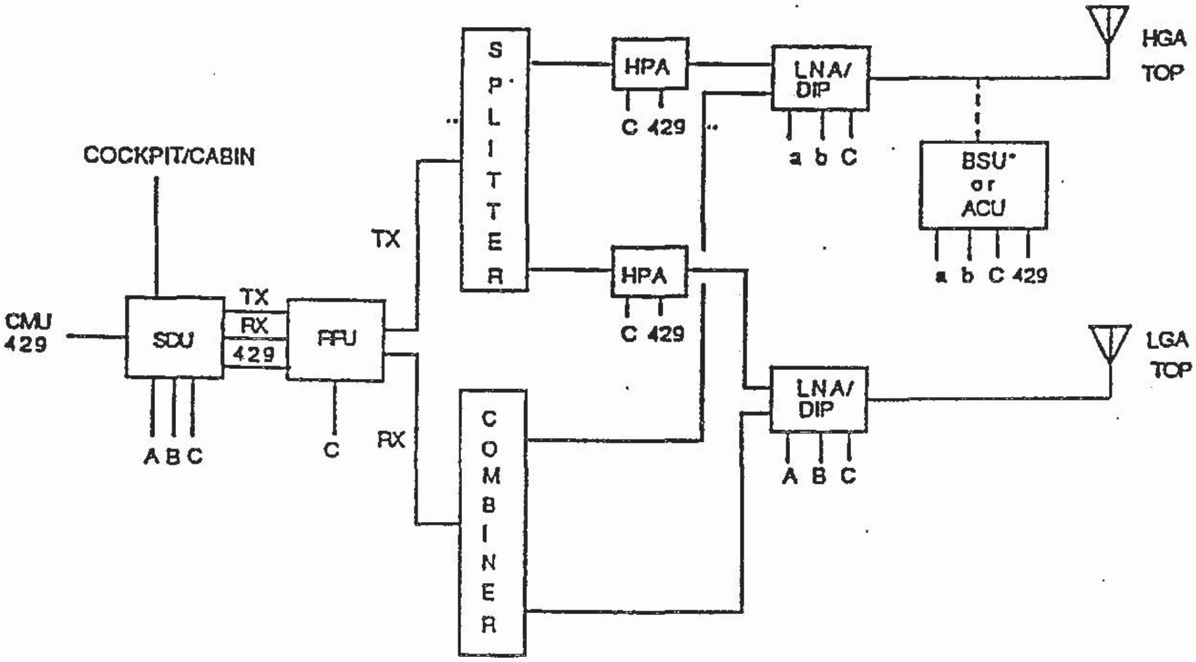
NOTES:
1. IN THE ABSENCE OF SDU #2, THE LGA HPA AND LGA LNA/DIP INTERFACE DIRECTLY WITH SDU #1.
2. SEE NOTE 31 IN ATTACHMENT 1-4.

¢-2

Figure 7 - Antenna Subsystem Control Interfaces (RF Excluded)
Side Mounted Phased Array Configuration with High Power Relay Option

ATTACHMENT 1-2 (cont'd)
ANTENNA CONFIGURATION

c-6



LEGEND

A - LNA ON/OFF	LNA/DIP - LOW NOISE AMPLIFIER/DIPLEXER
B - LNA BITE	HPA - HIGH POWER AMPLIFIER
C - 115 VAC	LGA - LOW GAIN ANTENNA
CMU - COMMUNICATIONS MANAGEMENT UNIT	RFU - RADIO FREQUENCY UNIT
429 - ARINC 429 DATA BUS	SDU - SATELLITE DATA UNIT

NOTE 1: This block diagram does not necessarily include every interface.

Figure 8 Low Gain Antenna System

ATTACHMENT 1-3
STANDARD INTERWIRING

NOTE: Digital data bus shield grounds should be grounded to aircraft structure at both ends and on both sides of each production break.

FUNCTION	SDU	RFU	⟨33⟩ SPLTR	⟨33⟩ COMB	HPA	⟨1⟩⟨33⟩⟨34⟩ HP RELAY	⟨33⟩ LNA/DIP	⟨32⟩⟨33⟩ BEAM STRNG	ANT	OTHER	NOTES	
Reserved for Analog Cabin Voice Channel 1 Hook-switch (0-15V input)	TP1A									To non-CCS Cabin Tele-phone		¢-4 ¢-6
Reserved for Analog Cabin Voice Channel 2 Hook-switch (0-15V input)	TP1B											¢-4 ¢-6
Reserved for Analog Cabin Voice Channel 1 Ringer (0-7V output)	A TP1C B TP1D											¢-4 ¢-6
Reserved for Analog Cabin Voice Channel 2 Ringer (0-7V output)	A TP1E B TP1F											¢-4 ¢-6
2Reserved for Avionics Sub-system SATCOM Fail Warning (0-28V output)	TP1G											
Reserved for Analog Cabin Voice Channel 1 In-Use (0-28V output)	TP1H									To non-CCS Cabin Tele-phone		
Satellite Link Not Ready (0-28V output)	TP1J											¢-4
Reserved for Analog Cabin Voice Channel 2 In-Use (0-28V output)	TP1K									To non-CCS Cabin Tele-phone		
Reserved Analog PBX Channel 1 Input HI	TP2A									from CTU TP12A	48	¢-5
Reserved Analog PBX Channel 1 Input LO	TP2B									TP12B		
Reserved Analog PBX Channel 1 Output HI	TP2C									to CTU TP12C		
Reserved Analog PBX Channel 1 Output LO	TP2D									TP12D		
Reserved Analog PBX Channel 2 Input HI	TP2E									from CTU TP12E		
Reserved Analog PBX Channel 2 Input LO	TP2F									TP12F		
Reserved Analog PBX Channel 2 Output HI	TP2G									to CTU TP12G		
Reserved Analog PBX Channel 2 Output LO	TP2H									TP12H		
Future Spare	TP2J										53	¢-6
Future Spare	TP2K										53	

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

C-4

			33	33		1 33 34	33	32 33			
FUNCTION	SDU	RFU	SPLTR	COMB	HPA	HP RELAY	LNA/DIP	BEAM STRNG	ANT	OTHER	NOTES
Reserved for Cockpit Voice Unavailable (0-28V output)	TP3A o										
Reserved for Cabin Voice Unavailable (0-28V output)	TP3B o										
Reserved for Packet Data Unavailable (0-28V output)	TP3C o										
Reserved for Packet Data Low Speed Only Available (0-28V output)	TP3D o										
Reserved for SATCOM Inoperable (0-28V output)	TP3E o										
Future Spare	TP3F o										
Future Spare	TP3G o										
Future Spare	TP3H o										
Future Spare	TP3J o										
Future Spare	TP3K o										

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

FUNCTION	SDU	RFU	(33) SPLTR	(33) COMB	HPA	(1)(33)(34) HP RELAY	(33) LNA/DIP	(32)(33) BEAM STRNG	ANT	OTHER	NOTES	
Future Spare	TP4A o											
Future Spare	TP4B o											
Future Spare	TP4C o											
Future Spare	TP4D o											¢-4
Future Spare	TP4E o											
Future Spare	TP4F o											
Future Spare	TP4G o											
Future Spare	TP4H o											
Future Spare	TP4J o											
Future Spare	TP4K o											
Reserved Optional												
Port 1_TXD	TP5A o									o Aux Async Port 1	50	¢-6
Port 1_RXD	TP5B o									o		
Port 1_RTS	TP5C o									o		
Port 1_CTS	TP5D o									o		
Port 1_GND	TP5E o									o		
Port 2_TXD	TP5F o									o Aux Async Port 2	50	¢-5
Port 2_RXD	TP5G o									o		
Port 2_GND	TP5H o									o		
Port 3_TXD	TP5J o									o Aux Async Port 3	50	
Port 3_RXD	TP5K o									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 Optional												¢-6
Port 3_GND	TP6E o									o Aux Async	50	
Future Spare	TP6F o											¢-5
Reserved Optional												
CH1_Ser_Out	TP6G o									o Encryption Data Intf CH1 and CH2	51	
CH1_Ser_In	TP6H o									o		
CH2_Ser_Out	TP6J o									o		
CH2_Ser_In	TP6K o									o		
CH1_CMD_ACT	TP7A o									o		¢-6
CH1_CMD_REQ	TP7B o									o		
CH1_DCD	TP7C o									o		
CH2_CMD_ACT	TP7D o									o		
CH2_CMD_REQ	TP7E o									o		
CH2 DCD	TP7F o									o		
TXCLK1	TP7G o									o		
TXCLK2	TP7H o									o		
RXCLK1	TP7J o									o		
RXCLK2	TP7K o									o		
Maintenance Mode Enable	TP8A o										44	
Future Spare	TP8B o											
Future Spare	TP8C o											
Future Spare	TP8D o											
Future Spare	TP8E o											
Future Spare	TP8F o											¢-4
Future Spare	TP8G o											
Future Spare	TP8H o											
Future Spare	TP8J o											
Future Spare	TP8K o											

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

	FUNCTION	SDU	RFU	(33) SPLTR	(33) COMB	HPA	(1)(33)(34) HP RELAY	(33) LNA/DIP	(32)(33) BEAM STRNG	ANT	OTHER	NOTES
	Spare Discrete inputs	TP9A o										
	(Config. straps type)	TP9B o										
¢-5	Future Spare	TP9C o										
	Future Spare	TP9D o										
	Future Spare	TP9E o										
	Future Spare	TP9F o										
	Future Spare	TP9G o										
	Future Spare	TP9H o										
¢-4	Future Spare	TP9J o										
	Future Spare	TP9K o										
	Strap Option	TP10A o										38
	Strap Option	TP10B o										
	Strap Option	TP10C o										
	Strap Option	TP10D o										
¢-5	Strap Option	TP10E o										
¢-6	Strap Option	TP10F o										
	Reserved for Strap Option	TP10G o										
¢-4	Reserved for Strap Option	TP10H o										
	Reserved for Strap Option	TP10J o										
¢-7	Strap Option	TP10K o										
	Strap Option	TP11A o										
	Strap Option	TP11B o										
	Strap Option	TP11C o										
	Strap Option	TP11D o										
	Strap Option	TP11E o										
	Strap Option	TP11F o										
	Strap Option	TP11G o										
	Strap Option	TP11H o										
	Strap Option	TP11J o										
	Strap Option	TP11K o										
	Strap Option	TP12A o										
	Strap Option	TP12B o										
	Strap Option	TP12C o										
	Reserved A/C ID or CFDS/SDU Config	TP12D o										
	Strap Option	TP12E o										
¢-4	Strap Option	TP12F o										
	Strap Option	TP12G o										
	Strap Option	TP12H o										
	Strap Option	TP12J o										
	Strap Option	TP12K o										
	Strap Option	TP13A o										
	Strap Option	TP13B o										
	Strap Option	TP13C o										
	Strap Option	TP13D o										
	Strap Option	TP13E o										
	Strap Option	TP13F o										
	Strap Option	TP13G o										
	Strap Option	TP13H o										
	Strap Option	TP13J o										
	Strap Option	TP13K o										

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

FUNCTION	SDU	RFU	⟨33⟩ SPLTR	⟨33⟩ COMB	HPA	⟨1⟩⟨33⟩⟨34⟩ HP RELAY	⟨33⟩ LNA/DIP	⟨32⟩⟨33⟩ BEAM STRNG	ANT	OTHER	NOTES
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	TP14J o	TP6J o			TP6J o						
Reserved ATE	TP14K o	TP6K o			TP6K o						
Reserved ATE	TP15A o	TP7A o			TP7A o						
Reserved ATE	TP15B o	TP7B o			TP7B o						
Reserved ATE	TP15C o	TP7C o			TP7C o						
Reserved ATE	TP15D o	TP7D o			TP7D o						
Reserved ATE	TP15E o	TP7E o			TP7E o						
Reserved ATE	TP15F o	TP7F o			TP7F o						
Reserved ATE	TP15G o	TP7G o			TP7G o						
Reserved ATE	TP15H o	TP7H o			TP7H o						
Reserved ATE	TP15J o	TP7J o			TP7J o						
Reserved ATE	TP15K o	TP7K o			TP7K o						

¢-5

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

	FUNCTION	SDU	RFU	33 SPLTR	33 COMB	HPA	1 33 34 HP RELAY	33 LNA/DIP	32 33 BEAM STRNG	ANT	OTHER	NOTES
	Reserved for Cabin Audio Input #1	HI MP1A LO MP1B									To non-CCS Cabin Tele-Phone	
c-5	Reserved for Cabin Audio Output #1	HI MP1C LO MP1D										
c-6	Reserved Data Bus from Cabin Packet Data (ARINC 429)	A MP1E B MP1F									To Cabin Packet Data Function	7,54
	Data Bus from CMU #1 (ARINC 429)	A MP1G B MP1H									To CMU #1	6,3,47
c-5	Data Bus to CMU #1 & #2 (ARINC 429)	A MP1J B MP1K									To CMU #1 & #2	6,30 47,52
c-4 c-7	Cockpit Audio Ch 1 Input	HI MP2A LO MP2B									To Audio Sys	15,56
	Cockpit Audio Ch 1 Output	HI MP2C LO MP2D										
	Cockpit Audio Ch 2 Input	HI MP2E LO MP2F										
	Cockpit Audio Ch 2 Output	HI MP2G LO MP2H										
	Cabin Digital Voice/Data Input (CEPT-E1)	A MP2J B MP2K									To CCS	41
c-4	Cabin Digital Voice/Data Output (CEPT-E1)	A MP3A B MP3B										
	Data from SCDU #1 (ARINC 429)	A MP3C B MP3D										7,
	Data from SCDU #2 (ARINC 429)	A MP3E B MP3F										
	Data Bus from CMU #2 (ARINC 429)	A MP3G B MP3H									To CMU #2	6,47,3
c-5	Data Bus to SCDU #1, #2 & #3 (ARINC 429)	A MP3J B MP3K									To SCDU #1, #2 and #3	25, 39
	Reserved AES ID Input	A MP4A B MP4B										3, 55
c-6	CFDS Interface (604) Input (ARINC 429)	A MP4C B MP4D									To Central BITE System	7
c-4	CFDS Interface (604) Output (ARINC 429)	A MP4E B MP4F										
	Multi-Control Output (ARINC 429)	A MP4G B MP4H					TP1A TP1B		T U			8, 16 20
c-5	Reserved for Cabin Audio Input #2	HI MP4J LO MP4K									To non-CCS Cabin Telephone	
	LGA LNA ON/OFF Control	MP5A						B LGA LNA				10
c-4	Reserved for Weight-On-Wheels Input #1	MP5B										40
	Input #2	MP5C										
	Program Select	MP5D										
c-5	Reserved for Cabin Audio Output #2	HI MP5E LO MP5F									To non-CCS Cabin Telephone	
	BITE Input Disc. from LGA LNA	MP5G						H LGA LNA				9
c-4	Chime/Lamps Inhibit	MP5H										43
	Dual System Select Discrete I/O	MP5J									Other SDU MP5K	
	Dual System Disable Discrete Input	MP5K									Other SDU MP5J	

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

FUNCTION		SDU	RFU	33 SPLTR	33 COMB	HPA	1 33 34 HP RELAY	33 LNA/DIP	32 33 BEAM STRNG	ANT	OTHER	NOTES	
Data from Primary IRS (ARINC 429)	A B	MP6A MP6B									To IRS #1	8, 36 42	¢-4
Data from Secondary IRS (ARINC 429)	A B	MP6C MP6D									To IRS #2		
BITE Input from HGA HPA (ARINC 429)	A B	MP6E MP6F				TP1C TP1D HGA HPA						7	¢-5
Spare ARINC 429 Input	A B	MP6G MP6H											
BITE Input from LGA HPA (ARINC 429)	A B	MP6J MP6K				TP1C TP1D LGA HPA							¢-4
Data Bus from Airborne Data Loader (ARINC 429)	A B	MP7A MP7B									ARINC 615 Data Loader (If present)	8, 29	
Data Bus to Airborne Data Loader (ARINC 429)	A B	MP7C MP7D											
Steering Inhibit to BSU #1, #2	A B	MP7E MP7F										18,19, 21	¢-5
BITE Input from ACU or Top/Port BSU (ARINC 429)	A B	MP7G MP7H							W Top/Port X Top/Port			7, 17 20	¢-4
BITE Input from STBD BSU (ARINC 429)	A B	MP7J MP7K							W STBD X STBD			7, 20	
Data Loader Link A		MP8A									ARINC 615 (if present)	29	
Data Loader Link B		MP8B											
Reserved Data Bus from RMP (ARINC 429)	A B	MP8C MP8D									From RMP	7	
Cockpit Voice Call Light Output #1		MP8E										10,56	¢-7
Cockpit Voice Mic. on Input #1		MP8F										11,56	
Cockpit Voice Call Light Output #2		MP8G										10,56	
Cockpit Voice Mic. on Input #2		MP8H										11,56	
Data from SCDU #3 ARINC 429 In	A B	MP8J MP8K										7, 25	¢-4
Reserved Data Bus to SNU and/or CPDF	A B	MP9A MP9B									To SNU and/or CPDF	7, 49	¢-6
Reserved Data Bus to RMP (ARINC 429)	A B	MP9C MP9D									To RMP Call Annunciation Panel	7	¢-4
Data Bus from RFU to SDU (ARINC 429)	A B	MP9E MP9F	TP1A TP1B									12	
Data Bus to RFU from SDU (ARINC 429)	A B	MP9G MP9H	TP1C TP1D										
Unspecified Function Wires	A B	MP9J MP9K	TP1E TP1F										
Unspecified Function Wires	A B	MP10A MP10B	TP1G TP1H										
Unspecified Function Wires	A B	MP10C MP10D	TP1J TP1K										
Spare 429 Input			TP2A										
Spare 429 Input			TP2B										
Spare 429 Output			TP2C										
Spare 429 Output			TP2D										
Spare Disc. Input			TP2E										
Spare Disc. Input			TP2F										
Spare Disc. Input			TP2G										
Spare Disc. Output			TP2H										
Spare Disc. Output			TP2J										
Spare Disc. Output			TP2K										
Unspecified Function Wires	A B	MP10E MP10F	TP3A TP3B									12	
Unspecified Function Wires	A B	MP10G MP10H	TP3C TP3D										
Unspecified Function Wires	A B	MP10J MP10K	TP3E TP3F										

