AVIATION SATELLITE COMMUNICATION SYSTEM PART 1 AIRCRAFT INSTALLATION PROVISIONS

ARINC CHARACTERISTIC 741P1-12

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Prepared by the Airlines Electronic Engineering Committee

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A description of the changes introduced by each supplement is included on Goldenrod paper at the end of this document.

FOREWORD

Aeronautical Radio, Inc., the AEEC, and ARINC Standards

Aeronautical Radio, Inc. (ARINC) was incorporated in 1929 by four fledgling airlines in the United States as a privately-owned company dedicated to serving the communications needs of the air transport industry. Today, the major U.S. airlines remain the Company's principal shareholders. Other shareholders include a number of non-U.S. airlines and other aircraft operators.

ARINC sponsors aviation industry committees and participates in related industry activities that benefit aviation at large by providing technical leadership and guidance and frequency management. These activities directly support airline goals: promote safety, efficiency, regularity, and cost-effectiveness in aircraft operations.

The Airlines Electronic Engineering Committee (AEEC) is an international body of airline technical professionals that leads the development of technical standards for airborne electronic equipment-including avionics and in-flight entertainment equipment-used in commercial, military, and business aviation. The AEEC establishes consensus-based, voluntary form, fit, function, and interface standards that are published by ARINC and are known as ARINC Standards. The use of ARINC Standards results in substantial benefits to airlines by allowing avionics interchangeability and commonality and reducing avionics cost by promoting competition.

There are three classes of ARINC Standards:

a) ARINC Characteristics – Define the form, fit, function, and interfaces of avionics and other airline electronic equipment. ARINC Characteristics indicate to prospective manufacturers of airline electronic equipment the considered and coordinated opinion of the airline technical community concerning the requisites of new equipment including standardized physical and electrical characteristics to foster interchangeability and competition.

b) ARINC Specifications – Are principally used to define either the physical packaging or mounting of avionics equipment, data communication standards, or a high-level computer language.

c) ARINC Reports – Provide guidelines or general information found by the airlines to be good practices, often related to avionics maintenance and support.

The release of an ARINC Standard does not obligate any airline or ARINC to purchase equipment so described, nor does it establish or indicate recognition or 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 ARINC Standard.

In order to facilitate the continuous product improvement of this ARINC Standard, two items are included in the back of this volume:

An Errata Report solicits any corrections to the text or diagrams in this ARINC Standard.

An ARINC IA Project Initiation/Modification (APIM) form solicits any recommendations for addition of substantive material to this volume which would be the subject of a new Supplement.

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APPENDIX

1.0 INTRODUCTION AND DESCRIPTION

1.1 Purpose of this Characteristic

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.

1.2 Relationship of this Document to ARINC Characteristics 597, 724, 724B, and 758

The Aviation Satellite Communications (SATCOM) System will present standard interfaces to a number of other aircraft systems. These include ACARS, 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 2 of this Characteristic, and in **ARINC Characteristic 746**: *Cabin Communications System (CCS)*.

ARINC Characteristic 597: *Aircraft Communications Addressing and Reporting System (ACARS)*, describes ARINC 404A-packaged airborne ACARS equipment against the background of a fairly detailed system description. ARINC Characteristics 724 and 724B describe ARINC 600-packaged equipment intended to perform essentially the same functions as the ARINC 597 equipment in the same framework. ARINC 724/724B equipment will more readily interface with other ARINC “700-Series” equipment on those aircraft on which such equipment is employed. ARINC Characteristic 758 defines the third generation of datalink management unit. Its initial implementation will perform the same functions as the ARINC 724B ACARS MU. The ARINC 758 CMU Mark 2 contains provisions to evolve into an ATN compatible router. However, all versions of ACARS avionics should interface with the Aviation Satellite Communications system avionics by means of ARINC 429 data buses.

COMMENTARY

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

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

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.

The airborne system may also include support of higher speed data services designated by Inmarsat as “Swift64” or “SwiftBroadband.” Initial implementations may add this capability as an additional LRU (refer to Section 1.5.11) or by integrating this capability into the existing form factors of the SDU, RFU, or HPA. Provisions to accommodate incorporation of these higher speed services within the existing SDU, RFU, or HPA are defined in Attachment 4. **Also refer to ARINC Characteristic 781 for pertinent additional information regarding SwiftBroadband (e.g., the Ethernet interface control document (ICD) attachment, aircraft position data requirements from the inertial/GNSS interface to support RF transmit signal timing requirements, Type D diplexer details, etc.).**

1.5 Unit Description

1.5.1 Satellite Data Unit (SDU)

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 and 724B.

1.5.2 Radio Frequency Unit (RFU)

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 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

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)

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)

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)

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.

1.5.7.2 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.

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.

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.

1.5.11 High Speed Data Unit (HSDU)

This characteristic also reserves certain SDU pins for interfacing to one or more optional external High Speed Data Units (HSDUs). The HSDU is an optional LRU that may be used to support SwiftBroadband and other possible future High Speed Data (HSD) services from Inmarsat. The functionality and interconnect wiring to these external LRUs varies by manufacturer, and is outside the scope of this characteristic. However, several SDU rear connector pins are reserved to accommodate the necessary interfaces to the HSDUs. (Provisions are also included in Appendix 1 for bit-oriented fault reporting for such external HSDUs.) Installers should contact their HSDU manufacturer for the specific interwiring modifications necessary.

A Type D diplexer/LNA (Section 2.2.4.3) is required if the HSDU is capable of providing SwiftBroadband services.

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.

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

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.

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 antennas 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 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

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 100K. 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:

1. Clear sky climatic conditions.
2. Satellite elevation angles greater than or equal to 5 degrees within the coverage volume of the aircraft antenna.
3. With residual antenna pointing errors (including the effects of errors introduced by the antenna beam steering system).
4. Including the noise contribution of the complete RF subsystem including antenna and low noise amplifier at a temperature of 290K.
5. With the transmitter power amplifier at maximum output level.
6. Including the loss and noise temperature contribution of a radome where a radome is fitted.
7. 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 1×10^{-5} for packet mode data, 1×10^{-3} for circuit mode voice, and 1×10^{-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.

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 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. 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.

1.8 Regulatory Approval

The equipment should meet all applicable aviation and telecommunication 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. Reference RTCA MOPS, RTCA MASPS, and ICAO SARPS.

COMMENTARY

Minimum Operational Performance Standards (MOPS) are prepared by Special Committees of RTCA Inc. MOPS cover the performance required of equipment certified by the FAA.

Minimum Aviation System Performance Standards (MASPS) are also prepared by Special Committees of RTCA Inc. MASPS document end-to-end performance requirements, including terrestrial elements where required.

Standards and Recommended Practices (SARPs) are prepared by the ICAO Aeronautical Mobile Communications Panel (AMCP). SARPs cover interoperability requirements for safety services (ATS and AOC).

COMMENTARY

This document does not define service levels provided (i.e. Safety vs. Non-safety) by any particular system or avionics implementation.

2.0 INTERCHANGEABILITY 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* 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

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

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

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.

2.2.2.3 Form Factor

See Attachment 1-6.

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.

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:

Frequency (MHz)	Power/Density	Notes
0.0 to 1150.0	-30 dBc/4 kHz	
1150.0 to 1525.0	-55 dBc/4 kHz	
1525.0 to 1559.0	-83 dBc/4 kHz	
1559.0 to 1614.0	-55 dBc/1 kHz	
1614.0 to 1660.0	-55 dBc/4 kHz	1
1660.0 to 1670.0	-55 dBc/20 kHz	1, 2
1670.0 to 1675.0	-55 dBc/1 MHz	
1675.0 to 12000.0	-55 dBc/4 kHz	
12000.0 to 18000.0	-30 dBc/4 kHz	

Notes:

1. Excluding the carrier frequency ±35 kHz.
2. This level is not applicable for Intermodulation products.

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

COMMENTARY

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.

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

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

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

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

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.

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 <u>does not</u> 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.

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.

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°C. The noise figure may increase with temperature to a maximum of 2.1 dB at the maximum operating temperature (70°C). The gain should be between 53 and 60 dB under all operating conditions.

2.2.4.3 Diplexer/LNA Types

COMMENTARY

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.

Use of the Type A diplexer/LNA (Section 2.2.4.3.1) provides interference protection for GPS, but may not provide sufficient interference protection for GLONASS receivers on the same or nearby aircraft. Some GLONASS interference protection for nearby aircraft using GLONASS should be provided as GLONASS moves to frequencies below 1610 MHz after 1998.

Use of the Modified Type A diplexer/LNA (Section 2.2.4.3.3) provides interference protection for GPS and GLONASS in its final configuration (after 2005). It may not provide sufficient interference protection for GLONASS receivers on the same aircraft for GLONASS operations before 2006. More GLONASS interference protection for nearby aircraft using GLONASS is provided than by Type A diplexer.

In the above cases, frequency management techniques are required to prevent 3rd and 5th order intermodulation products in the GPS and GLONASS bands (reference ARINC Characteristic 741, Part 2, Section 3.5.4.1.1).

The ICAO SARPs and RTCA MOPS are expected to require the use of the Modified Type A (or better) diplexer/LNA for those AESs that are installed in aircraft that will operate in environments requiring GPS/GLONASS navigational positioning data.

Installations supporting SwiftBroadband high-speed data services (Section 1.5.11 and Attachment 4) require a Type D diplexer/LNA (Section 2.2.4.3.4). Type D diplexers provide additional levels of rejection of 3rd and 5th order intermodulation products for the GPS, GLONASS, and Iridium bands. Reference ARINC Characteristic 741, Part 2, Section 3.5.4.1.1, for related frequency management and interference check algorithm considerations for the ground stations and the SDU.

2.2.4.3.1 Type A Diplexer - For Protection of GPS Only

Antenna Port to LNA Output

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

Frequency (MHz)	Rejection
0.0 to 1450.0	> 75 dB
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 1605.0	> 50 dB
1605.0 to 1610.0	> 30 dB
1610.0 to 1626.5	> Decreases
1626.5 to 1660.5	Insertion loss < 0.8 dB
1660.5 to 1735.0	Increases
1735.0 to 12000.0	> 50 dB
12000.0 to 18000.0	> 15 dB

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 1530.0	> 80 dB
1530.0 to 1559.0	> 120 dB
1559.0 to 1565.0	> 80 dB
1565.0 to 1585.0	> 100 dB
1585.0 to 1626.5	> 40 dB
1626.5 to 1660.5	> 120 dB
1660.5 to 12000.0	> 80 dB
12000.0 to 18000.0	> 50 dB

2.2.4.3.2 Type B

The content of this section has been deleted. (The Type B diplexer/LNA, which never progressed beyond the concept stage, was intended to protect TFTS as well as GPS and GLONASS).

2.2.4.3.3 Modified Type A Diplexer - For Protection of GPS and GLONASS

Antenna Port to LNA Output

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

Frequency (MHz)	Rejection
0.0 to 1450.0	> 75 dB
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 1585.0	> 100 dB
1585.0 to 1605.0	> 88 dB
1605.0 to 1610.0	> 62 dB
1610.0 to 1614.0	> 40 dB
1614.0 to 1626.5	> Decreases
1626.5 to 1631.5	Insertion loss < 2.3 dB
1631.5 to 1660.5	Insertion loss < 0.8 dB
1660.5 to 1735.0	Increases
1735.0 to 12000.0	> 50 dB
12000.0 to 18000.0	> 15 dB

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 1530.0	> 80 dB
1530.0 to 1559.0	> 120 dB
1559.0 to 1565.0	> 80 dB
1565.0 to 1585.0	> 100 dB
1585.0 to 1626.5	> 40 dB
1626.5 to 1660.5	> 120 dB
1660.5 to 2000.0	> 80 dB
2000.0 to 18000.0	> 50 dB

2.2.4.3.4 Type D - For Use With SwiftBroadband High-Speed Data

Reference ARINC Characteristic 781, Section 2.2.4.3, and its subsections for details of the Type D diplexer.

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.

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 to 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 1-9A for the form factor of the Type A, Modified Type A, and Type D Diplexer/LNA.

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	Notes
Amplifier Type	Class C	Linear	
Unit Size	4 MCU	8 MCU	
Max. Heat Dissipation	125 W	250 W	1
Intermodulation Products			
(3rd Order)	N/A	-25 dBc	2
(5th Order)	N/A	-25 dBc	7
(7th Order)	N/A	-30 dBc	8
(7th Order)	N/A	-33 dBc	9
(Greater than 7th Order, <12 GHz band)	N/A	-35 dBc	7
(Greater than 7th Order, 12-18 GHz band)	N/A	-70 dBc	
(Alternate 6-tone)	N/A	-19 dBc	10
AM/PM Conversion	N/A	<2°/dB or <30°/2 msec	3
HPA RF Power Output			4
0 dB Back-off, Input	40 W Min.,	40 W Min.,	
-12 dBm to -2 dBm	80 W Max.	80 W Max.	
Back-off Adjustment	At Least ≥16 dB range in steps of 0.5 dB min. to 1.5 dB max		6
Back-off Stability	±2 dB	N/A	5
Gain Stability	N/A	±2 dB	5

Notes:

3. 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.

4. This performance applies when the HPA is driven by two carriers, with a spacing from 5 kHz to 17 MHz, (e.g., 10 kHz, 100 kHz, 1 MHz, and 14 MHz) so as to produce two carriers each at a power level of half the rated output power measured at the HPA output connector. This permits a 10 dB degradation in third order intermodulation products for the HPA compared to the RFU.

5. The performance should meet the goal of introducing sufficiently small phase differentials during gain adjustments to avoid bit transitions in ABPSK or AQPSK.

6. 40 watts is the desired minimum power output when 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 input drive level and operating into a load impedance of

50 + j0 ohms, 40 W is the expected minimum, with 80 W the maximum power out.

7. “Stability” includes the effects of temperature, and input frequency.

8. The HPA may optionally provide an extended back-off range. The step size and overall accuracy requirements are relaxed to ±1 dB for the 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.

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

10. This performance applies when the HPA is driven by two carriers, with a spacing equal or greater than 13.5 MHz to 14.5 MHz (e.g., 14 MHz), so as to produce two carriers each at a power level of half the rated output power measured at the HPA output connector.

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

12. An alternate method to demonstrate Intermodulation compliance is to transmit 6 equal, unmodulated carriers each at a power level of one sixth the rated output power at f, f+Δf, f+2Δf, f+4Δf, f+5Δf, f+6Δf, with Δf ranging from 10 kHz to 1 MHz (e.g., 10 kHz, 100 kHz and 1 MHz). The intermodulation product produced at f+3Δf 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 the HPA, for an input level of -12 dBm or higher.

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

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 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

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

Frequency (MHz)	Power/Density	Notes
0.0 to 1525.0	-70 dBc/ 4 kHz	
1525.0 to 1559.0	-83 dBc/ 4 kHz	
1559.0 to 1614.0	-70 dBc/1 MHz	
1614.0 to 1660.0	-70 dBc/4 kHz	1
1660.0 to 1670.0	-70 dBc/ 20 kHz	2
1670.0 to 1675.0	-70 dBc/4kHz	
1675.0 to 18000.0	-70 dBc/ 4 kHz	

Note: These levels apply when the HPA is driven by an RFU.

1. Excluding the carrier frequency ±35 kHz.

2. This level is not applicable for Intermodulation products.

COMMENTARY

These levels are expressed in dB below single 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 -70 dBc is equivalent to -54 dBW.

The noise and spurious levels specified in 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 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.

To limit the HPA output to -70 dBc/4kHz in the frequency ranges 0 to 1150 MHz and 12000 to 18000 MHz, in conjunction with an RFU output of -30 dBc/4kHz, requires a minimum frequency response rejection of 40 dB in the HPA over those specific frequency ranges. Reference Section 2.2.2.5.

2.2.5.2 Noise Figure

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

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.

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.

2.2.5.4 HPA Connectors

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.

2.2.5.5 Form Factor

See Attachment 1-10.

2.2.5.6 HPA Muting and Carriers Off Level

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 Command 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

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

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

COMMENTARY

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).

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.

2.2.6.4 Loss Between LNA and RFU

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

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 to 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.

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.

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

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

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

The receive antenna systems should operate on any frequency within the band 1525 to 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)

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 100K should be used. In practice, sky temperature varies over a wide range depending on many factors.

ADDITIONAL COMMENTARY

The -13 dB/K G/T figure of merit should be met at room temperature (i.e., 290K), 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

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.

“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.

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

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.

2.3.2.7 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 to 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 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.

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 2 MCU 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

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)

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

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:

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

2.3.3.14 Antenna Intermodulation

COMMENTARY

The inherent non-linearities associated with RF coaxial connectors play a significant role in the generation of intermodulation products. If the end user is not using coaxial cables and connectors which are specifically made or recommended by the equipment system supplier, the choice of coaxial cables and connectors should be made carefully. Studies have concluded that there are significant differences in the levels of non-linear properties depending on the connector conductor materials used. More specifically, connectors which employ the use of ferromagnetic materials such as stainless steel and nickel plated metal should be avoided. Instead, the use of non-ferromagnetic materials should be used (e.g., silver plated brass, etc.).

In addition, insulating layers from oxidation and dissimilar material migration at the connector interface further degrade linearity and increase with time. Therefore, connectors should be tightened to the connector manufacturer's recommended value and checked periodically.

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

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).

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 to 1559 MHz.

2.3.4.2 Polarization

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

2.3.4.3 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 elevation angles from 5° to 45°.

2.3.4.4 Receive System Figure of Merit (G/T)

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 100K. 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

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

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

The antenna transmit subsystem should operate on any frequency within the band 1626.5 to 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 elevation angles from 5° to 45°.

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.

2.3.5.5 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.

2.3.5.6 LGA Form Factor

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:

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.

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

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 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

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

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.

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.

2.8.2 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.

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 should be 5 ±3 mm of water at this rate. Another HPA configuration uses an 8 MCU unit which will need cooling for a maximum of 250 W heat dissipation. The airflow rate for this unit should be 55 kg/hr of 40°C (max.) air and the pressure drop through the unit should 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)

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)

The 2 MCU 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.

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

2.10.1 General

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

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)

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.

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.

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

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

The BITE Monitor Memory output should consist of the following:

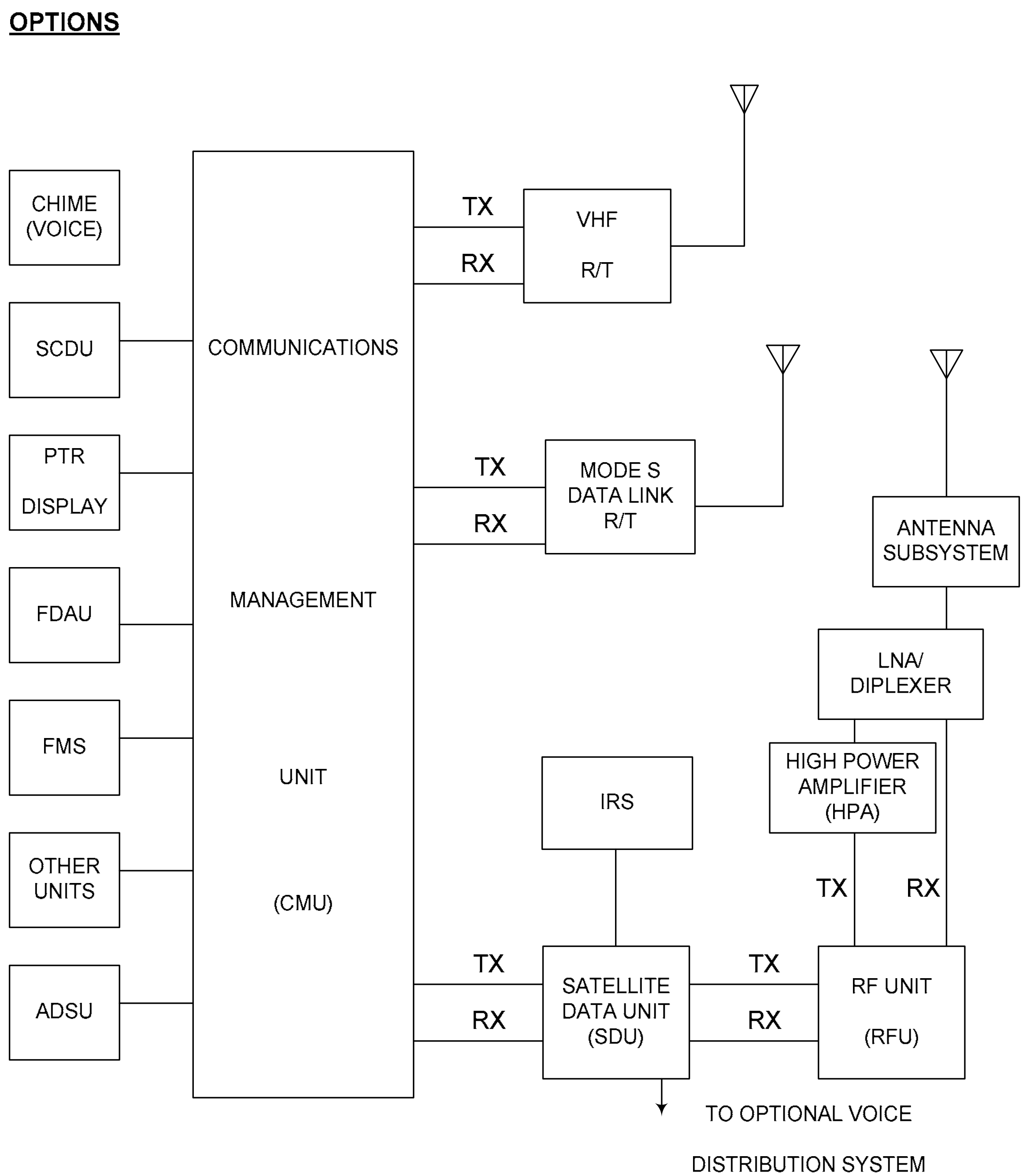
- An output on all low speed ARINC 429 Data Buses to the centralized fault display interface unit, when so requested, as described in ARINC Report 604 using the format described therein.
- An output to the display (if provided) located on the SDU, indicating system and LRU status. An English language alpha-numeric display is preferred over LEDs of coded messages.
- 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 affected. The reset should be initiated only by shop maintenance.

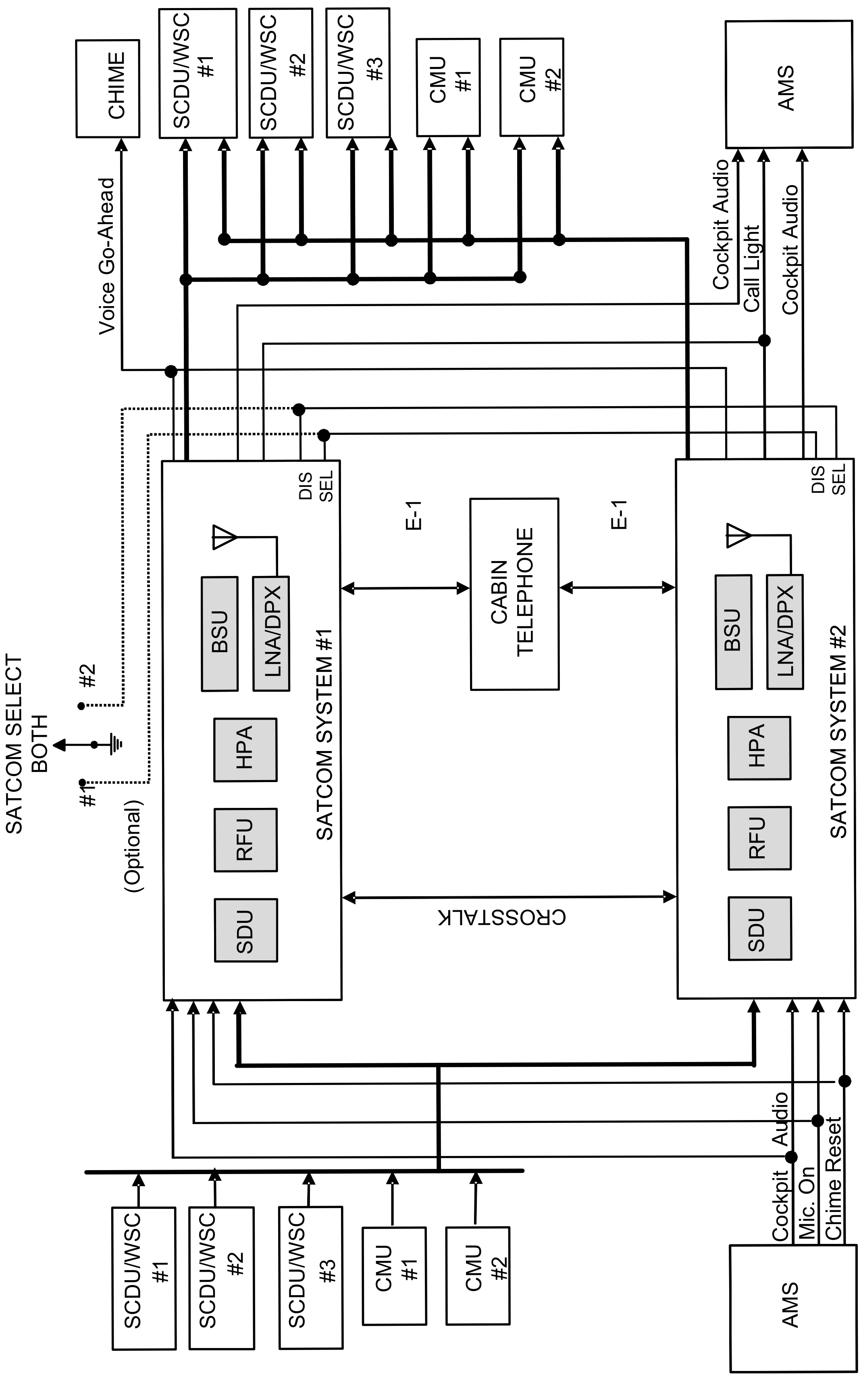
2.10.3.5 Use of Automatic Test Equipment

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*.

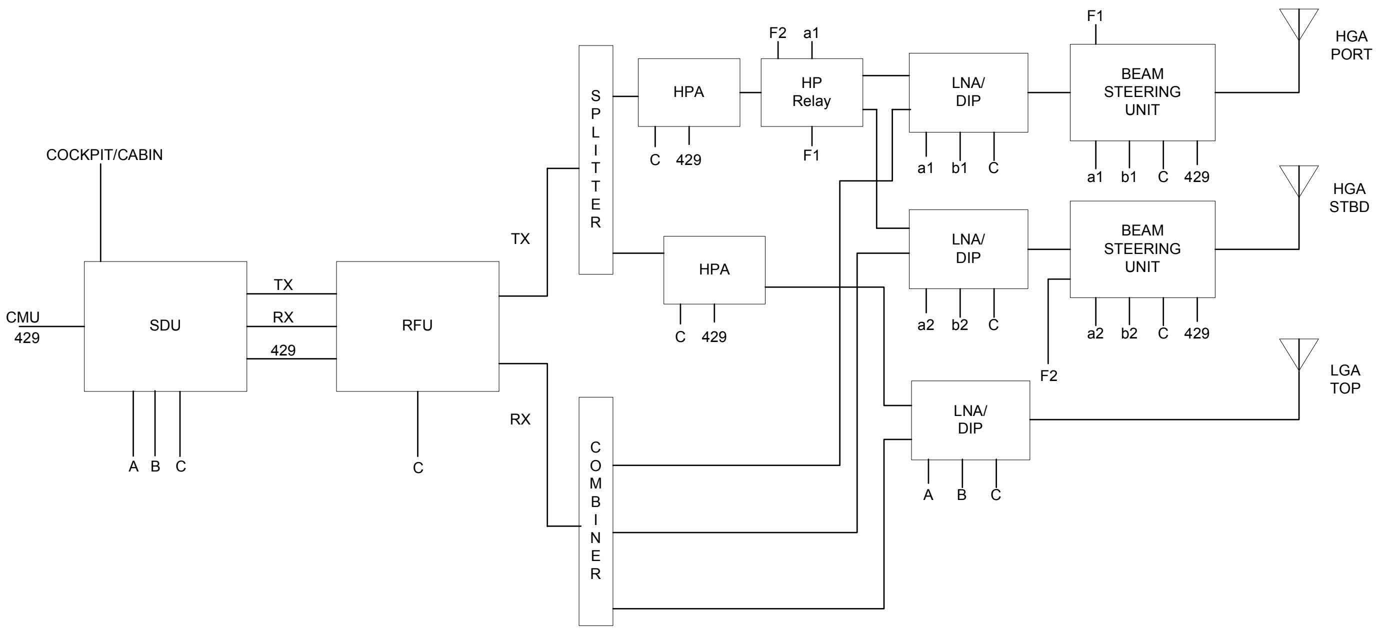
ATTACHMENT 1-1
GENERAL CONFIGURATION OVERVIEW



ATTACHMENT 1-1A
SAMPLE DUAL SATCOM INSTALLATION



ATTACHMENT 1-2
ANTENNA CONFIGURATION



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

Notes:

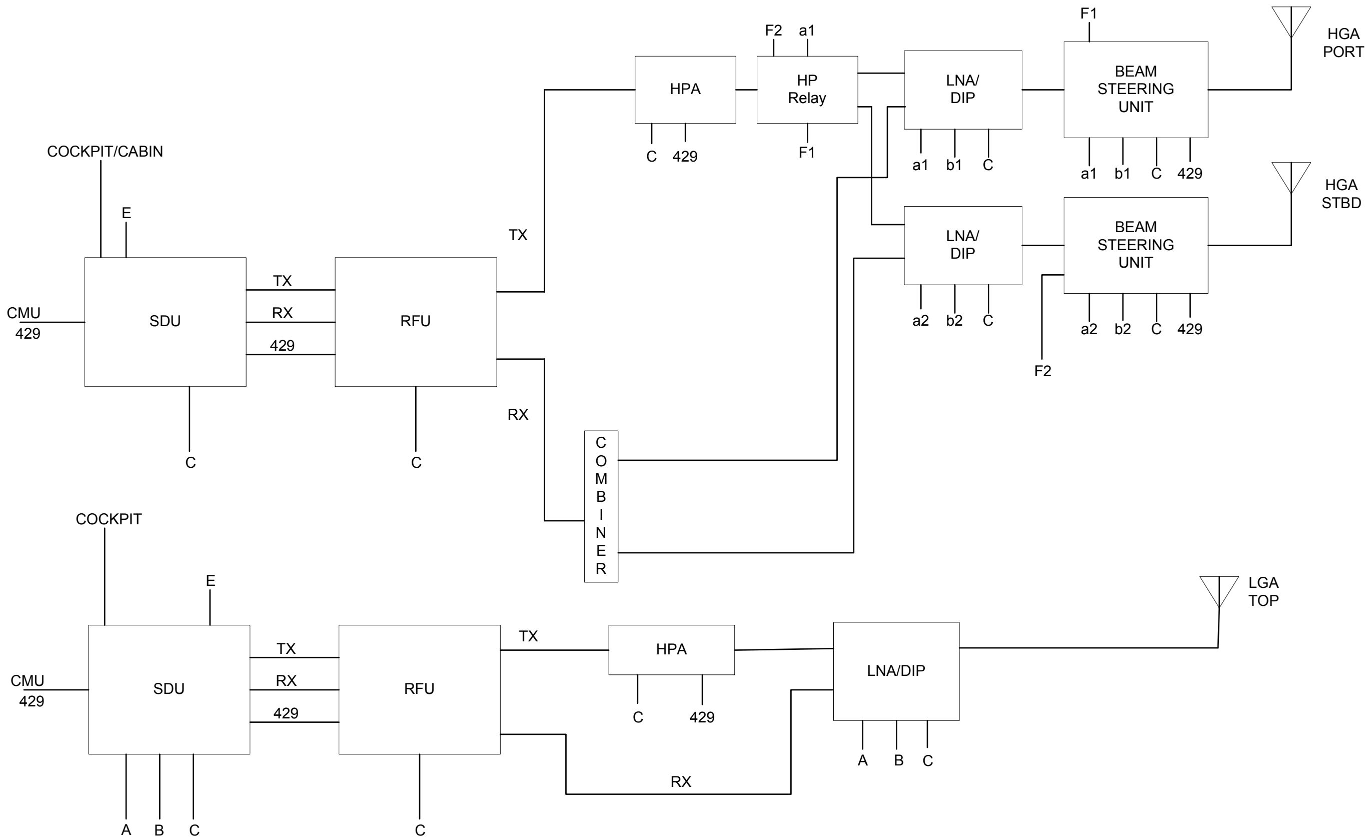
1. This block diagram does not necessarily include every interface.

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.

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

ATTACHMENT 1-2
ANTENNA CONFIGURATION



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

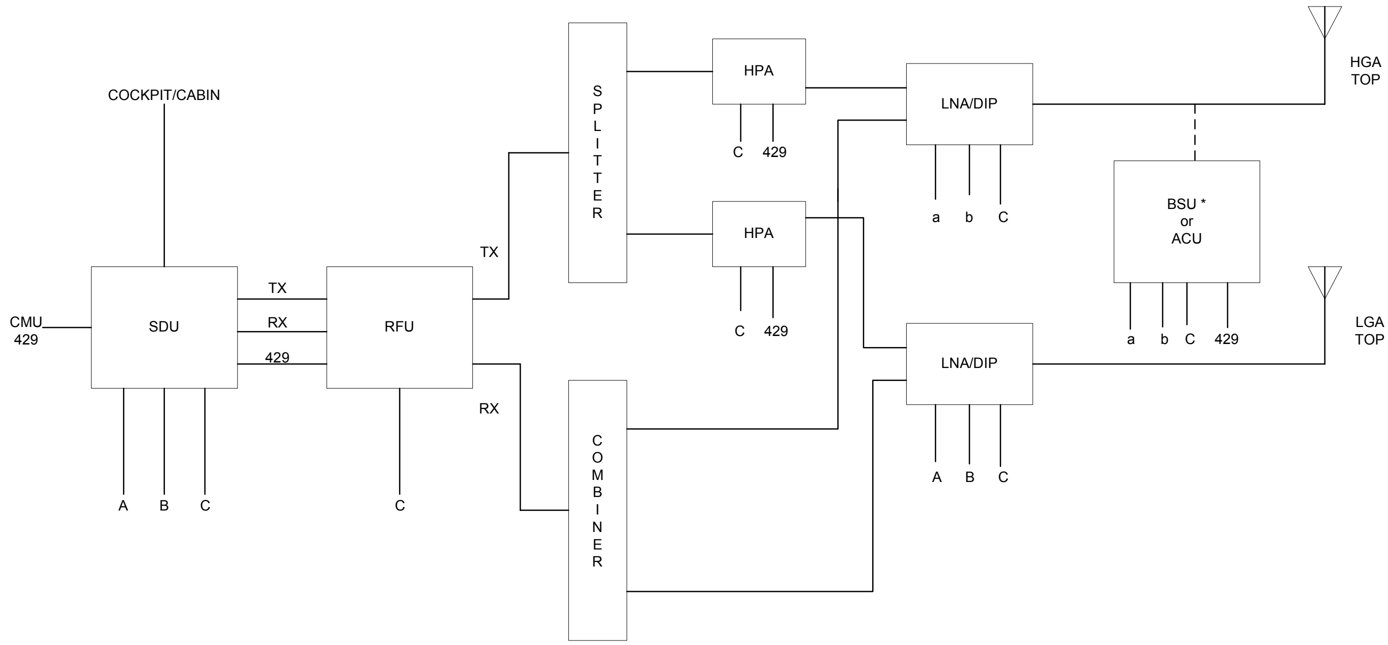
Notes:

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

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
ANTENNA CONFIGURATION



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.

Notes:

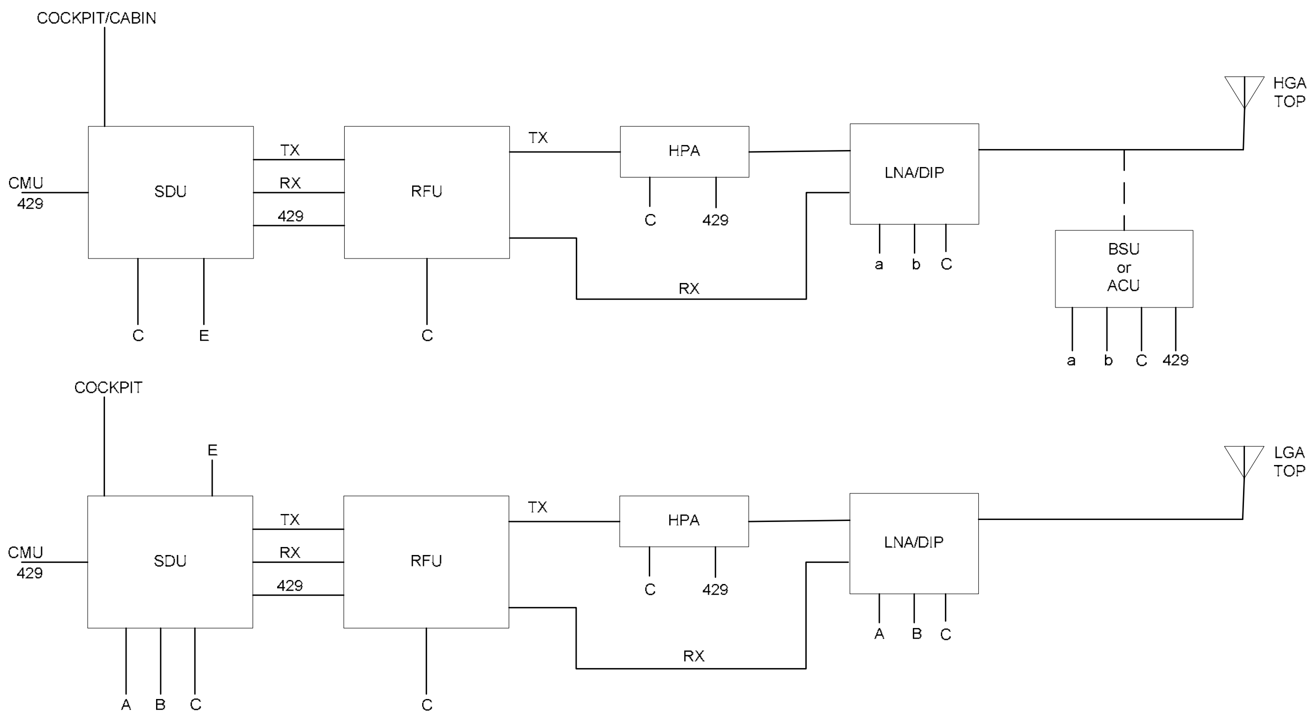
1. This block diagram does not necessarily include every interface.

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.

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

Figure 3 – Top Mounted Antenna Configuration

ATTACHMENT 1-2
ANTENNA CONFIGURATION



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.

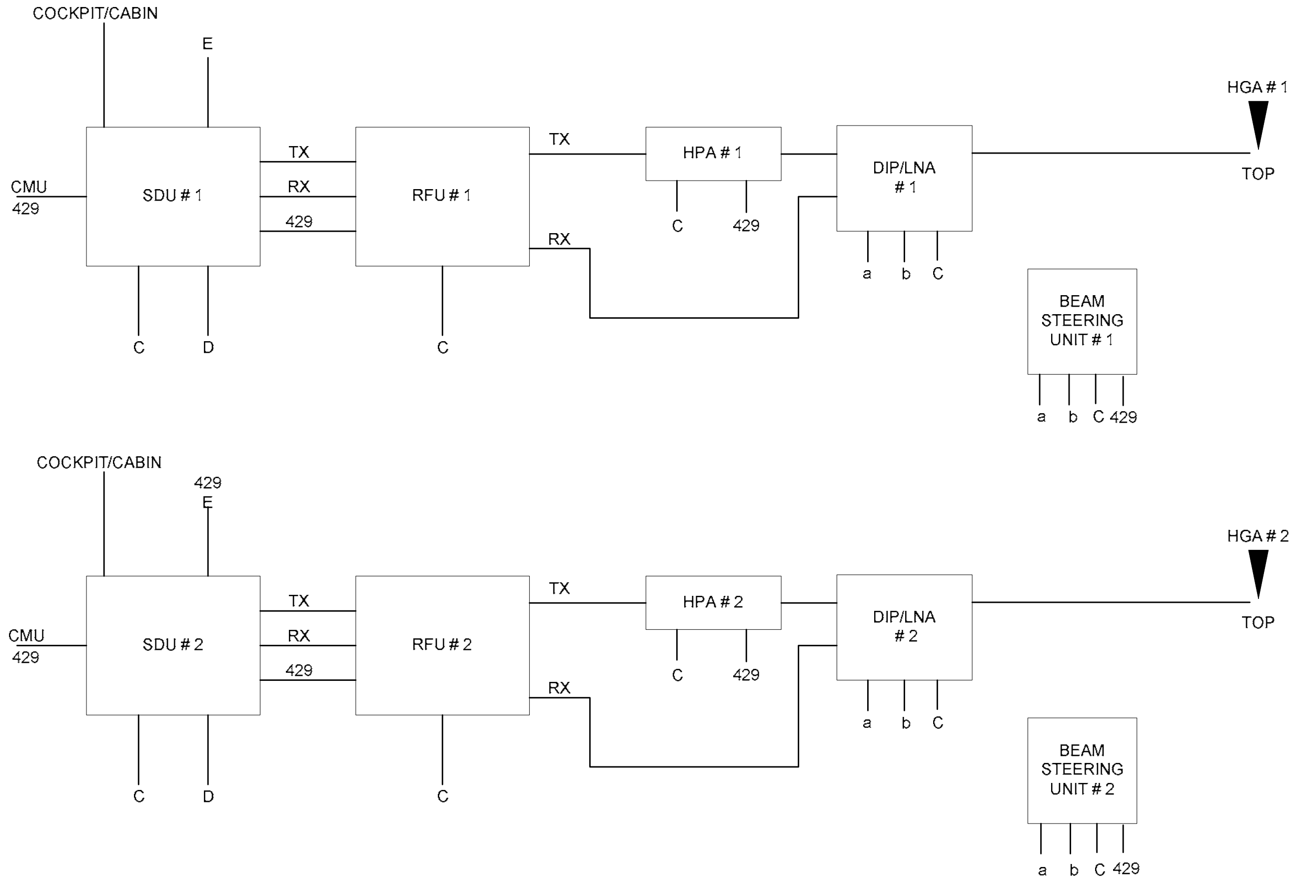
Notes:

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

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
ANTENNA CONFIGURATION



LEGEND
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

Notes:

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

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
ANTENNA CONFIGURATION

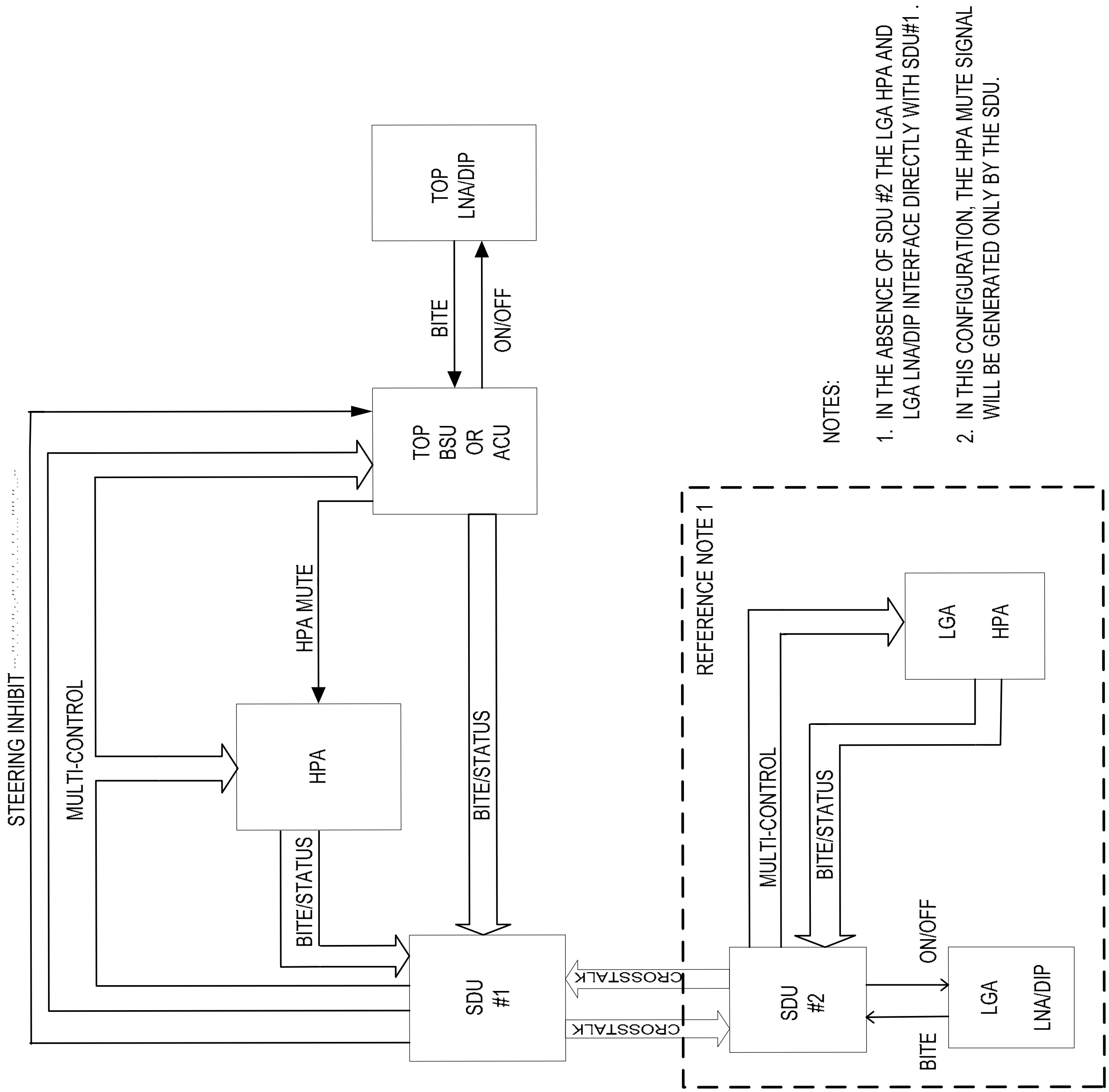


Figure 6 – Antenna Subsystem Control Interfaces (RF Excluded)
Top Mounted Antenna Configuration

ATTACHMENT 1-2
ANTENNA CONFIGURATION

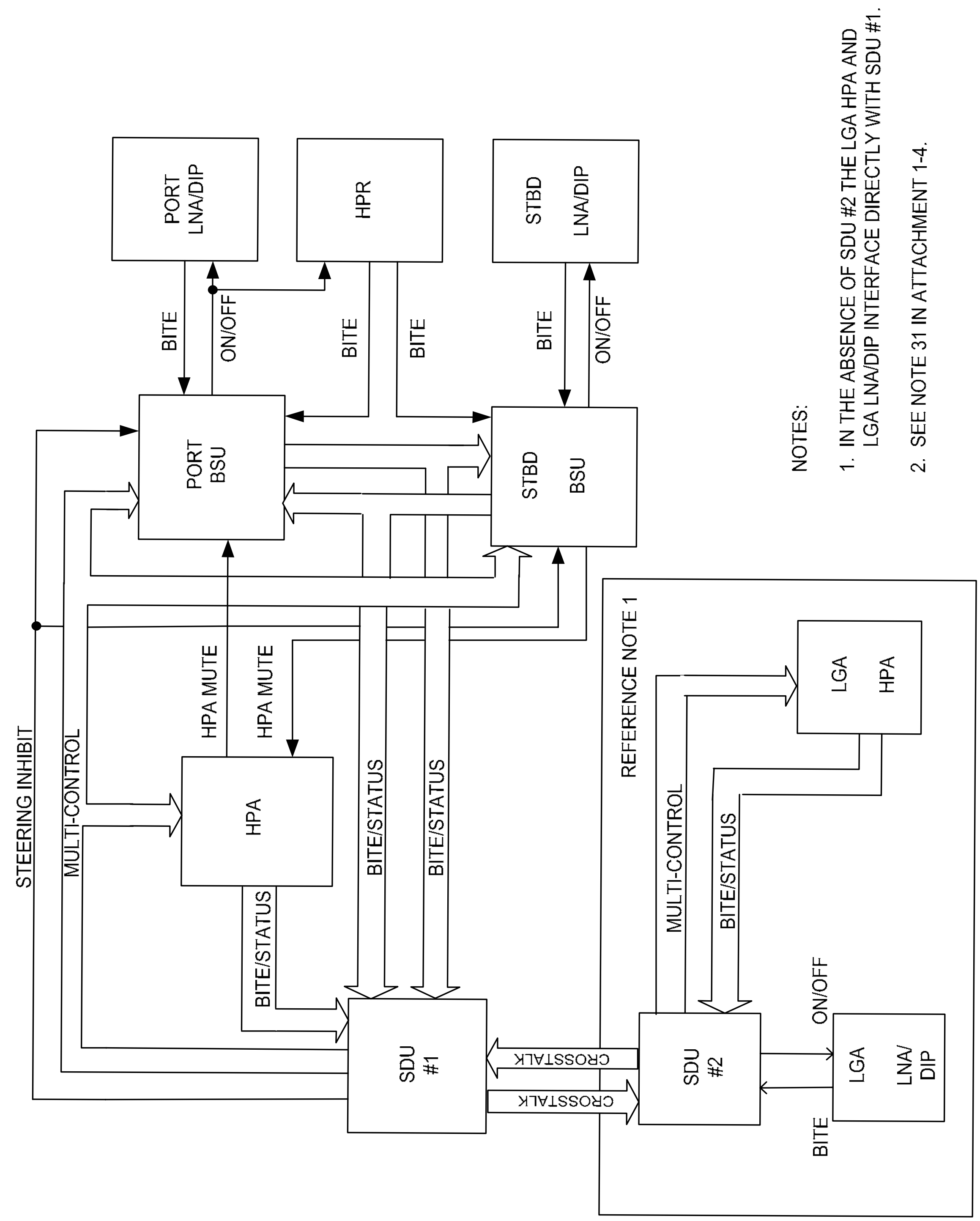
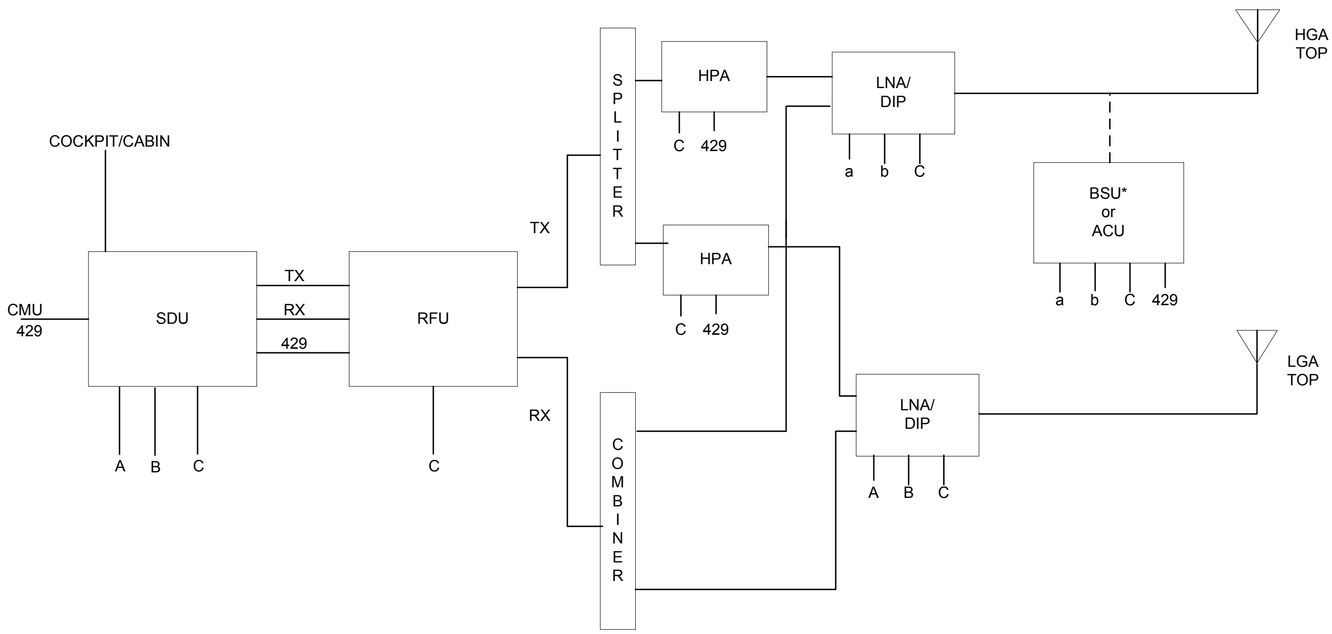


Figure 7 – Antenna Subsystem Control Interfaces (RF Excluded)
Side Mounted Phased Array Configuration with High Power Relay Option

ATTACHMENT 1-2
ANTENNA CONFIGURATION



LEGEND
A - LNA ON/OFF
B - LNA BITE
C - 115 Vac
CMU - COMMUNICATIONS MANAGEMENT UNIT
429 - ARINC 429 DATA BUS
LNA/DIP - LOW NOISE AMPLIFIER/DIPLEXER
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.

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 STEERING	ANT	OTHER	NOTES
Reserved for Analog Cabin Voice Channel 1 Hookswitch (0-15V input)	TP1A o									To non-CCS Cabin Telephone	
Reserved for Analog Cabin Voice Channel 2 Hookswitch (0-15V input)	TP1B o									To non-CCS Cabin Telephone	
Reserved for Analog Cabin Voice Channel 1 Ringer (0-7V output)	A TP1C o B TP1D o									To non-CCS Cabin Telephone	
Reserved for Analog Cabin Voice Channel 2 Ringer (0-7V output)	A TP1E o B TP1F o									To non-CCS Cabin Telephone	
Reserved for Avionics Subsystem SATCOM Fail Warning (0-28V output)	TP1G o										
Reserved for Analog Cabin Voice Channel 1 In-Use (0-28V output)	TP1H o									To non-CCS Cabin Telephone	
Satellite Link Not Ready (0-28V output)	TP1J o										
Reserved for Analog Cabin Voice Channel 2 In-Use or Reserved for Disable Discrete to HSDU (0-28V output)	TP1K o									To non-CCS Cabin Telephone	59
Reserved Analog PBX Channel 1 Input HI	TP2A o									o TP12A From CTU	48, 57
Reserved Analog PBX Channel 1 Input LO	TP2B o									o TP12B From CTU	48, 57
Reserved Analog PBX Channel 1 Output HI	TP2C o									o TP12C To CTU	48, 57
Reserved Analog PBX Channel 1 Output LO	TP2D o									o TP12D To CTU	48, 57
Reserved Analog PBX Channel 2 Input HI	TP2E o									o TP12E From CTU	48, 57
Reserved Analog PBX Channel 2 Input LO	TP2F o									o TP12F From CTU	48, 57
Reserved Analog PBX Channel 2 Output HI	TP2G o									o TP12G To CTU	48, 57
Reserved Analog PBX Channel 2 Output LO	TP2H o									o TP12H To CTU	48, 57
Future Spare	TP2J o										53
Future Spare	TP2K o										53

ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION	SDU		RFU	[33] SPLTR	[33] COMB	HPA	[1] [33] [34] HP RELAY	[33] LNA/DIP	[32] [33] BEAM STEERING	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										
Reserved MFR. Specific	TP3F	o										58
Reserved MFR. Specific	TP3G	o										58
Reserved MFR. Specific	TP3H	o										58
Reserved MFR. Specific	TP3J	o										58
Reserved MFR. Specific	TP3K	o										58

ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION	SDU	RFU	[33] SPLTR	[33] COMB	HPA	[1] [33] [34] HP RELAY	[33] LNA/DIP	[32] [33] BEAM STEERING	ANT	OTHER	NOTES
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										
Reserved Optional											
Port 1_TXD	TP5A o									o	
Port 1_RXD	TP5B o									o Aux	
Port 1_RTS	TP5C o									o Async	50
Port 1_CTS	TP5D o									o Port 1	
Port 1_GND	TP5E o									o	
Port 2_TXD	TP5F o									o Aux	
Port 2_RXD	TP5G o									o Async	50
Port 2_GND	TP5H o									o Port 2	
Port 3_TXD	TP5J o									o Aux	
Port 3_RXD	TP5K o									o Async	50
										Port 3	
Reserved Data Bus A	TP6A o										8, 59
From HSDU B	TP6B o										
(ARINC 429)											
Spare 429 Output A	TP6C o										
Spare 429 Output B	TP6D o										
Reserved Optional										Aux	50
Port 3_GND	TP6E o									o Async	
Future Spare	TP6F o										
Reserved Optional											
CH1_Ser_Out	TP6G o									o	
CH1_Ser_In	TP6H o									o	
CH2_Ser_Out	TP6J o									o	
CH2_Ser_In	TP6K o									o	
										Encryption	
CH1_CMD_ACT	TP7A o									o Data	
CH1_CMD_REQ	TP7B o									o Interface	51
CH1_DCD	TP7C o									o CH1 and	
CH2_CMD_ACT	TP7D o									o CH2	
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	
Future Spare	TP8A o										44
Future Spare	TP8B o										
Future Spare	TP8C o										
Future Spare	TP8D o										
Future Spare	TP8E o										
Future Spare	TP8F o										
Future Spare	TP8G o										
Future Spare	TP8H o										
Future Spare	TP8J o										
Future Spare	TP8K o										

ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION	SDU	RFU	[33] SPLTR	[33] COMB	HPA	[1] [33] [34] HP RELAY	[33] LNA/DIP	[32] [33] BEAM STEERING	ANT	OTHER	NOTES
Spare Discrete inputs	TP9A o										
(Config.straps type)	TP9B o										
Future Spare	TP9C o										
Future Spare	TP9D o										
Future Spare	TP9E o										
Future Spare	TP9F o										
Future Spare	TP9G o										
Future Spare	TP9H o										
Future Spare	TP9J o										
Future Spare	TP9K o										
Strap Option	TP10A o										
Strap Option	TP10B o										
Strap Option	TP10C o										38
Strap Option	TP10D o										
Strap Option	TP10E o										
Strap Option	TP10F o										
Strap Option	TP10G o										38, 59
Strap Option	TP10H o										
Reserved for Strap Option	TP10J o										
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										38
Strap Option	TP12E o										
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
STANDARD INTERWIRING

FUNCTION	SDU	RFU	[33] SPLTR	[33] COMB	HPA	[1] [33] [34] HP RELAY	[33] LNA/DIP	[32] [33] BEAM STEERING	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						62
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						

ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION		SDU	RFU	SPLTR [33]	COMB [33]	HPA	HP RELAY [1] [33] [34]	LNA/DIP [33]	BEAM STEERING [32] [33]	ANT	OTHER	NOTES
Reserved for Cabin Audio Input #1	HI	MP1A									To non-CCS Cabin Telephone	
	LO	MP1B										
Reserved for Cabin Audio Output #1	HI	MP1C										
	LO	MP1D										
Reserved Data Bus From Cabin Packet Data (ARINC 429)	A	MP1E									To Cabin Packet Data Function	7, 54
	B	MP1F										
Data Bus from CMU #1 (ARINC 429)	A	MP1G									To CMU #1	6, 3, 47
	B	MP1H										
Data Bus to CMU #1 & #2 (ARINC 429)	A	MP1J									To CMU #1& #2	6, 47, 52
	B	MP1K										
Cockpit Audio Ch 1 Input	HI	MP2A									To Audio System	15, 56
	LO	MP2B										
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									To CCS	41, 57
	B	MP2K										
Cabin Digital Voice/Data Output (CEPT-E1)	A	MP3A										
	B	MP3B										
Data from SCDU/WSC #1 (ARINC 429)	A	MP3C										7, 25
	B	MP3D										
Data from SCDU/WSC #2 (ARINC 429)	A	MP3E										
	B	MP3F										
Data Bus from CMU #2 (ARINC 429)	A	MP3G										6, 47, 3
	B	MP3H										
Data Bus to SCDU/WSC #1, #2, & #3 (ARINC 429)	A	MP3J										25, 39
	B	MP3K										
Reserved AES ID Input	A	MP4A										3, 55
	B	MP4B										
CFDS Interface (604) Input (ARINC 429)	A	MP4C									To Central BITE System	7
	B	MP4D										
CFDS Interface (604) Output (ARINC 429)	A	MP4E										
	B	MP4F										
Multi-Control Output (ARINC 429)	A	MP4G				TP1A			T			8, 16, 20
	B	MP4H				TP1B			U			
Reserved for Cabin Audio Input #2	HI	MP4J									To non-CCS Cabin Telephone	
	LO	MP4K										
LGA LNA On/Off Control		MP5A						B LGA LNA				10
Reserved for Weight-On-Wheels												
Input #1		MP5B										40
Input #2		MP5C										
Program Select		MP5D										
Reserved for Cabin Audio Output #2	HI	MP5E									To non-CCS Cabin Telephone	
	LO	MP5F										
BITE Input Disc. From LGA LNA		MP5G						H LGA LNA				9
Chime/Lamps Inhibit		MP5H										43
Dual System Select Discrete I/O or Reserved for Disable Discrete to HSDU		MP5J									Other SDU MP5K	59
Dual System Disable Discrete Input		MP5K									Other SDU MP5J	

ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION		SDU	RFU	[33] SPLTR	[33] COM B	HPA	[1] [33] [34] HP Relay	[33] LNA/DIP	[32] [33] BEAM STEERING	ANT	OTHER	NOTES
Data from Primary IRS (ARINC 429)	A	MP6A									To IRS #1	8, 36, 42
	B	MP6B										
Data from Secondary IRS (ARINC 429)	A	MP6C									To IRS #2	
	B	MP6D										
BITE Input from HGA HPA (ARINC 429)	A	MP6E				TP1C	HGA HPA					7
	B	MP6F				TP1C						
Spare ARINC 429 Input	A	MP6G										
	B	MP6H										
BITE Input from LGA HPA (ARINC 429)	A	MP6J				TP1C	LGA HPA					
	B	MP6K				TP1D						
Data Bus from Airborne Data Loader (ARINC 429)	A	MP7A									ARINC 615 Data Loader (If present)	8, 29
	B	MP7B										
Data bus to Airborne Data Loader (ARINC 429)	A	MP7C										
	B	MP7D										
Reserved Data Bus to HSDU (ARINC 429)	A	MP7E										8,59
	B	MP7F										
BITE Input from ACU or Top/Port BSU (ARINC 429)	A	MP7G							W Top/Port			7, 17, 20
	B	MP7H							X Top/Port			
BITE Input from STBD BSU (ARINC 429)	A	MP7J							W STBD			7, 20
	B	MP7K							X STBD			
Data Loader Link	A	MP8A									ARINC 615 (if present)	29
Data Loader Link	B	MP8B										
Spare 429 Input	A	MP8C										60
	B	MP8D										
Cockpit Voice Call Light Output #1		MP8E										10, 56
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/WSC #3 (ARINC 429)	A	MP8J										7, 25
	B	MP8K										
Reserved Data Bus to SNU and/or CPDF	A	MP9A									To SNU and/or CPDF	7, 49
	B	MP9B										
Spare 429 Output	A	MP9C										60
	B	MP9D										
Reserved Data Bus from RFU to SDU or Reserved Data bus from HSDU to SDU (ARINC 429)	A	MP9E	TP1A									12, 59
	B	MP9F	TP1B									
Reserved Data Bus to RFU from SDU or Reserved Data Bus to HSDU from SDU (ARINC 429)	A	MP9G	TP1C									
	B	MP9H	TP1D									
Unspecified Function Wires	A	MP9J	TP1E									
	B	MP9K	TP1F									
Unspecified Function Wires	A	MP10A	TP1G									
	B	MP10B	TP1H									
Unspecified Function Wires	A	MP10C	TP1J									
	B	MP10D	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									

ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION		SDU	RFU	[33] SPLTR	[33] COMB	HPA	[1][33][34] HP RELAY	[33] LNA/DIP	[32] [33] BEAM STEERING	ANT	OTHER	NOTES
Unspecified Function Wires	A	MP10E	TP3A									12
	B	MP10F	TP3B									
Unspecified Function Wires	A	MP10G	TP3C									
	B	MP10H	TP3D									
Unspecified Function Wires	A	MP10J	TP3E									
	B	MP10K	TP3F									
Future Spare			TP3G									
Future Spare			TP3H									
Future Spare			TP3J									
Future Spare			TP3K									
Data Bus from Airborne Data Loader (ARINC 429)	A		TP4A								ARINC 615 Data Loader (If present)	8,29
	B		TP4B									
Data Bus to Airborne Data Loader (ARINC 429)	A		TP4C									
	B		TP4D									
Data Loader Link A			TP4E								ARINC 615 Data Loader (If present)	29
Data Loader Link B			TP4F									
Future Spare			TP4G									
Future Spare			TP4H									
Future Spare			TP4J									
Future Spare			TP4K									
Future Spare			TP5A									
Future Spare			TP5B									
Future Spare			TP5C									
Future Spare			TP5D									
Future Spare			TP5E									
Future Spare			TP5F									
Future Spare			TP5G									
Future Spare			TP5H									
Future Spare			TP5J									
Future Spare			TP5K									
Future Spare			TP6A									
Future Spare			TP6B									
Future Spare			TP6C									
Future Spare			TP6D									
Future Spare			TP6E									
Future Spare			TP6F									
Future Spare			TP6G									
Future Spare			TP6H									
Future Spare			TP6J									
Future Spare			TP6K									
Future Spare			MP1A									
Future Spare			MP1B									
Future Spare			MP1C									
Future Spare			MP1D									
Future Spare			MP1E									
Future Spare			MP1F									
Future Spare			MP1G									
Future Spare			MP1H									
Future Spare			MP1J									
Future Spare			MP1K									
Future Spare			MP2A									
Future Spare			MP2B									
Future Spare			MP2C									
Future Spare			MP2D									
Future Spare			MP2E									
Future Spare			MP2F									
Future Spare			MP2G									
Future Spare			MP2H									
Future Spare			MP2J									
Future Spare			MP2K									

ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION	SDU	RFU	[33] SPLTR	[33] COMB	HPA	[1] [33] [34] HP RELAY	[33] LNA/DIP	[32] [33] BEAM STEERING	ANT	OTHER	NOTES
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									
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									

ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION	SDU	RFU	[33] SPLTR	[33] COMB	HPA	[1] [33] [34] HP RELAY	[33] LNA/DIP	[32] [33] BEAM STEERING	ANT	OTHER	NOTES
Motion Sensor Input	MP11A										26
Sensor Program Select	MP11B										
Place/End Call Discrete Input #1	MP11C										46, 56
Place/End Call Discrete Input #2	MP11D										
Reserved as Unspecified Program Pins	MP11E										27
	MP11F										
Strap Option	MP11G										59
Reserved as Unspecified Program Pins	MP11H										27
	MP11J										
	MP11K										
Reserved SDU Crosstalk From other SDU or **HPA** HSDU (ARINC 429)	A MP12A										8, 12, 59 **61**
	B MP12B										
Reserved SDU Crosstalk To other SDU or **HPA** HSDU (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	
	B MP12K										
Reserved for Disable Discrete to HSDU	MP13A										59
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										
Current to Chime	MP14C										
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
STANDARD INTERWIRING

FUNCTION	SDU	RFU	SPLTR [33]	COMB [33]	HPA	HP RELAY [1] [33] [34]	LNA/DIP [33]	BEAM STEERING [32] [33]	ANT	OTHER	NOTES
115 Vac Hot	BP1	BP1			BP1		F	M			21, 37
Reserved 28V Hot	BP2	BP2			BP2		G				
Reserved 28V Ground	BP3	BP3			BP3		K				
Future Spare	BP4	BP4									
Reserved for HPA External Blower Control					BP4						
Future Spare	BP5	BP5			BP5						
Future Spare	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			
ac and dc HP Relay BITE to STBD BSU						D		Y STBD			9, 24
ac and dc HP Relay +15 Vdc						C		V Top/Port			
dc HP Relay Power (+15 Vdc)						F					
ac HP Power Relay (115 Vac Hot to HPR)						F		N Top/Port			
ac HP Relay Control (Switched 115 Vac Cold to HPR)						H		K Top/Port			24
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

ATTACHMENT 1-3
STANDARD INTERWIRING

	FUNCTION		SDU	RFU	SPLTR	COMB	HPA	HP RELAY	LNA/DIP	BEAM STEERING	ANT	OTHER	NOTES
					[33]	[33]		[1] [33] [34]	[33]	[32] [33]			
	Data Bus from Airborne Data Loader (ARINC 429)	A					TP1E o					o ARINC 615 Data Loader (if present)	8, 29
		B					TP1F o					o	
c-4	Data Bus to Airborne Data Loader (ARINC 429)	A					TP1G o					o	
		B					TP1H o					o	
	Data Loader Link A						TP1J o					o ARINC 615 Data Loader (if present)	29
	Data Loader Link B						TP1K o					o	
	Future Spare						TP2A o						
c-6	Future Spare						TP2B o						
	Future Spare						TP2C o						
	Future Spare						TP2D o						
c-4	Spare Discrete Input						TP2E o						61
	Future Spare						TP2F o						61
c-6	Future Spare						TP2G o						
c-4	Spare Discrete Output						TP2H o						61
	Future Spare						TP2J o						61
c-6	Future Spare						TP2K o						
c-5							NOTE: For top-mounted antenna, HPA pins TP3C and TP3D are not wired.						
	HPA MUTE from Top/Port BSU	A					TP3A o			o G Top/Port			
		B					TP3B o			o H Top/Port			
c-4	HPA MUTE from STBD BSU	A					TP3C o			o G STBD			
		B					TP3D o			o H STBD			

ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION		SDU	RFU	[33] SPLTR	[33] COMB	HPA	[1] [33] [34] HP RELAY	[33] LNA/DIP	[32] [33] BEAM STEERING	ANT	OTHER	NOTES
Future Spare							E o					
Future Spare							G o					
Future Spare								C o				
Future Spare								D o				
Future Spare												
Future Spare												
Future Spare						TP3E o						
Future Spare						TP3F o						
Future Spare						TP3G o						
Future Spare						TP3H o						
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						
Extended SDI	#1					TP5A o			o A			
Program	#2					TP5B o			o B			
Pins	#3								o C			
	#4								o E			
	#5								o F			19
	#6								o J			
	#7								o S			
	#8								o Z			
	Common					TP5D o			o D			
Future Spare						TP5C 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						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
STANDARD INTERWIRING

FUNCTION	SDU	RFU	[33] SPLTR	[33] COMB	HPA	[1] [33] [34] HP RELAY	[33] LNA/DIP	[32] [33] BEAM STEERING	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						

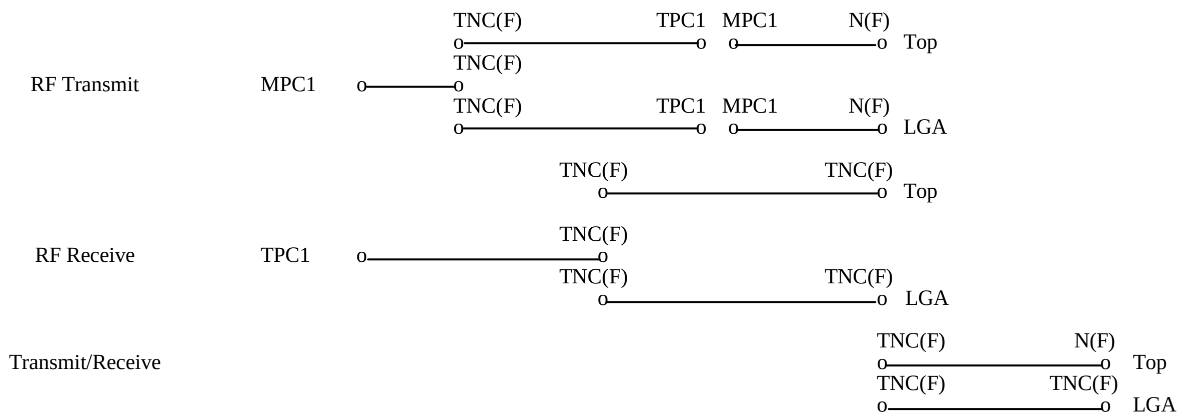
ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION	SDU	RFU	[33] SPLTR	[33] COMB	HPA	[1] [33] [34] HP RELAY	[33] LNA/DIP	[32] [33] BEAM STEERING	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						

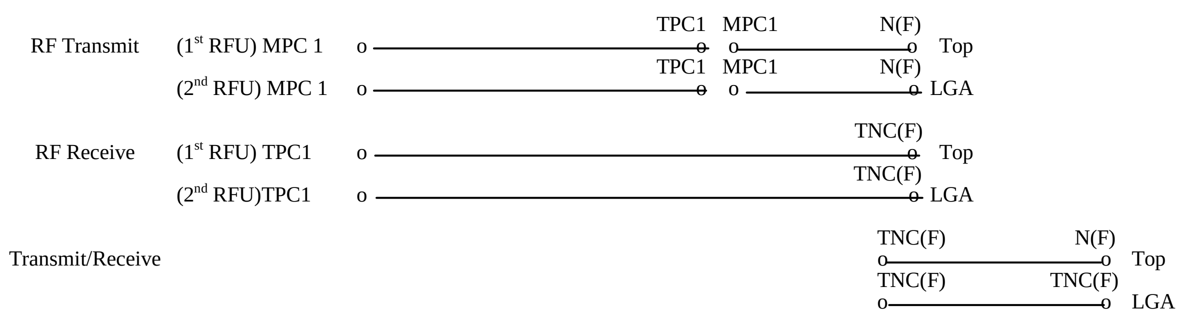
ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION	SDU	RFU	SPLTR	COMB	HPA	HP RELAY	LNA/DIP	BEAM STEERING	ANT	OTHER	NOTES
			[2] [28]	[2] [28]		[1] [2]	[4][28]		[28]		

TOP MOUNTED ANTENNA CONFIGURATION 22



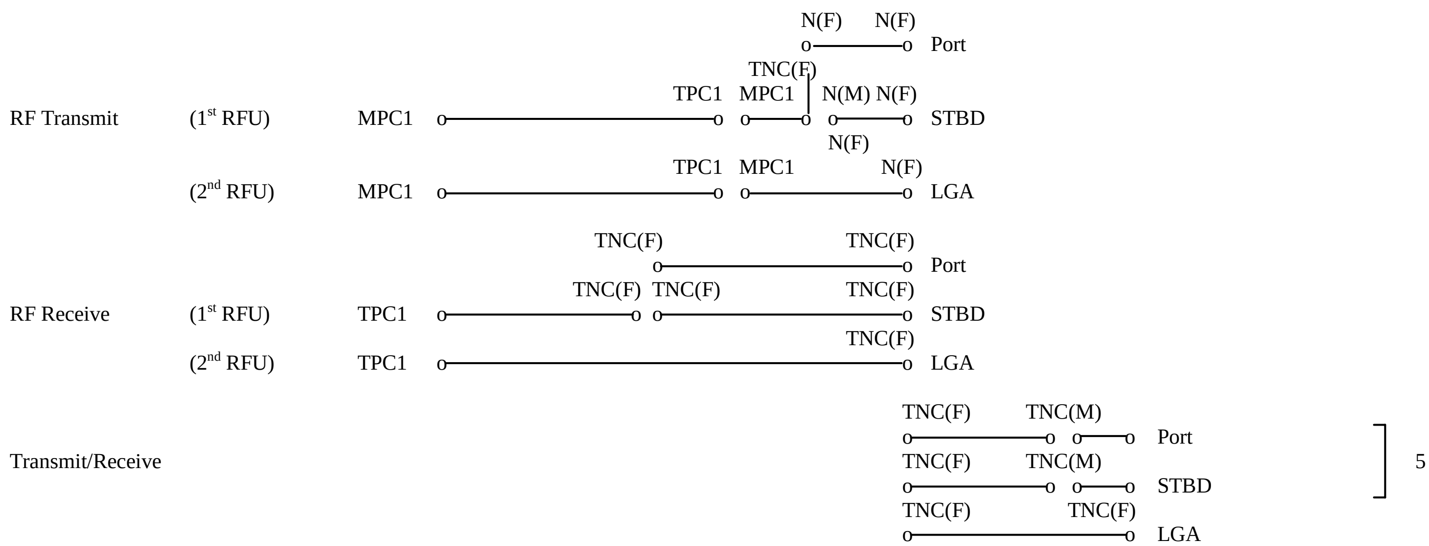
TOP-MOUNTED ANTENNA CONFIGURATION – DUAL SYSTEM 22



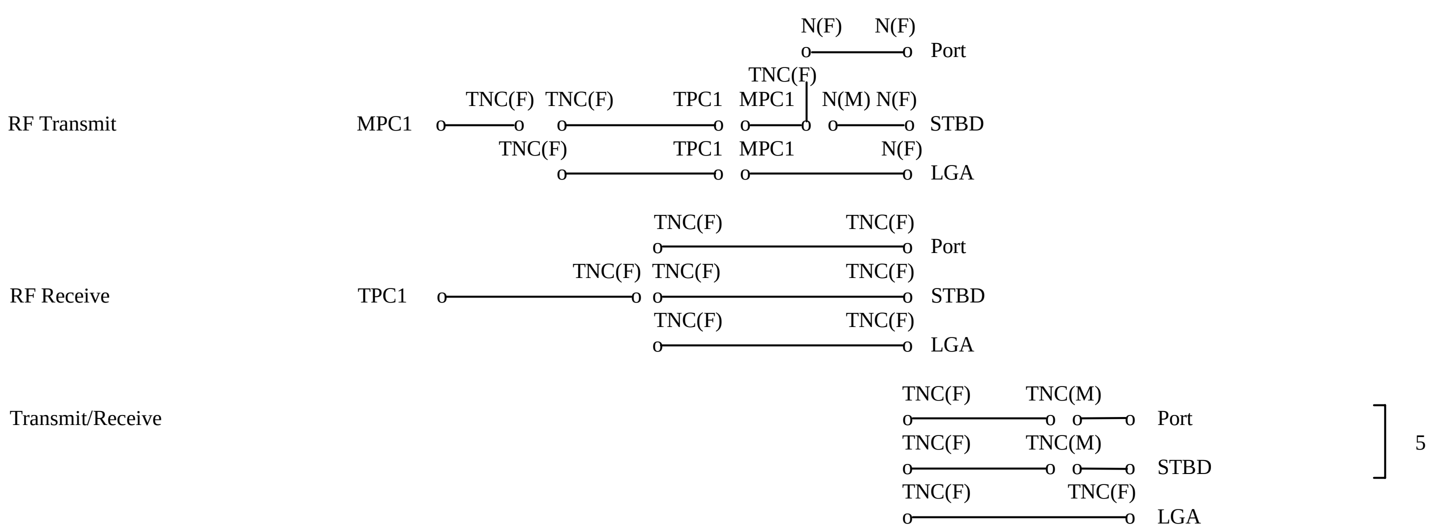
ATTACHMENT 1-3
STANDARD INTERWIRING

FUNCTION	SDU	RFU	[2] [28] SPLTR	[2] 28] COMB	HPA	[1] [2] HP RELAY	[4][28] LNA/DIP	BEAM STEERING	[28] ANT	OTHER	NOTES

SIDE MOUNTED PHASED ARRAY CONFIGURATION – DUAL SYSTEM 22



SIDE MOUNTED PHASED ARRAY CONFIGURATION 22



ATTACHMENT 1-3A
2 MCU BEAMS 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	"
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
LNA/BSU Return		TP	10C	LNA	P3–J	than 10mA (see commentary)
LNA BITE (Top)		TP	10D	LNA	P3–H	15 ohm max.
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.
					To be	
Ant. Power		TP	2B	HGA	assigned	1.0 ohm max.
					by HGA	
Ant. BITE	A	TP	4A	HGA	Mfr.	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			max. current
						requirement 2.0A
115 Vac Cold		BP	4	Aircraft		
Chassis GND		BP	3			

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.

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.

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 ARINC 429 data is available. Data from the CMUs is available on Labels 214 and 216 (as specified in ARINC Specification 429, Attachment 6), or on the AES ID input bus on Labels 275 and 276 (at 5 to 10 words per second) as specified in ARINC Specification 429 for Mode-S Transponder to TCAS. 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.

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.

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.”

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 hold off 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>

    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.

    If the ORT (item o) is set for ACP initiated ATC Calls and, if the <u>Call Light is OFF</u>, 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. When enabled by ORT item n (reference Part 2 Section 4.5.2.3), 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 hold off voltage in the open circuit condition should be 36 Vdc. The minimum hold time (for both the on and off states) should be 250 ms. 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.

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. Not Used

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.”

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

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
Reserved	0	0	Reserved	0	0	Up	0
LGA HPA	0	1	Port/Top BSU	0	1		
HGA HPA	1	0	Starboard BSU	1	0	Down	1
Unused	1	1	ACU	1	1		

* ARINC 429

** 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.

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°

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

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.

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

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
15 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. The Satellite Control/Display Unit (SCDU) interface or Williamsburg SDU Controller (WSC) Interface (WSCI) is required to permit the SDU to be managed by cockpit control/status devices. The SDU should be capable of exchanging command and control information with SCDUs using the MCDU protocol standards defined in ARINC Characteristic 739, or with a WSC using ARINC 429 Williamsburg protocol to communicate specific messages and their signal elements as defined in Attachment 2F-42.1 of ARINC Characteristic 741, Part 2. 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/ WSC over this interface. The details of the SCDU interface are manufacturer specific.

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

26. This discrete input is 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 is programmed to the open circuit state, such that the unterminated (default) Motion Sensor Input is interrupted as “In Motion”.

    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 are defined by the avionics suppliers. They are to be left open circuit or wired to pin MP15K, “ICAO 24-Bit Aircraft Address Common”, as necessary.

28. 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. Not Used.

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 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:

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

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	RF to/from LNA/DIP	1	J1
(with RF)	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

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
NOTES APPLICABLE TO STANDARD INTERWIRING

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.

    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.

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 signaling is still active on the satellite channel when the inhibit is released (i.e., the call has not yet been cleared by the terrestrial party), the chime and light should be activated immediately in the normal fashion.

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

44. Not used.

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

46. The SDU should sense a momentary (typically no less than 100 milliseconds) closure of external switches to dc ground. The resistance to airframe dc ground presented to the SDU connector pins should be 100,000 ohms or more when open, and less than 10 ohms when grounded. The transition from open to ground on the external switches 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.

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

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

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 signaling. Either this analog interface, or the digital (CEPT E-1) interface, may be used between the SDU and the CTU, but not both simultaneously. Use of either interface is indicated by the presence of signaling on the appropriate wire pairs.

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".

    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.

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:

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.

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

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.

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 signaling outputs in a dual system should only be asserted by the SDU supporting a call with one of its physical channels.

57. There are a variety of means of interfacing different kinds of facsimile (fax) machines and other circuit-mode data equipment (e.g., personal computers, secure voice terminals) to the SATCOM system, including direct connection to the SDU, or via a DIU or TIFU (either of which can be a physical unit or integrated into the SDU -- reference ARINC Characteristic 741 Part 2 Section 4.4.3 and its subsections, which in turn reference the Inmarsat aeronautical system definition manual modules 1, 2 and 5), or via an ARINC 746 cabin communications system (CCS) cabin telecommunications unit (CTU, which may also involve an intervening cabin distribution system [CDS -- reference ARINC Specification 628]). Options include analog

ATTACHMENT 1-4
NOTES APPLICABLE TO STANDARD INTERWIRING

interconnections (utilizing voice-band modems) and direct digital-interconnect data service. The SDU physical interfaces referencing this note (Cabin Digital Voice/Data CEPT-E1 [CTU] and Analog PBX) have the potential to support one or more of these options. Refer to the relevant vendors for specific options and details.

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

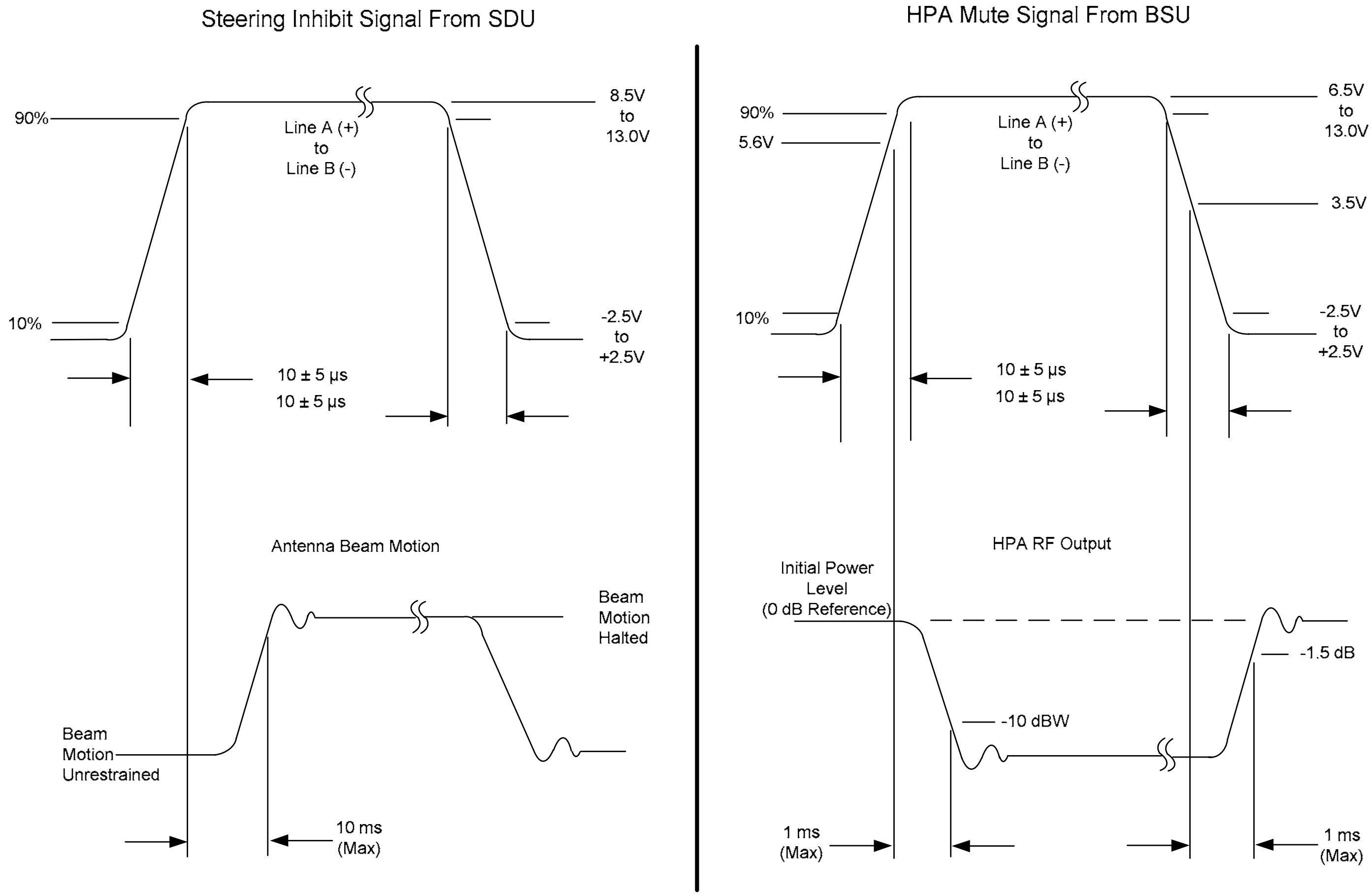
59. This interface may be used by one or more manufacturers to support external HSDUs. Different signal designations may be manufacturer-dependent and/or may be SDU system-configuration-pin-dependent. Contact the manufacturer for specific usage and interwiring information.

60. These ARINC 429 interfaces were formerly reserved for a future to-be-defined Radio Management Panel (RMP) and Call Annunciation Panel (CAP). Those units were never implemented as originally conceived. Non-MCDU/SCDU SATCOM controllers did evolve, but they utilize the SCDU/WSC ARINC 429 interfaces on MP3C/D, 3E/F, 3J/K, and 8J/K -- reference Note 25. Since one type of WSC uses the nomenclature RMP, in order to avoid confusion with the former and different RMP concept, the former RMP (and CAP) references have been deleted.

61. The non-HSD HPA and the HPA HSDU utilize different electrical signal characteristics and functionality (ARINC 429 vs. 0-15V discrete) on pins TP2E, TP2F, TP2H and TP2J, with different interwiring requirements for those two applications. Aircraft wiring for non-HSD HPAs is obviously not adequate for HPA HSDUs, but aircraft wiring for HPA HSDUs that utilizes these particular circuits may not be electrically compatible with non-HSD HPAs and their affiliated SDUs. Consult the SDU, HPA and HPA HSDU manufacturers, and exercise appropriate caution.

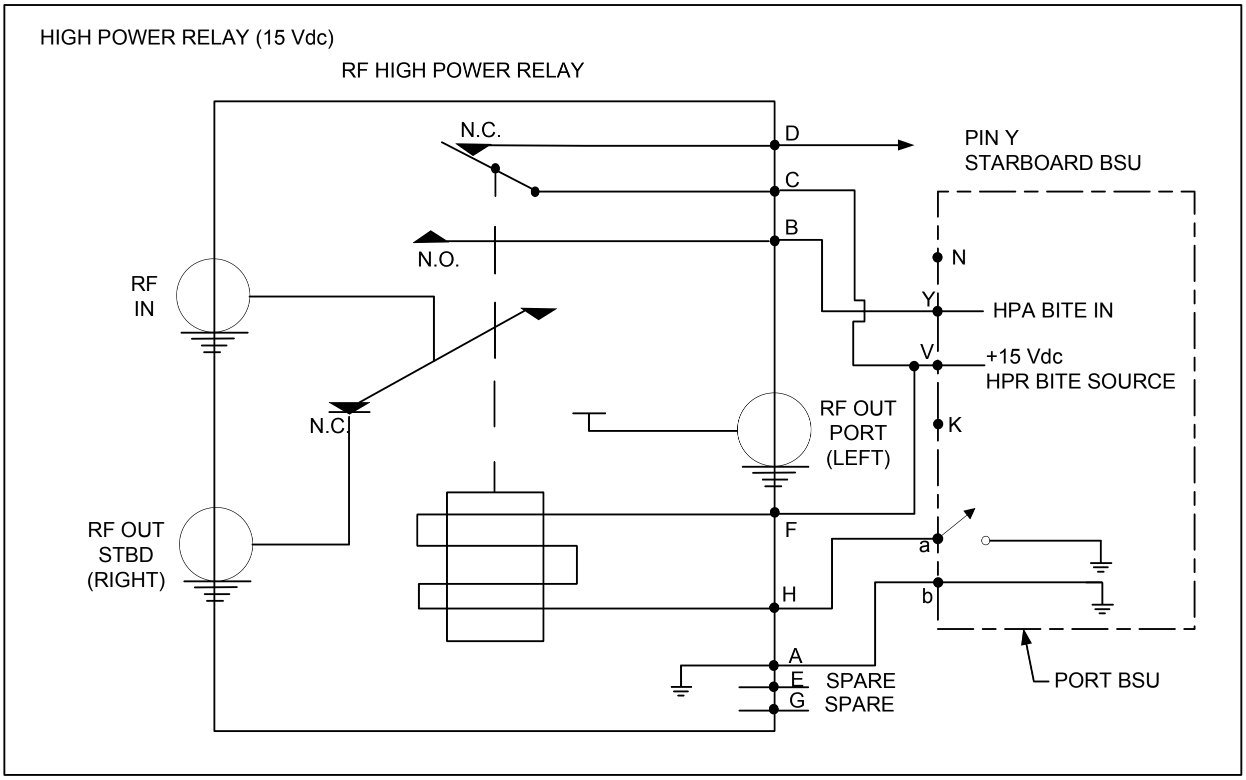
62. Note that in Attachment 4, these HPA pins are used for part of the Swift64 high-speed data 24-bit Forward ID strapping for the HPA HSDU. Some of these circuits will therefore be strapped to signal ground in aircraft interwiring. As these pins are reserved for automatic test equipment (ATE) signals for non-HSD HPAs, and those ATE circuits may not have been designed to be permanently grounded via aircraft wiring, non-HSD HPAs may be electrically incompatible with such Forward ID strapping, and equipment damage may result if such non-HSD HPAs are installed on aircraft wired for HPA HSDUs. Consult the HPA and HPA HSDU manufacturers, and exercise appropriate caution.

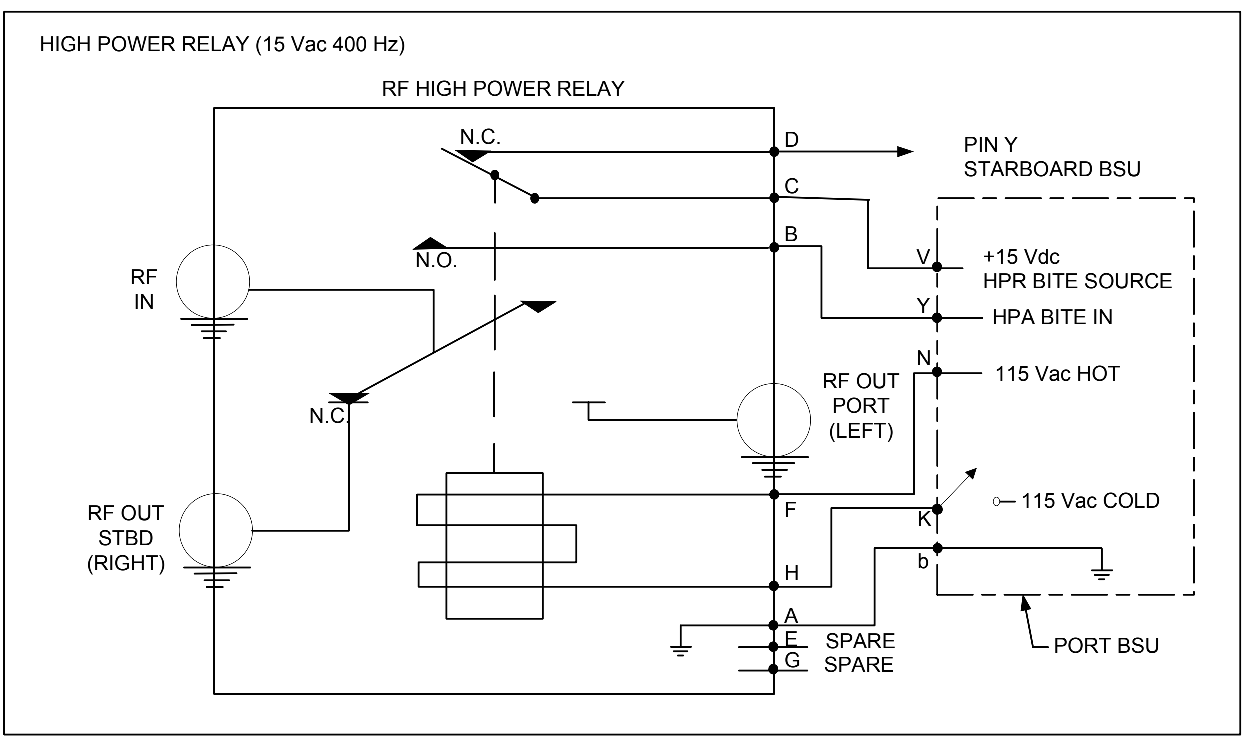
ATTACHMENT 1-4A
STEERING INHIBIT AND HPA MUTE SIGNAL CHARACTERISTICS



Note: For Timing Reference Only.