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

FUNCTION	SDU	RFU	(33) SPLTR	(33) COMB	HPA	(1)(33)(34) HP RELAY	(33) LNA/DIP	(32)(33) BEAM STRNG	ANT	OTHER	NOTES
Future Spare		TP3G o									
Future Spare		TP3H o									
Future Spare		TP3J o									
Future Spare		TP3K o									
Data Bus from Airborne Data Loader (ARINC 429) A		TP4A o								o ARINC 615 Data Loader (if present) present)	8, 29
B		TP4B o								o	
Data Bus to Airborne Data Loader (ARINC 429) A		TP4C o								o	
B		TP4D o								o	
Data Loader Link A		TP4E o								o ARINC 615(if present)	29
Data Loader Link B		TP4F o								o	
Future Spare		TP4G o									
Future Spare		TP4H o									
Future Spare		TP4J o									
Future Spare		TP4K o									
Future Spare		TP5A o									
Future Spare		TP5B o									
Future Spare		TP5C o									
Future Spare		TP5D o									
Future Spare		TP5E o									
Future Spare		TP5F o									
Future Spare		TP5G o									
Future Spare		TP5H o									
Future Spare		TP5J o									
Future Spare		TP5K o									
Future Spare		TP6A o									
Future Spare		TP6B o									
Future Spare		TP6C o									
Future Spare		TP6D o									
Future Spare		TP6E o									
Future Spare		TP6F o									
¢-4 Future Spare		TP6G o									
Future Spare		TP6H o									
Future Spare		TP6J o									
Future Spare		TP6K o									
Future Spare		MP1A o									
Future Spare		MP1B o									
Future Spare		MP1C o									
Future Spare		MP1D o									
Future Spare		MP1E o									
Future Spare		MP1F o									
Future Spare		MP1G o									
Future Spare		MP1H o									
Future Spare		MP1J o									
Future Spare		MP1K o									
Future Spare		MP2A o									
Future Spare		MP2B o									
Future Spare		MP2C o									
Future Spare		MP2D o									
Future Spare		MP2E o									
Future Spare		MP2F o									
Future Spare		MP2G o									
Future Spare		MP2H o									
Future Spare		MP2J o									
Future Spare		MP2K o									
Future Spare		MP3A o									
Future Spare		MP3B o									
Future Spare		MP3C o									
Future Spare		MP3D o									
Future Spare		MP3E o									
Future Spare		MP3F o									
Future Spare		MP3G o									
Future Spare		MP3H o									
Future Spare		MP3J o									
Future Spare		MP3K o									

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

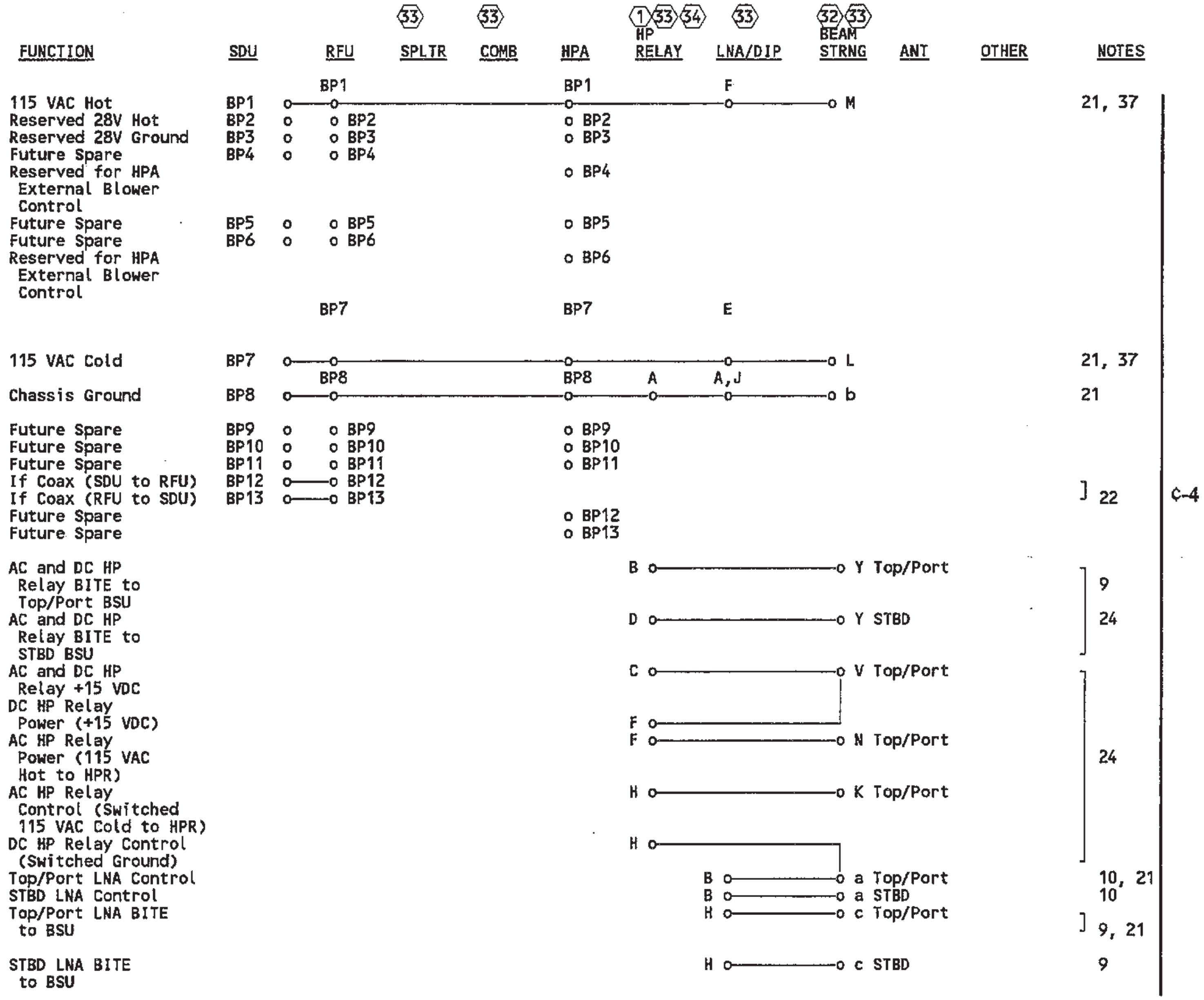
FUNCTION	SDU	RFU	33 SPLTR	33 COMB	HPA	1 33 34 HP RELAY	33 LNA/DIP	32 33 BEAM STRNG	ANT	OTHER	NOTES
Future Spare		MP4A o									
Future Spare		MP4B o									
Future Spare		MP4C o									
Future Spare		MP4D o									
Future Spare		MP4E o									
Future Spare		MP4F o									
Future Spare		MP4G o									
Future Spare		MP4H o									
Future Spare		MP4J o									
Future Spare		MP4K o									
Future Spare		MP5A o									
Future Spare		MP5B o									
Future Spare		MP5C o									
Future Spare		MP5D o									
Future Spare		MP5E o									
Future Spare		MP5F o									
Future Spare		MP5G o									
Future Spare		MP5H o									
Future Spare		MP5J o									
Future Spare		MP5K o									
Future Spare		MP6A o									
Future Spare		MP6B o									
Future Spare		MP6C o									
Future Spare		MP6D o									
Future Spare		MP6E o									
Future Spare		MP6F o									
Future Spare		MP6G o									
Future Spare		MP6H o									
Future Spare		MP6J o									
Future Spare		MP6K o									
Future Spare		MP7A o									
Future Spare		MP7B o									
Future Spare		MP7C o									
Future Spare		MP7D o									
Future Spare		MP7E o									
Future Spare		MP7F o									
Future Spare		MP7G o									
Future Spare		MP7H o									
Future Spare		MP7J o									
Future Spare		MP7K o									
Future Spare		MP8A o									
Future Spare		MP8B o									
Future Spare		MP8C o									
Future Spare		MP8D o									
Future Spare		MP8E o									
Future Spare		MP8F o									
Future Spare		MP8G o									
Future Spare		MP8H o									
Future Spare		MP8J o									
Future Spare		MP8K o									

¢-4

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

				33	33		1 33 34	33	32 33			
	FUNCTION	SDU	RFU	SPLTR	COMB	HPA	HP RELAY	LNA/DIP	BEAM STRNG	ANT	OTHER	NOTES
¢-4	Motion Sensor Input	MP11A									o	26
¢-5	Sensor Program Select	MP11B										
¢-7	Place/End Call Discrete Input #1	MP11C										46,56
	Place/End Call Discrete Input #2	MP11D										
	Reserved as Unspecified Program Pins	MP11E										27
		MP11F										
		MP11G										
		MP11H										
		MP11J										
		MP11K										
	Reserved SDU Crosstalk from other SDU (ARINC 429)	A MP12A										8,12
		B MP12B										
¢-4	Reserved SDU Crosstalk to other SDU (ARINC 429)	A MP12C										
		B MP12D										
	Future Spare	MP12E										
	Future Spare	MP12F										
	Reserved Data Bus from FMC #1 (ARINC 429)	A MP12G									From FMC #1	7,35,45
		B MP12H										
	Reserved Data Bus from FMC #2 (ARINC 429)	A MP12J									From FMC #2	7,35
		B MP12K										
¢-5	Spare Discrete Output (28 VDC call lamp type)	MP13A										
	Future Spare	MP13B										
	ICAO Address Bits #1 MSB	MP13C										3, 14
	#2	MP13D										
	#3	MP13E										
	#4	MP13F										
	#5	MP13G										
	#6	MP13H										
	#7	MP13J										
	#8	MP13K										
	Cockpit Voice Go-Ahead Chime Signal Reset	MP14A									To Reset Switch	11,13,56
	Signal Contacts Current from Chime	MP14B									o	
¢-4	Current to Chime	MP14C									o	
	ICAO Address Bits #9	MP14D										3, 14
	#10	MP14E										
	#11	MP14F										
	#12	MP14G										
	#13	MP14H										
	#14	MP14J										
	#15	MP14K										
	#16	MP15A										
	#17	MP15B										
	#18	MP15C										
	#19	MP15D										
	#20	MP15E										
	#21	MP15F										
	#22	MP15G										
	#23	MP15H										
	#24 LSB	MP15J										
	ICAO Common Address	MP15K										

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING



FUNCTION	SDU	RFU	⟨33⟩ SPLTR	⟨33⟩ COMB	HPA	⟨1⟩⟨33⟩⟨34⟩ HP RELAY	⟨33⟩ LNA/DIP	⟨32⟩⟨33⟩ BEAM STRNG	ANT	OTHER	NOTES
115 VAC Hot	BP1	BP1			BP1		F	M			21, 37
Reserved 28V Hot	BP2	BP2			BP2						
Reserved 28V Ground	BP3	BP3			BP3						
Future Spare	BP4	BP4									
Reserved for HPA External Blower Control					BP4						
Future Spare	BP5	BP5			BP5						
Future Spare	BP6	BP6			BP6						
Reserved for HPA External Blower Control					BP6						
115 VAC Cold	BP7	BP7			BP7		E	L			21, 37
Chassis Ground	BP8	BP8			BP8	A	A,J	b			21
Future Spare	BP9	BP9			BP9						
Future Spare	BP10	BP10			BP10						
Future Spare	BP11	BP11			BP11						
If Coax (SDU to RFU)	BP12	BP12									22
If Coax (RFU to SDU)	BP13	BP13									
Future Spare					BP12						
Future Spare					BP13						
AC and DC HP Relay BITE to Top/Port BSU						B		Y Top/Port			9
AC and DC HP Relay BITE to STBD BSU						D		Y STBD			24
AC and DC HP Relay +15 VDC						C		V Top/Port			
DC HP Relay Power (+15 VDC)						F					
AC HP Relay Power (115 VAC Hot to HPR)						F		N Top/Port			24
AC HP Relay Control (Switched 115 VAC Cold to HPR)						H		K Top/Port			
DC HP Relay Control (Switched Ground)						H					
Top/Port LNA Control							B	a Top/Port			10, 21
STBD LNA Control							B	a STBD			10
Top/Port LNA BITE to BSU							H	c Top/Port			9, 21
STBD LNA BITE to BSU							H	c STBD			9

C-4

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

	FUNCTION	SDU	RFU	⟨33⟩ SPLTR	⟨33⟩ COMB	HPA	⟨1⟩⟨33⟩⟨34⟩ HP RELAY	⟨33⟩ LNA/DIP	⟨32⟩⟨33⟩ BEAM STRNG	ANT	OTHER	NOTES
¢-4	Data Bus from Airborne Data Loader (ARINC 429)	A B				TP1E TP1F					ARINC 615 Data Loader (if present)	8 29
	Data Bus to Airborne Data Loader (ARINC 429)	A B				TP1G TP1H						
	Data Loader Link A					TP1J					ARINC 615 (if present)	29
	Data Loader Link B					TP1K						
¢-6	Future Spare					TP2A						
	Future Spare					TP2B						
	Future Spare					TP2C						
	Future Spare					TP2D						
¢-4	Spare Discrete Input					TP2E						
¢-6	Future Spare					TP2F						
	Future Spare					TP2G						
¢-4	Spare Discrete Output					TP2H						
¢-6	Future Spare					TP2J						
	Future Spare					TP2K						
¢-5						NOTE: For top-mounted antenna, HPA pins TP3C and TP3D are not wired.						
¢-4	HPA MUTE from Top/Port BSU	A B				TP3A TP3B			G Top/Port H Top/Port			31
	HPA MUTE from STBD BSU	A B				TP3C TP3D			G STBD H STBD			

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

			33	33		1 33 34	33	32 33				
FUNCTION	SDU	RFU	SPLTR	COMB	HPA	HP RELAY	LNA/DIP	BEAM STRNG	ANT	OTHER	NOTES	
Future Spare						E o						
Future Spare						G o						
Future Spare							C o					
Future Spare							D o					
Future Spare							G o					
Future Spare							J o					
Future Spare							K o					
Future Spare					TP3E o							
Future Spare					TP3F o							
Future Spare					TP3G o							
Future Spare					TP3H o							¢-4
Future Spare					TP3J o							
Future Spare					TP3K o							
Future Spare					TP4A o							
Future Spare					TP4B o							
Future Spare					TP4C o							
Future Spare					TP4D o							
Future Spare					TP4E o							
Future Spare					TP4F o							
Future Spare					TP4G o							
Future Spare					TP4H o							
Future Spare					TP4J o							
Future Spare					TP4K o							
Future Spare					TP5C o							
Extended SDI #1					TP5A o			o A				
Program #2					TP5B o			o B				
Pins #3								o C			19	
#4								o E				
#5								o F				
#6								o J				¢-5
#7								o S				
#8								o Z				
Common					TP5D o			o D				
Future Spare					TP5E o							
Future Spare					TP5F o							
Future Spare					TP5G o							
Future Spare					TP5H o							
Future Spare					TP5J o							
Future Spare					TP5K o							
Future Spare					TP6A o							
Future Spare					TP6B o							
Future Spare					TP6C o							
Future Spare					TP6D o							
Future Spare					TP6E o							¢-4
Future Spare					TP6F o							
Future Spare					TP6G o							
Future Spare					TP6H o							
Future Spare					TP6J o							
Future Spare					TP6K o							
Future Spare					MP1A o							
Future Spare					MP1B o							
Future Spare					MP1C o							
Future Spare					MP1D o							
Future Spare					MP1E o							
Future Spare					MP1F o							
Future Spare					MP1G o							
Future Spare					MP1H o							
Future Spare					MP1J o							
Future Spare					MP1K o							

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

FUNCTION	SDU	RFU	⟨33⟩ SPLTR	⟨33⟩ COMB	HPA	⟨1⟩⟨33⟩⟨34⟩ HP RELAY	⟨33⟩ LNA/DIP	⟨32⟩⟨33⟩ BEAM STRNG	ANT	OTHER	NOTES
Future Spare					MP2A o						
Future Spare					MP2B o						
Future Spare					MP2C o						
Future Spare					MP2D o						
Future Spare					MP2E o						
Future Spare					MP2F o						
Future Spare					MP2G o						
Future Spare					MP2H o						
Future Spare					MP2J o						
Future Spare					MP2K o						
Future Spare					MP3A o						
Future Spare					MP3B o						
Future Spare					MP3C o						
Future Spare					MP3D o						
Future Spare					MP3E o						
Future Spare					MP3F o						
Future Spare					MP3G o						
Future Spare					MP3H o						
Future Spare					MP3J o						
Future Spare					MP3K o						
Future Spare					MP4A o						
Future Spare					MP4B o						
Future Spare					MP4C o						
Future Spare					MP4D o						
Future Spare					MP4E o						
Future Spare					MP4F o						
Future Spare					MP4G o						
Future Spare					MP4H o						
Future Spare					MP4J o						
Future Spare					MP4K o						
Future Spare					MP5A o						
Future Spare					MP5B o						
Future Spare					MP5C o						
Future Spare					MP5D o						
Future Spare					MP5E o						
Future Spare					MP5F o						
Future Spare					MP5G o						
Future Spare					MP5H o						
Future Spare					MP5J o						
Future Spare					MP5K o						
Future Spare					MP6A o						
Future Spare					MP6B o						
Future Spare					MP6C o						
Future Spare					MP6D o						
Future Spare					MP6E o						
Future Spare					MP6F o						
Future Spare					MP6G o						
Future Spare					MP6H o						
Future Spare					MP6J o						
Future Spare					MP6K o						
Future Spare					MP7A o						
Future Spare					MP7B o						
Future Spare					MP7C o						
Future Spare					MP7D o						
Future Spare					MP7E o						
Future Spare					MP7F o						
Future Spare					MP7G o						
Future Spare					MP7H o						
Future Spare					MP7J o						
Future Spare					MP7K o						