ATTACHMENT 1-4B
BSU/HPR WIRING DIAGRAMS





ATTACHMENT 1-4C
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION

Table 1-4 – Signal Assignments

Summary	Description
TP10A:	Availability of ARINC 429 SSR Mode S Address (AES ID) from ARINC 429 Ports
TP10B:	FMC Connection to SDU
TP10C:	FMC Connection to SDU
TP10D:	ARINC 429 Bus Speed to/from CMU #1/#2
TP10E:	CPDF Configuration
TP10F:	ARINC 429 Bus Speed of AES ID Input
TP10G:	Reserved for HSDU #1 Configuration
TP10H:	SDU Controller Type
TP10J:	Reserved for Strap Option
TP10K:	Call Light Activation
TP11A:	Strap Parity (Odd); Covering the other 39 standard specified system configuration pins in the range TP10A – TP13K only
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
TP12A:	CFDS Type
TP12B:	CFDS Type
TP12C:	CFDS Type
TP12D:	Reserved for Aircraft ID ARINC 429 Input, or PAD for CFDS/SDU Configuration
TP12E:	SDU/HSDU Configuration
TP12F:	SDU Number
TP12G:	CMU #1 Configuration
TP12H:	CMU #2 Configuration
TP12J:	SCDU/WSC #1 Configuration
TP12K:	SCDU/WSC #2 Configuration
TP13A:	Option Priority 4 Calls to/from Cockpit
TP13B:	ARINC 429 Bus Speed to SCDU/WSC #1, #2, #3
TP13C:	Cockpit Voice Call Light/Chime Options
TP13D:	Cockpit Voice Call Light/Chime Options
TP13E:	SCDU/WSC #3 Configuration
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
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION

Table 1-4 (TP10A) – Availability of ARINC 429 SSR Mode S Address (AES ID) from ARINC 429 Ports

TP10A	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

Table 1-4 (TP10B-C) – FMC Connection to SDU

TP10B	TP10C	Interpretation
0	0	FMC #1 Connected, FMC #2 Connected
0	1	FMC #1 Connected, FMC #2 Not Connected
1	0	FMC #1 Not Connected, FMC #2 Connected
1	1	Neither FMC Connected

Table 1-4 (TP10D) – ARINC 429 Bus Speed to/from CMU #1/#2

TP10D	Interpretation
0	High Speed ARINC 429 bus
1	Low Speed ARINC 429 bus

Table 1-4 (TP10E) – Cabin Packet Data Function (CPDF)

TP10E	Interpretation
0	CPDF Installed
1	CPDF Not Installed

Table 1-4 (TP10F) – ARINC 429 Bus Speed of AES ID Input

TP10F	Interpretation
0	High Speed ARINC 429 bus
1	Low Speed ARINC 429 bus

Table 1-4 (TP10G) – HSDU Configuration [8]

TP10G	Interpretation
0	HSDU #1 (or RFU HSDU) Installed
1	HSDU #1 (or RFU HSDU) Not Installed

Table 1-4 (TP10H) – SDU Controller Type

TP10H	Interpretation
0	ARINC 741P2 ATT.2F-42.1 WSC
1	ARINC 739 MCDU/SCDU

Table 1-4 (TP10K) – Call Light Activation

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

ATTACHMENT 1-4C
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION

Table 1-4 (TP11A) – Strap Parity (Odd) [2]

TP11A	Interpretation
0	Sum of all other Straps set to 1 is Odd
1	Sum of all other Straps set to 1 is Even

Table 1-4 (TP11B) – Cabin Communication System (CCS)

TP11B	Interpretation
0	CCS Installed
1	CCS Not Installed

Table 1-4 (TP11C-D) – IRS Configuration

TP11C	TP11D	Interpretation
0	0	Primary IRS Installed, Secondary IRS Installed
0	1	Primary IRS Installed, Secondary IRS Not Installed
1	0	Primary IRS Not Installed, Secondary IRS Installed
1	1	Primary IRS Not Installed, Secondary IRS Not Installed

ATTACHMENT 1-4C
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION

Table 1-4 (TP11E-K) – HPA/Antenna Subsystem Configuration [3]

[10] Decimal Code	Pins TP11 E	F	G	H	J	K	LGA	LGA HPA	TOP/PORT BSU + HGA	STARBOARD BSU + HGA	HGA HPA	HPR	NON-TYPE D LNA/DIPLEXER	TYPE D LNA/DIPLEXER	ARINC 781 HGA	RESERVED FOR FUTURE	RESERVED FOR MFR	NOTES
	E	F	G	H	J	K												
63	1	1	1	1	1	1	*	*					*					
62	0	1	1	1	1	1			*		*		*					
61	1	0	1	1	1	1	*	*	*		*		*					
60	0	0	1	1	1	1	*	*	*	*	*	*	*					
59	1	1	0	1	1	1							*			*		
58	0	1	0	1	1	1							*			*		
57	1	0	0	1	1	1	*		*		*	*	*					6
56	0	0	0	1	1	1	*	*	*	*		*	*					6
55	1	1	1	0	1	1			*	*	*	*	*					
54	**0**	**1**	**1**	**0**	**1**	**1**					*		*		*			
48-**53**	**1** 0	**0** 0	1 0	0 0	1 1	1 1	t o									*		
47	1	1	1	1	0	1	*	*						*				
46	0	1	1	1	0	1			*		*			*				
45	1	0	1	1	0	1	*	*	*		*			*				
44	0	0	1	1	0	1	*	*	*	*	*	*		*				
43	1	1	0	1	0	1								*		*		
42	0	1	0	1	0	1								*		*		
41	1	0	0	1	0	1	*		*		*	*		*				6
40	0	0	0	1	0	1	*	*	*	*		*		*				6
39	1	1	1	0	0	1			*	*	*	*		*				
38	**0**	**1**	**1**	**0**	**0**	**1**					*			*	*			
8-**37**	**1** 0	**0** 0	1 0	0 1	0 0	1 0	t o									*		
0-7	1 0	1 0	1 0	0 0	0 0	0 0	t o										*	

ATTACHMENT 1-4C
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION

Table 1-4 (TP12A-C) – CFDS Type

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	Reserved for Honeywell CAIMS
1	0	0	Boeing Type CFDS
1	0	1	Undefined
1	1	0	Undefined
1	1	1	CFDS Not Installed

Table 1-4 (TP12E) – SDU/HSDU Configuration [8]

TP12E	Interpretation
0	Second SDU Installed or HSDU Installed
1	Second SDU or HSDU Not Installed

Table 1-4 (TP12F) – SDU Number [4]

TP12F	Interpretation
0	SDU #2
1	SDU #1

Table 1-4 (TP12G) – CMU #1

TP12G	Interpretation
0	CMU #1 Installed
1	CMU #1 Not Installed

Table 1-4 (TP12H) – CMU #2

TP12H	Interpretation
0	CMU #2 Installed
1	CMU #2 Not Installed

Table 1-4 (TP12J) – SCDU/WSC #1

TP12J	Interpretation
0	SCDU/WSC #1 Installed
1	SCDU/WSC #1 Not Installed

Table 1-4 (TP12K) – SCDU/WSC #2

TP12K	Interpretation
0	SCDU/WSC #2 Installed
1	SCDU/WSC #2 Not Installed

Table 1-4 (TP13A) – Priority 4 Calls to/from Cockpit [7]

TP13A	Interpretation
1	Allow Priority 4 Calls to/from the Cockpit
0	Inhibit Priority 4 Calls to/from the Cockpit

ATTACHMENT 1-4C
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION

Table 1-4 (TP13B) – ARINC 429 Bus Speed to SCDU/WSC #1, #2, #3

TP13B	Interpretation
0	Low Speed ARINC 429 bus
1	High Speed ARINC 429 bus

Table 1-4 (TP13C-D) – Cockpit Voice Call Light/Chime Option

TP13C	TP13D	Interpretation
0	0	Spare
0	1	Steady Lights & Multistroke Chime
1	0	Flashing Lights & Single Stroke Chime
1	1	Steady Lights & Single Stroke Chime

Table 1-4 (TP13E) – SCDU/WSC #3

TP13E	Interpretation
0	SCDU/WSC #3 Installed
1	SCDU/WSC #3 Not Installed

Table 1-4 (TP13F-G) – SDU CODEC 1 Wiring

TP13F	TP13G	Interpretation
0	0	AMS Wired, Cabin Audio Wired
0	1	AMS Wired, Cabin Audio Not Wired
1	0	AMS Not Wired, Cabin Audio Wired
1	1	AMS Not Wired, Cabin Audio Not Wired

Table 1-4 (TP13H-J) – SDU CODEC 2 Wiring

TP13H	TP13J	Interpretation
0	0	AMS Wired, Cabin Audio Wired
0	1	AMS Wired, Cabin Audio Not Wired
1	0	AMS Not Wired, Cabin Audio Wired
1	1	AMS Not Wired, Cabin Audio Not Wired

Table 1-4 (TP13K) – Cockpit Hookswitch Signaling Method

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

Table 1-4 (MP11G) – HSDU Configuration [8] [9]

MP11G	Interpretation
0	HSDU #2 Installed
1	HSDU #2 Not Installed

ATTACHMENT 1-4C
SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION

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. Note that ARINC Characteristic 761 Attachment 1-4B Table 1-3K (which is an extension of ARINC Characteristic 741 Table 1-4K) defines configurations which include intermediate-gain antennas (IGAs). Those IGA configurations may also apply to ARINC Characteristic 741-compatible equipment; therefore, the IGA codes defined in ARINC Characteristic 761 should be considered as reserved for those definitions in this table as well. Any changes to this table should be coordinated with ARINC Characteristic 761. Note that the configuration codes for Type D and Non-Type D LNA/Diplexers are identical except for TP11J.

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 acknowledgment of the annunciation with either the STEADY or FLASHING option.

6. Interwiring and operation is TBD.

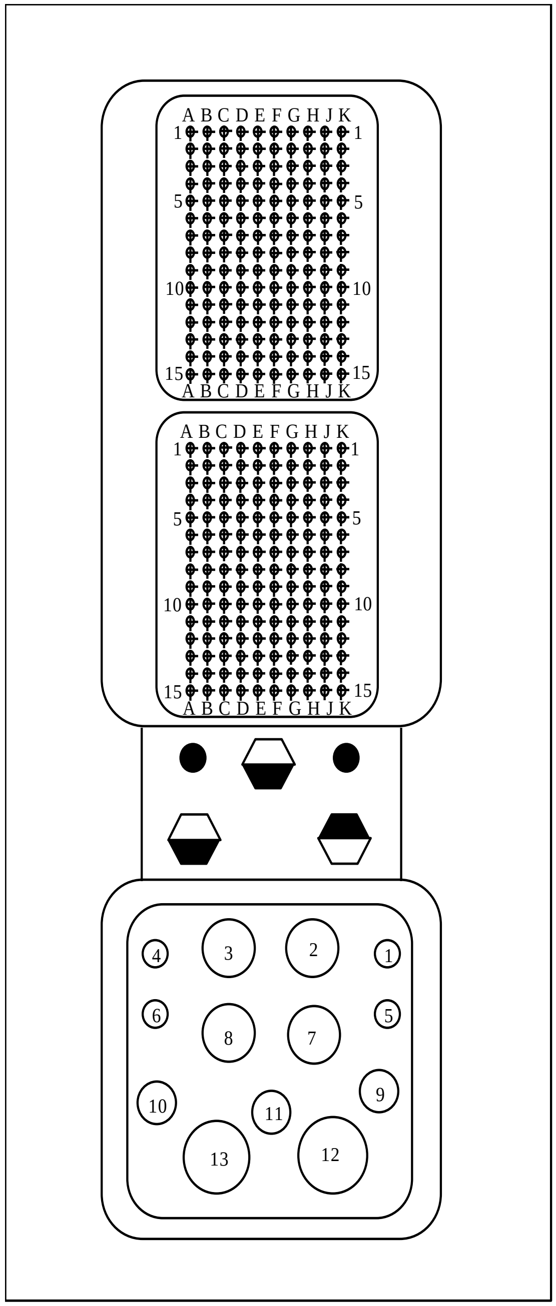
7. The following apply for the case of this pin wired to the 0 state: Priority 4 calls are not allowed to or from the cockpit AMS. ORT item “i” (Allowance and Routing of ground-initiated Public Correspondence/Priority 4 calls--reference ARINC Characteristic 741 Part 2 Section 4.5.2.3) cannot be allowed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

8. This configuration pin may be used by one or more manufacturers to indicate the installation of an external HSDU, or the installation of an RFU HSDU (as described in Attachment 4). Contact the manufacturer for specific usage and interwiring information.

9. Pin MP11G is not included in the parity computations for TP11A.

10. For referencing convenience, the decimal equivalent is given for the binary coding shown for pins E-K, treating pin E as the LSB and pin K as the MSB.

ATTACHMENT 1-5
SDU FORM FACTOR



SIZE 6 MCU
#2 Shell Connector

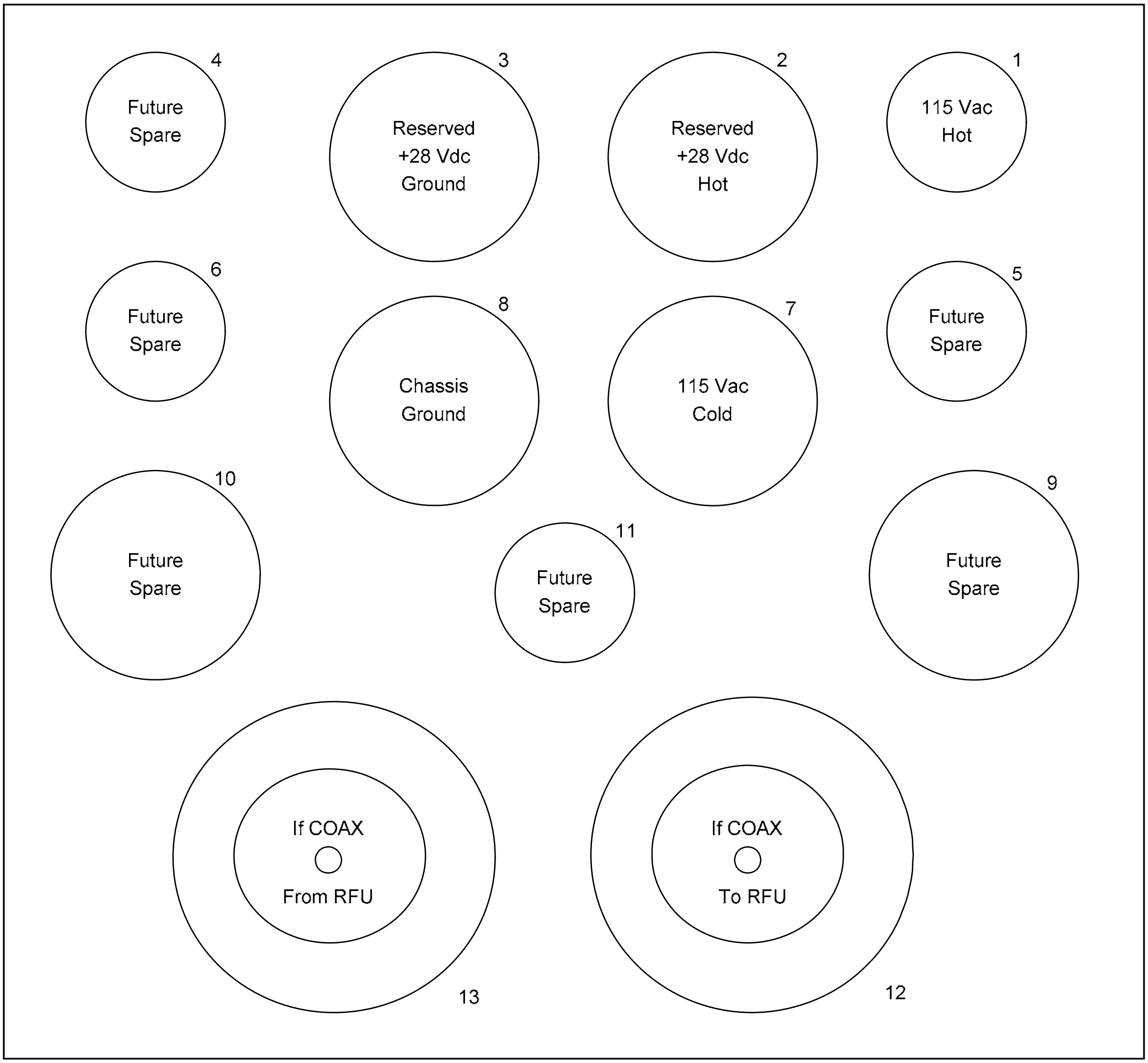
ATTACHMENT 1-5A
SDU TOP PLUG CONNECTOR LAYOUT

	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
2	Reserved Analog PBX Channel 1 Input Hi	Reserved Analog PBX Channel 1 Input Lo	Reserved Analog PBX Channel 1 Output Hi	Reserved Analog PBX Channel 1 Output Lo	Reserved Analog PBX Channel 2 Input Hi	Reserved Analog PBX Channel 2 Input Lo	Reserved Analog PBX Channel 2 Output Hi	Reserved Analog PBX Channel 2 Output Lo	o	o
3	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	Reserved MFR. Specific	Reserved MFR. Specific	Reserved MFR. Specific	Reserved MFR. Specific	Reserved MFR. Specific
4	o	o	o	o	o	o	o	o	o	o
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
6	Reserved Bus from HSDU (ARINC 429) A	Spare 429 Input B	Spare 429 Output A	Spare 429 Output B	± 15 V Discrete Output	o	± 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
8	o	o	o	o	o	o	o	o	o	o
9	Spare Discrete Input Config. Strap Type	Spare Discrete Input Config. Strap Type	o	o	o	o	o	o	o	o
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	Option AES ID 429 Input Bus Speed	Reserved For HSDU #1 Configuration	Option SDU Controller Type	Reserved For Strap Option	Option Call Light Activation
11	Option Strap Parity (Odd)	Option CCS Presence	Option IRS Config.	Option IRS Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.
12	Option CFDS Type	Option CFDS Type	Option CFDS Type	Reserved A/C ID or CFDS/SDU Config.	Option SDU/HSDU Config.	Option SDU Number	Option CMU #1 Config.	Option CMU #2 Config.	Option SCDU/ WSC #1 Config.	Option SCDU/ WSC #2 Config.
13	Option Priority 4 Calls To/From Cockpit	Option **SCDU/** **WSC** Bus Speed	Option Light/ Chime Code	Option Light/ Chime Code	Option SCDU/ WSC #3 Config.	SDU CODEC 1 Wiring	SDU CODEC 1 Wiring	SDU CODEC 2 Wiring	SDU CODEC 2 Wiring	Cockpit Signaling Method
14	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE
15	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE

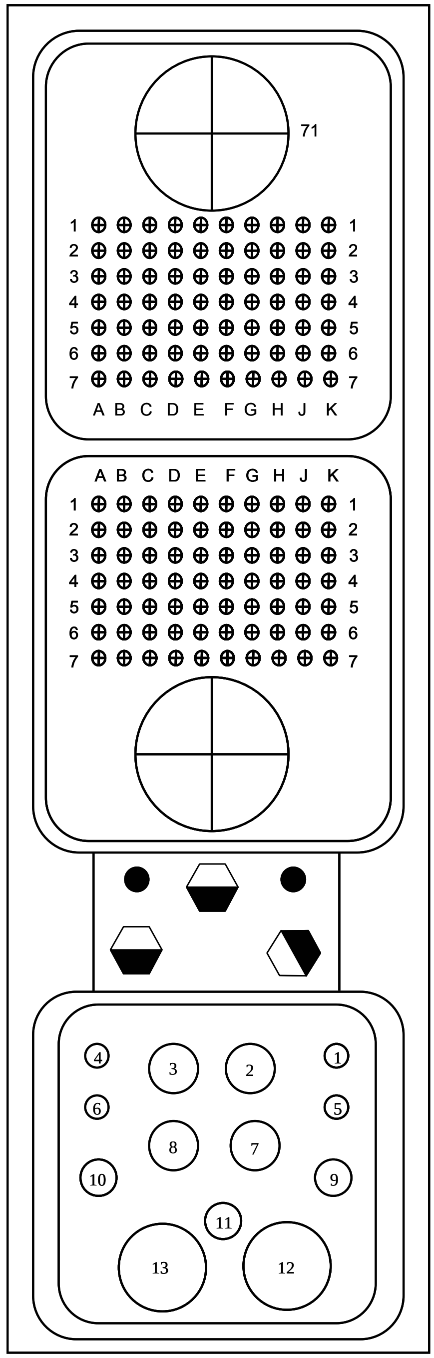
ATTACHMENT 1-5B
SDU MIDDLE PLUG CONNECTOR LAYOUT

	A	B	C	D	E	F	G	H	J	K
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
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
3	Cabin Dig Voice/ Data Out CEPT-E1 A	Cabin Dig Voice/ Data Out CEPT-E1 B	Data From SCDU/WSC #1 A	Data From SCDU/WSC #1 B	Data From SCDU/WSC #2 A	Data From SCDU/WSC #2 B	Data From CMU #2 A	Data From CMU #2 B	Data To SCDU/WSC #1, #2, & #3 A	Data To SCDU/WSC #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
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 or Reserved for Disable Discrete to HSDU	Dual System Disable Discrete I/O
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
7	From Airborne Data Loader A	From Airborne Data Loader B	To Airborne Data Loader A	To Airborne Data Loader B	Reserved Data Bus To HSDU A	Reserved Data Bus To HSDU 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	Spare 429 Input A	Spare 429 Input B	CP Voice Call Light Output #1	CP Voice Mic On Input #1	CP Voice Call Light Output #2	CP Voice Mic On Input #2	Data From SCDU/WSC #3 A	Data From SCDU/WSC #3 B
9	Reserved Data To SNU/CPDF A	Reserved Data To SNU/CPDF B	Spare 429 Output A	Spare 429 Output B	Reserved Data Bus from RFU to SDU, or from HSDU to SDU A	Reserved Data Bus from RFU to SDU or from HSDU to SDU B	Data To RFU A	Data To RFU B	Unspec Function o A	Unspec Function o B
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
11	From Motion Sensor #1	Motion Sensor #1 Program Select	Place/End Call Discrete Input #1	Place/End Call Discrete Input #2	Reserved Unspec Program	Reserved Unspec Program	Strap Option	Reserved Unspec Program	Reserved Unspec Program	Reserved Unspec Program
12	Reserved Crosstalk From Other SDU or HSDU (ARINC 429) A	Reserved Crosstalk From Other SDU or HSDU (ARINC 429) B	Reserved Crosstalk To Other SDU or HSDU (ARINC 429) A	Reserved Crosstalk To Other SDU or HSDU (ARINC 429) B	o	o	Reserved Data From FMC #1 A	Reserved Data From FMC #1 B	Reserved Data From FMC #2 A	Reserved Data From FMC #2 B
13	Reserved for Disable Discrete To HSDU	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
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

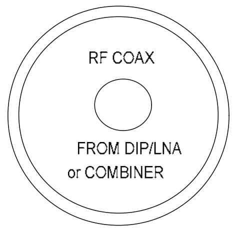


ATTACHMENT 1-6
RFU FORM FACTOR



SIZE 4 MCU #2 Shell Connector

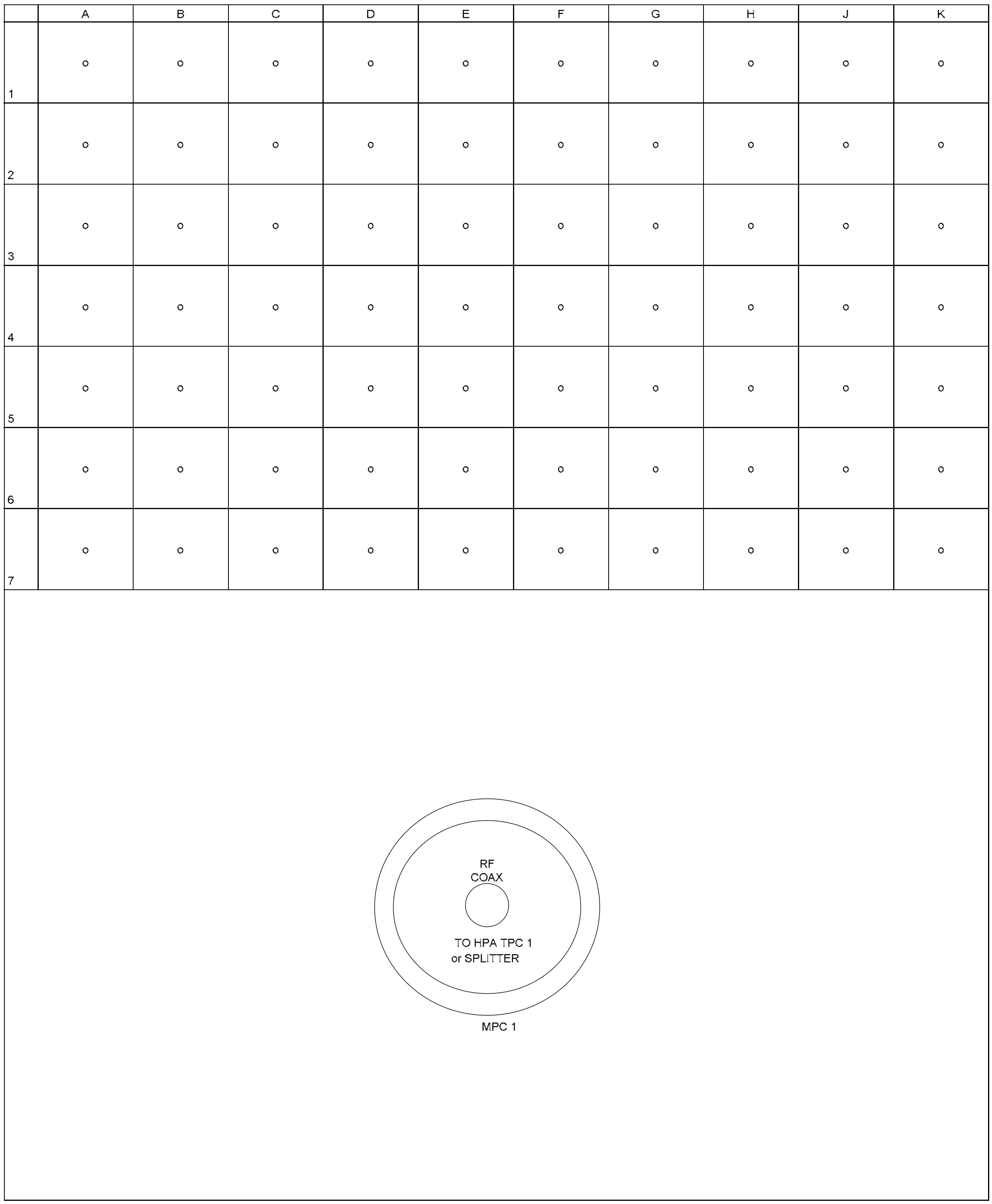
ATTACHMENT 1-6A
RFU TOP PLUG CONNECTOR LAYOUT



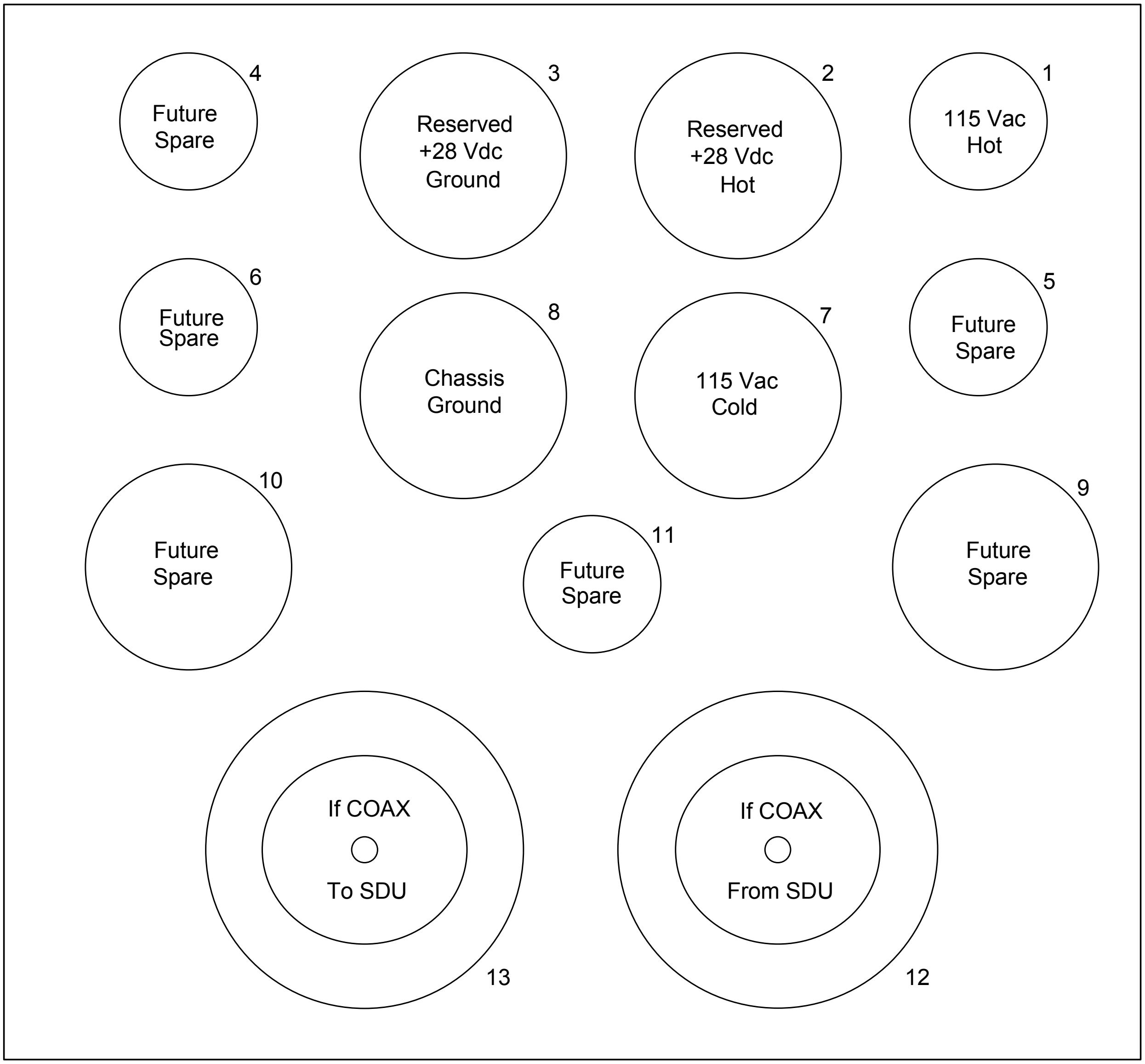
TPC 1

	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 2 A	UNSPEC FUNCTION 2B	UNSPEC FUNCTION 3 A	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 4 A	UNSPEC FUNCTION 4B	UNSPEC FUNCTION 5 A	UNSPEC FUNCTION 5B	UNSPEC FUNCTION 6 A	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

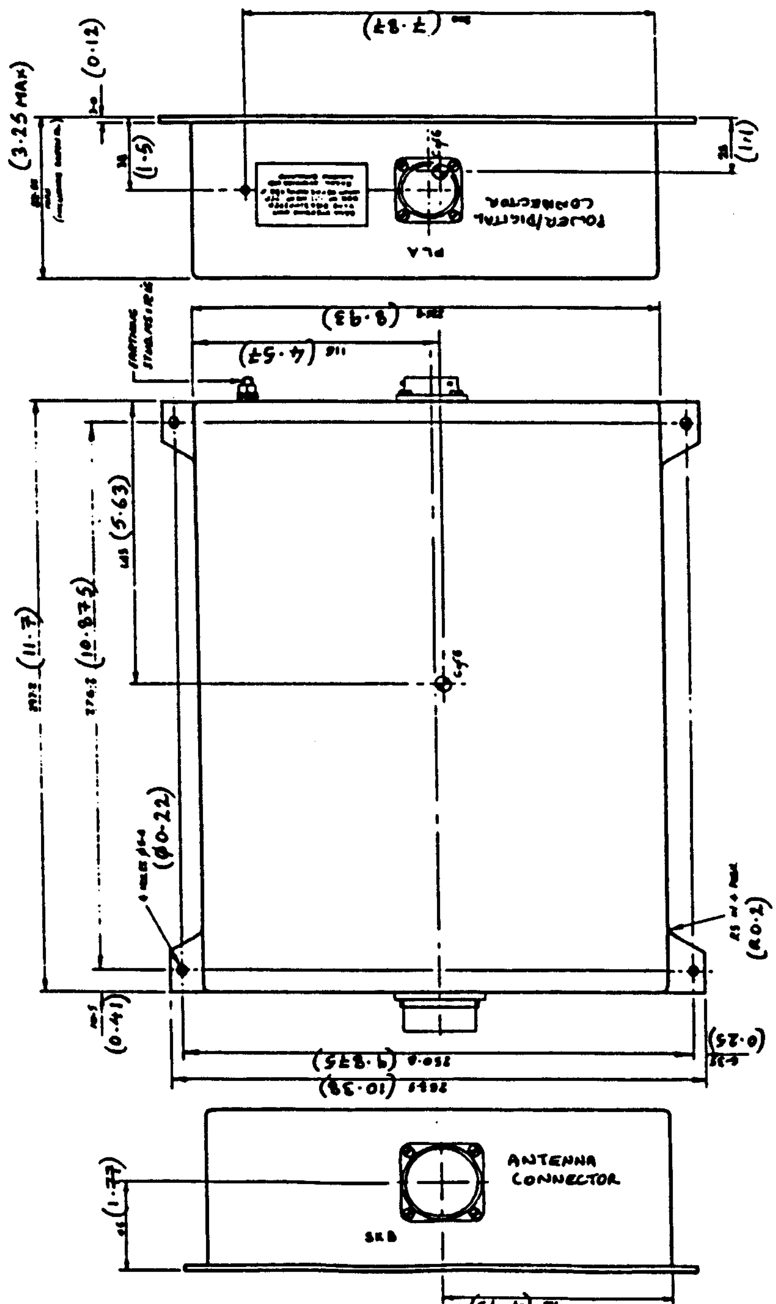
ATTACHMENT 1-6B
RFU MIDDLE PLUG CONNECTOR LAYOUT



ATTACHMENT 1-6C
RFU TOP PLUG CONNECTOR LAYOUT

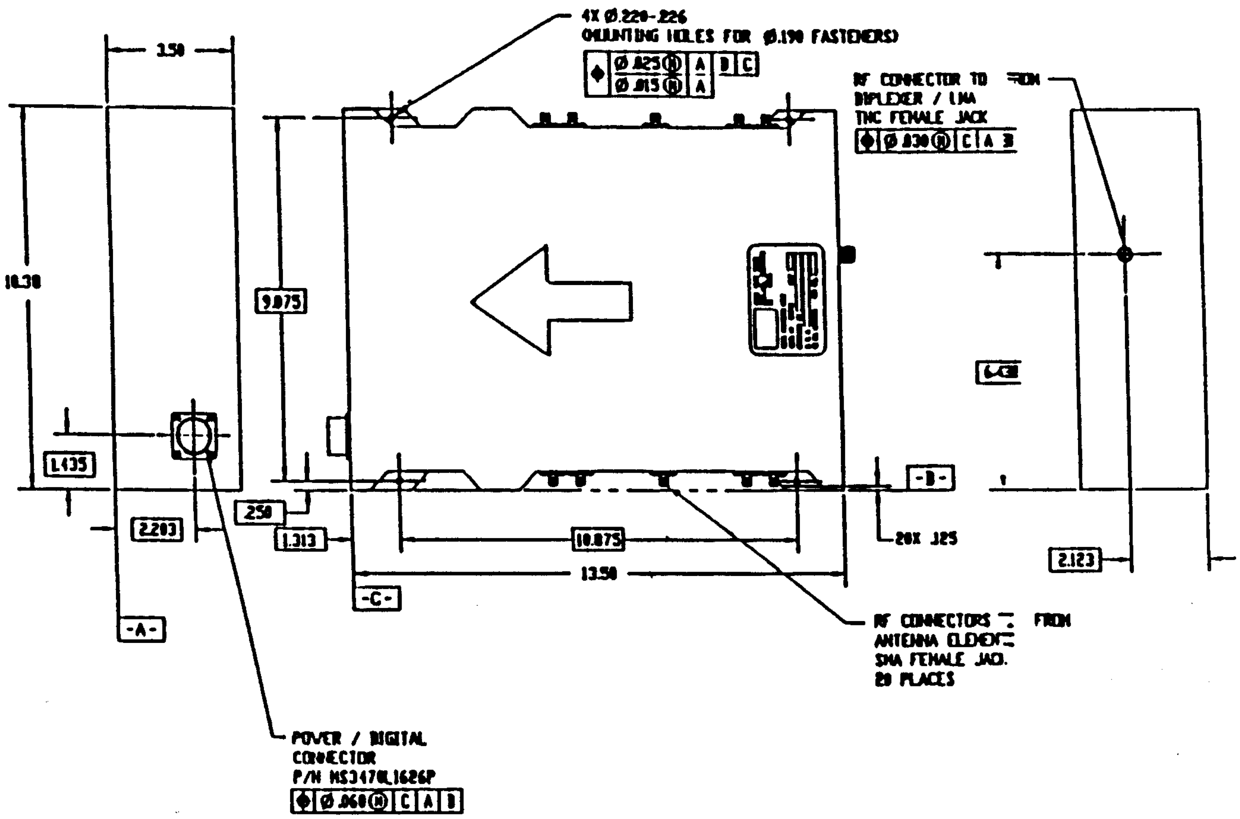


ATTACHMENT 1-7A
BEAM STEERING UNIT (BSU) – "ALTERNATE A"



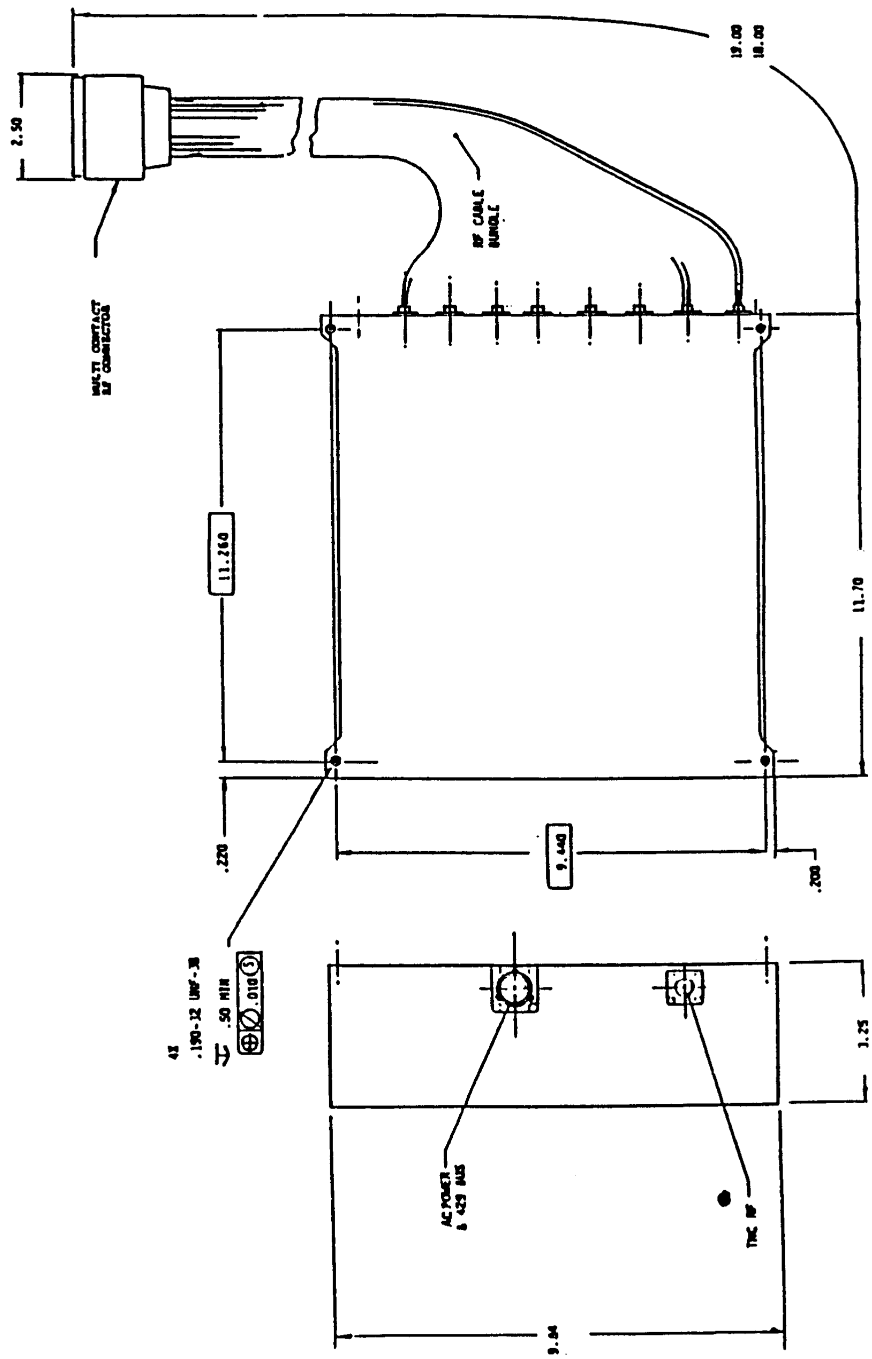
Note: RF BSU Connector should be installed within 10 feet of the antenna.
Dimensions are mm (inches).

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

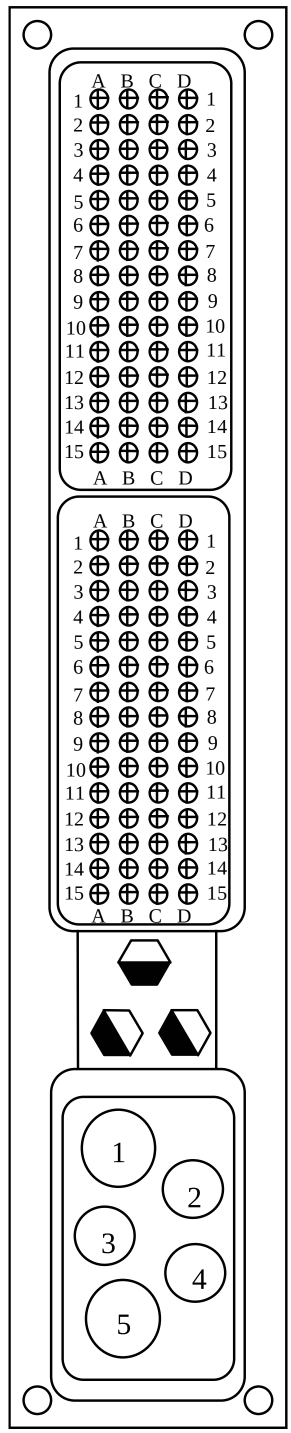


Note: Smaller enclosure may be utilized if mounting hole provisions are maintained.

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

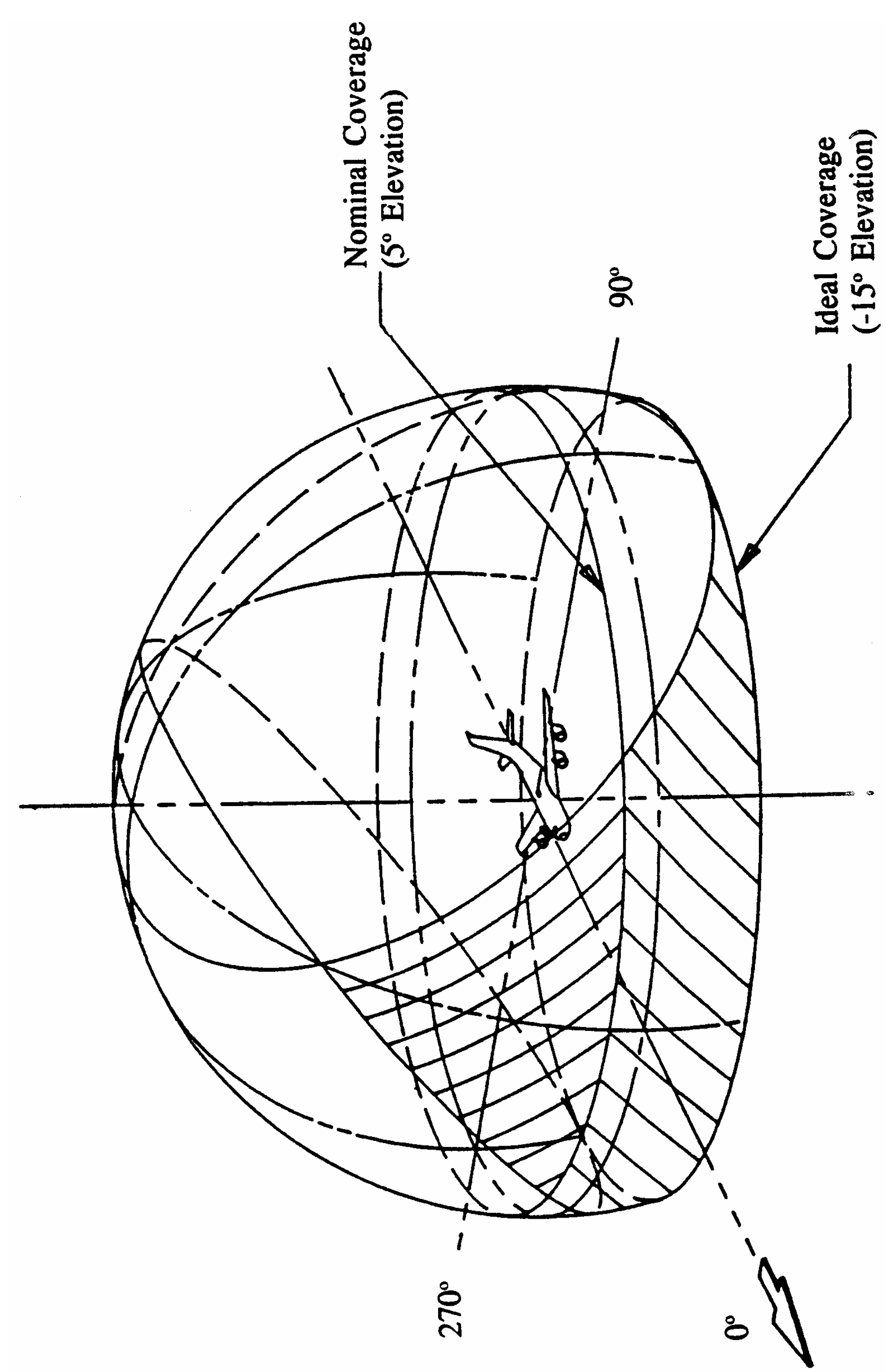


ATTACHMENT 1-7D
2MCU BEAM STEERING UNIT (BSU)
REAR CONNECTOR CONFIGURATION



Size 2 MCU #1 Shell Connector

ATTACHMENT 1-8
ANTENNA COVERAGE



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

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

ATTACHMENT 1-8
ANTENNA COVERAGE

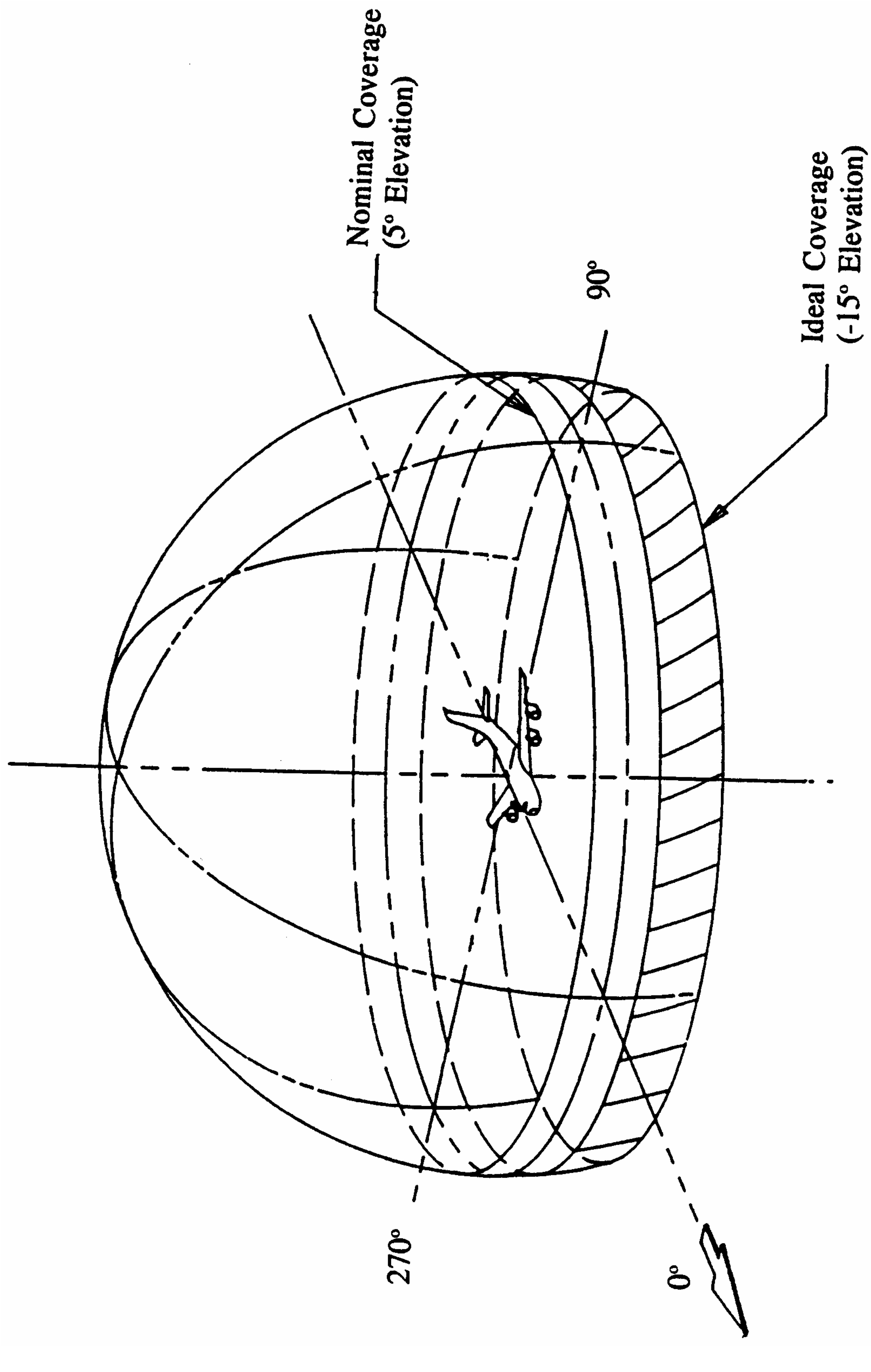


Figure 2 – Single Top Mounted, Mechanically Steered Antenna Coverage Region

ATTACHMENT 1-8
ANTENNA COVERAGE

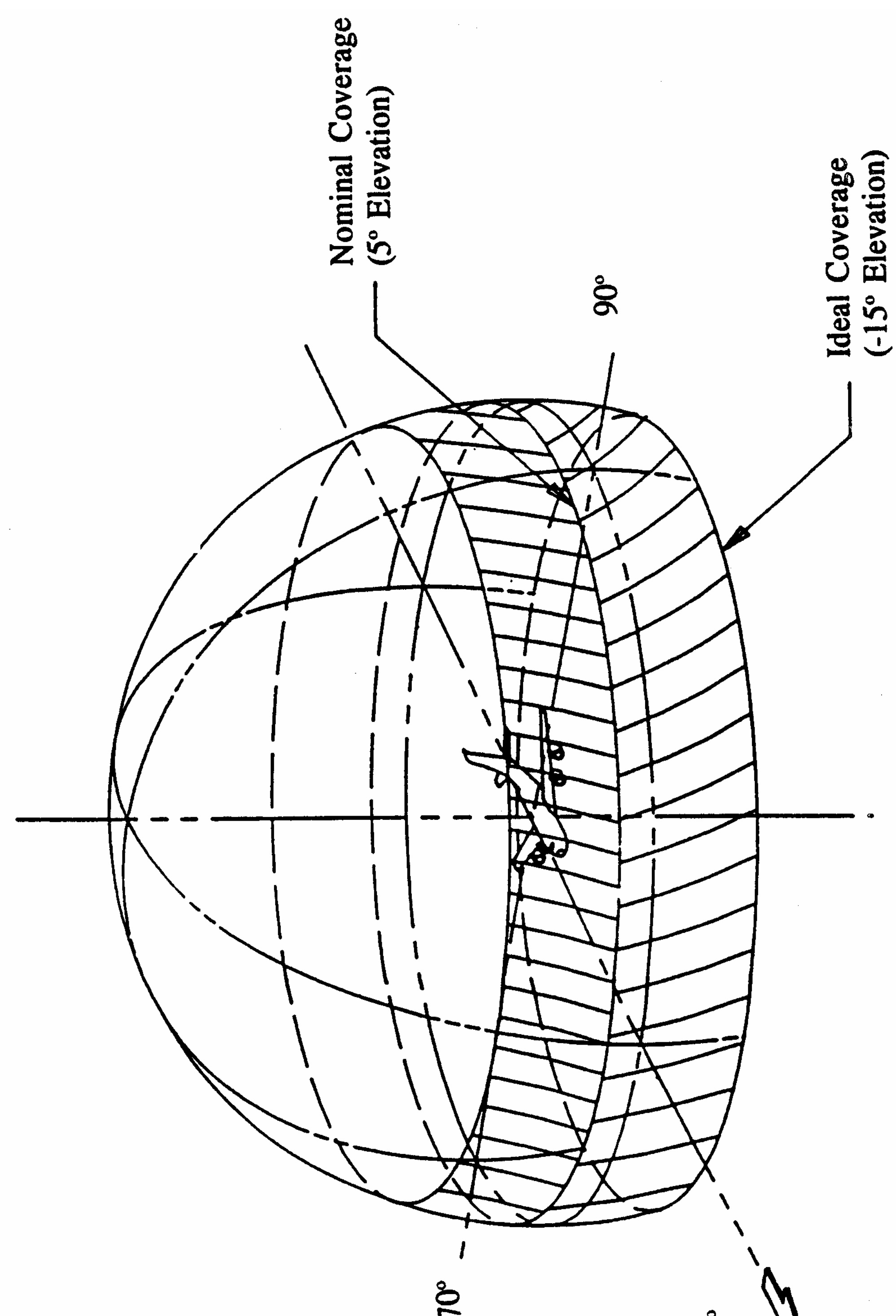
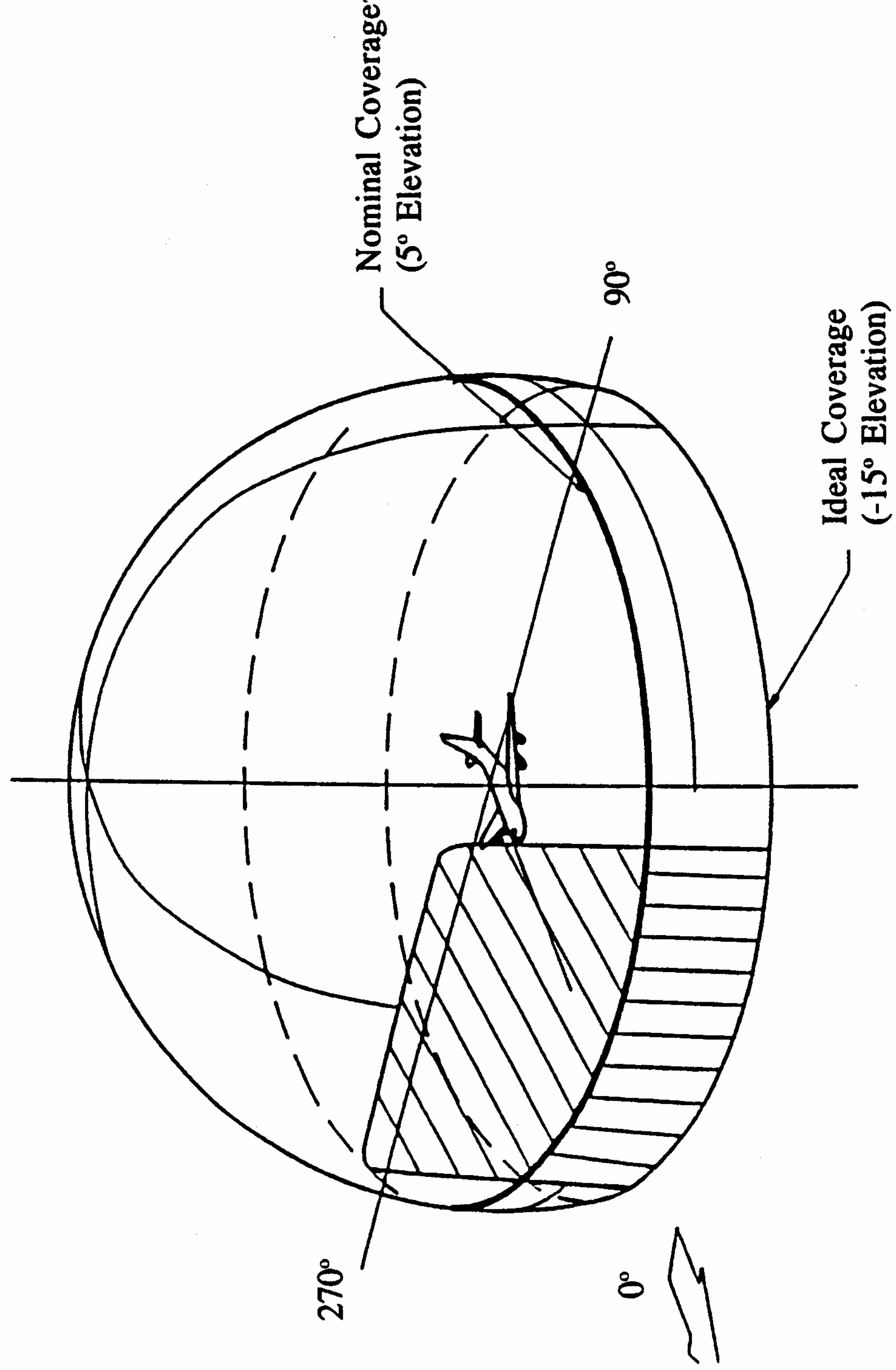


Figure 3 – Top Mounted, Electronically Steered, Low profile Antenna Coverage Region

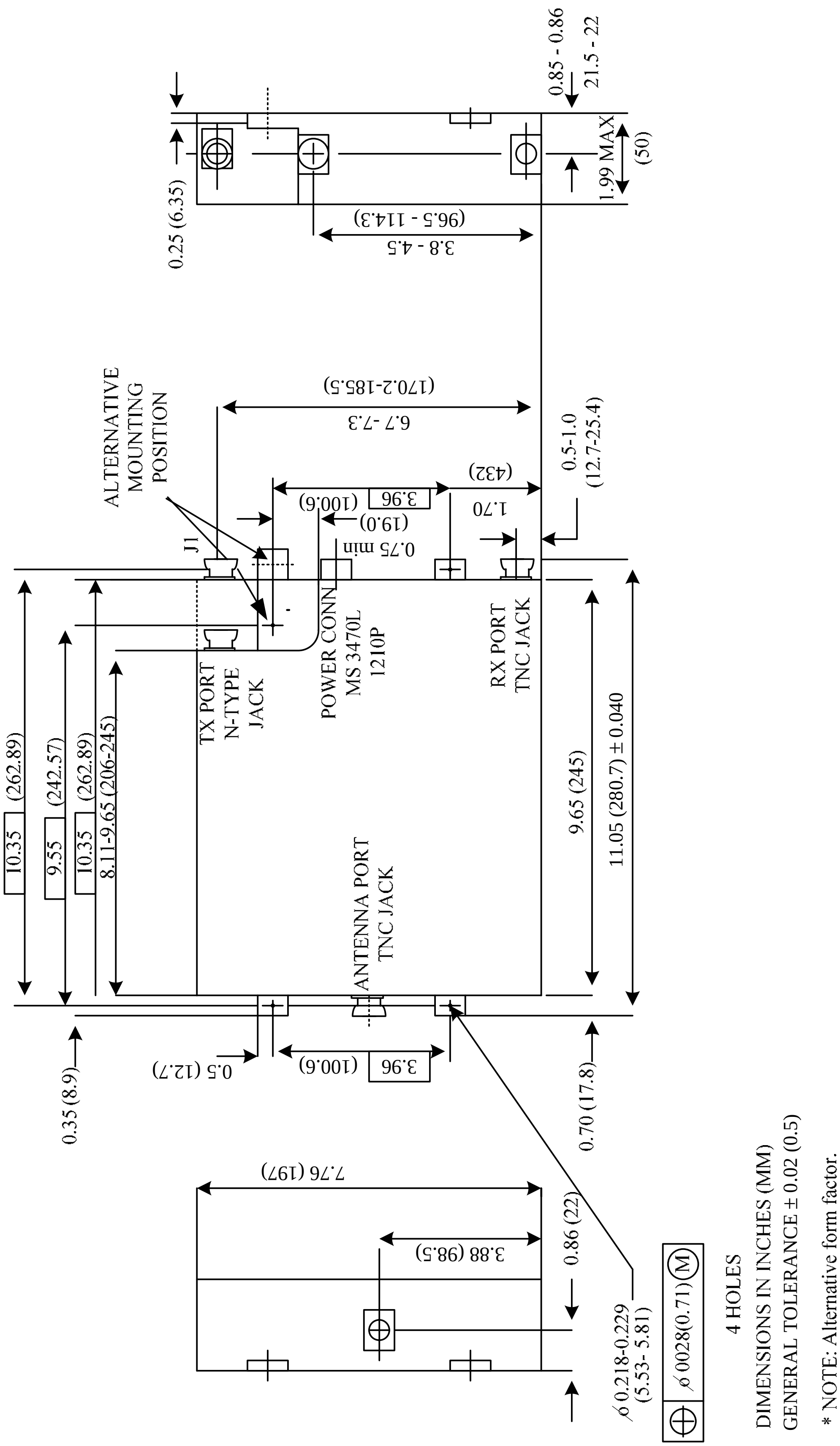
ATTACHMENT 1-8
ANTENNA COVERAGE



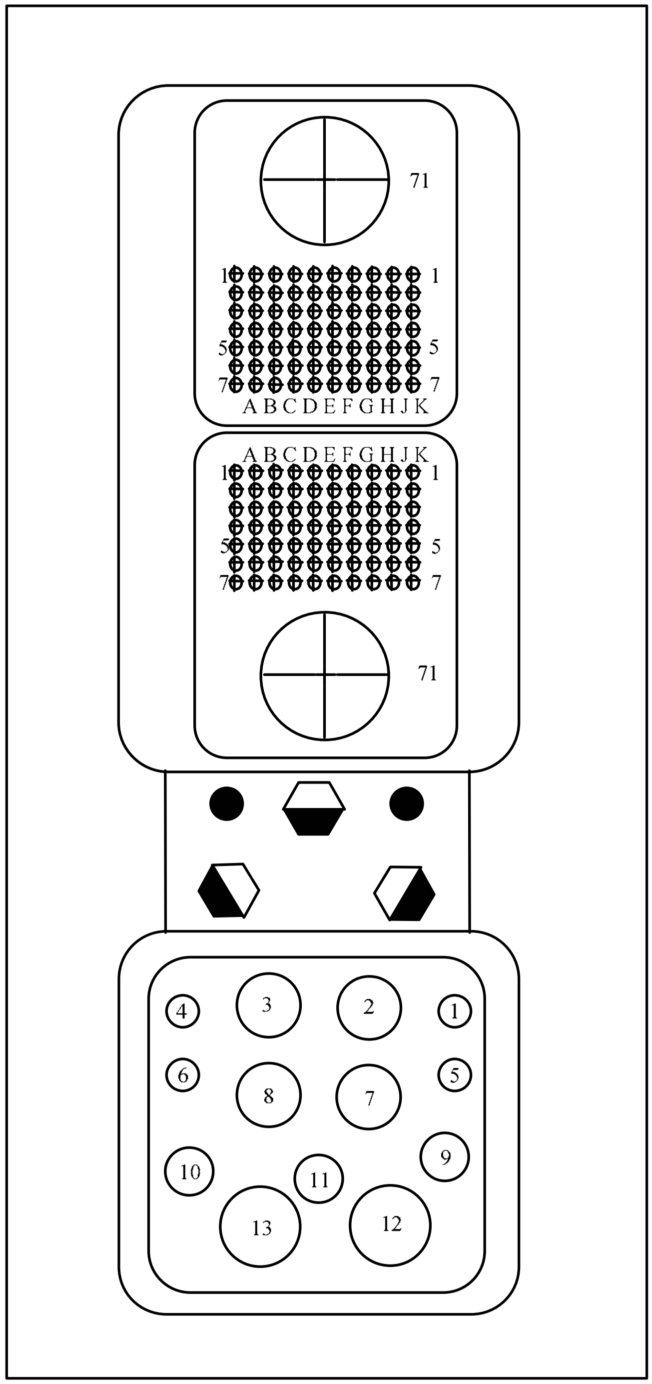
Note: This coverage results in a fore and aft “keyhole.”