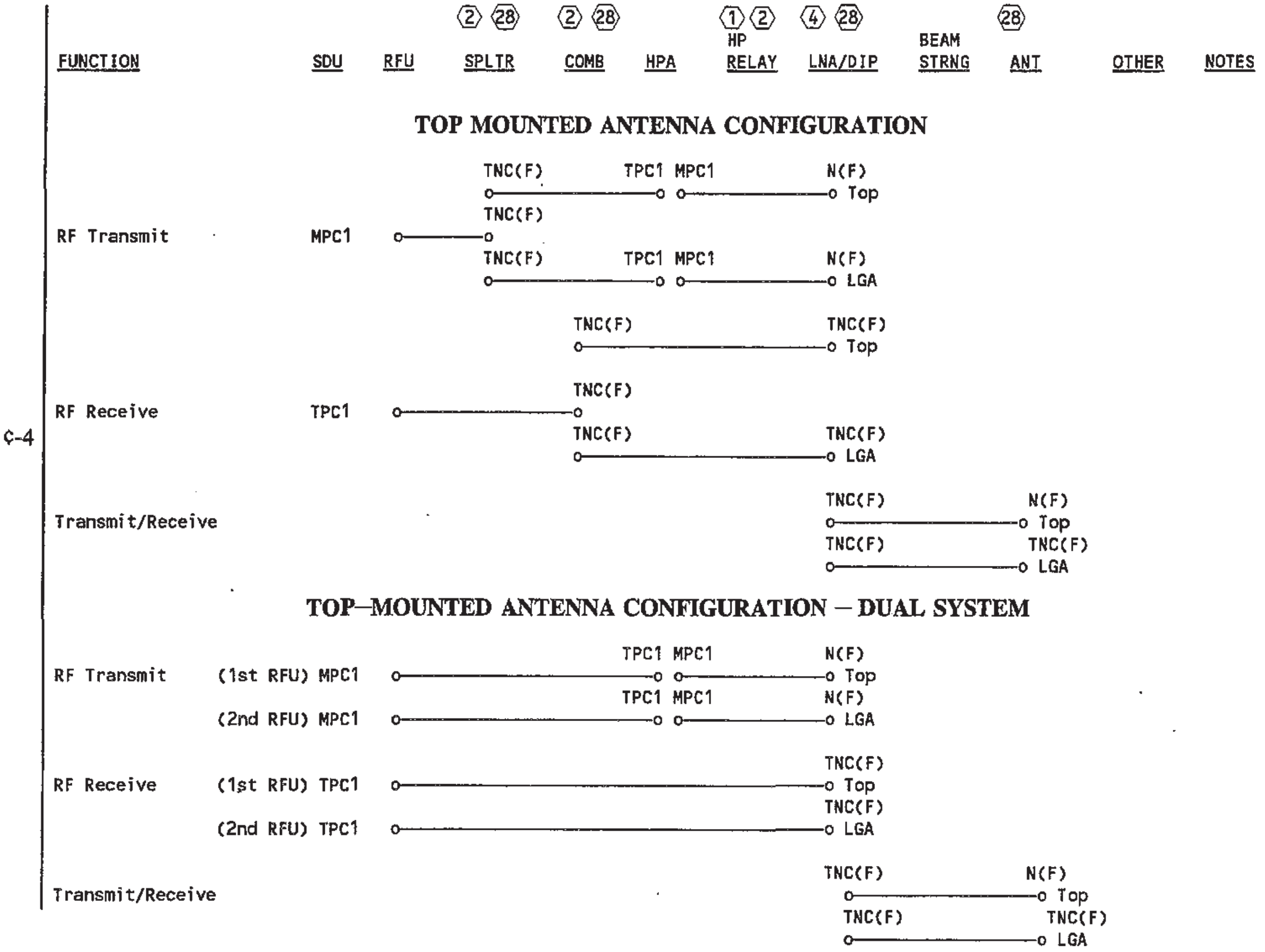
C-4

ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING

FUNCTION	SDU	RFU	33 SPLTR	33 COMB	HPA	1 33 34 HP RELAY	33 LNA/DIP	32 33 BEAM STRNG	ANT	OTHER	NOTES
Future Spare					MP8A o						
Future Spare					MP8B o						
Future Spare					MP8C o						
Future Spare					MP8D o						
Future Spare					MP8E o						
Future Spare					MP8F o						
Future Spare					MP8G o						
Future Spare					MP8H o						
Future Spare					MP8J o						
Future Spare					MP8K o						

¢-4

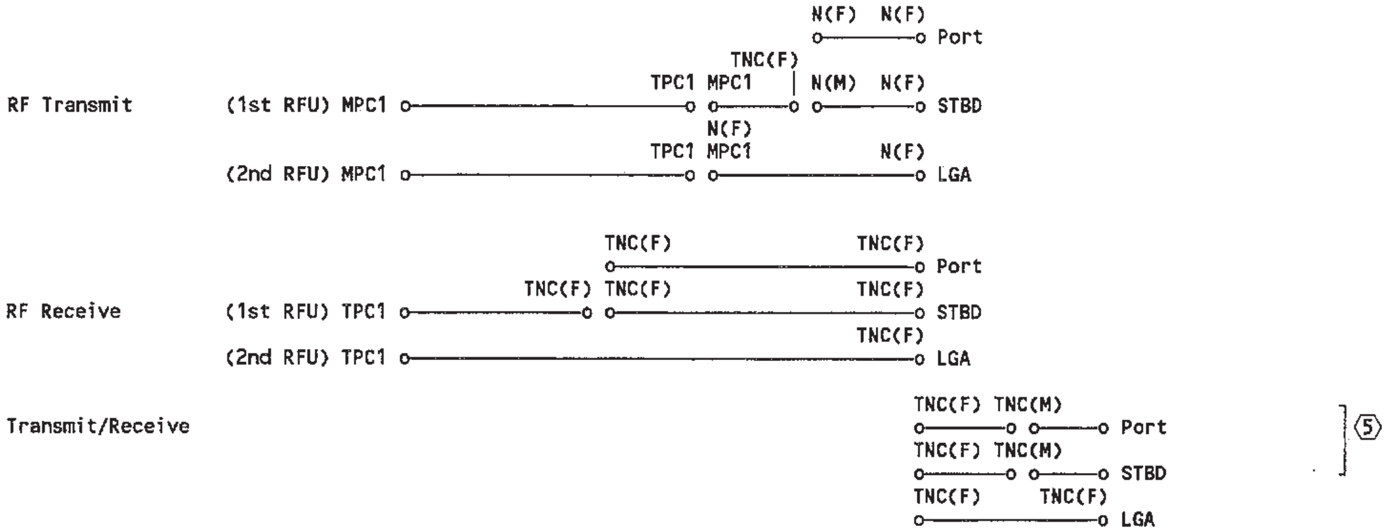
ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING RF ㉒



ATTACHMENT 1-3 (cont'd)
STANDARD INTERWIRING RF ㉒

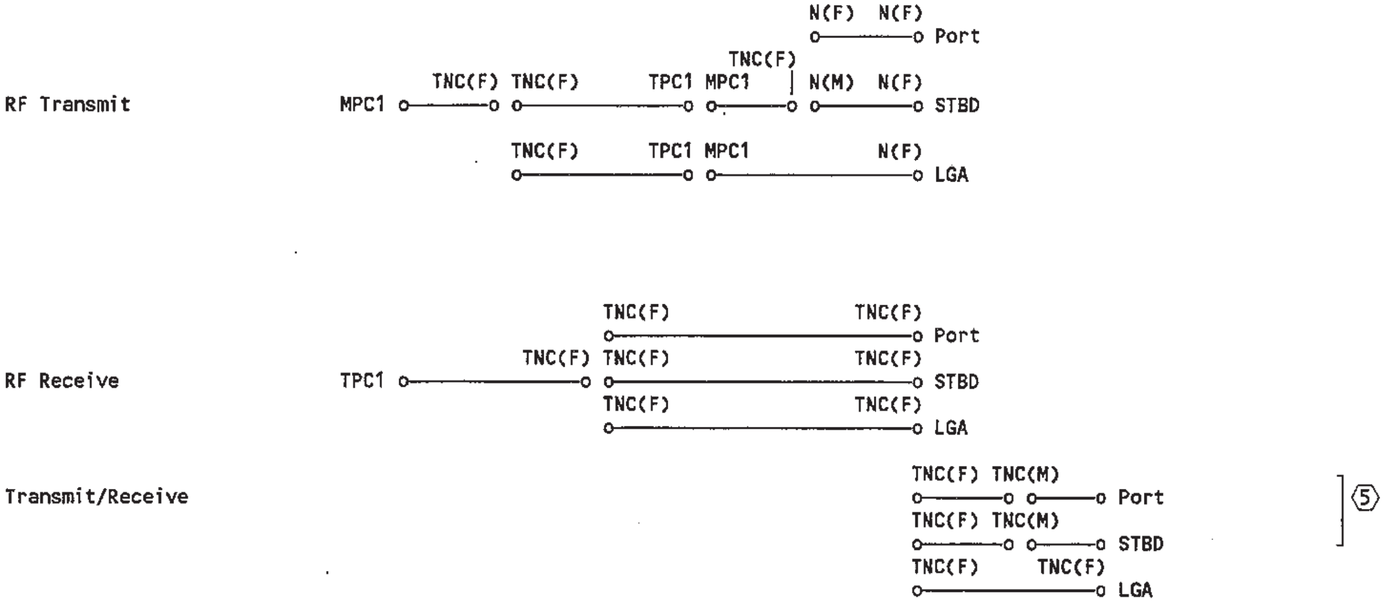
FUNCTION | SDU | RFU | SPLTR ② ㉘ | COMB ② ㉘ | HPA | HP RELAY ① ② | LNA/DIP ④ ㉘ | BEAM STRNG ㉘ | ANT ㉘ | OTHER | NOTES

SIDE MOUNTED PHASED ARRAY CONFIGURATION – DUAL SYSTEM



c-5

SIDE MOUNTED PHASED ARRAY CONFIGURATION



ATTACHMENT 1–3A
2 MCU BEAM STEERING UNIT
SIZE 1 CONNECTOR PIN ASSIGNMENTS

	FUNCTION		CONNECTOR SECTION	CONNECTOR PIN#	DESTINATION	DESTINATION PIN#	INTERWIRING REQUIREMENTS
	Multi–Control Output	A	TP	11C	SDU	MP 4G	PER ARINC 429
		B	TP	11D	SDU	MP 4H	"
	Steering Inhibit	A	TP	11A	SDU	MP 7E	"
		B	TP	11B	SDU	MP 7F	"
¢-2	BITE Input	A	TP	15C	SDU	MP 7G	"
		B	TP	15D	SDU	MP 7H	"
	LNA Control (Top)		TP	10B	LNA	P3–B	Typical current requirements less than 10mA (see commentary)
	LNA/BSU Return		TP	10C	LNA	P3–J	
	LNA BITE (Top)		TP	10D	LNA	P3–H	15 ohm max.
¢-5	HPA Mute (Top)	A	TP	14A	HPA	TP 3A	15 ohm max. (1,2)
		B	TP	14B	HPA	TP 3B	15 ohm max. (1,2)
	Ant. Return		TP	1B	HGA		0.5 ohm max.
	Ant. Power		TP	2B	HGA	To be assigned by HGA Mfr.	1.0 ohm max.
¢-2	Ant. BITE	A	TP	4A	HGA		15 ohm max.
		B	TP	4B	HGA		"
	Ant. Control	A	TP	6A	HGA		"
		B	TP	6B	HGA		"
	All other pins on Section A reserved by HGA Mfr. for control and programming.						
	Spare		MP	All			
	115 VAC Hot		BP	2	Aircraft		max. current requirement 2.0A
	115 VAC Cold		BP	4			
	Chassis GND		BP	3			

¢-5 Note: (1) HPA mute is not required for those high gain antennas which may be hot-switched.

(2) Index pin code 12 should be used for the 2MCU BSU.

¢-2 Commentary: Note 10, Att. 1–4 presently allows 0.5A. Present mfr's are using 10mA max.

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

⟨1⟩ This option to the Standard Interwiring is dependent on the aircraft structure and configuration. Its use will be determined by the installation designer.

¢-4

⟨2⟩ The splitter connectors are called out in Section 2.2.3.1. The combiner connectors are called out in Section 2.2.3.2. The HPR connectors are called out in Section 2.2.3.3.1.

⟨3⟩ The 24-bit ICAO SSR Mode S Address (used as the AES ID) should be read from the Data Bus from CMU #1 (SDU pins MP1G and MP1H) or the Data Bus from CMU #2 (SDU pins MP3G and MP3H) or the AES ID input (SDU pins MP4A and MP4B) if available. System configuration pin TP10A identifies whether or not the 429 data is available. Available data is formatted and transmitted as specified in ARINC Characteristic 748 (CMU), Section 3.7.1.1.4 ("ICAO Address") (but is typically transmitted at the higher data rate of 5 to 10 words per second per label on the AES ID Input). If the address is not available on any 429 input (as defined by TP10A), it should be read from the Address Bit discretes (SDU pins MP13C - K and MP14D - MP15J). Hexadecimal codes 000000 and FFFFFF are not valid; the presence of either of these codes on either a 429 input or the discrete interface is an indication of an unprogrammed address. ¢-5

COMMENTARY

> Installers wishing to use a single Mode-S transponder as the source of the ICAO address should ensure that the transponder will continue to transmit a valid ICAO address when in standby mode. The SATCOM system may be rendered inoperative if a valid ICAO address cannot be obtained due to deselection or failure of the single transponder. ¢-6

⟨4⟩ The diplexer/LNA uses a female (F) TNC connector (jack) at one end to interface with the antenna. A female (F) N jack is used at the other end to interface with the input from the HPA along with a female (F) TNC for interface with the RFU receive path.

⟨5⟩ The number of matched coaxial cables used depends on the number of antenna array elements.

⟨6⟩ The Communications Management Unit (CMU) or equivalent is responsible for integrating data communications via the satellite communications system with data communications via other data links on the aircraft. It 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. It utilizes the ISO 8208 subnetwork layer (packet level) protocol, as described in that international standard and Part 2 of this document.

⟨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 BITE discrete output. Absence of this voltage will be interpreted as a fault annunciation. BITE annunciation is not required when the unit has been commanded "off". ¢-4

⟨10⟩ The SDU and BSU (LNA on/off control only) should provide an internal switch closure to ground. The switch "contact" should be open for (i) LNA off, (ii) no cockpit voice call annunciation, and closed for (i) LNA on, (ii) cockpit voice call annunciation active. The "open" voltage holdoff should be 36 VDC max., the potential across the "closed" switch should be 1 VDC or less and the current handling capacity should be 500 mA max. System Configuration pins TP13C and TP13D (ref. Attachment 1-4C) specify whether the 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 will indicate that (i) a cockpit microphone is in use with SATCOM, (ii) the Voice Go-Ahead (Chime) output should be reset. In the case of (i), this input can be wired to either the SATCOM-selected PTT switch, or to an ACP SATCOM mic transmit key switch suitably latched for the duration of the call as specified by system configuration pin TP13K (see Attachment 1-4C).

<u>LATCHED Mic-On OPERATION (TP13K = 0)</u>

¢-7

If the <u>Call Light is ON</u>, the Mic-steady ground is interpreted as off-hook, which answers an incoming call when the signal goes low and ends the call when the signal goes high.

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

¢-7 If the ORT (item o) is set for ACP initiated ATC Calls and, if the Call Light is OFF, the Mic-On discrete going to ground is interpreted as Place ATC Call. Reference Section 4.13.

⑫ These pins are wired to permit ARINC 429 high speed data buses to be used. 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. System Configuration pins TP13C and TP13D (ref. Attachment 1-4C) specify 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 are used to encode the ICAO 24-bit address of the aircraft in which the SDU is installed. Pins assigned to bits required to 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 cockpit audio channels, the SDU need provide the electronics for only one.

¢-4 ⑯ When the installation uses a mechanically steered antenna, an Antenna Control Unit (ACU) will be used instead of the Beam Steering Unit (BSU). In this case the ARINC 429 high speed multi-control bus should be connected to pins BP37 (wire A) and BP38 (wire B) of the ACU service connector.

⑰ In an installation using a mechanically steered antenna and its associated ACU, the ACU BITE output to the SDU will originate from ACU connector pins BP39 (wire A) and BP40 (wire B). A low speed ARINC 429 bus will be used.

⑱ This twisted and shielded pair is provided to handle a fast rise-time discrete output from the SDU to the BSU. This discrete instructs the BSU to "inhibit" or "not inhibit" normal operation. For closed loop steering, the SDU modem requires its receive signal strength to be measured at a single beam position and hence inhibits the BSU from steering during an integration period of about 40 milliseconds (see also note 29 on the Closed Loop ACU/BSU Steering Word in Attachment 2). Changeover to a new beam position is allowed on assertion of "not inhibit", at which stimulus the BSU must react and settle to its new position. The "inhibit" case is functional only when line A with respect to line B has a voltage of +6.5 to +13 volts on it. The "not inhibit" case is defined as all other states of the circuit, including the "zero" state of 0 ±2.5 volts and -6.5 to -13 volts measured from line A with respect to line B, and the open circuit condition. Consult ARINC Specification 429 for additional details of the interface such as rise and fall times. These voltage levels and desired reaction times are shown on Attachment 1-4A.

⑲ Source/Destination Identification should be provided for the BSU and the HPA as shown below. Pins required to take on the binary "zero" state in a code should be left open circuit. Pins required to take on the binary "one" state should be jumpered on the airframe side of the connector to the pin assigned as "SDI Common".

	HPA SDI Code*			BSU SDI Code*			BSU-Up/Down Code**	
	Meaning	TP5B (Bit 10)	TP5A (Bit 9)	Meaning	Pin B (Bit 10)	Pin A (Bit 9)	Meaning	Pin C
¢-5	Reserved	0	0	Reserved	0	0	Up	0
¢-4	LGA HPA	0	1	Port/Top BSU	0	1		
	HGA HPA	1	0	Starboard BSU	1	0	Down	1
¢-5	Unused	1	1	ACU	1	1		

¢-4 * ARINC 429

¢-5 ** This is only applicable for HGA configurations as shown in Attachment 1-11B. For HGA configurations as shown in Attachment 1-11A, this pin should always remain in the binary "zero" (open circuit) state.

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

ANTENNA MOUNTING ANGLE

PIN

E F J S Z	Degrees from Zenith
1 1 1 1 1	30°
1 1 1 1 0	31°
1 1 1 0 1	32°
1 1 1 0 0	33°
1 1 0 1 1	34°
1 1 0 1 0	35°
1 1 0 0 1	36°
1 1 0 0 0	37°
1 0 1 1 1	38°
1 0 1 1 0	39°
1 0 1 0 1	40°
1 0 1 0 0	41°
1 0 0 1 1	42°
1 0 0 1 0	43°
1 0 0 0 1	44°
0 0 0 0 0	45°
0 0 0 0 1	46°
0 0 0 1 0	47°
0 0 0 1 1	48°
0 0 1 0 0	49°
0 0 1 0 1	50°
0 0 1 1 0	51°
0 0 1 1 1	52°
0 1 0 0 0	53°
0 1 0 0 1	54°
0 1 0 1 0	55°
0 1 0 1 1	56°
0 1 1 0 0	57°
0 1 1 0 1	58°
0 1 1 1 0	59°
0 1 1 1 1	60°

¢-5

COMMENTARY

BSU Pins E and F were previously assigned to the optional Steering Inhibit function. The Steering Inhibit function has not yet been incorporated in production SDUs or BSUs. The connections were from SDU Pins MP7E and MP7F to BSU Pins E and F. The signals were defined in Note 18. To allow for implementation of the Steering Inhibit function at a later date, some aircraft have been wired in this manner. This wiring has the potential to cause the antenna to mispoint. To eliminate this potential problem, these wires should be disconnected from BSU Pins E and F, then capped and stowed. The Pins MP7E and MP7F may optionally be disconnected from the SDU, then capped and stowed.

⑳ If a starboard BSU is installed, the following connections should be made with the port BSU for secondary control and BITE information transfer. Also, SDU Multi-Control Output from Pins MP4G and MP4H should be connected to Pin Nos. T and U on Starboard BSU as well as Pins T and U on Port BSU.

¢-4

Port BSU Pin	Starboard BSU Pin
W	P
X	R
P	W
R	X

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

⟨21⟩ The following pin assignments are defined for the mechanically steered antenna ACU in addition to those discussed in Notes 16 and 17 above:

Function	Pin
115 VAC Hot	BP1
115 VAC Cold	BP2
Chassis Ground	TP1
LNA On/Off Control	BP5
BITE Discrete from LNA	BP6
Steering Inhibit A	BP13
Steering Inhibit B	BP14

⟨22⟩ The characteristic impedance of each coaxial interface, including the SDU/RFU IF interfaces (if used) should be 50 ohms.

⟨23⟩ Not Used.

⟨24⟩ The BSU and the High Power Relay (HPR) may be wired as in Attachment 1-4B.

⟨25⟩ This Satellite Control/Display Unit (SCDU) interface is required to permit the SDU to be managed by a cockpit control panel. The SDU should be capable of exchanging command and control information with the SCDU using the MCDU protocol standards defined in ARINC Characteristic 739. Display and control details are manufacturer-specific. Note that no messages for the air-ground link will originate in or be routed to the SCDU over this interface. The details of this interface are manufacturer-specific.

⟨26⟩ This discrete input will be used to enable the SDU to determine whether or not the aircraft is in motion. The input 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 MP11A, or an open circuit or voltage. An open circuit is defined as a resistance of 100,000 ohms or more between pin MP11A 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. In lieu of any available discrete to drive this circuit, Pin MP11B will be programmed to the open circuit state, such that the unterminated (default) Motion Sensor Input will be interrupted as "In Motion". c-4

Programming should be achieved by means of SDU connector pin MP11B. When this pin is open circuit, the "true" state of its associated input should be indicated by the open circuit or voltage condition and the "false" state by the DC ground condition. When the program pin is connected to MP15K (address common), the true state of the associated input should be indicated by the DC ground condition and the "false" state by the open circuit or voltage condition. In all cases the "true" state is associated with the aircraft in motion.

One possible source of the discrete is the aircraft parking brake. When this is set, the aircraft is not in motion. When it is not set the SDU may assume the aircraft is in motion. Other sources of the discrete which permit the SDU to draw the same inferences are also suitable. Note that in an IRS/INS equipped aircraft which supplies ground speed information to the SDU, the use of this discrete is unnecessary.

⟨27⟩ These pins are reserved for possible future use as unspecified program pins whose functions will be defined by the user to the avionics suppliers and installer. They will be left open circuit or wired to pin MP15K, "ICAO Address Common", as necessary.

⟨28⟩ All TNC and N type connectors should be provided with means to prevent the effects of vibration from causing the threaded collar with which the mating halves are secured together from becoming loose.

⟨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.

⟨30⟩ This bus should transmit UTC to the Automatic Dependent Surveillance Unit(s) (ADSU) via ARINC 429 label 150 at least once every 10 minutes if available.

⟨31⟩ These twisted and shielded pairs are provided to handle fast rise-time discrete outputs from the BSU(s) to the HPA(s). These discretes instruct the HPA(s) to mute in a side mounted antenna system when it is required to switch between port and starboard antennas. This action may also increase the life of the High Power

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

Relay (HPR), if installed. The HPA mute condition is asserted when line A with respect to line B has a voltage of +6.5 to +13 volts on it. The "normal operation" condition is defined as all other states of the circuit, including the "zero" state of 0 ±2.5 volts and -6.5 to -13 volts measured from line A with respect to line B, and the open circuit condition. Consult ARINC Specification 429 for additional details of the interface such as rise and fall times. These voltage levels and desired HPA reaction times are shown on Attachment 1-4A. The HPA muting functions should be a logical "OR" from the STBD and port BSU mute commands.

㉜ Pin assignments will be different for the 2 MCU remote-located BSU using the ARINC 600 series connector. In this case, the pin assignments should conform to Attachment 1-3A "2 MCU Beam Steering Unit Size 1 Connector Pin Assignments".

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

LRU	Connector Function (Common)	Numeric Code	Wire Bundle
LNA/DIP	Antenna I/O	1	J1
	Rx Output	2	J2
	Tx Input	3	J3
	Power/Signal	4	J4
BSU (with RF)	RF to/from LNA/DIP	1	J1
	Power/Signal	2	J2
HPR	RF Input	1	J1
	RF Out (port)	2	J2
	RF Out (stbd)	3	J3
	Power/Signal	4	J4
RF Splitter	Output	1	J1
	Output	2	J2
	Input	3	J3

¢-4

㉞ The HPR should use a MIL-C-26482 Series (crimp) type connector for the control interconnections. It should be identified by part number MS 3120E-12-8P or equivalent which mates with a MS3126E-12-8S.

㉟ Details of this interface are not yet defined.

㊱ For ANTENNA CONTROL STEERING and computed Doppler correction, the following ARINC 429 Octal labels should be transmitted from the IRS, ADIRS, ADSU or equivalent equipment. These labels are:

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 Circuit breaker protection information for the single SATCOM systems is as follows:

- One (1) 115 VAC 5 amp, circuit breaker is provided for RFU-1 and SDU-1
- One (1) 115 VAC 7.5 amp circuit breaker is provided for BSU-1, Diplexer/Low Noise Amplifier-1 and HPA-1.

Each circuit breaker shall have a Type A (short delay) response. When dual SATCOM systems are installed, the circuit breakers utilized in each system are the same as those given above.

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

㊴ Reference Attachment 1-4C (pin TP13B) for the definition of the speed (high or low) of this ARINC 429 bus.

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

¢-4 ㊵ These discretes will be 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.

¢-6 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 required to be 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 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.

¢-4 ㊶ CEPT-E1 data bus defined in CCITT G.703 and G.704.

㊷ An SDU may be wired to any two of up to 3 IRSs. Attachment 1-4C System Configuration Pins TP11C and D define which IRS pins on the SDU are wired to sources of IRS data.

㊸ This discrete input will be 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 signalling 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.

¢-5 ㊹ Not used.

¢-4 ㊺ Messages for the Air/Ground link will not be routed over this interface.

¢-5 ¢-7 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 will indicate 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, and if ORT (item o) is selected, and if TP13K=1. Reference Section 4.13.

¢-5 ㊼ Reference Attachment 1-4C (pin TP10D) for the definition of the speed (high or low) of these ARINC 429 buses.

㊽ 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 signalling. 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 signalling on the appropriate wire pairs.

¢-6 ¢-5 ㊾ This optional output 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 Attachment 2 for the "GSDB Word Sequence - SDU to SNU".

¢-6 This optional output port may also be used for Cabin Packet-Mode Data (CPD), see Note 54. Both applications may share the port by using unique labels/SALs.

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

㊿ The optional Auxiliary Asynchronous Port interfaces shall function as defined in EIA Standard RS-232.

(51) The optional Encryptographic Data Interface lines for Channels 1 and 2 are defined as follows: ¢-5

CH1_SER_OUT, CH2_SER_OUT --- Encrypted Data, 9600 bps output from SDU.
CH1_SER_IN, CH2_SER_IN --- Encrypted Data, 9600 bps input to SDU.
CH1_CMD_ACT, CH2_CMD_ACT --- Circuit Mode Data Activate, output from SDU.
CH1_CMD_REQ, CH2_CMD_REQ --- Circuit Mode Data Request, input to SDU.
CH1_DCD, CH2_DCD --- Data Carrier Detect, output from SDU
TXCLK1, TXCLK2 --- Transmit Data Clock 9600 Hz, output from SDU.
RXCLK1, RXCLK2 --- Receive Data Clock 9600 Hz, output from SDU.

(Note: the electrical characteristics of the signals are as defined in the EIA/TIA-232 Standard). ¢-6

(52) This SDU output may also be wired to the EICAS/ECAM/EDU to permit that unit to monitor the Label 270 word, which is specified in ARINC Characteristic 741, Part 2, Section 4.7.3.1. ¢-5

(53) At least one manufacturer has connected this pin to common ground. This pin was so designated in Supplement 4.

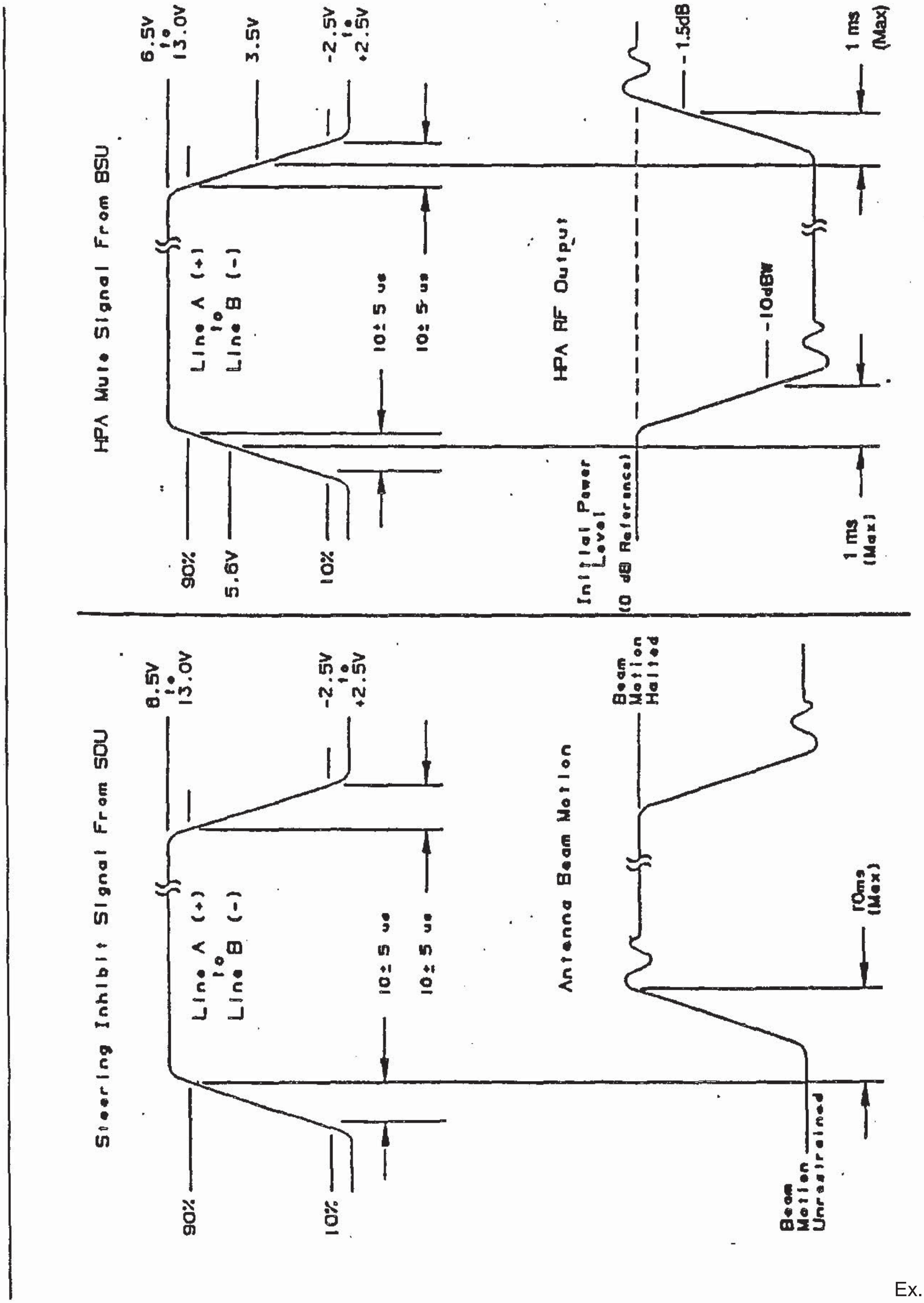
(54) These optional ARINC 429 input and output ports may be used to provide packet-mode data services for the Cabin Packet-mode Data Function (CPDF), as specified in Part 2, Section 4.9. ¢-6

(55) Reference Attachment 1-4C (pin TP10E) for the definition of the speed (high or low) of this ARINC 429 bus.

(56) Reference Part 2 Section 4.8.7.4 regarding the usage of this interface signal in a dual SATCOM system. In a dual system, the physical channel 1 and 2 interfaces on each SDU map to the AMS/ACP logical channel interfaces per ORT (Item p) (Reference Part 2 Section 4.5.2.3). The SDU cockpit telephony signalling outputs in a dual system should only be asserted by the SDU supporting a call with one of its physical channels. ¢-7