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

ATTACHMENT 1-9A
TYPE A, MODIFIED TYPE A, AND TYPE D – DIPLEXER/LNA FORM FACTOR

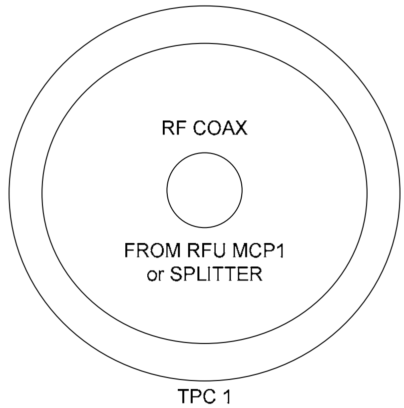


ATTACHMENT 1-10
HPA FORM FACTOR



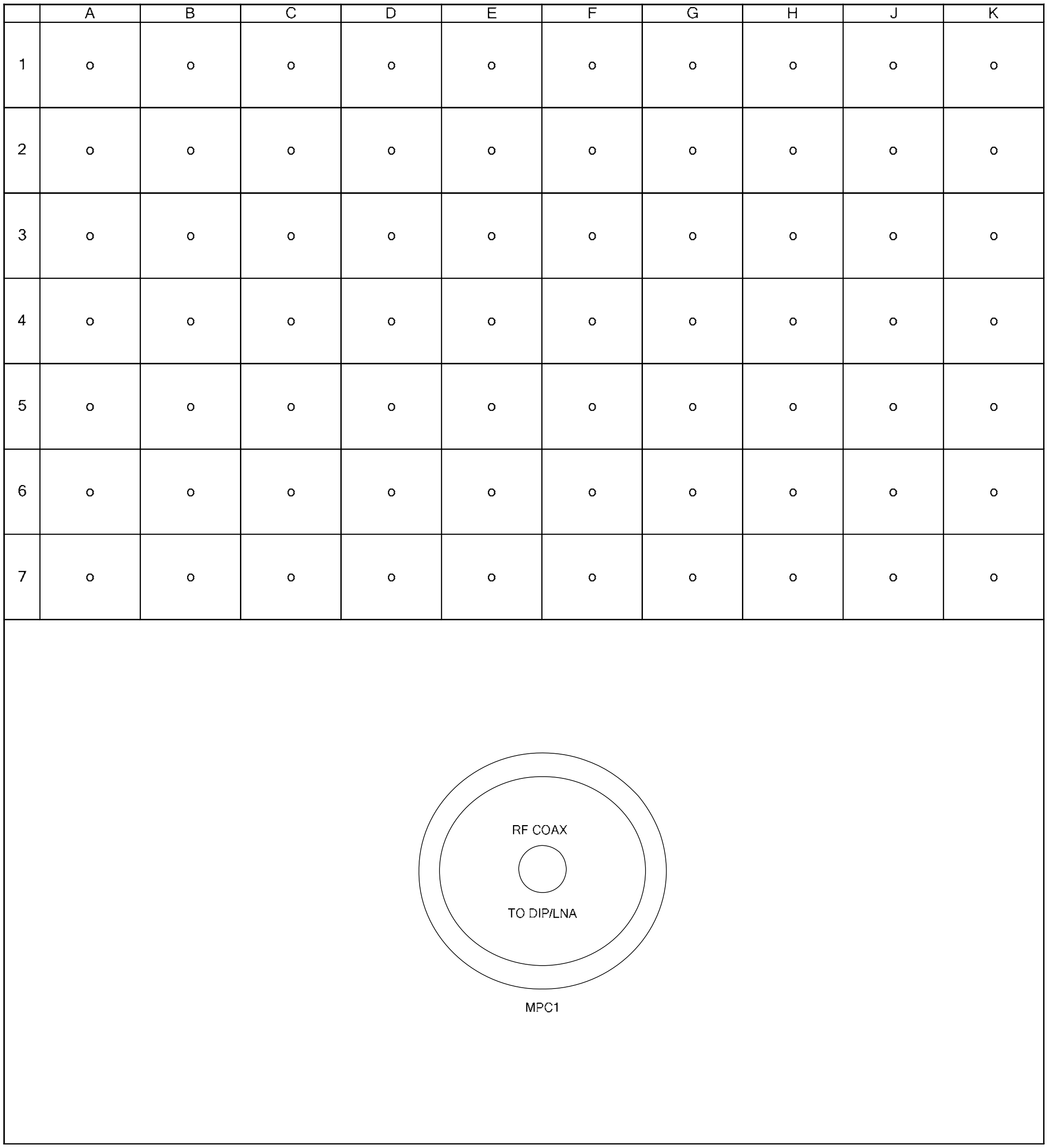
SIZE 4 or 8 MCU – #2 Shell Connector

ATTACHMENT 1-10A
HPA TOP PLUG CONNECTOR LAYOUT

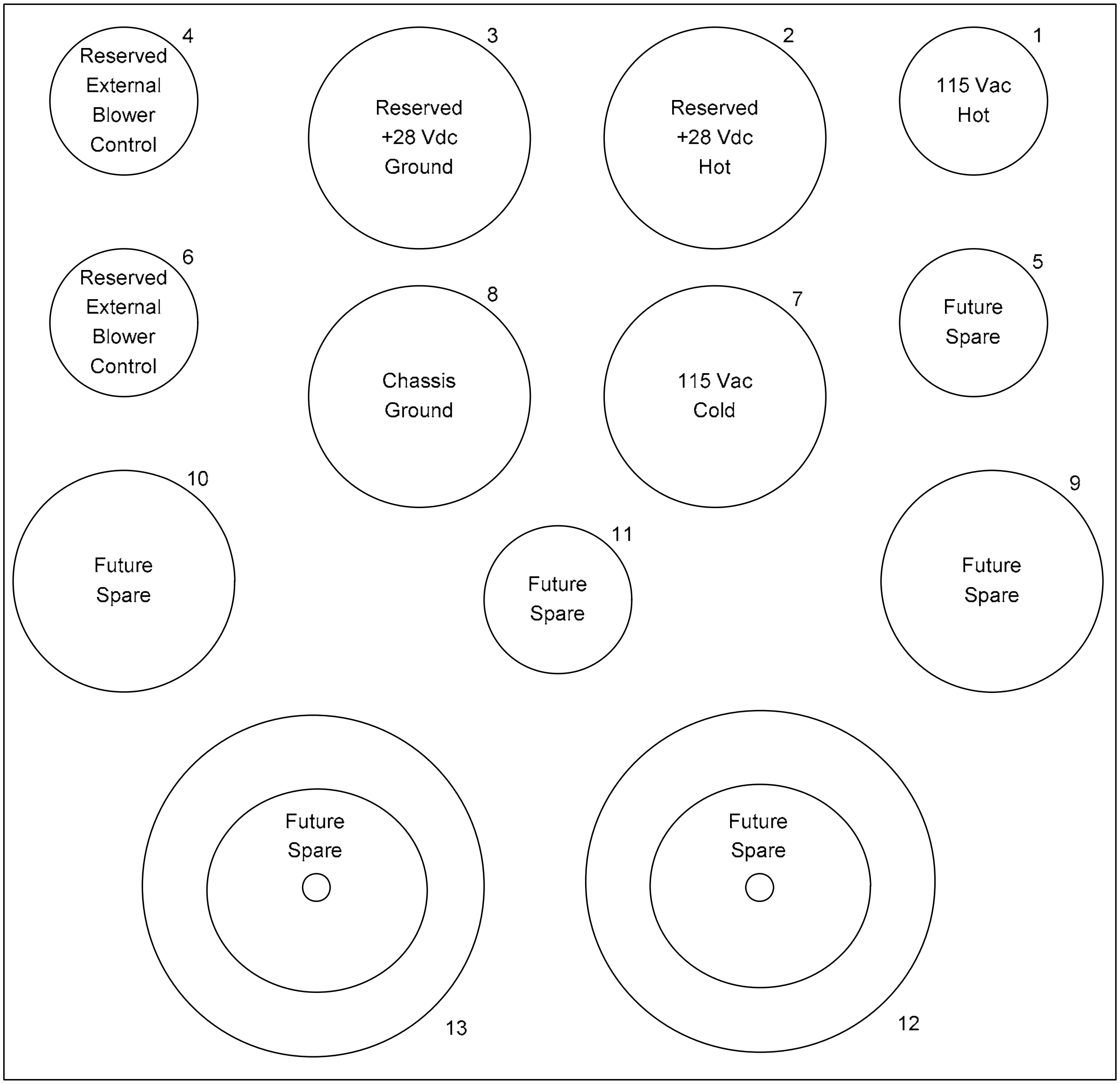


	A	B	C	D	E	F	G	H	J	K
1	INPUT MULTI-CTL A	INPUT MULTI-CTL B	OUTPUT HPA BITE A	OUTPUT HPA BITE B	FROM AIRBORNE DATA LDR A	FROM AIRBORNE DATA LDR B	TO AIRBORNE DATA LDR A	TO AIRBORNE DATA LDR B	DATA LOADER LINK A	DATA LOADER LINK B
2	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	SPARE DISCRETE INPUT	FUTURE SPARE	FUTURE SPARE	SPARE DISCRETE OUTPUT	FUTURE SPARE	FUTURE SPARE
3	TOP/PORT HPA (1) A	TOP/PORT HPA (1) B	STRB HPA (2) A	STRB HPA (2) B	o	o	o	o	o	o
4	o	o	o	o	o	o	o	o	o	o
5	SDI #1	SDI #2	o	SDI COMMON	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

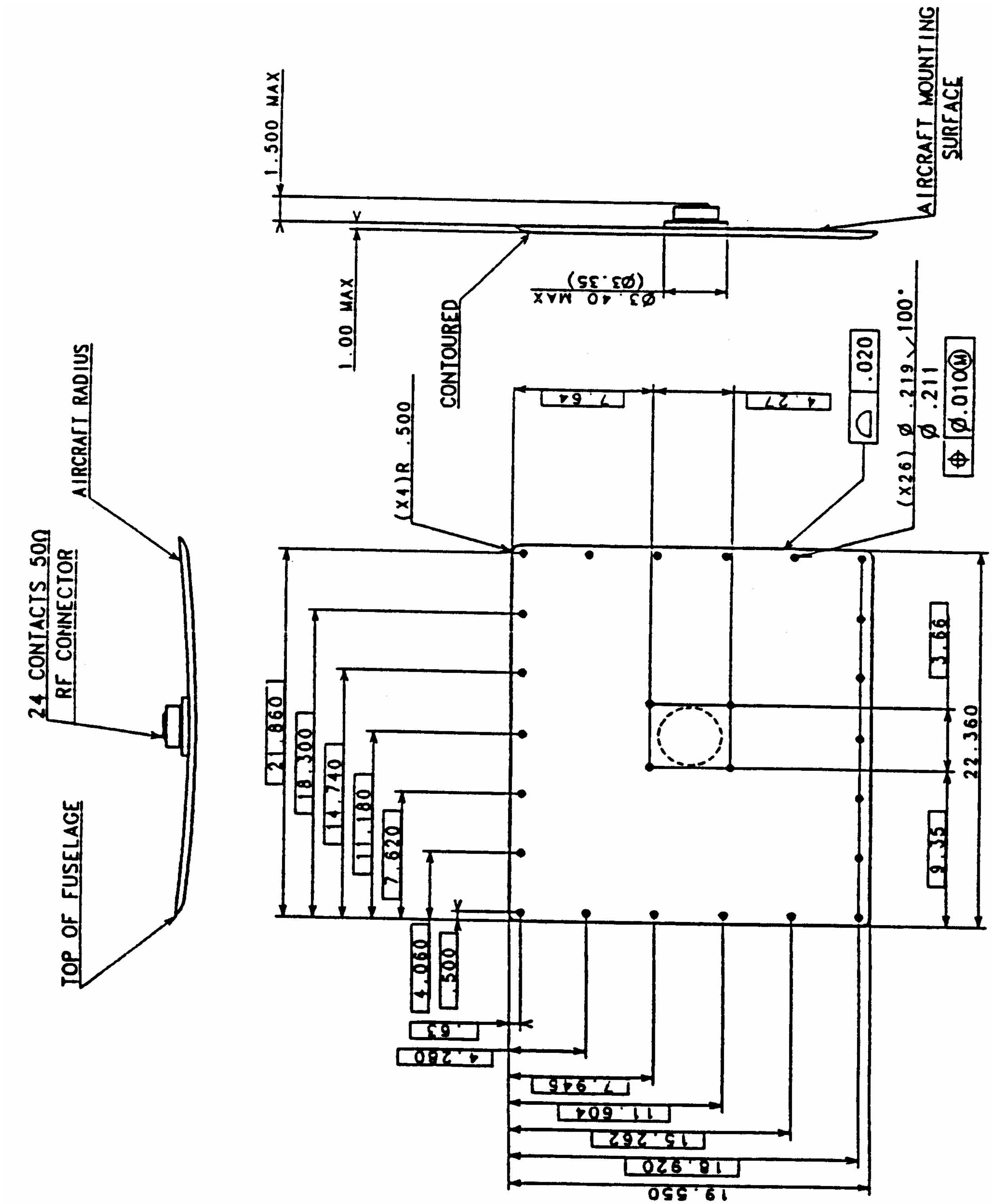
ATTACHMENT 1-10B
HPA MIDDLE PLUG CONNECTOR LAYOUT



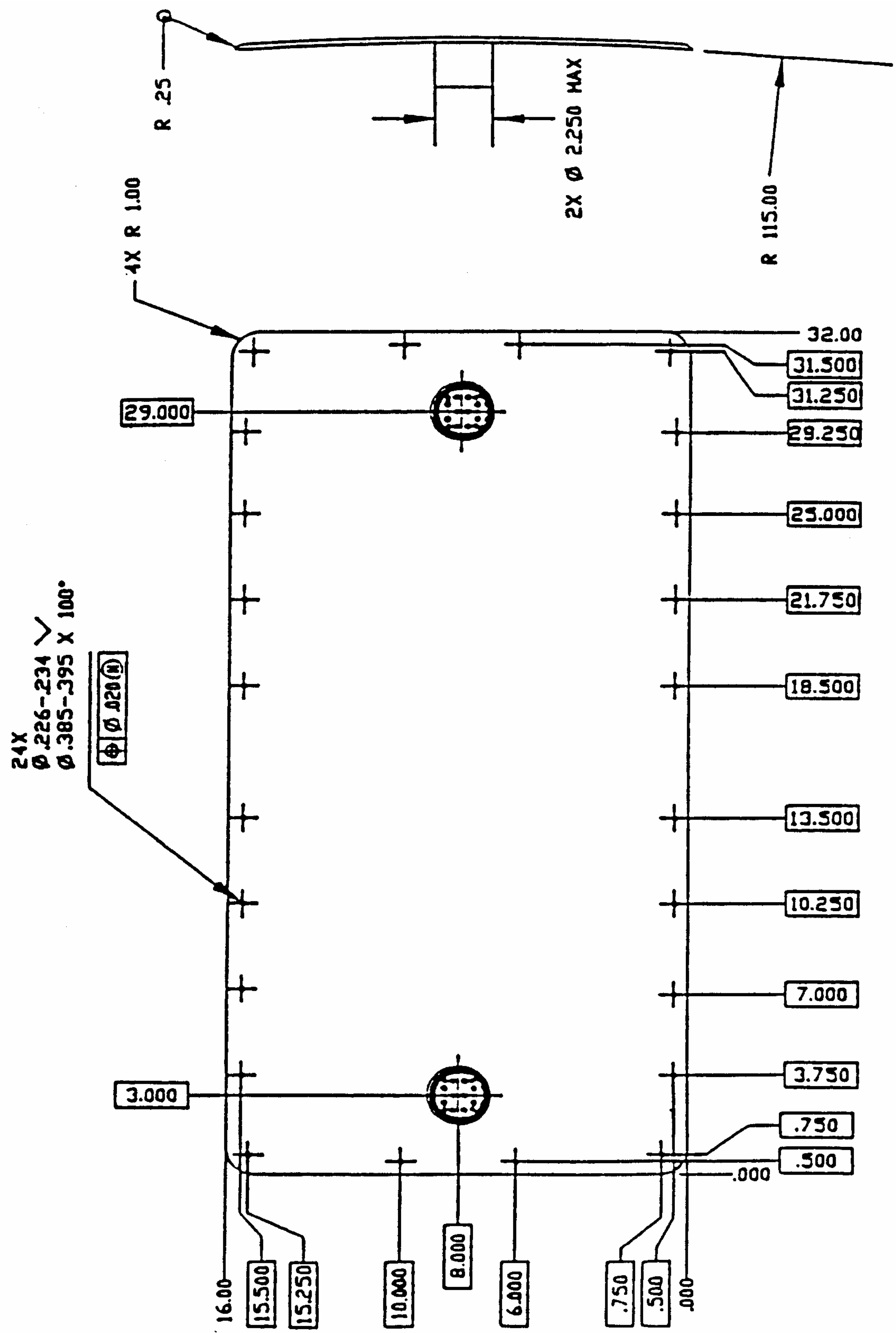
ATTACHMENT 1-10C
HPA BOTTOM PLUG CONNECTOR LAYOUT



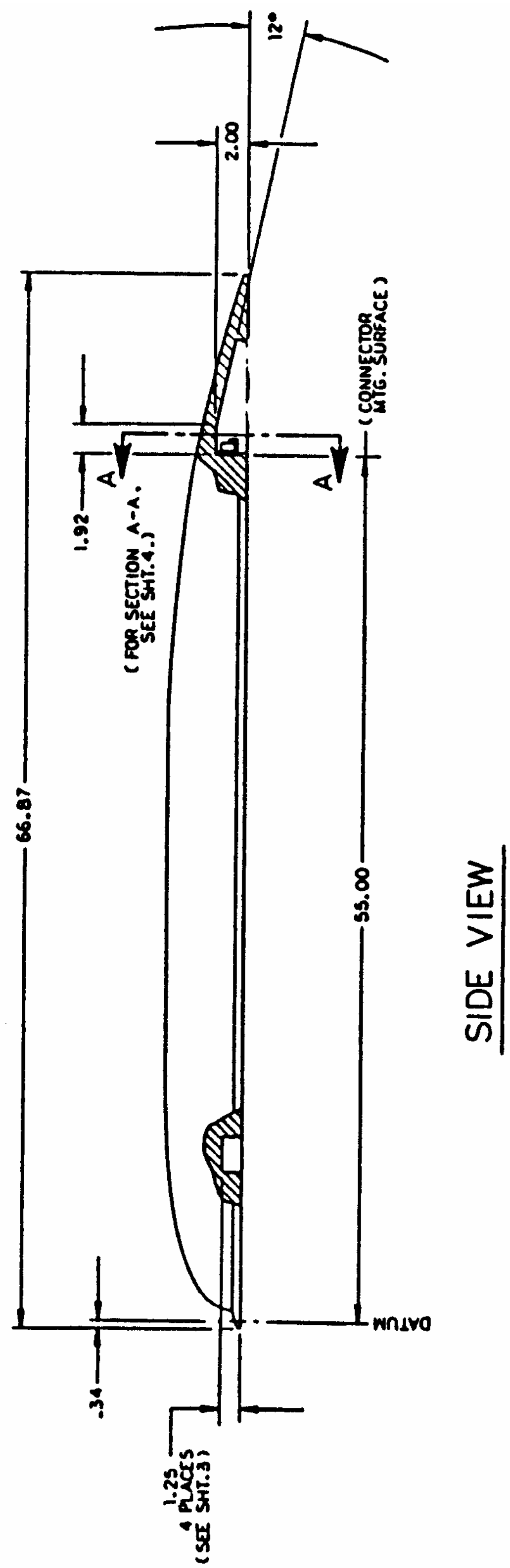
ATTACHMENT 1-11A
HIGH-GAIN ANTENNA FORM FACTOR
"CONFORMAL-PHASED ARRAY ANTENNA 19.55 X 22.36 INCHES"



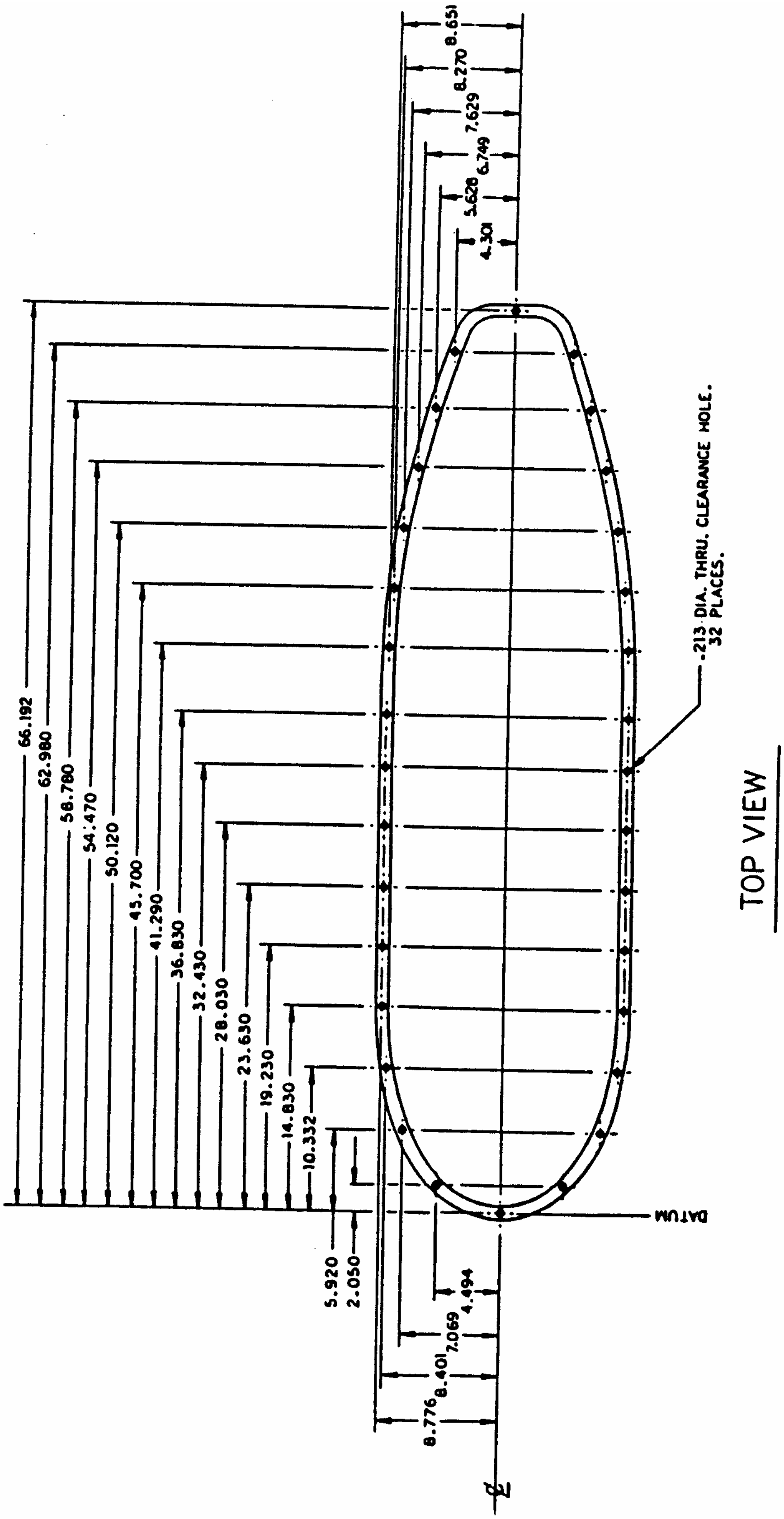
ATTACHMENT 1-11B
HIGH-GAIN ANTENNA FORM FACTOR
"CONFORMAL-PHASED ARRAY ANTENNA 16 x 32 INCHES"



ATTACHMENT 1-11C
TOP-MOUNTED LOW-PROFILE ARRAY -12 dBic
(SIDE VIEW)



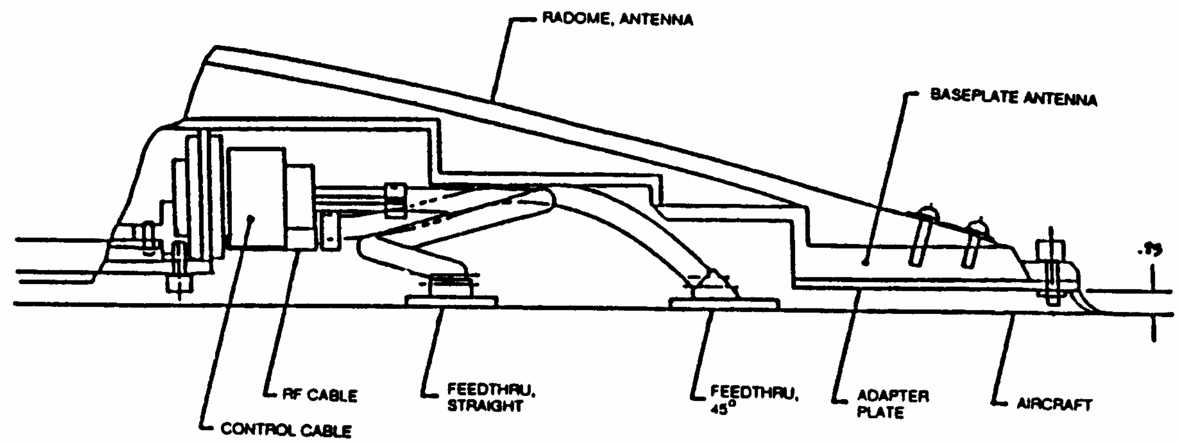
ATTACHMENT 1-11D
TOP MOUNTED LOW -PROFILE ARRAY -12 dBic
(TOP VIEW)



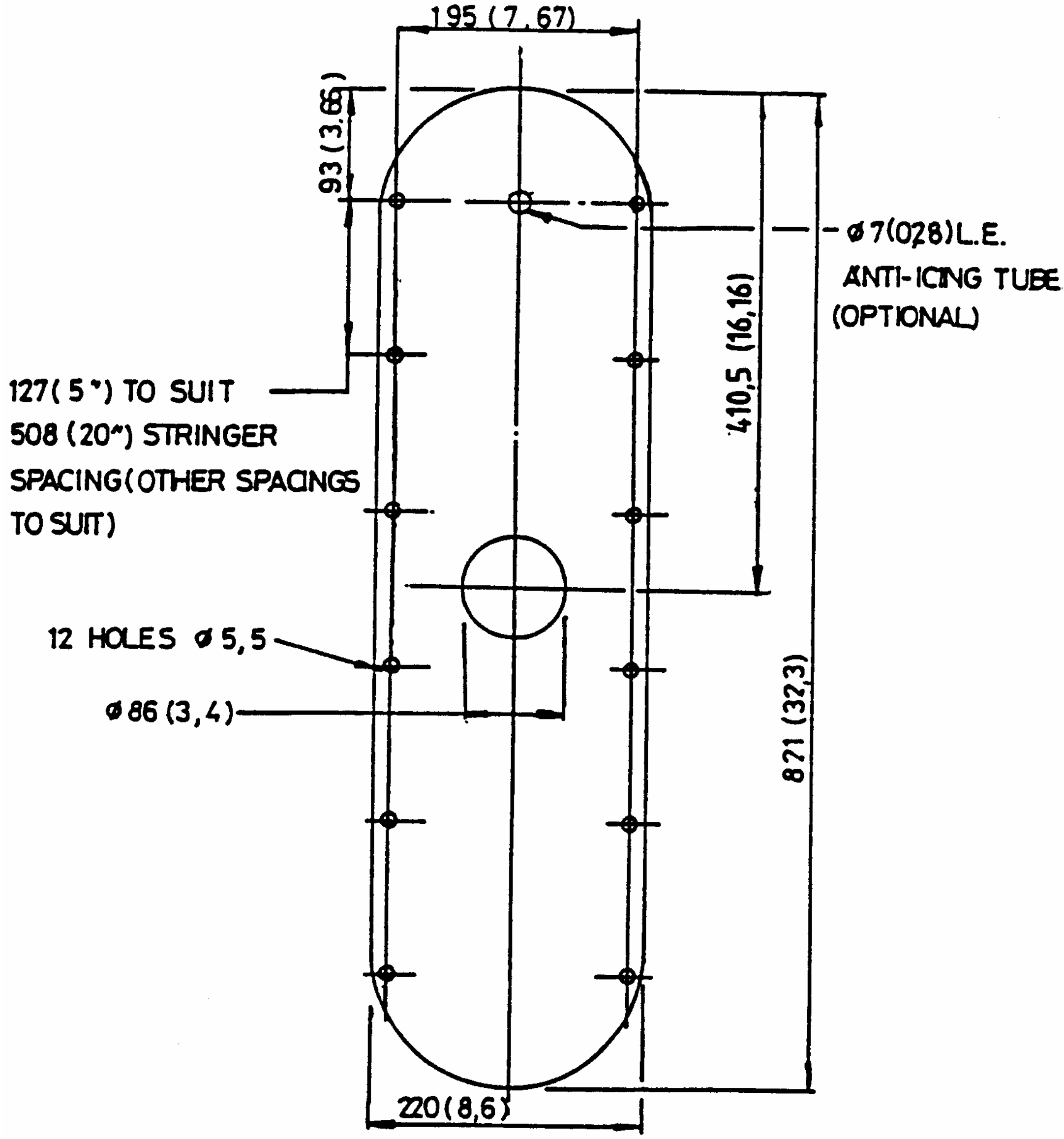
NOTES:

1. ALL DIMENSIONS ARE SYMETRICAL ABOUT ℄ UNLESS OTHERWISE INDICATED.

ATTACHMENT 1-11E
CLOSEUP VIEW OF THE COAXIAL INTERFACE
TOP MOUNTED LOW-PROFILE ARRAY -12dBic

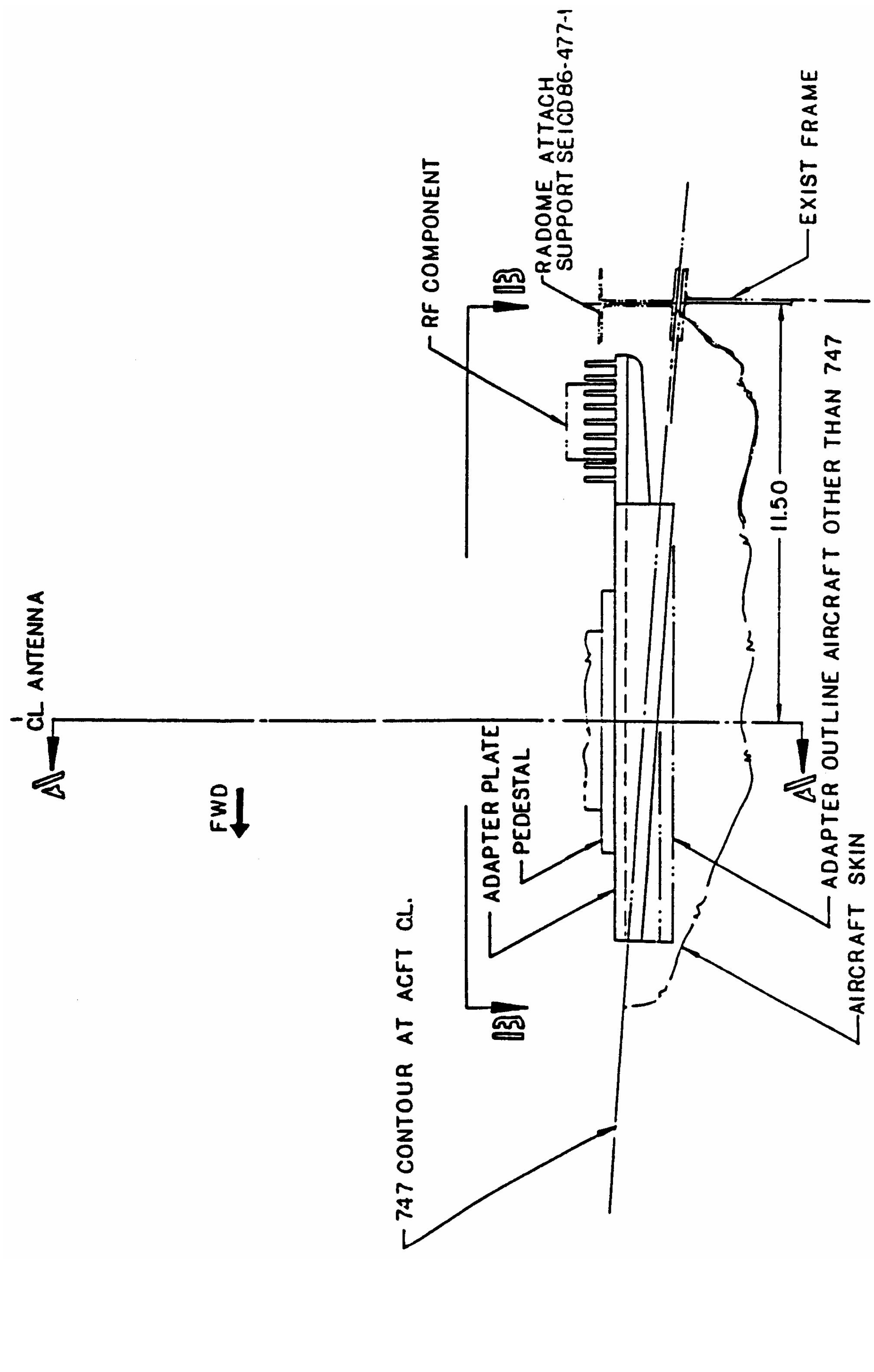


ATTACHMENT 1-11F
BLADE ANTENNA HIGH-GAIN FOOTPRINT

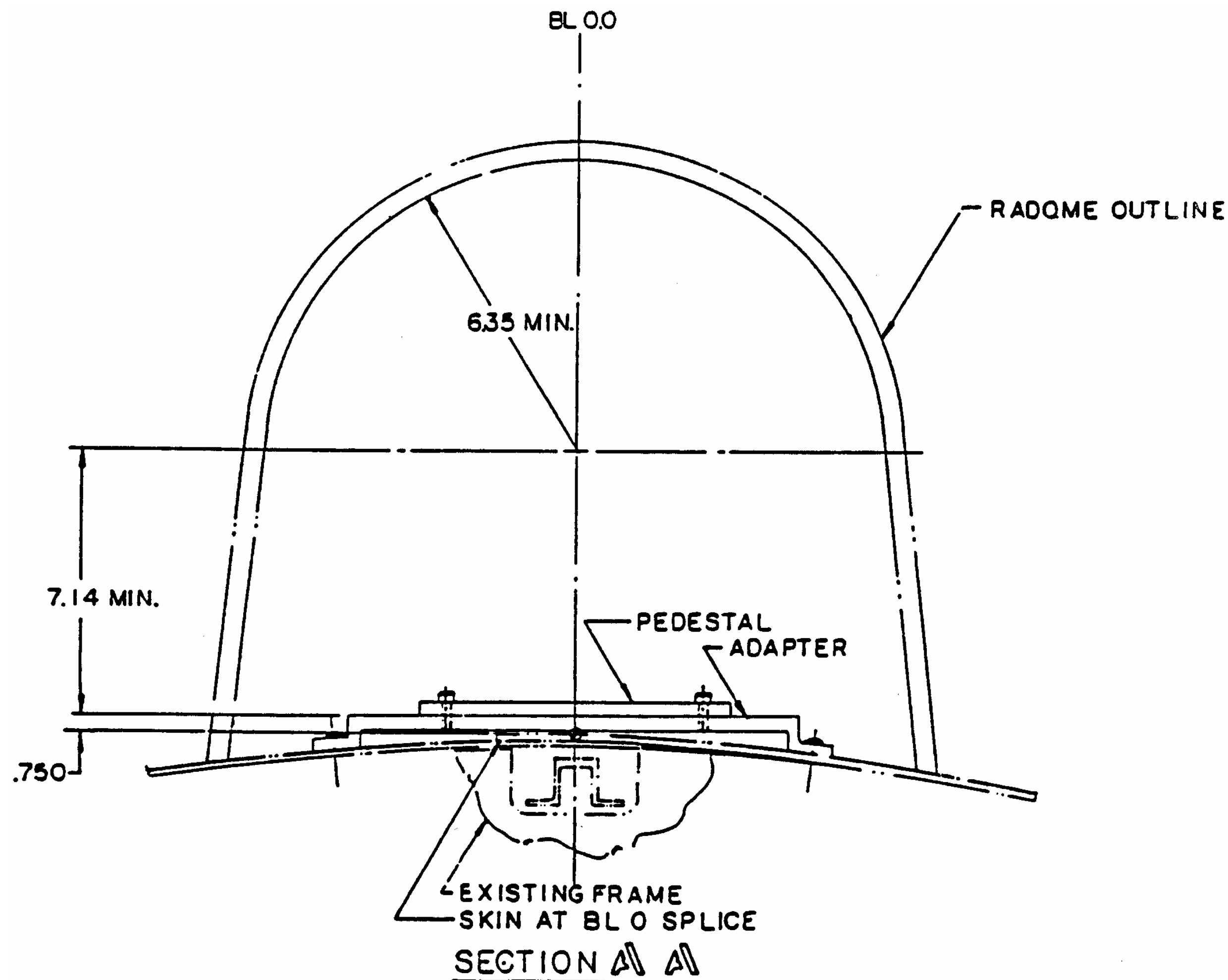


Note: Maximum height is 20 inches. Dimensions in mm (inches).

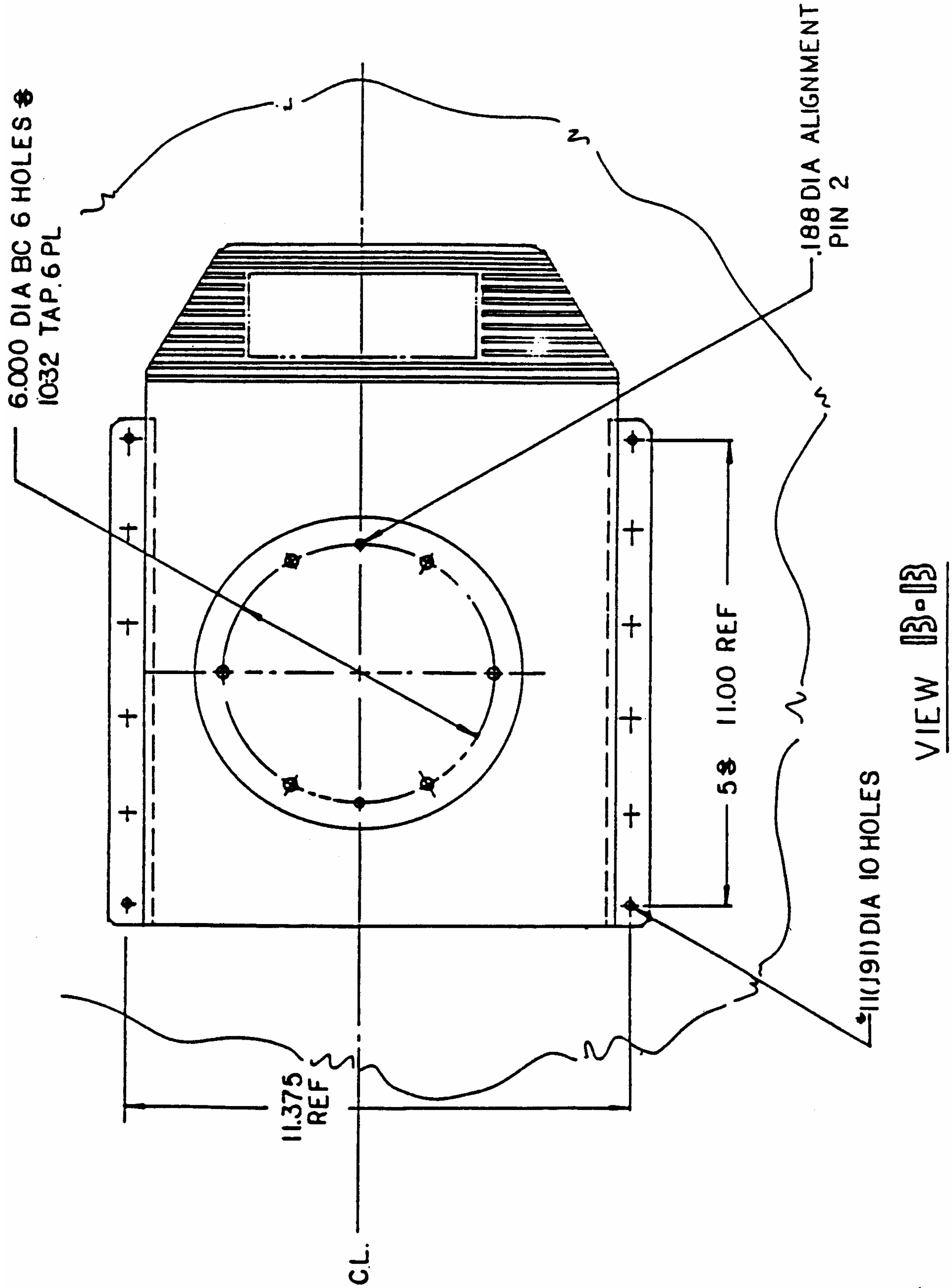
ATTACHMENT 1-11G-1
INTERFACE CONTROL DRAWING FOR 747 FUSELAGE-MOUNTED MECHANICALLY STEERED HIGH-GAIN ANTENNA SUBSYSTEM



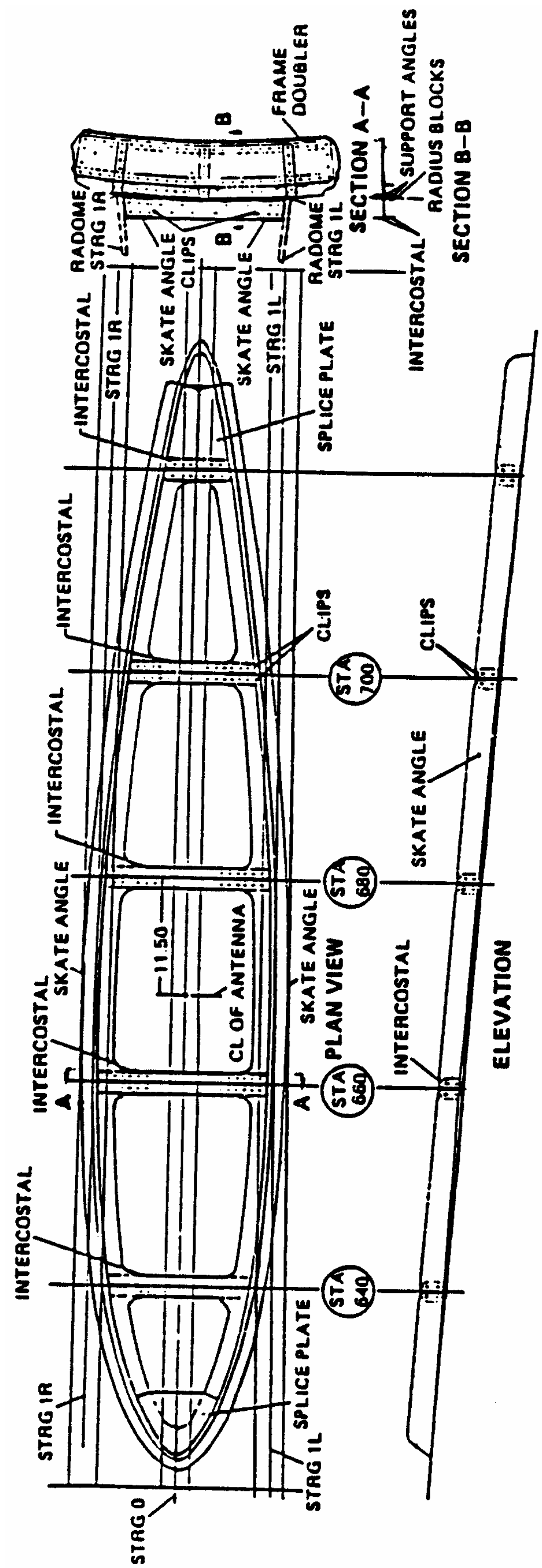
ATTACHMENT 1-11G-2
RADOME OUTLINE



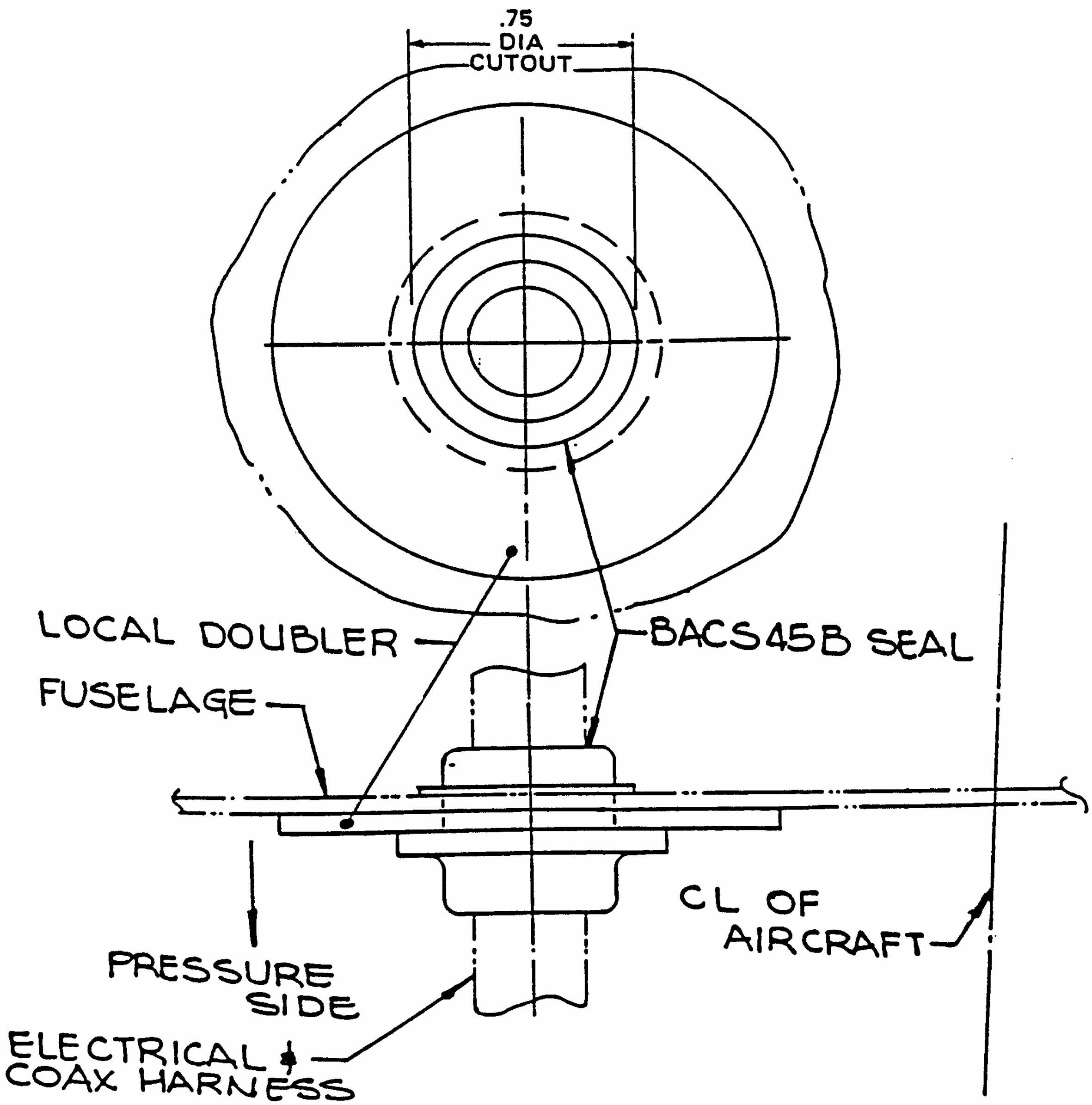
ATTACHMENT 1-11G-3
TOP VIEW



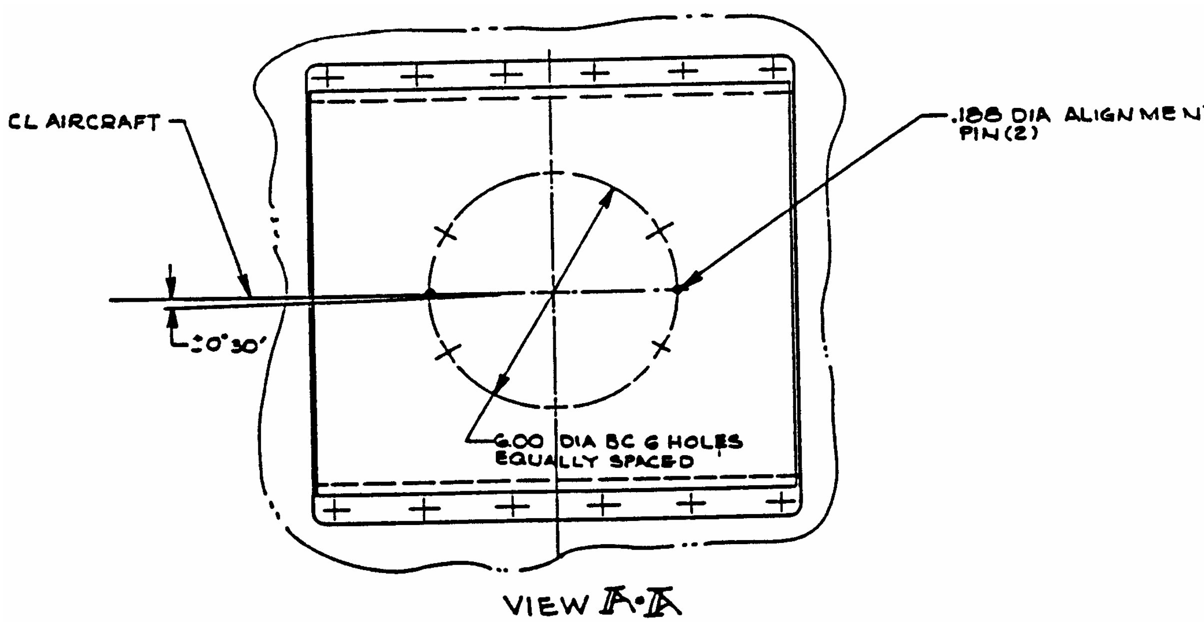
ATTACHMENT 1-11G-4
STRINGER LOCATIONS



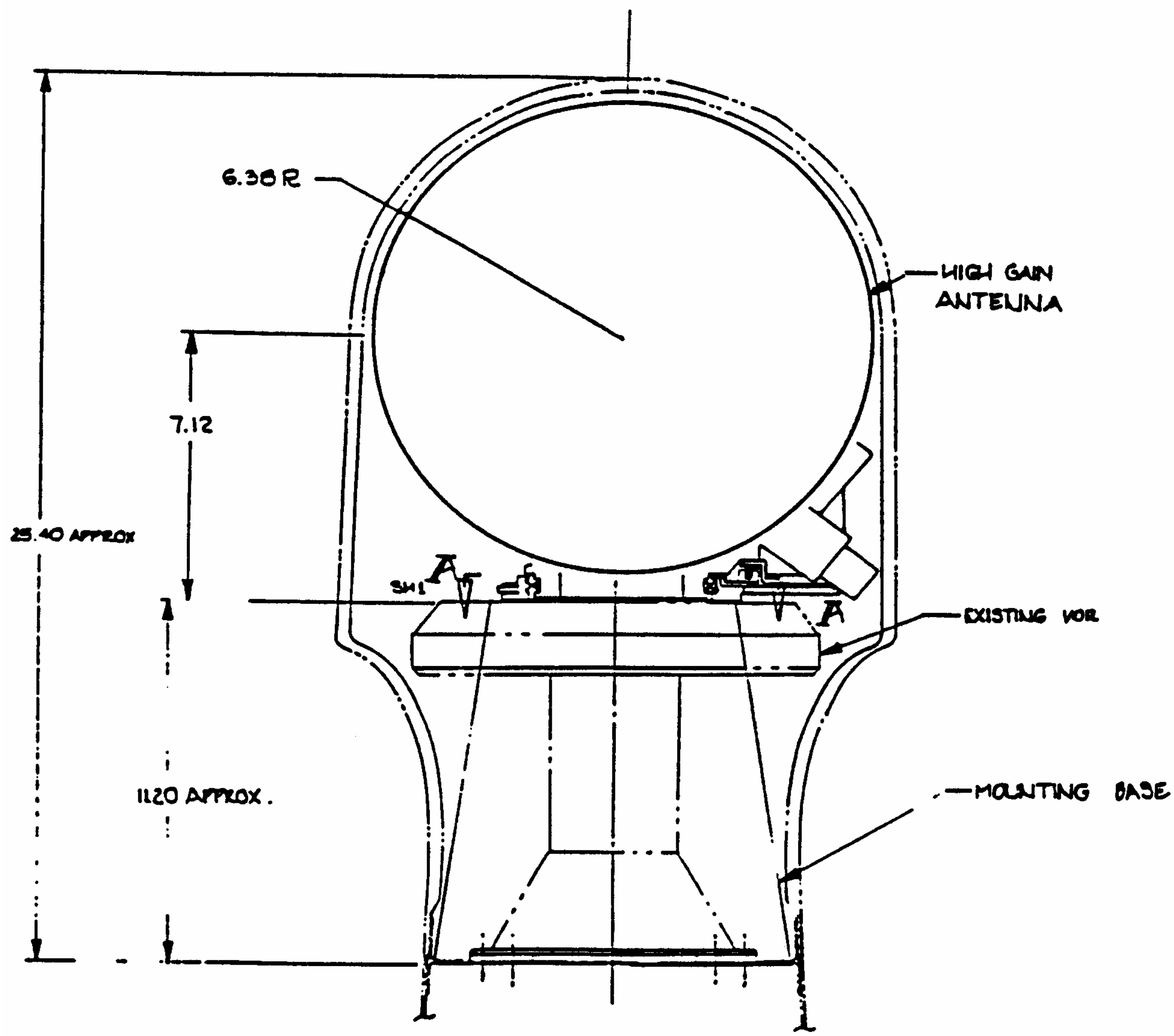
ATTACHMENT 1-11G-5
DOUBLER OUTLINE



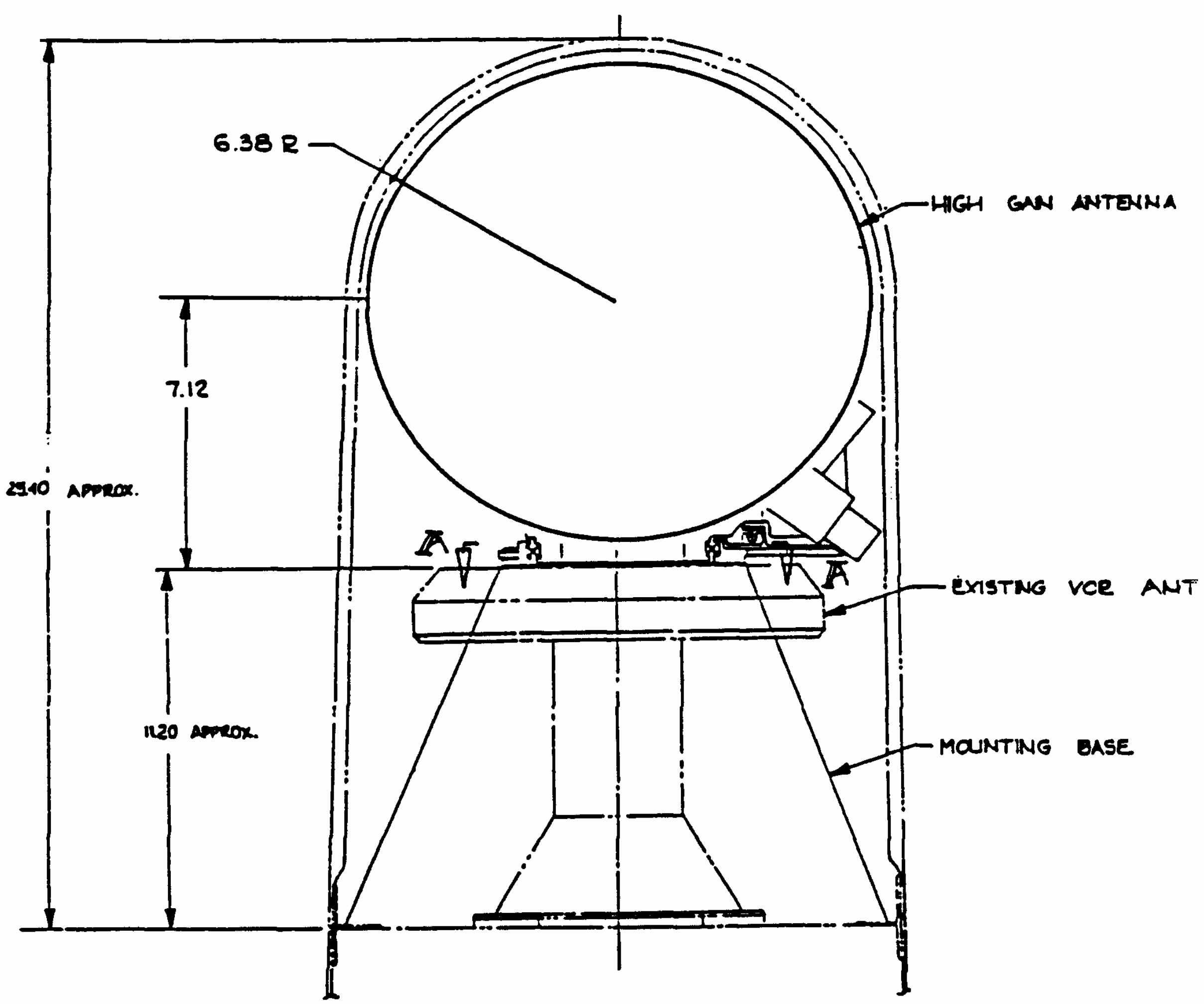
ATTACHMENT 1-11H-1
INTERFACE CONTROL DRAWING FOR 747 VERTICAL STABLIZER
MECHANICALLY STEERED HIGH-GAIN ANTENNA SUBSYSTEM



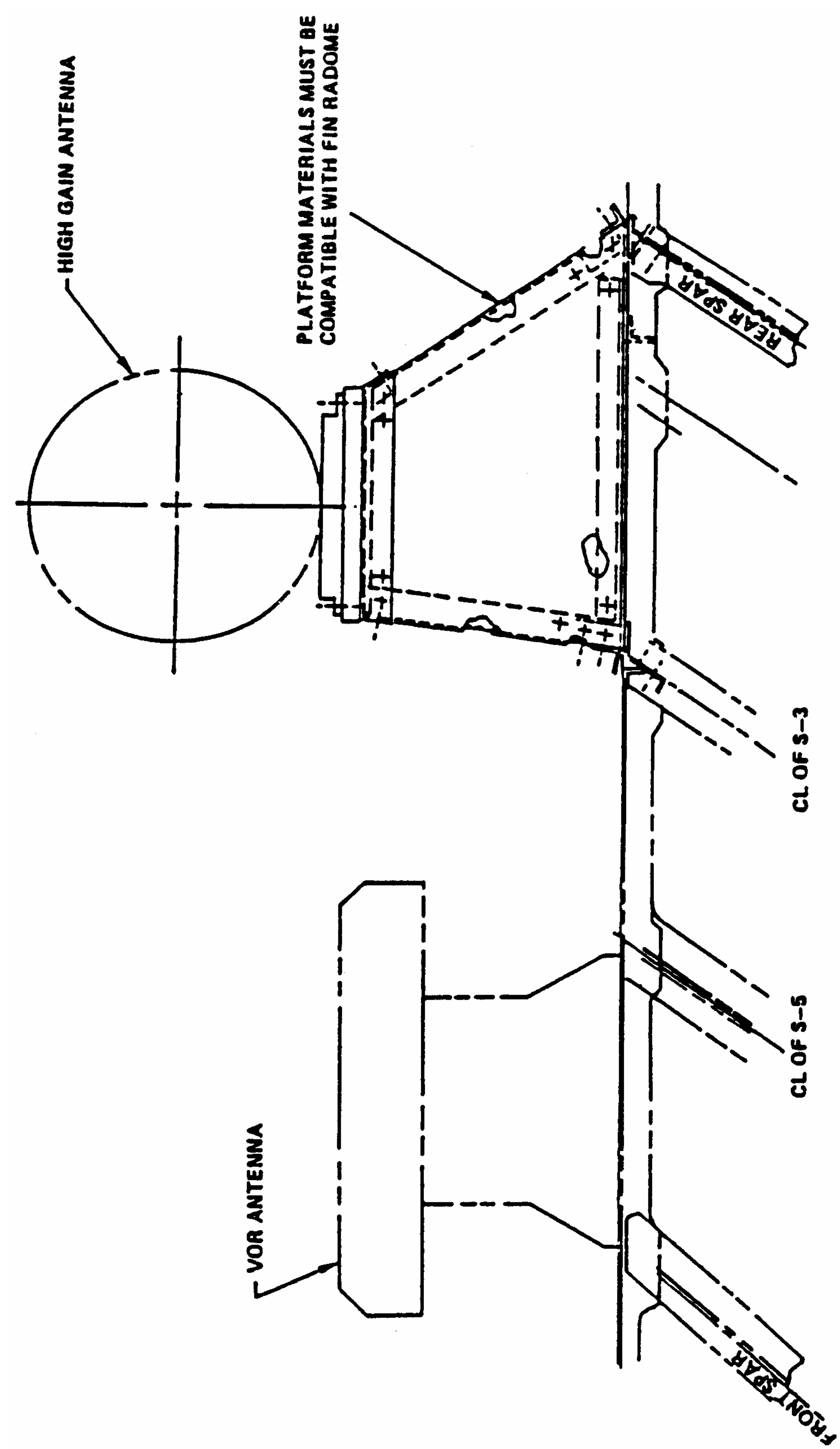
ATTACHMENT 1-11H-2
TAIL FIN INSTALLATION - 747SP



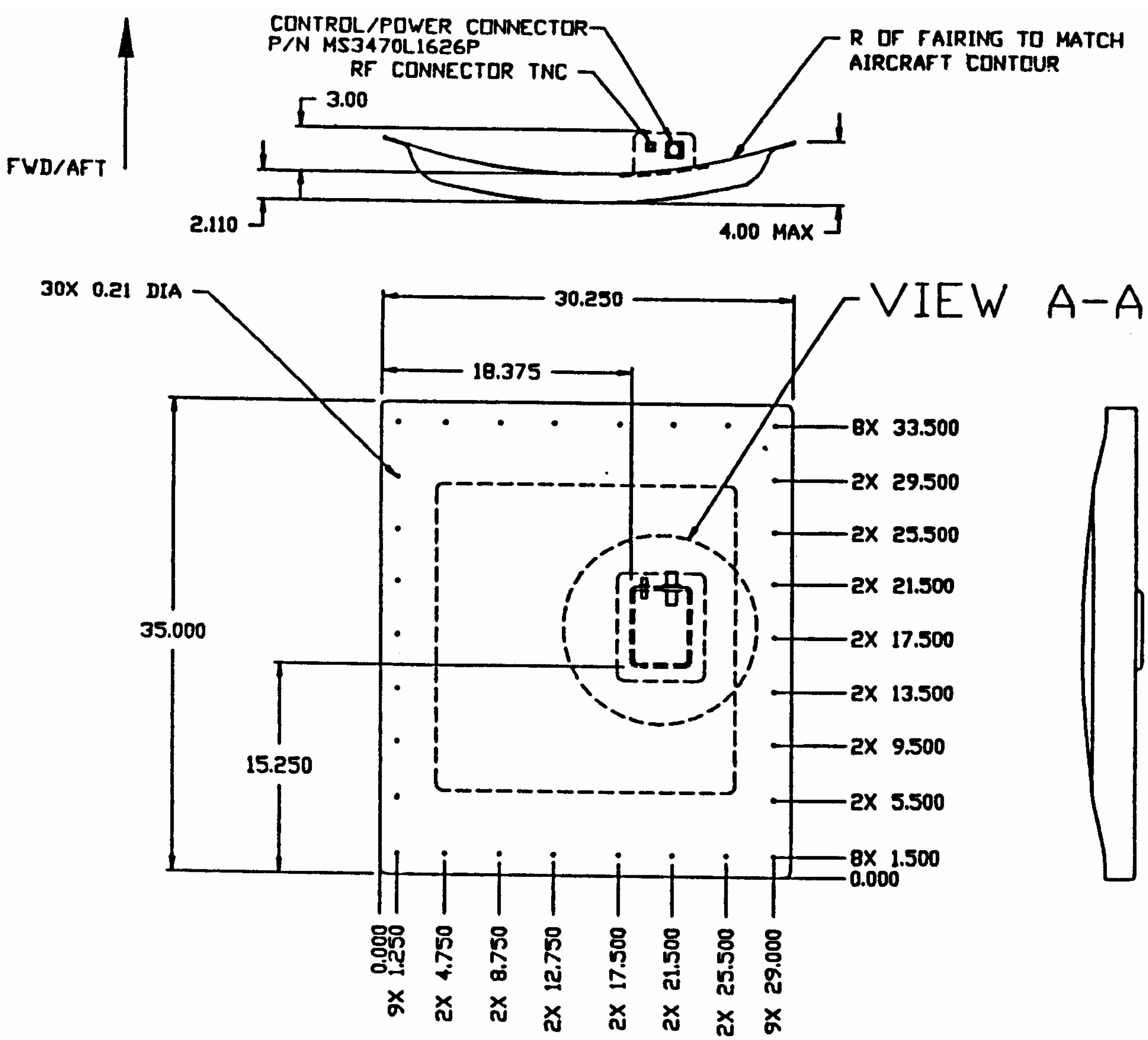
ATTACHMENT 1-11H-3
TAIL FIN INSTALLATION - 747-200 AND 300