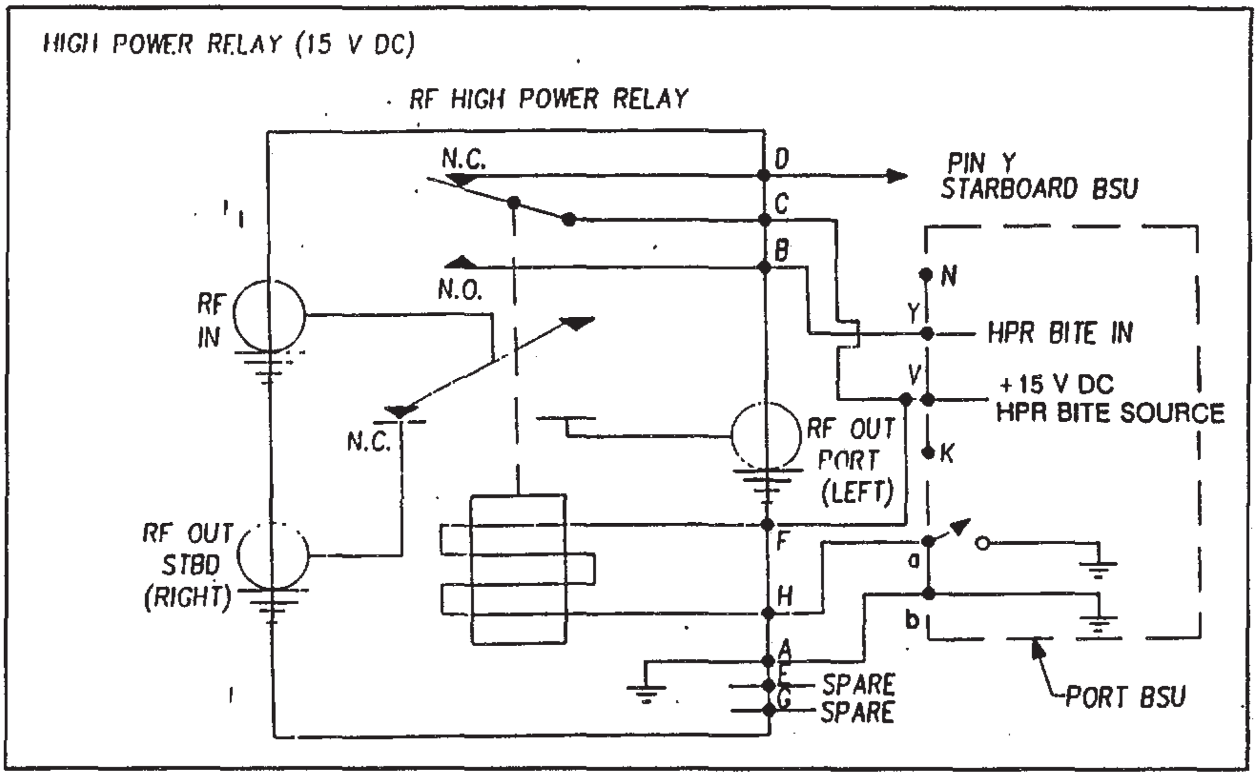
ATTACHMENT 1-4A
STEERING INHIBIT AND HPA MUTE SIGNAL CHARACTERISTICS

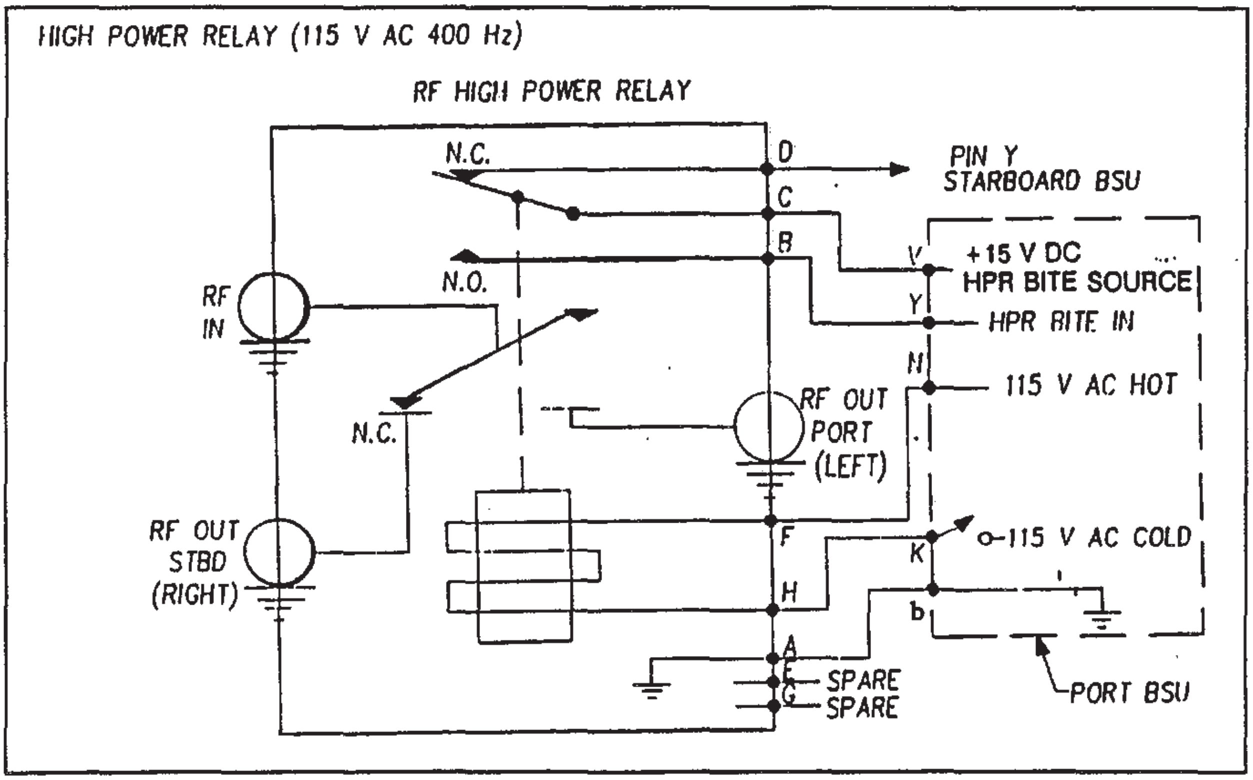
¢-2



NOTE: For Timing Reference Only.

ATTACHMENT 1-4B
BSU/HPR WIRING DIAGRAMS





c-2

ATTACHMENT 1-4C
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION

SUMMARY

¢-5	TP10A:	AVAILABILITY OF ARINC 429 SSR MODE S ADDRESS (AES ID) FROM 429 PORTS
¢-4	TP10B:	FMC CONNECTION TO SDU
	TP10C:	FMC CONNECTION TO SDU
¢-5	TP10D:	429 BUS SPEED TO/FROM CMU #1/#2
¢-6	TP10E:	CPDF CONFIGURATION
	TP10F:	429 BUS SPEED OF AES ID INPUT
	TP10G:	RESERVED FOR STRAP OPTION
¢-4	TP10H:	RESERVED FOR STRAP OPTION
	TP10J:	RESERVED FOR STRAP OPTION
¢-7	TP10K:	CALL LIGHT ACTIVATION
	TP11A:	STRAP PARITY (ODD; COVERING THE OTHER 39 STRAP PINS)
	TP11B:	CCS PRESENCE
	TP11C:	IRS CONFIGURATION
	TP11D:	IRS CONFIGURATION
	TP11E:	HPA/ANTENNA SUBSYSTEM CONFIGURATION
	TP11F:	HPA/ANTENNA SUBSYSTEM CONFIGURATION
	TP11G:	HPA/ANTENNA SUBSYSTEM CONFIGURATION
	TP11H:	HPA/ANTENNA SUBSYSTEM CONFIGURATION
	TP11J:	HPA/ANTENNA SUBSYSTEM CONFIGURATION
	TP11K:	HPA/ANTENNA SUBSYSTEM CONFIGURATION
¢-4	TP12A:	CFDS TYPE
	TP12B:	CFDS TYPE
	TP12C:	CFDS TYPE
	TP12D:	(RESERVED FOR AIRCRAFT ID 429 INPUT, OR PAD FOR CFDS/SDU CONFIG)
	TP12E:	SDU CONFIGURATION
	TP12F:	SDU NUMBER
	TP12G:	CMU #1 CONFIGURATION
	TP12H:	CMU #2 CONFIGURATION
	TP12J:	MCDU/SCDU #1 CONFIGURATION
	TP12K:	MCDU/SCDU #2 CONFIGURATION
¢-6	TP13A:	OPTION PRIORITY 4 CALLS TO/FROM COCKPIT
¢-5	TP13B:	429 BUS SPEED TO MCDU/SCDU #1, #2, #3
	TP13C:	COCKPIT VOICE CALL LIGHT/CHIME OPTIONS
	TP13D:	COCKPIT VOICE CALL LIGHT/CHIME OPTIONS
	TP13E:	MCDU/SCDU #3 CONFIGURATION
¢-4	TP13F:	SDU CODEC 1 WIRING
	TP13G:	SDU CODEC 1 WIRING
	TP13H:	SDU CODEC 2 WIRING
	TP13J:	SDU CODEC 2 WIRING
	TP13K:	COCKPIT HOOKSWITCH SIGNALING METHOD

ATTACHMENT 1-4C (Cont'd)
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION ⟨1⟩

AVAILABILITY OF ARINC 429 SSR MODE S ADDRESS (AES ID) FROM 429 PORTS

TP10 PIN A	INTERPRETATION
1	SSR MODE S ADDRESS (AES ID) NOT AVAILABLE FROM CMU #1 NOR CMU #2 NOR (RESERVED) AES ID INPUT
0	SSR MODE S ADDRESS (AES ID) IS AVAILABLE FROM CMU #1 AND/OR CMU #2 AND/OR AES ID INPUT

¢-5

FMC CONNECTION TO SDU

TP10 PINS		INTERPRETATION
B	C	
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

429 BUS SPEED TO/FROM CMU #1/#2

TP10 PIN D	INTERPRETATION
0	HIGH SPEED ARINC 429 BUS
1	LOW SPEED ARINC 429 BUS

¢-4

CABIN PACKET DATA FUNCTION (CPDF)

TP10 PIN E	INTERPRETATION
0	CPDF INSTALLED
1	CPDF NOT INSTALLED

429 BUS SPEED OF AES ID INPUT

TP10 PIN F	INTERPRETATION
0	HIGH SPEED ARINC 429 BUS
1	LOW SPEED ARINC 429 BUS

¢-6

⟨2⟩ STRAP PARITY (ODD)

TP11 PIN A	INTERPRETATION
0	SUM OF ALL OTHER STRAPS SET TO 1 IS ODD
1	SUM OF ALL OTHER STRAPS SET TO 1 IS EVEN

¢-5

CALL LIGHT ACTIVATION

TP10 PIN K	INTERPRETATION
0	CALL LIGHT ON AT CALL INITIATION (FOR AIR/GROUND CALLS)
1	CALL LIGHT ON AT CALL CONNECTION (FOR AIR/GROUND CALLS)

¢-7

ATTACHMENT 1-4C (Cont'd)
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION ①

CABIN COMMUNICATION SYSTEM (CCS)	
TP11 PIN B	INTERPRETATION
0	CCS INSTALLED
1	CCS NOT INSTALLED

IRS CONFIGURATION		
TP11 PINS		INTERPRETATION
C	D	
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

	③						HPA/ANTENNA SUBSYSTEM CONFIGURATION								
¢-5	TP11 PINS						LGA + LNA/DIPLEXER	LGA HPA	TOP/PORT BSU + HGA	STARBOARD BSU + HGA	HGA HPA	HPR	RESERVED FOR FUTURE	RESERVED FOR MFR	
	E	F	G	H	J	K									
	1	1	1	1	1	1	*	*							
	0	1	1	1	1	1			*		*				
	1	0	1	1	1	1	*	*	*		*				
	0	0	1	1	1	1	*	*	*	*	*	*			
	1	1	0	1	1	1							*		
	0	1	0	1	1	1							*		
¢-6	1	0	0	1	1	1	*		*		*	*			⑥
	0	0	0	1	1	1	*	*	*	*		*			⑥
	1	1	1	0	1	1			*	*	*	*			
¢-5	0 0	1 0	1 0	0 1	1 0	1 0	to						*		
	1 0	1 0	1 0	0 0	0 0	0 0	to							*	

ATTACHMENT 1-4C (Cont'd)
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION ①

C-4

CFDS			
TP12			INTERPRETATION
A	B	C	
0	0	0	Undefined
0	0	1	McDonnell-Douglas type CFDS
0	1	0	Airbus type CFDS
0	1	1	Undefined
1	0	0	Boeing type CFDS
1	0	1	Undefined
1	1	0	Undefined
1	1	1	CFDS Not Installed

SDU CONFIGURATION	
TP12 PIN E	INTERPRETATION
0	SECOND SDU INSTALLED
1	SECOND SDU NOT INSTALLED

④	SDU NUMBER
TP12 PIN F	INTERPRETATION
0	SDU #2
1	SDU #1

CMU #1	
TP12 PIN G	INTERPRETATION
0	CMU #1 INSTALLED
1	CMU #1 NOT INSTALLED

CMU #2	
TP12 PIN H	INTERPRETATION
0	CMU #2 INSTALLED
1	CMU #2 NOT INSTALLED

ATTACHMENT 1-4C (cont'd)
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION ⟨1⟩

¢-4

MCDU/SCDU #1	
TP12 PIN J	INTERPRETATION
0	MCDU/SCDU #1 INSTALLED
1	MCDU/SCDU #1 NOT INSTALLED

MCDU/SCDU #2	
TP12 PIN K	INTERPRETATION
0	MCDU/SCDU #2 INSTALLED
1	MCDU/SCDU #2 NOT INSTALLED

¢-6

⟨7⟩ PRIORITY 4 CALLS TO/FROM COCKPIT	
TP13 PIN A	INTERPRETATION
1	ALLOW PRIORITY 4 CALLS TO/FROM THE COCKPIT
0	INHIBIT PRIORITY 4 CALLS TO/FROM THE COCKPIT

¢-5

429 BUS SPEED TO MCDU/SCDU #1, #2, #3	
TP13 PIN B	INTERPRETATION
0	LOW SPEED ARINC 429 BUS
1	HIGH SPEED ARINC 429 BUS

¢-4

⟨5⟩ COCKPIT VOICE CALL LIGHT/CHIME OPTION		
TP13 PINS		INTERPRETATION
C	D	
0	0	SPARE
0	1	STEADY LIGHTS & MULTISTROKE CHIME
1	0	FLASHING LIGHTS & SINGLE STROKE CHIME
1	1	STEADY LIGHTS & SINGLE STROKE CHIME

MCDU/SCDU #3	
TP13 PIN E	INTERPRETATION
0	MCDU/SCDU #3 INSTALLED
1	MCDU/SCDU #3 NOT INSTALLED

ATTACHMENT 1-4C (cont'd)
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION①

SDU CODEC 1 WIRING		
TP13 PINS		INTERPRETATION
F	G	
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

SDU CODEC 2 WIRING		
TP13 PINS		INTERPRETATION
H	J	
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

¢-4

COCKPIT HOOKSWITCH SIGNALING METHOD	
TP13 PIN K	INTERPRETATION
1	SWITCHED PTT AND/OR SCDU LINE SWITCH(ES)
0	LATCHED AUDIO CONTROL PANEL SATCOM MIC SWITCH

① Pins assigned to bits required to 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 is TP10A through TP10K and TP11B through TP13K (39 pins other than itself). 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 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.

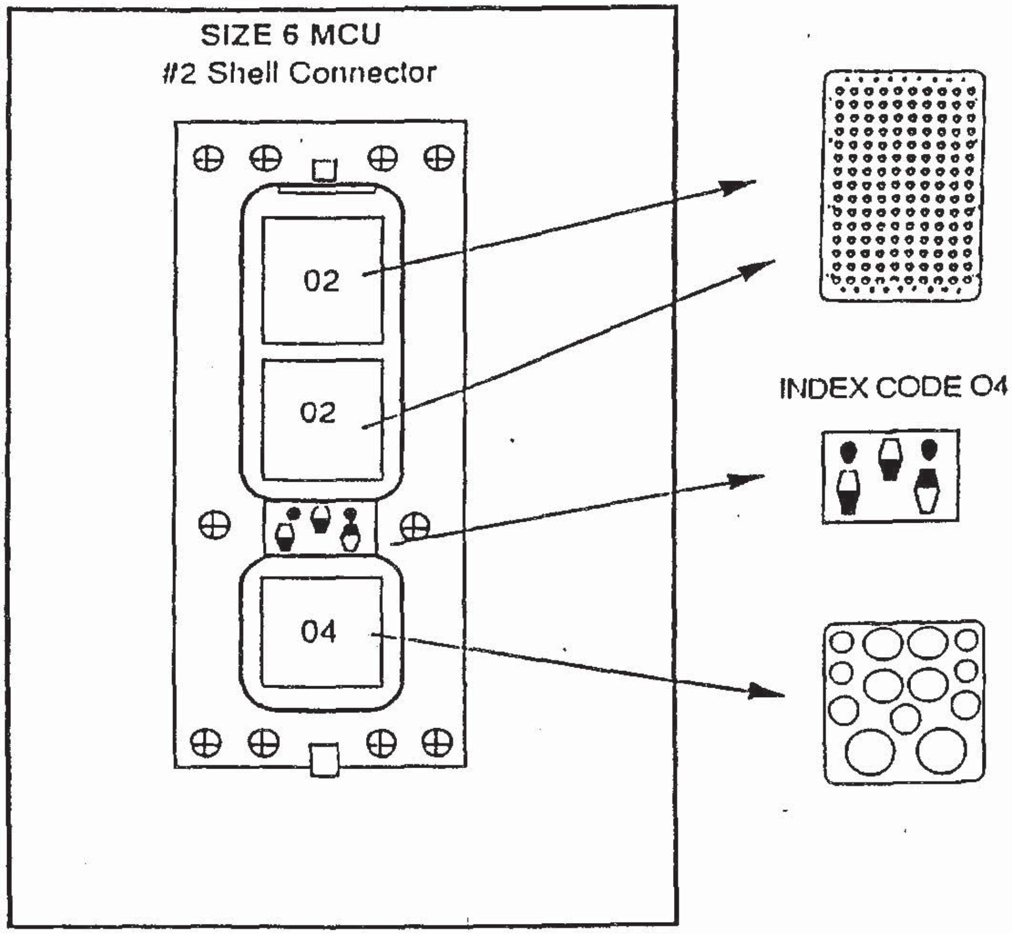
⑤ The steady vs. flashing light option applies to the call annunciation phase only. The light remains on (steady) for the duration of the call after the acknowledgement of the annunciation with either the STEADY or FLASHING option.

⑥ Interwiring and operation is TBD.

⑦ The following requirements 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 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 must be routed to the CCS or cabin analog phones). All cockpit AMS-initiated calls must be processed at Priority 3 or higher. Additionally, ORT item "g" (Codec Dedication) cannot be allowed to specify Cabin dedication. ¢-6

ATTACHMENT 1-5
SDU FORM FACTOR

c-2



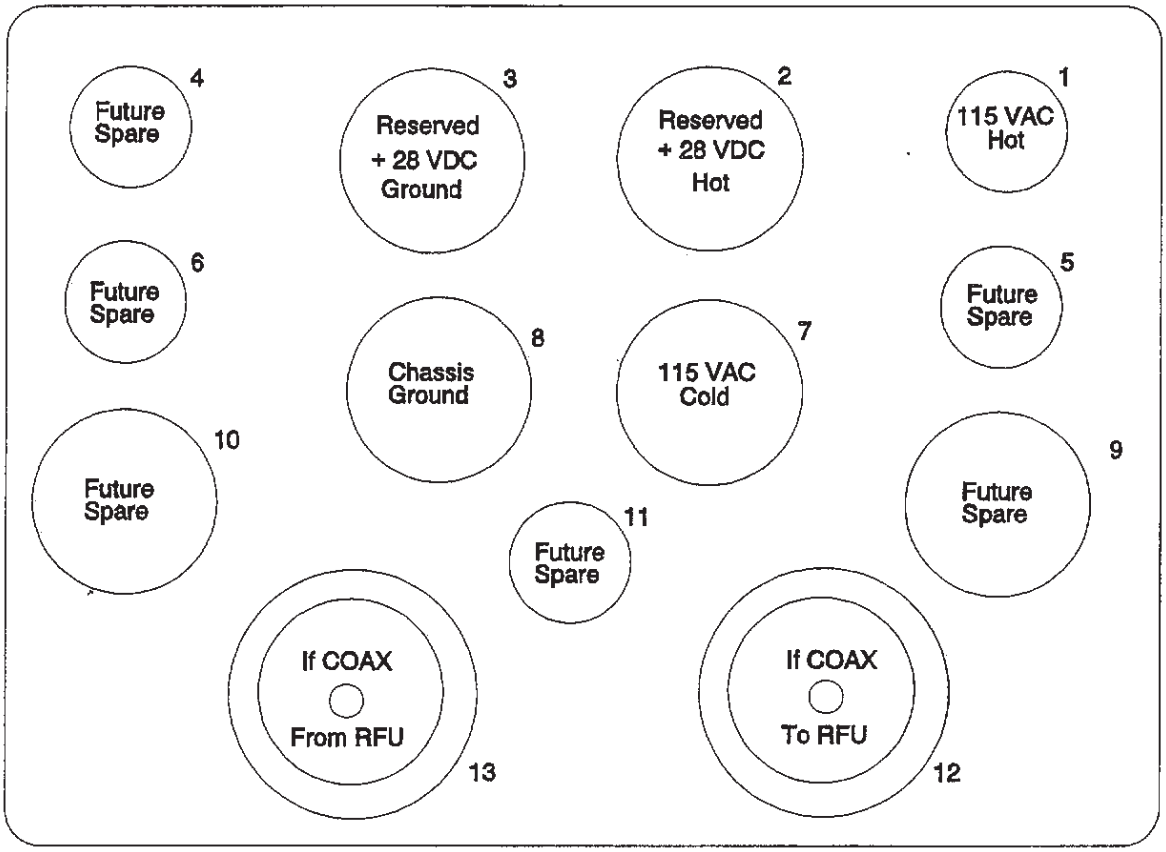
ATTACHMENT 1-5A
SDU TOP PLUG CONNECTOR LAYOUT

	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	c-6
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	○	○	c-5
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	○	○	○	○	○	c-4
4	○	○	○	○	○	○	○	○	○	○	c-5
5	±15 V DISCRETE OUTPUT	±15 V DISCRETE INPUT	±15 V DISCRETE OUTPUT	±15 V DISCRETE INPUT	COMMON GROUND	±15 V DISCRETE OUTPUT	±15 V DISCRETE INPUT	COMMON GROUND	±15 V DISCRETE OUTPUT	±15 V DISCRETE OUTPUT	c-6
6	SPARE 429 INPUT A	SPARE 429 INPUT B	SPARE 429 OUTPUT A	SPARE 429 OUTPUT B	±15 V DISCRETE OUTPUT	○	±15 V DISCRETE OUTPUT	±15 V DISCRETE INPUT	±15 V DISCRETE OUTPUT	±15 V DISCRETE INPUT	
7	±15 V DISCRETE OUTPUT	±15 V DISCRETE INPUT	±15 V DISCRETE OUTPUT	±15 V DISCRETE OUTPUT	±15 V DISCRETE INPUT	±15 V DISCRETE OUTPUT	±15 V DISCRETE INPUT	±15 V DISCRETE OUTPUT	±15 V DISCRETE INPUT	±15 V DISCRETE OUTPUT	c-5
8	○	○	○	○	○	○	○	○	○	○	
9	SPARE DISCRETE INPUT CONFIG. STRAP TYPE	SPARE DISCRETE INPUT CONFIG. STRAP TYPE	○	○	○	○	○	○	○	○	
10	OPTION AVAIL. OF ARINC 429 SSR MODE S ADDRESS	OPTION FMC CONFIG	OPTION FMC CONFIG	OPTION CMU #1/#2 BUS SPEED	OPTION CPDF PRESENCE	RESERVED FOR STRAP OPTION	RESERVED FOR STRAP OPTION	RESERVED FOR STRAP OPTION	RESERVED FOR STRAP OPTION	OPTION CALL LIGHT ACTIVATION	c-7
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	c-4
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 SIGNALLING METHOD	c-6
14	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	c-4
15	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	

ATTACHMENT 1-5B
SDU MIDDLE PLUG CONNECTOR LAYOUT

		A	B	C	D	E	F	G	H	J	K
¢-6	1	RESERVED CABIN #1 AUDIO IN HI	RESERVED CABIN #1 AUDIO IN LO	RESERVED CABIN #1 AUDIO OUT HI	RESERVED CABIN #1 AUDIO OUT 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
¢-4	2	COCKPIT AUDIO IN #1 HI	COCKPIT AUDIO IN #1 LO	COCKPIT AUDIO OUT #1 HI	COCKPIT AUDIO OUT #1 LO	COCKPIT AUDIO IN #2 HI	COCKPIT AUDIO IN #2 LO	COCKPIT AUDIO OUT #2 HI	COCKPIT AUDIO OUT #2 LO	CABIN DIG VOICE/ DATA IN CEPT-E1 A	CABIN DIG VOICE/ DATA IN CEPT-E1 B
¢-5	3	CABIN DIG VOICE/ DATA OUT CEPT-E1 A	CABIN DIG VOICE/ DATA OUT 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 IN HI	RESERVED CABIN #2 AUDIO IN LO
¢-4	5	LGA LNA ON/OFF CONTROL	RESERVED FOR WEIGHT-ON-WHEELS INPUT #1	INPUT #2	PROGRAM SELECT	RESERVED CABIN #2 AUDIO OUT HI	RESERVED CABIN #2 AUDIO OUT LO	BITE INPUT DISC FROM LGA LNA	CHIME/ LAMPS INHIBIT	DUAL SYSTEM SELECT DISCRETE I/O	DUAL SYSTEM DISABLE DISCRETE I/O
¢-5	6	DATA FROM PRIMARY IRS	DATA FROM PRIMARY IRS	DATA FROM SECONDARY IRS	DATA FROM SECONDARY IRS	BITE INPUT FROM HGA/HPA A	BITE INPUT FROM HGA/HPA B	SPARE 429 INPUT A	SPARE 429 INPUT B	BITE INPUT FROM LGA HPA A	BITE INPUT FROM LGA HPA B
¢-4	7	FROM AIRBORNE DATA LOADER A	FROM AIRBORNE DATA LOADER B	TO AIRBORNE DATA LOADER A	TO AIRBORNE DATA LOADER B	OUTPUT BSU #1&#2 STEER INHB A	OUTPUT BSU #1&#2 STEER INHB B	BITE INPUT FROM ACU OR TOP/PORT BSU A	BITE INPUT FROM ACU OR TOP/PORT BSU B	BITE INPUT FROM STBD BSU A	BITE INPUT FROM STBD BSU B
	8	DATA LOADER LINK A	DATA LOADER LINK B	RESERVED DATA FROM RMP A	RESERVED DATA FROM RMP B	CP VOICE CALL LGT OUTPUT #1	CP VOICE MIC ON INPUT #1	CP VOICE CALL LGT OUTPUT #2	CP VOICE MIC ON INPUT #2	DATA FROM SCDU #3 A	DATA FROM SCDU #3 B
¢-6	9	RESERVED DATA TO SNU/CPDF A	RESERVED DATA TO SNU/CPDF B	RESERVED DATA TO RMP A	RESERVED DATA TO RMP B	DATA FROM RFU A	DATA FROM RFU B	DATA TO RFU A	DATA TO RFU B	UNSPEC FUNCTION o A	UNSPEC FUNCTION o B
¢-4	10	UNSPEC FUNCTION o A	UNSPEC FUNCTION o B	UNSPEC FUNCTION o A	UNSPEC FUNCTION o B	UNSPEC FUNCTION o A	UNSPEC FUNCTION o B	UNSPEC FUNCTION o A	UNSPEC FUNCTION o B	UNSPEC FUNCTION o A	UNSPEC FUNCTION o B
¢-5	11	FROM MOTION SENSOR #1	MOTION SENSOR #1 PROGRAM SELECT	CALL CANCEL DISCRETE INPUT #1	CALL CANCEL DISCRETE INPUT #2	RESERVED UNSPEC PROGRAM	RESERVED UNSPEC PROGRAM	RESERVED UNSPEC PROGRAM	RESERVED UNSPEC PROGRAM	RESERVED UNSPEC PROGRAM	RESERVED UNSPEC PROGRAM
¢-4	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
¢-5	13	SPARE DISCRETE OUTPUT 28 VDC CALL-LAMP TYPE	o	ICAO ADDRESS BIT #1 (MSB)	ICAO ADDRESS BIT #2	ICAO ADDRESS BIT #3	ICAO ADDRESS BIT #4	ICAO ADDRESS BIT #5	ICAO ADDRESS BIT #6	ICAO ADDRESS BIT #7	ICAO ADDRESS BIT #8
¢-4	14	CP VOICE CHIME RESET #1	CP VOICE CHIME SIGNAL CONTACT 1	CP VOICE CHIME SIGNAL CONTACT 2	ICAO ADDRESS BIT #9	ICAO ADDRESS BIT #10	ICAO ADDRESS BIT #11	ICAO ADDRESS BIT #12	ICAO ADDRESS BIT #13	ICAO ADDRESS BIT #14	ICAO ADDRESS BIT #15
	15	ICAO ADDRESS BIT #16	ICAO ADDRESS BIT #17	ICAO ADDRESS BIT #18	ICAO ADDRESS BIT #19	ICAO ADDRESS BIT #20	ICAO ADDRESS BIT #21	ICAO ADDRESS BIT #22	ICAO ADDRESS BIT #23	ICAO ADDRESS BIT #24 (LSB)	ICAO ADDRESS COMMON

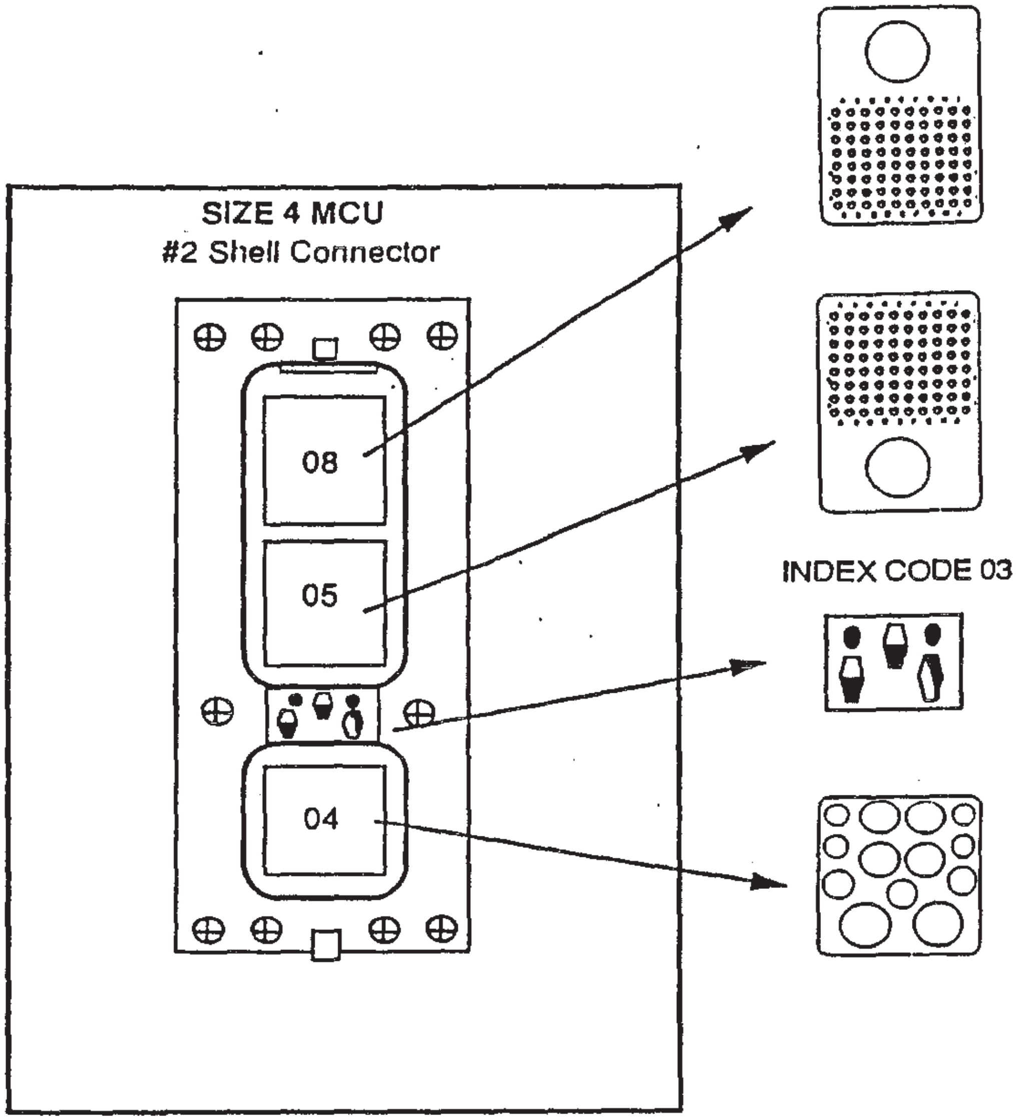
ATTACHMENT 1-5C
SDU BOTTOM PLUG CONNECTOR LAYOUT



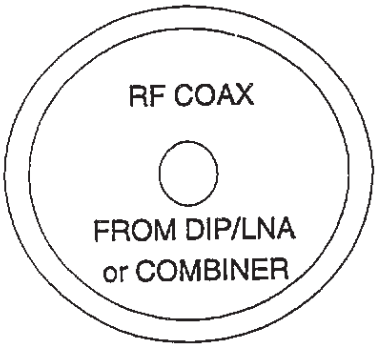
c-3

ATTACHMENT 1-6
RFU FORM FACTOR

c-2



ATTACHMENT 1-6A
RFU TOP PLUG CONNECTOR LAYOUT



TPC 1

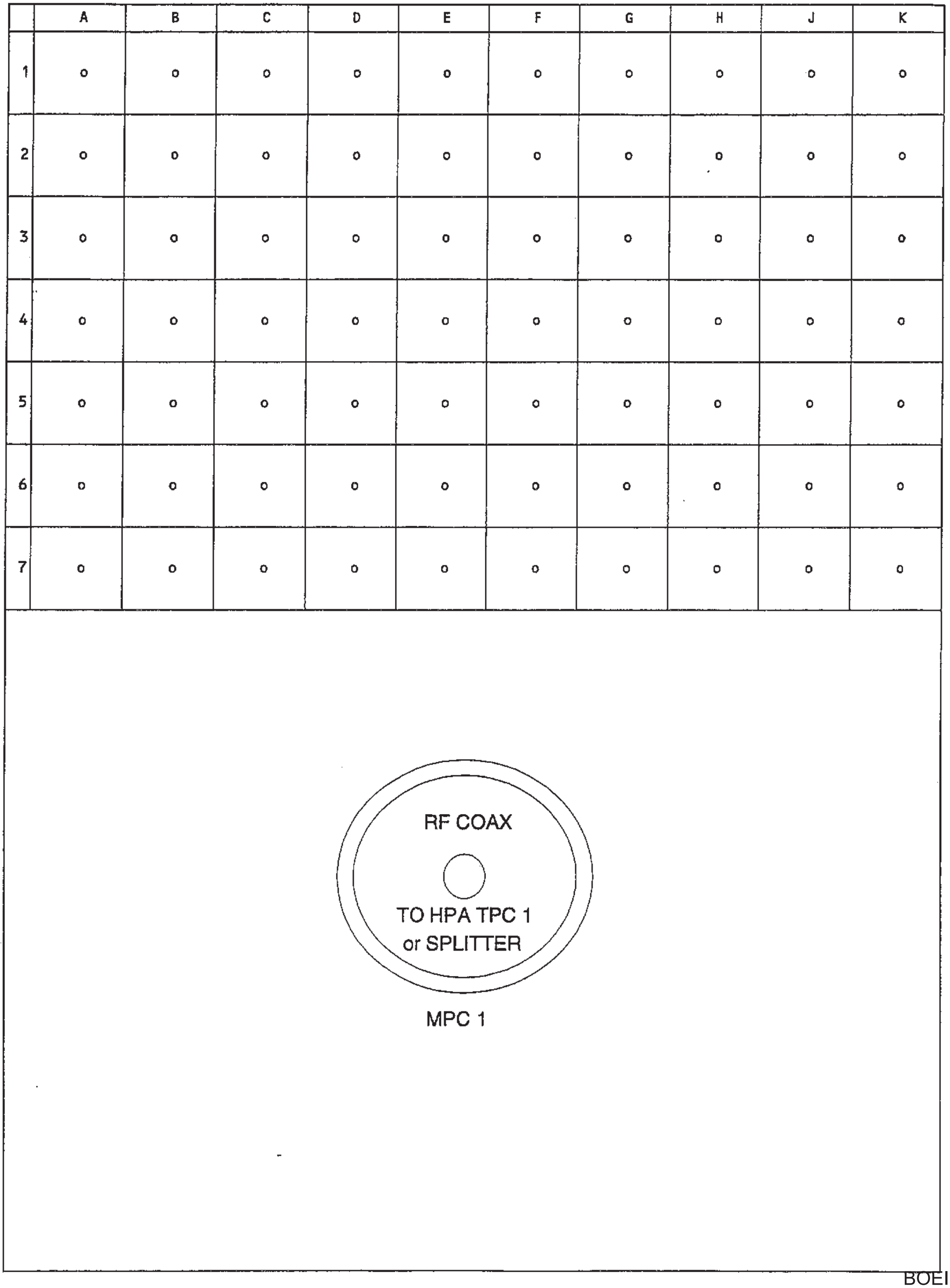
	A	B	C	D	E	F	G	H	J	K
1	DATA OUTPUT TO SDU A	DATA OUTPUT TO SDU B	DATA INPUT FROM SDU A	DATA INPUT FROM SDU B	UNSPEC FUNCTION 1A	UNSPEC FUNCTION 1B	UNSPEC FUNCTION 2A	UNSPEC FUNCTION 2B	UNSPEC FUNCTION 3A	UNSPEC FUNCTION 3B
2	SPARE 429 INPUT	SPARE 429 INPUT	SPARE 429 OUTPUT	SPARE 429 OUTPUT	SPARE DISC. INPUT	SPARE DISC. INPUT	SPARE DISC. INPUT	SPARE DISC. OUTPUT	SPARE DISC. OUTPUT	SPARE DISC. OUTPUT
3	UNSPEC FUNCTION 4A	UNSPEC FUNCTION 4B	UNSPEC FUNCTION 5A	UNSPEC FUNCTION 5B	UNSPEC FUNCTION 6A	UNSPEC FUNCTION 6B	o	o	o	o
4	FROM AIRBORNE DATA LOADER A	FROM AIRBORNE DATA LOADER B	TO AIRBORNE DATA LOADER A	TO AIRBORNE DATA LOADER B	DATA LOADER LINK A	DATA LOADER LINK B	o	o	o	o
5	o	o	o	o	o	o	o	o	o	o
6	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE
7	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE	RESERVED ATE

¢-4

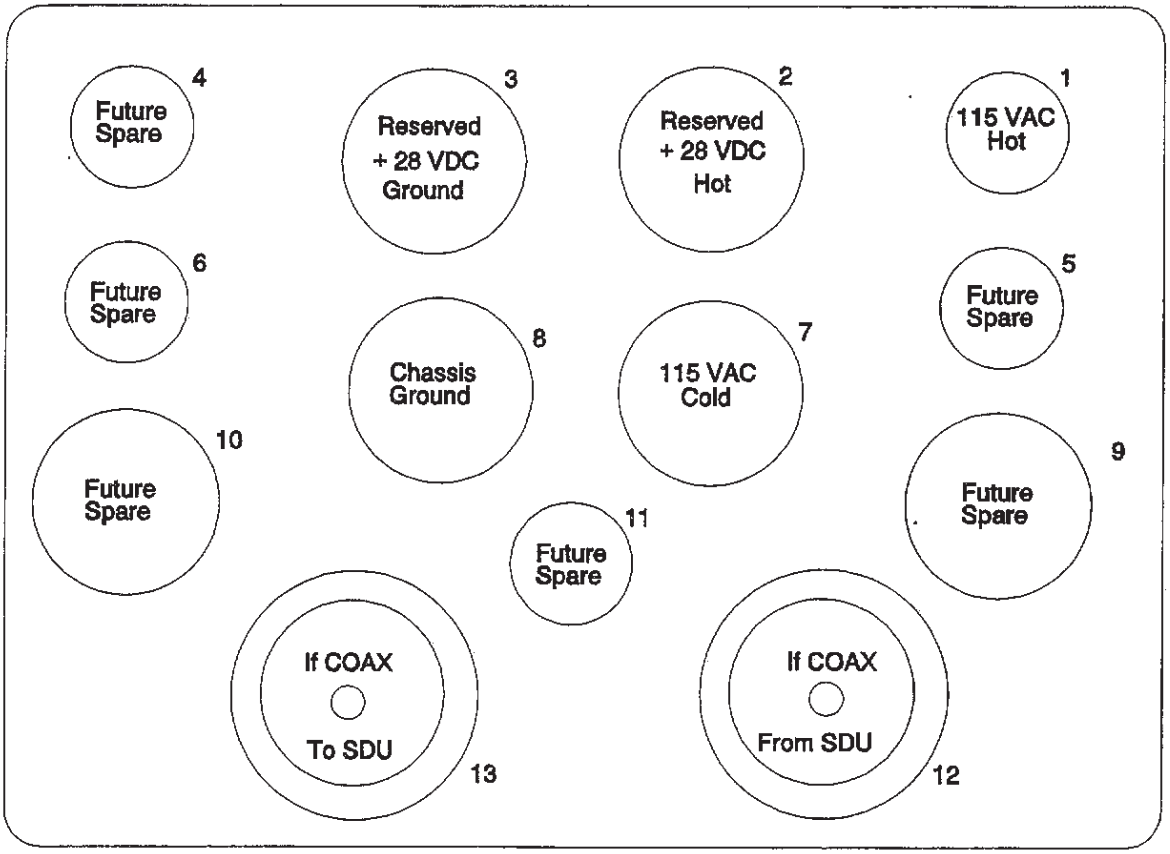
¢-5

ATTACHMENT 1-6B
RFU MIDDLE PLUG CONNECTOR LAYOUT

c-3



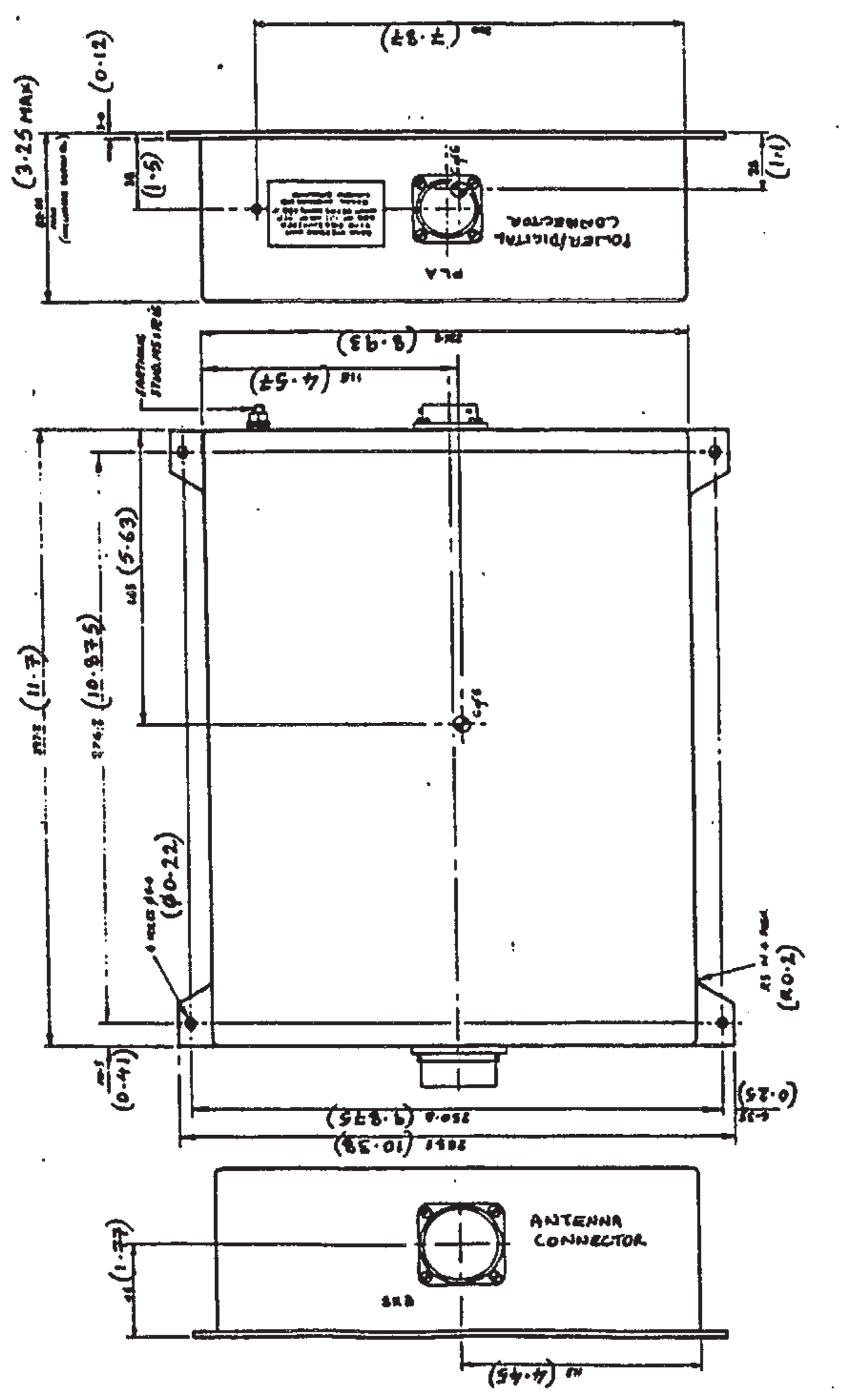
ATTACHMENT 1-6C
RFU BOTTOM PLUG CONNECTOR LAYOUT



c-3

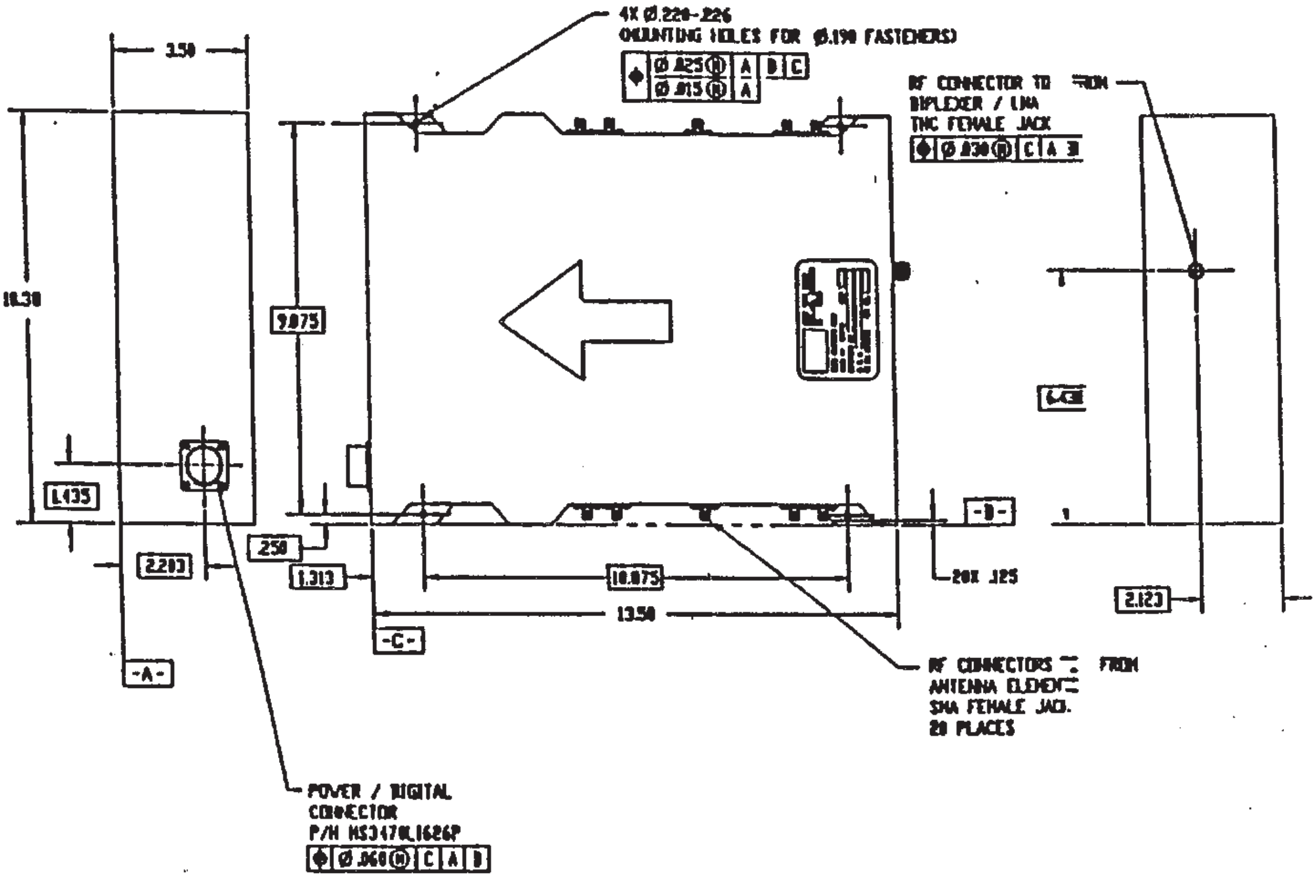
ATTACHMENT 1-7A
BEAM STEERING UNIT (BSU) - "ALTERNATE A"

¢-2



Note: RF BSU Connector should be installed within 10 feet of the antenna. Dimensions in mm (inches).

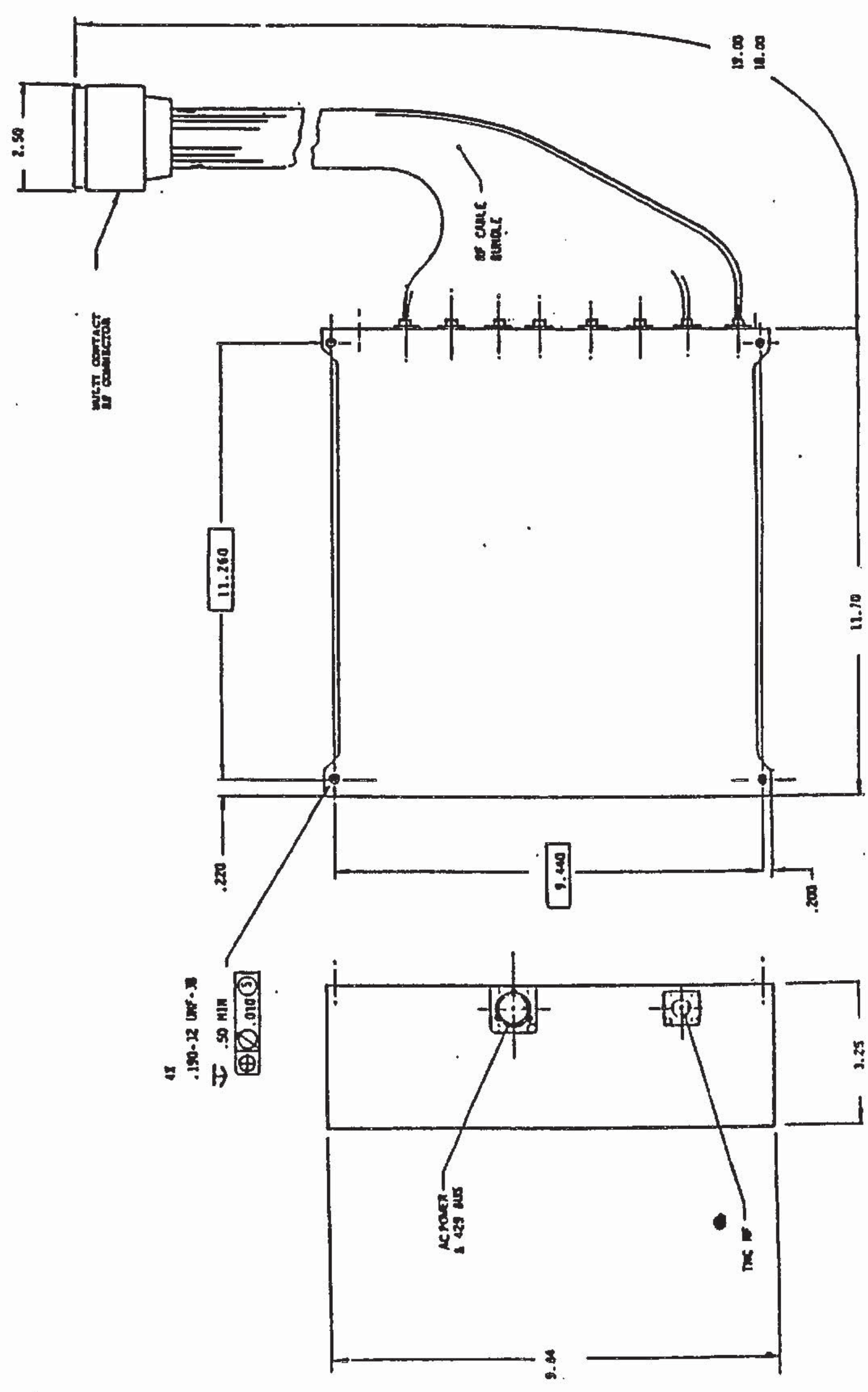
ATTACHMENT 1-7B
BEAM STEERING UNIT (BSU) - "ALTERNATE B"



¢-2

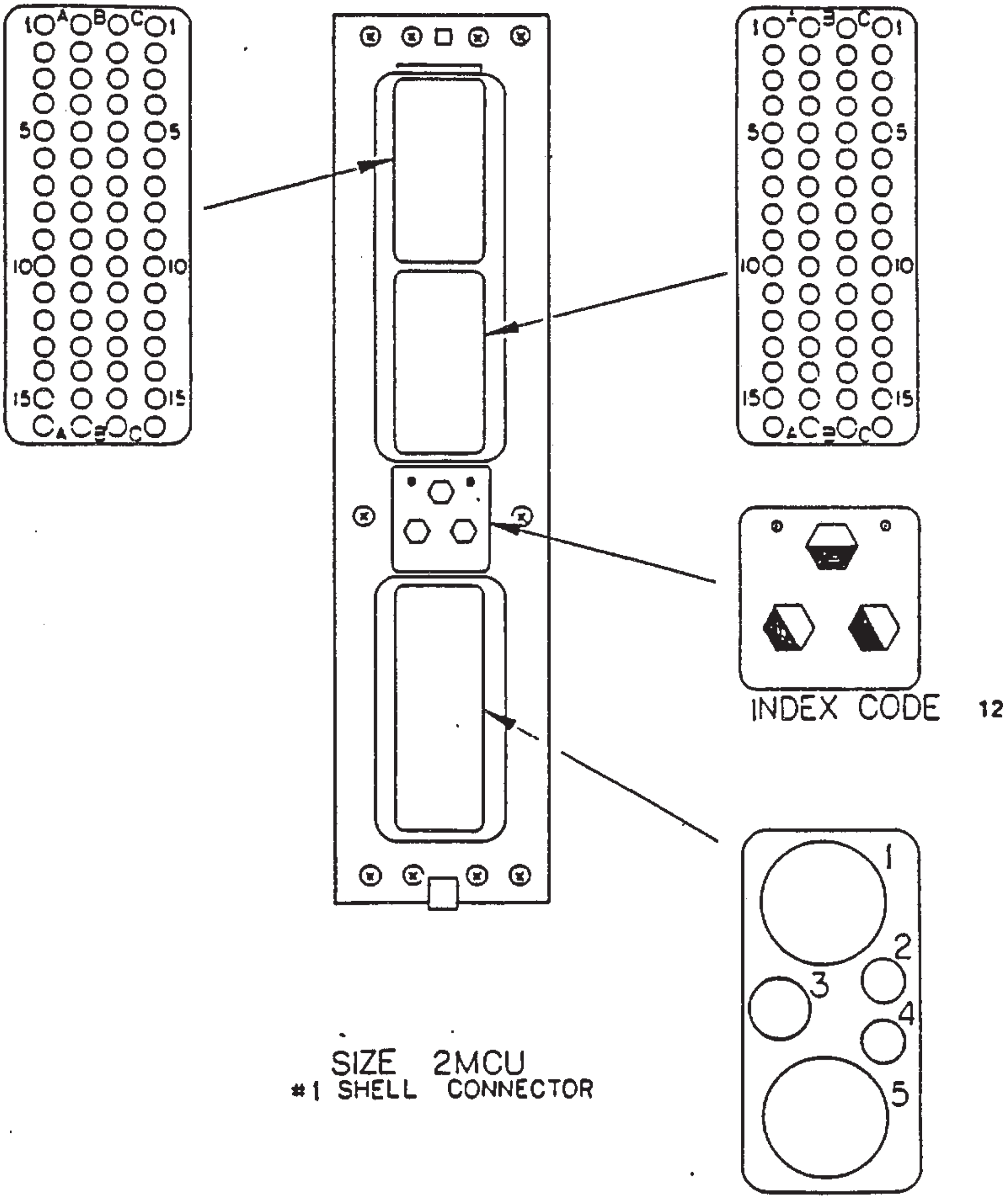
Note: Smaller enclosure may be utilized if mounting hole provisions are maintained.

ATTACHMENT 1-7C
BEAM STEERING UNIT (BSU) - "ALTERNATE C"



¢-2

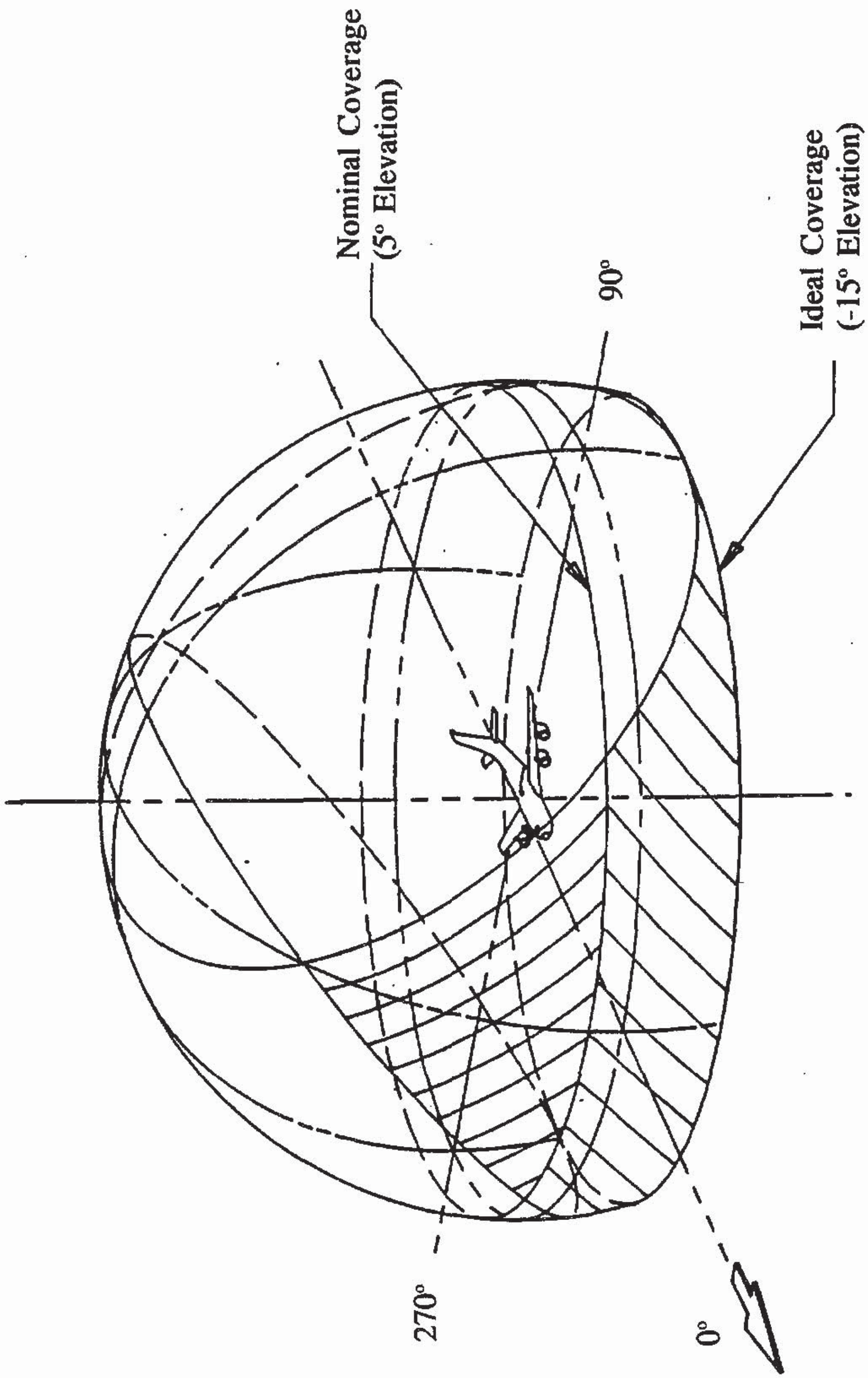
ATTACHMENT 1-7D
2MCU BEAM STEERING UNIT (BSU) REAR CONNECTOR CONFIGURATION



c-2

ATTACHMENT 1-8
ANTENNA COVERAGE

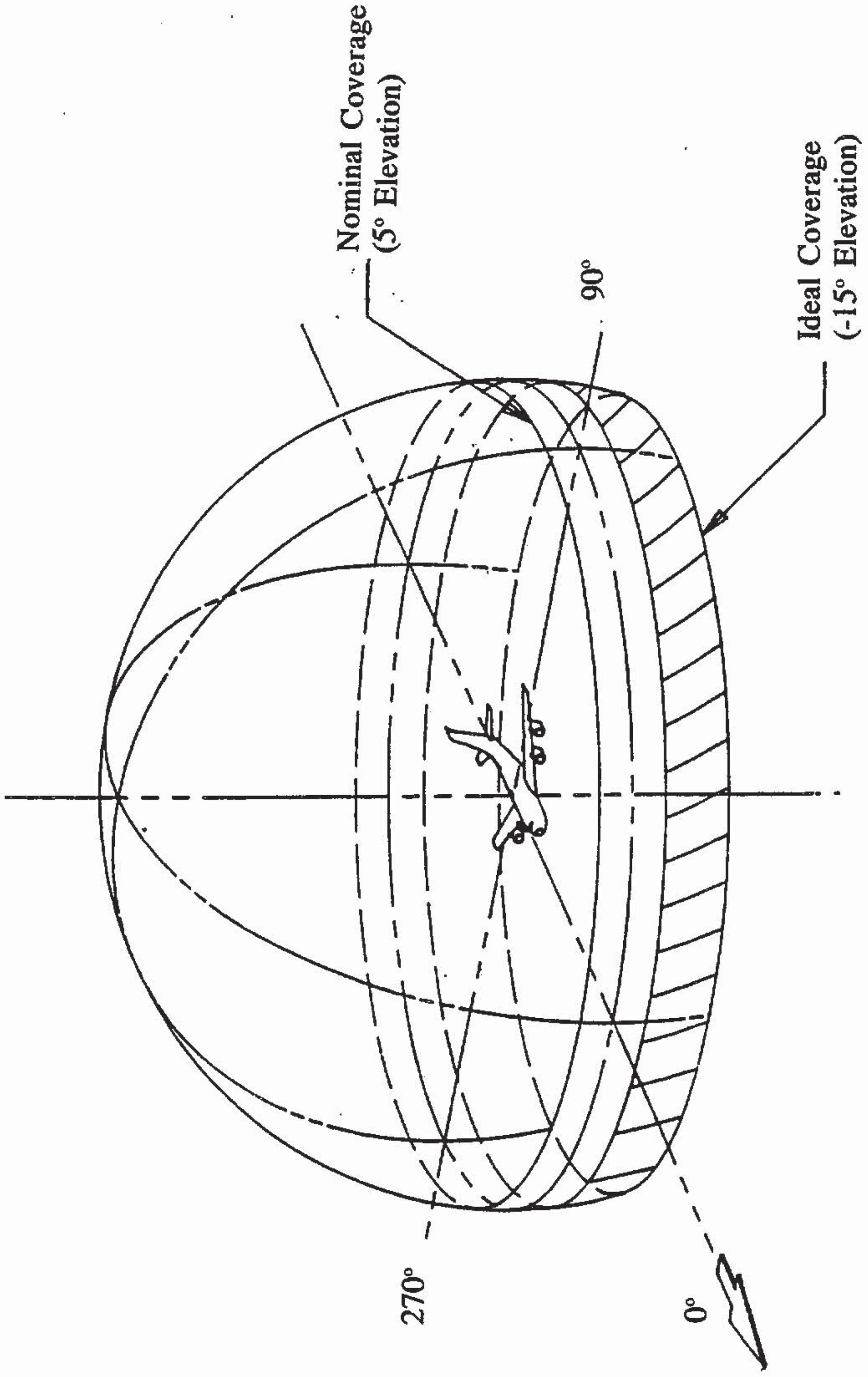
¢-2



Note: This coverage results in a fore and aft "keyhole".

Figure 1 - Typical High Gain Antenna Coverage Side Mounted, Electronically Steered

ATTACHMENT 1-8 (cont'd)
ANTENNA COVERAGE



¢-2

Figure 2 - Single Top Mounted, Mechanically Steered Antenna Coverage Region

ATTACHMENT 1-8 (cont'd)
ANTENNA COVERAGE

¢-2

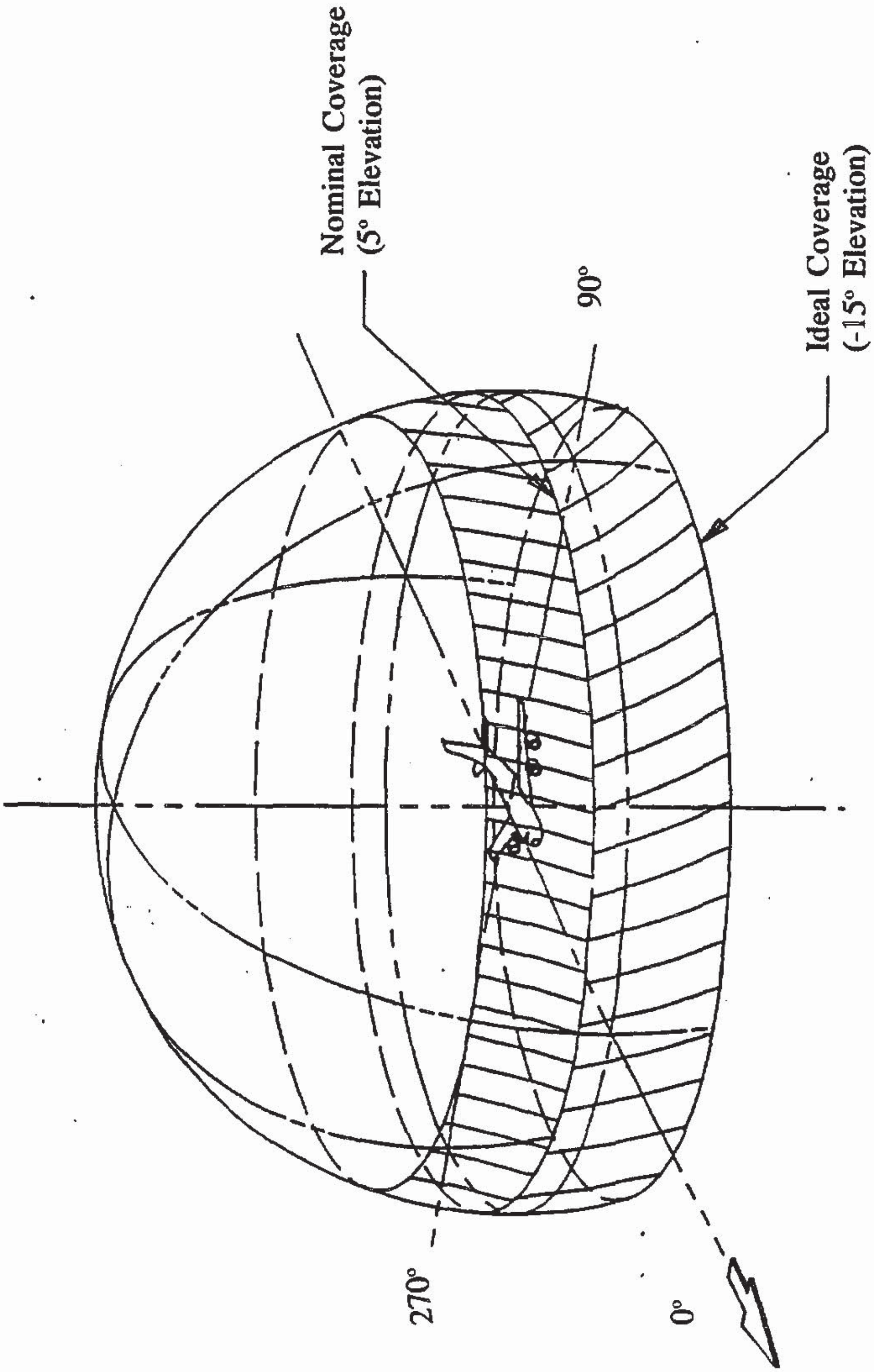
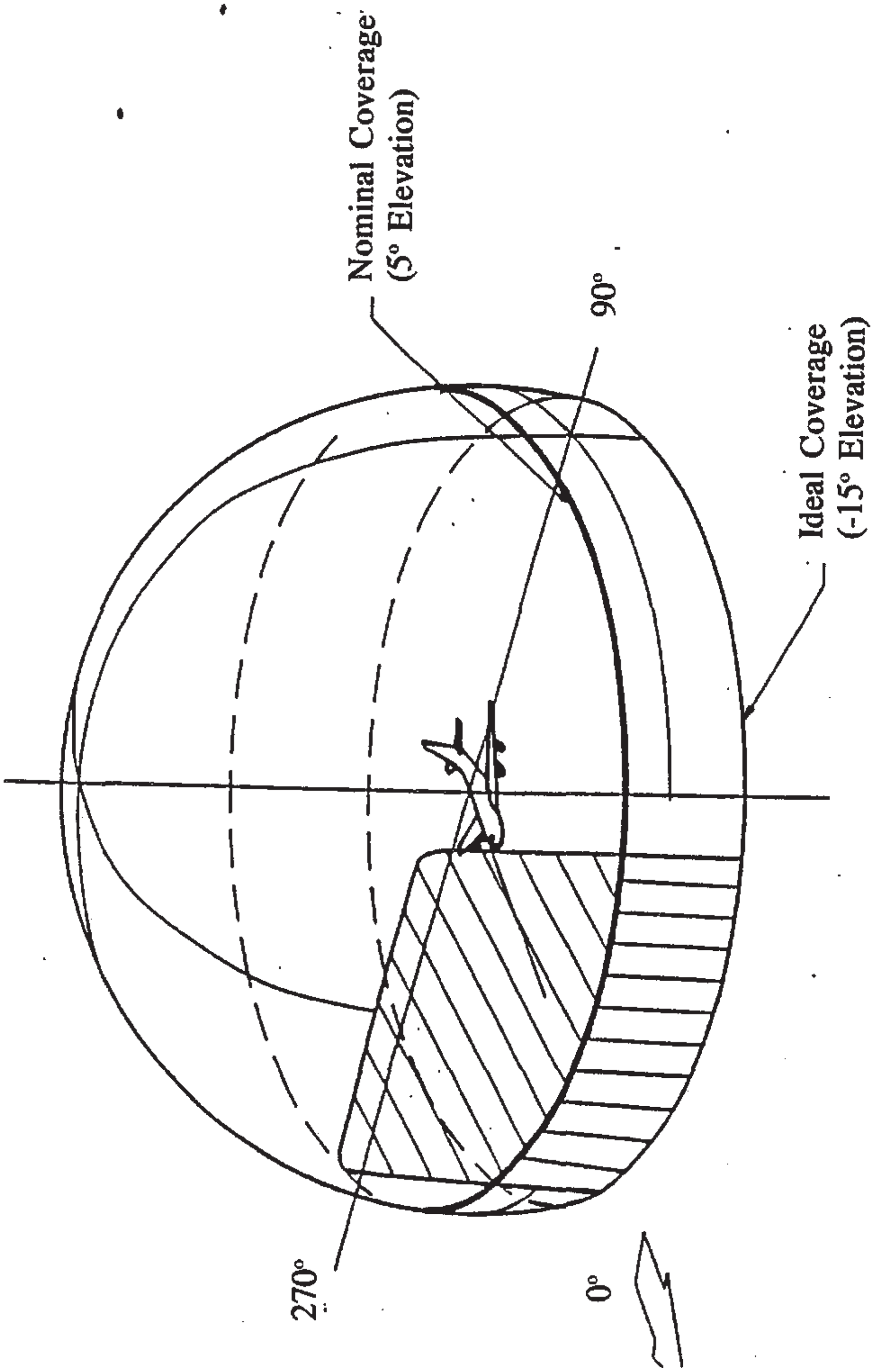


Figure 3 - Top Mounted, Electronically Steered, Low profile Antenna Coverage Region

ATTACHMENT 1-8 (cont'd)
ANTENNA COVERAGE



c-4

Note: This coverage results in a fore and aft "keyhole".

Figure 4 - Typical High Gain Antenna Coverage Electronically Steered T Blade