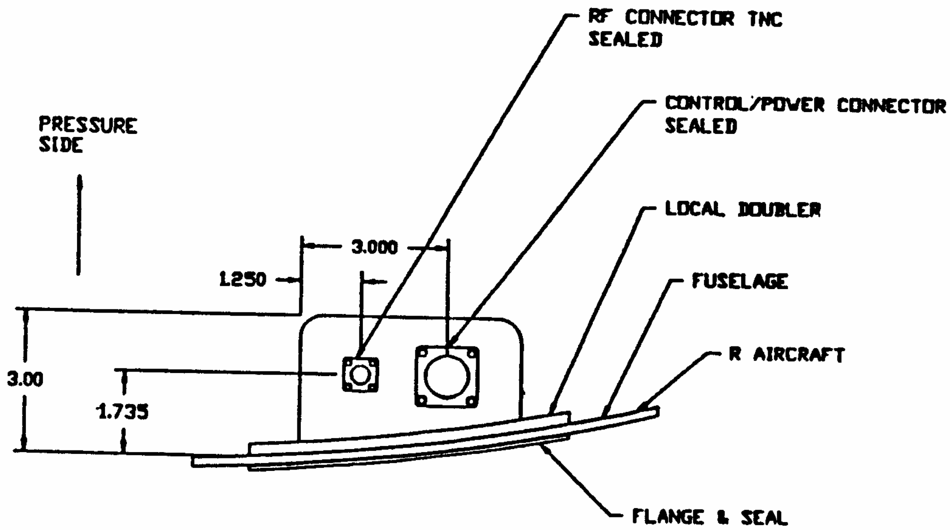
ATTACHMENT 1-11H-4
SIDE VIEW

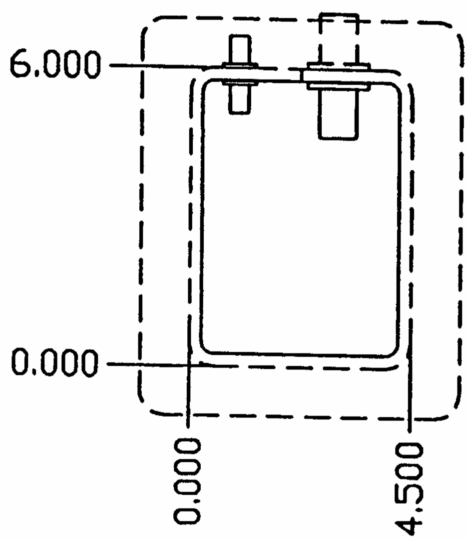


ATTACHMENT 1-11I-1
HIGH GAIN ANTENNA FORM FACTOR
PHASED ARRAY ANTENNA (19.55 X 23.00)
FAIRING FORM FACTOR (30.25 X 35.00)



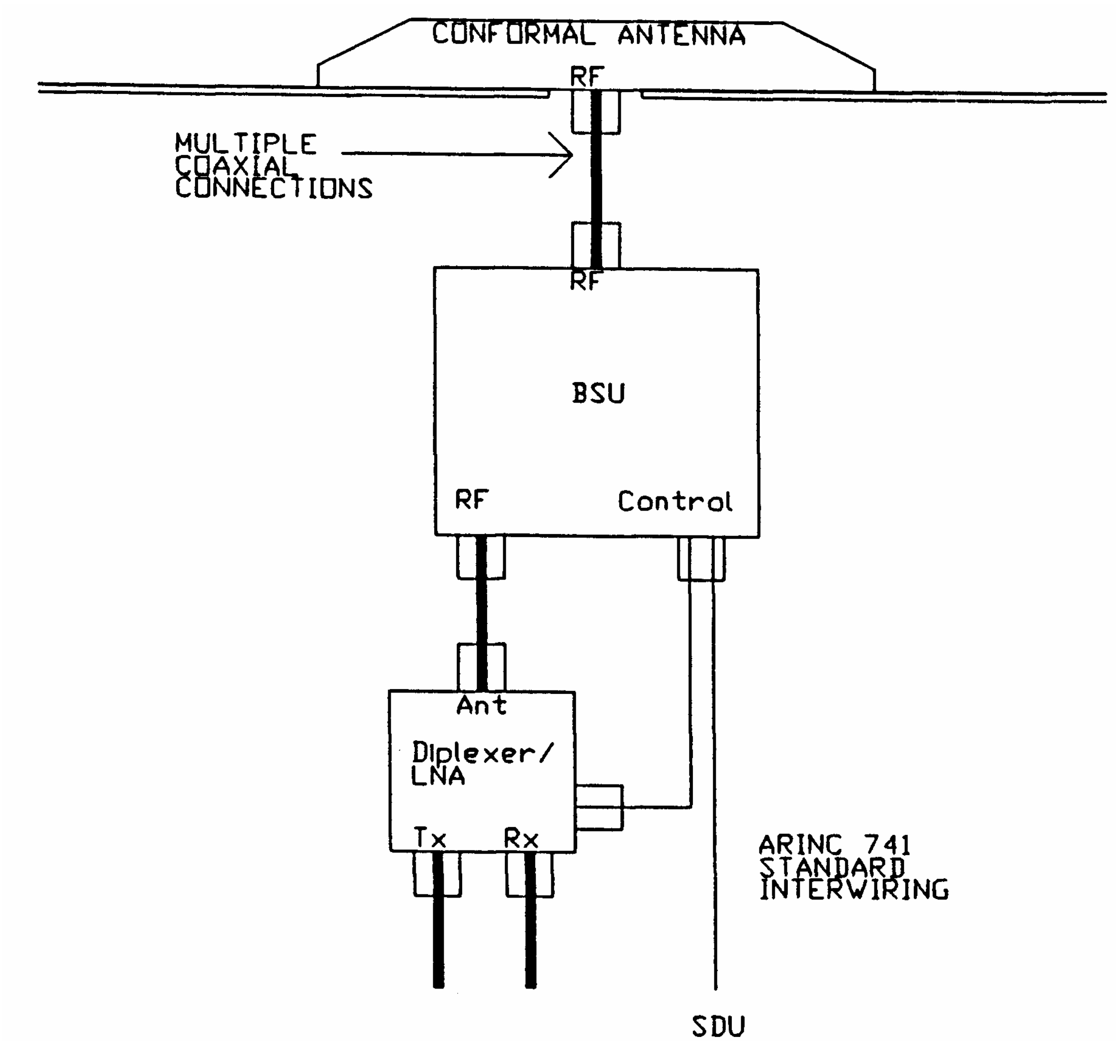
ATTACHMENT 1-11I-2
CONNECTOR INTERFACE
ANTENNA SEAL DETAIL



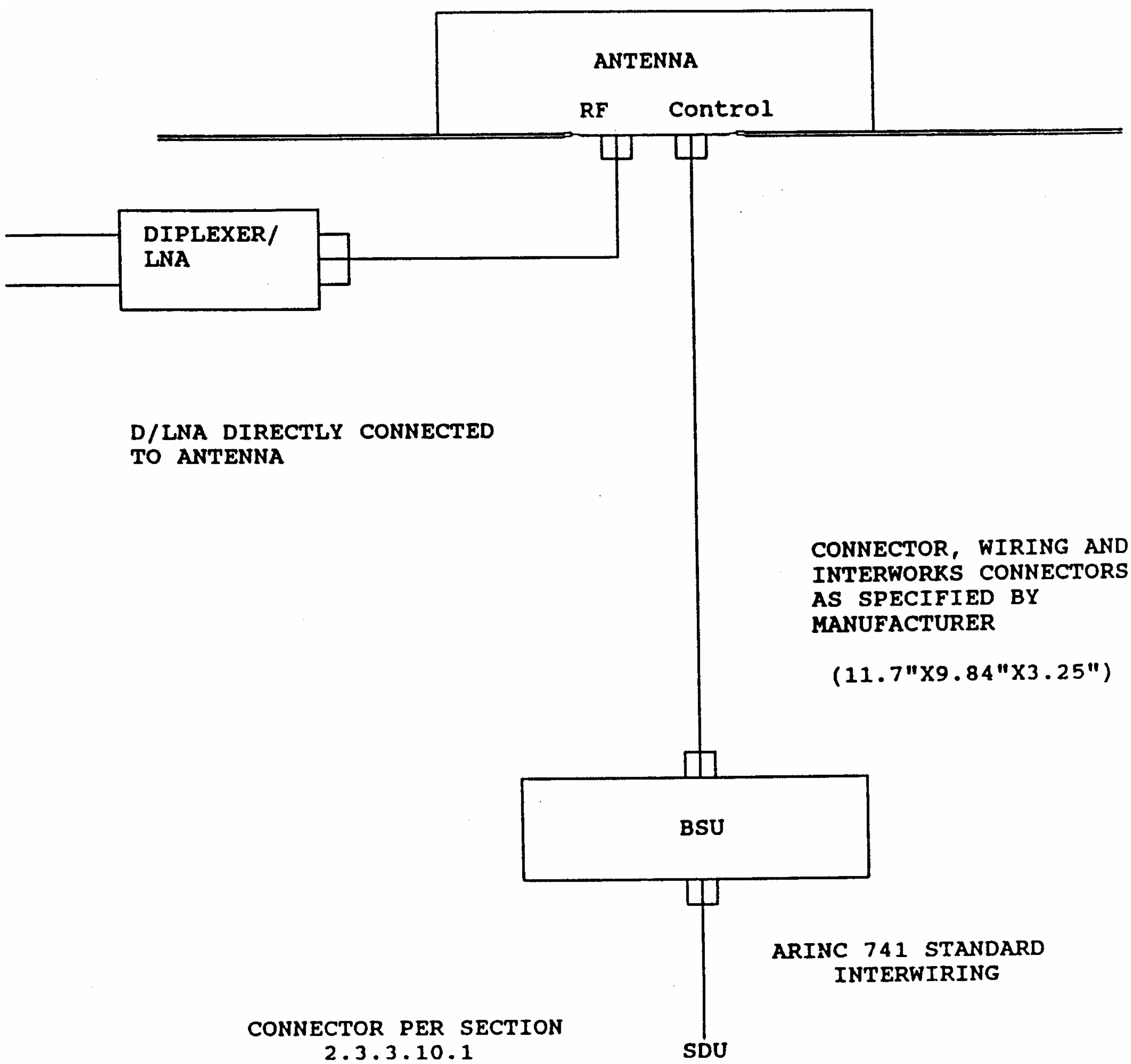


VIEW A-A

ATTACHMENT 1-12A
BEAM STEERING UNIT (BSU)
"ANTENNA CONFIGURATION A"

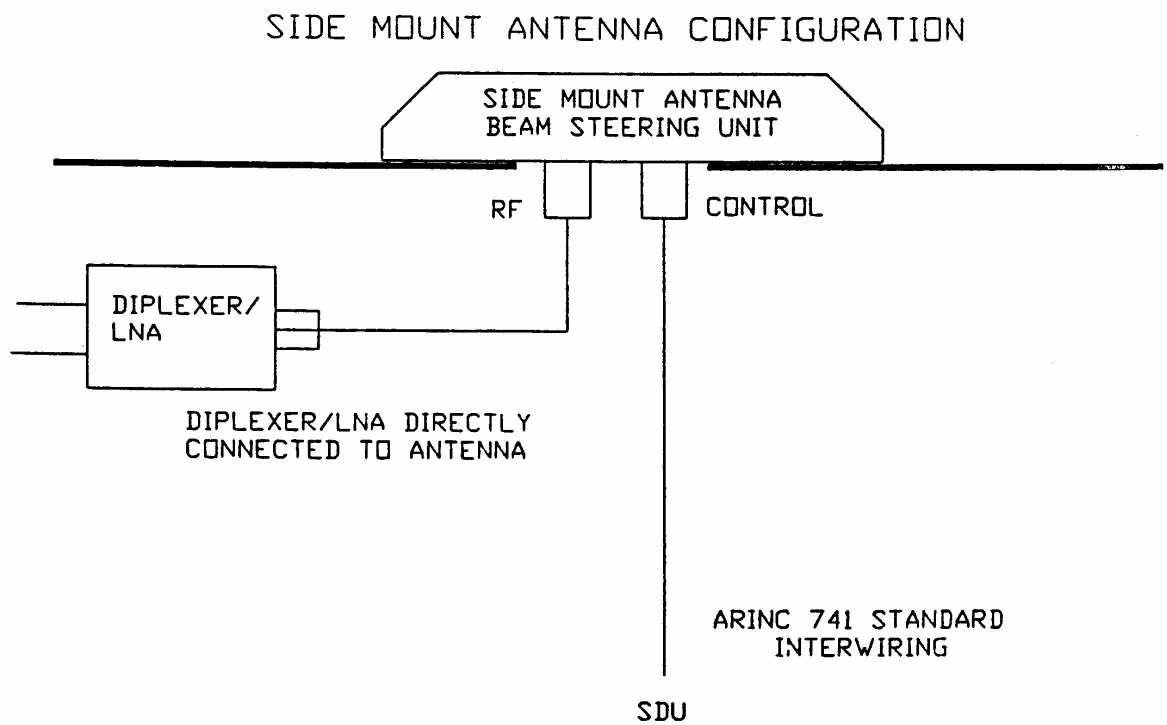


ATTACHMENT 1-12B
BEAM STEERING UNIT (BSU)
"ANTENNA CONFIGURATION B"

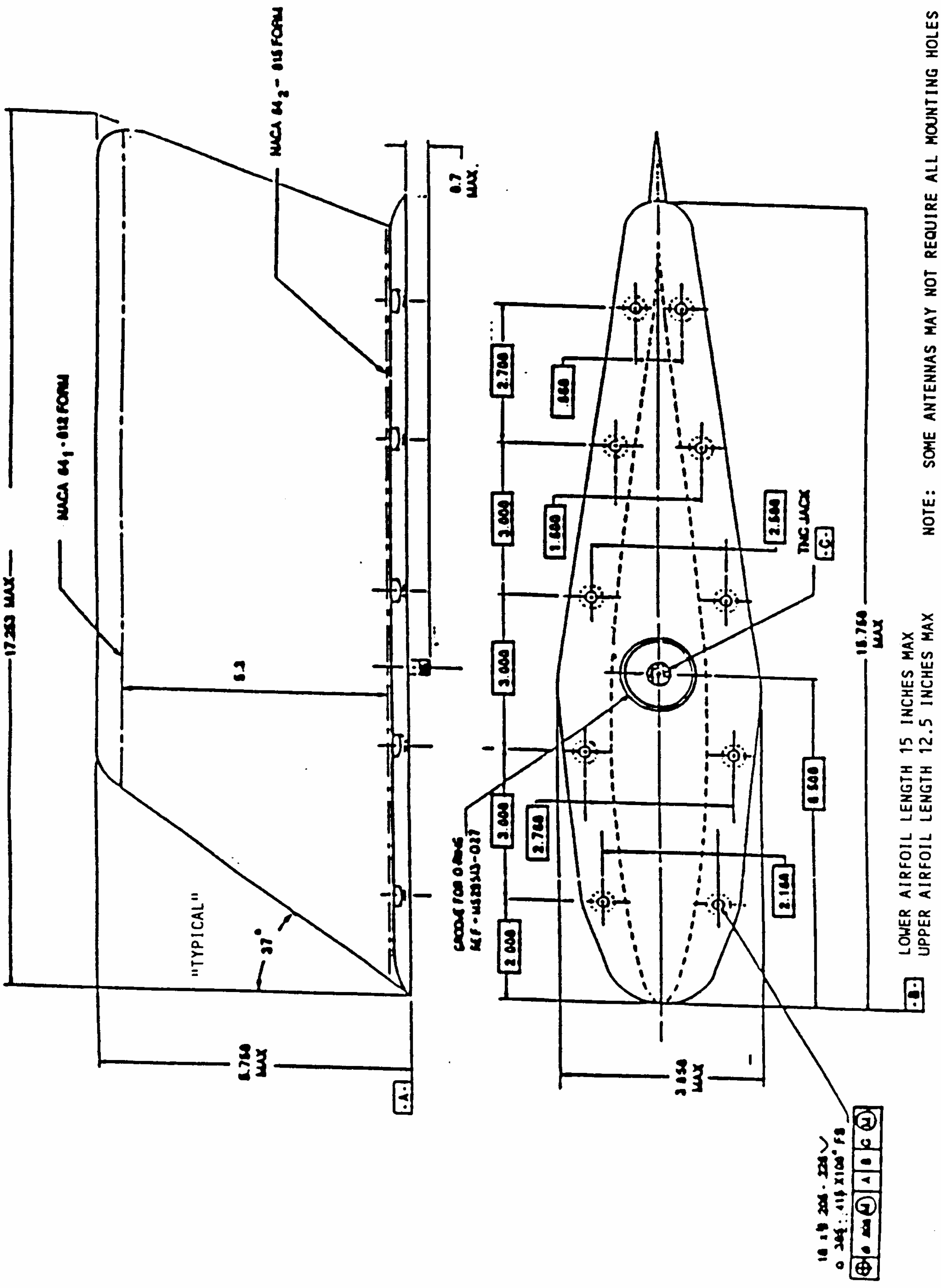


Note: The BSU may be implemented remote from the antenna in a 2MCU Configuration.

ATTACHMENT 1-12C
BEAM STEERING UNIT (BSU)
SIDE-MOUNT ANTENNA
"CONFIGURATION C"



ATTACHMENT 1-13
LOW GAIN ANTENNA



ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

BIT	32	31 30	29 28 27 26 25	24 23 22 21 20 19 18	17	16	15 14 13 12	11	10 9	8 7 6	5 4 3	2 1
Function	P	SSM	HPA Backoff	Pad	W O W	C	Peak/Avg [3]	R S V D	SDI	Label 143 [1] [4]		
										1 1 0	0 0 1	1 0
										3	4	1

SDU Equipment Identifier Code: 041 (HEX)

Sign/Status Matrix [6]		
BITS		Coding
31	30	
0	0	Failure Warning
0	1	No Computed Data
1	0	Functional Test
1	1	Normal Operation

Nominal HPA Backoff	
BITS 29 - 35	Coding
00000	No Backoff
11111	1 dB Backoff
11110	2 dB Backoff
11101	3 dB Backoff
11100	4 dB Backoff
etc.	
10000	16 dB Backoff
01111	17 dB Backoff
01110	18 dB Backoff
01101	19 dB Backoff
01100	20 dB Backoff
01011	21 dB Backoff
01010	22 dB Backoff
01001	23 dB Backoff
01000	24 dB Backoff
00111	25 dB Backoff
00110	26 dB Backoff
00101	27 dB Backoff
00100	28 dB Backoff
00011	29 dB Backoff
00010	30 dB Backoff
00001	31 dB Backoff

Weight-on-Wheels (WOW)	
BIT 17	Coding
0	Airborne or No WOW Capability
1	Aircraft on Ground

Note: Default Value of Bit 17=0

HPA Control (BIT 16) [2]	
0	Carrier(s) Off
1	Carrier(s) On

SDI Code [34]		
BITS		Coding
10	9	
0	0	All Call
0	1	LGA HPA
1	0	HGA HPA
1	1	Unused

Figure 1 – HPA Command Word – SDU to HPA

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

BIT	32	31 30	29 28 27 26 25 24	23 22 21 20 19	18	17	16	15 14 13 12	11	10 9	8 7 6	5 4 3	2 1
Function	P	SSM	Act. P. Out	Max Avail. RMS Power	APOS	HPA	C	HPA Backoff Range	RSVD	SDI	Label 143 [16]		
											1 1	0 0 0 1	1 0
											3	4	1

HPA Equipment Identifier Code: 241 (HEX)

Sign/Status Matrix [7]		
BITS		Coding
31	30	
0	0	Failure Warning
0	1	No Computed Data
1	0	Functional Test
1	1	Normal Operation

Actual Power Out [10]		
Type I Class C	Type II Linear	Meaning
BITS 29 - 25	BITS 29 - 24	
	011111	16.5 dB less than 40W
01111	011110	17.0 dB less than 40W
•	•	
00101	001010	27.0 dB less than 40W
	001001	27.5 dB less than 40W
00100	001000	At/Below Measurable Range
	000111	Illegal/Not Used
00011	000110	3 dB greater than 40W
00001	000010	1.0 dB greater than 40W
	000001	0.5 dB greater than 40W
00000	000000	40 Watts
	111111	0.5 dB less than 40W
11111	111110	1.0 dB less than 40W
•	•	
10001	100010	15.0 dB less than 40W
	100001	15.5 dB less than 40W
10000	100000	16.0 dB less than 40W

Max Avail. RMS Power (Linear HPA) [12]	
BITS 23 - 19	Meaning
00110	3 dB greater than 40W
00001	0.5 dB greater than 40W
00000	40 Watts
11111	0.5 dB less than 40W
11110	1 dB less than 40W
•	•
•	•
•	•
10000	8 dB less than 40W

Act. Power Out Status (APOS) [10]	
BIT 18	Meaning
0	Actual Power
1	Held Power

HPA Backoff Range [37]	
BITS 15 - 12	Meaning
0000	16 dB Backoff
0001	17 dB Backoff
0010	18 dB Backoff
0011	19 dB Backoff
etc.	•
1110	30 dB Backoff
1111	31 dB Backoff

SDI Code [11]		
BITS		Coding
10	9	
0	0	Reserved
0	1	LGA HPA
1	0	HGA HPA
1	1	Unused

HPA Type	
BIT 17	Meaning
0	Class C
1	Linear

HPA Control [9]	
BIT 16	Meaning
0	Carrier(s) Off
1	Carrier(s) On

Figure 2 – HPA Status Word – HPA to SDU

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE
AVIATION SATELLITE COMMUNICATIONS SYSTEM

BIT	32	31 30	29 28 27 26 25	24 23 22 21 20 19 18	17 16 15 14 13 12 11	10 9	8 7 6	5 4 3	2 1
Function	P	SSM	Undefined	Reserved	Discretes	SDI	Label 350 [16]		
							0 0 0	1 0 1	1 1
							0	5	3

HPA Equipment Identifier Code: 241 (HEX)

Sign/Status Matrix [30]		
BITS		Coding
31	30	
0	0	Failure Warning
0	1	No Computed Data
1	0	Functional Test
1	1	Normal Operation

Discretes [13] [30]		Values	
BIT	Description	0	1
11	Internal Power Supply	OK	Failure
12	Output VSWR [38]	OK	Failure
13	HPA Temperature	OK	Over
14	RF Power Input	OK -32 dBm)	Low
15	Control Bus Input	OK	Inactive
16	Internal RAM	OK	Failure
17	Internal ROM	OK	Failure

SDI Code [11]		
BITS		Coding
10	9	
0	0	Reserved
0	1	LGA HPA
1	0	HGA HPA
1	1	Unused

Figure 3 – HPA Maintenance Word – HPA to SDU

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

BIT	32	31 30	29 28 27 26 25 24 23 22 21 20 19 18 17	16 15 14 13	12 11	10 9	8 7 6	5 4 3	2 1
Function	P	SSM	Undefined	Reserved	DIS	SDI	Label 144 [23] [4]		
							0 0 1	0 0 1	1 0
							4	4	1

SDU Equipment Identifier Code: 041 (HEX)

Sign/Status Matrix [19] [20] [21]		
BITS		Coding
31	30	
0	0	Failure Warning
0	1	No Computed Data
1	0	Functional Test
1	1	Normal Operation

Discretes [22]		Values	
BIT	Description	0	1
11	Antenna System Select	LGA	HGA
12	HPR Present	No	Yes

SDI Code [35]		
BITS		Coding
10	9	
0	0	All Call
0	1	Port/Top
1	0	Starboard
1	1	Reserved

Figure 4 – ACU/BSU Control Word – SDU to ACU/BSU

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

BIT	32	31 30	29 28 27	26 25 24 23 22 21 20 19 18	17 16	15 14 13 12 11	10 9	8 7 6	5 4 3	2 1
Function	P	SSM	Undefined	Discrete	OP	Gain	SDI	Label 144 [4]		
								0 0 1	0 0 1	1 0
								4	4	1

ACU/BSU Equipment Identifier Code: 341 (HEX)

Sign/Status Matrix [17]		
BITS		Coding
31	30	
0	0	Failure Warning
0	1	No Computed Data
1	0	Functional Test
1	1	Normal Operation

Discretes		Values	
BIT	Description	0	1
18	BSU Selected	Port/Top	Starboard
19	Antenna Type	HGA	IGA
20	Reserved		
21	Reserved		
22	Reserved		
23	Reserved		
24	HGA LNA Status	Disabled	Enabled
25	Reserved		
26	Tracking Mode	Open	Closed

Operational Status [33]		
BITS		Coding
17	16	
0	0	Omnidirectional Mode
0	1	Acquisition Mode Active
1	0	Acquisition Complete
1	1	Closed Loop Tracking Mode Active

Antenna Tx Gain [36]	
BITS 15-11	Coding
00000	0 dBic
00001	1 dBic
Etc.	
11111	31 dBic

SDI Code [18]		
BITS		Coding
10	9	
0	0	Reserved
0	1	Port/Top BSU
1	0	Starboard BSU
1	1	ACU

Figure 5 – ACU/BSU Status Word – ACU/BSU to SDU

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

BIT	32	31 30	29 28 27 26 25	24 23 22 21 20 19 18 17 16 15 14 13 12 11	10 9	8 7 6	5 4 3	2 1
Function	P	SSM	Undefined	Discretes	SDI	Label 350 [4]		
						0 0 0	1 0 1	1 1
						0	5	3

ACU/BSU Equipment Identifier Code: 341 (HEX)

Sign/Status Matrix [41]		
BITS		Coding
31	30	
0	0	Failure Warning
0	1	No Computed Data
1	0	Functional Test
1	1	Normal Operation

Discretes [41]		Values	
BIT	Description	0	1
11	Reserved for HGA [14]	OK	Failed
12	Crosstalk Input	OK	Inactive
13	Control Bus Input	OK	Inactive
14	Internal RAM	OK	Failed
15	Internal ROM	OK	Failed
16	Internal Power Supply	OK	Failed
17	High Power Relay (HPR) Status [39]	OK	Failed
18	Any Internal BSU Parameter	OK	Failed
19	Reserved		
20	LNA/Diplexer [38] [40]	OK	Failed
21	Reserved		
22	ACU/BSU Temperature	OK	Over
23	Reserved		
24	Reserved		

SDI Code [18]		
BITS		Coding
10	9	
0	0	Reserved
0	1	Port/Top BSU
1	0	Starboard BSU
1	1	ACU

Figure 6 – ACU/BSU Maintenance Word – ACU/BSU to SDU

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

BIT	32	31 30	29 28 27 26 25 24 23 22 21 20 19	18 17 16 15 14 13 12 11 10 9	8 7 6	5 4 3	2 1
Function	P	SSM	(MSB) Azimuth (LSB) [25]	(MSB) Elevation (LSB) [24]	Label 152 [26] [27] [32]		
					0 1 0	1 0 1	1 0
					2	5	1

SDU Equipment Identifier Code: 041 (HEX)

Sign/Status Matrix		
BITS		Coding
31	30	
0	0	Failure Warning
0	1	No Computed Data [27]
1	0	Functional Test
1	1	Normal Operation

Figure 7 – Open Loop Steering Word – SDU to ACU/BSU

Figure 8 – Reserved for Future use

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

The following describes the implementation of the optional GSDB service; if this optional service is provided by the SDU, it shall be in accordance with these requirements. Following successful receipt, CRC verification and identification of Direct Link Service (DLS) GSDB S37 Lone Signal Units (LSUs) from the P-channel, the SDU shall extract the D2 9-octet GSDB Protocol Data Unit (GSDBPDU, octets 2 through 10 of S37), discarding the received Message Type and CRC fields. The SDU shall then construct a Link Interface Data Unit (LIDU) consisting of a Link Service Data Unit (LSDU) plus Link Interface Control Information (LICI). The LSDU shall contain the D2 GSDBPDU. The LICI shall include the current log-on GES ID, Satellite ID, Spot Beam ID, and a “flags” field. The ID fields shall be derived from the current Log-On Confirm table (specified in Part 2 Section 4.5.2.4); the Spot Beam ID field shall contain the code “zero” if the global beam is currently being used rather than a spot beam. The flags field shall specify the current P-channel rate (the P field).

A simple variant of the ARINC 429 Williamsburg methodology (reference ARINC 429 Attachment 11) shall be used to enable a sequence of six Label 374 ARINC 429 words to transmit the GSDB LIDU via the GSDB port. The Williamsburg Word Type field (bits 29-31) is not necessary, and shall be replaced by a Word Sequence Number (WSN) field, which shall indicate the relative position of each word within the sequence of six words (numbered from 0 to 5) to facilitate LDU frame synchronization at the receiver. The first five words shall be full data words (each containing five nibbles of data), and the sixth word shall be a partial data word (containing one nibble of data). No other aspects of the Williamsburg protocol (handshake words, timers, etc.) shall be utilized on the GSDB interface.

The six ARINC 429 words shall be transmitted at the physical layer as specified in ARINC 429, including the minimum word gap of four bit times between successive words in the six-word sequence.

The SDU shall map the LIDU to the ARINC 429 words as shown. All spare bits shall be set to zero.

Note: Except for the SAL, least significant bits of octets and nibbles are right-justified.

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

1st Word

32	31 30 29	28 27 26 25	24 23 22 21 20 19 18 17	16 15 14 13 12 11 10 9	8 7 6 5 4 3 2 1
	0 0 0	Bits 1-4	x x x x x x x x	[Spare] [P]	0 0 1 1 1 1 1 1
P	WSN	SAT ID	GES ID	Flags	SAL 374

2nd Word

32	31 30 29	28 27 26 25 24 23 22 21	20 19 18 17 16 15 14 13	12 11 10 9	8 7 6 5 4 3 2 1
	0 0 1		0 0 x x x x x x	0 0 x x	0 0 1 1 1 1 1 1
P	WSN	S37 Octet No. 2	Spot Beam ID	SAT ID	SAL 374

3rd Word

32	31 30 29	28 27 26 25	24 23 22 21 20 19 18 17	16 15 14 13 12 11 10 9	8 7 6 5 4 3 2 1
	0 1 0	Bits 1-4			0 0 1 1 1 1 1 1
P	WSN	S37 Octet 5	S37 Octet No. 4	S37 Octet No. 3	SAL 374

4th Word

32	31 30 29	28 27 26 25 24 23 22 21	20 19 18 17 16 15 14 13	12 11 10 9	8 7 6 5 4 3 2 1
	0 1 1			Bits 5-8	0 0 1 1 1 1 1 1
P	WSN	S37 Octet No. 7	S37 Octet No. 6	S37 Octet 5	SAL 374

5th Word

32	31 30 29	28 27 26 25	24 23 22 21 20 19 18 17	16 15 14 13 12 11 10 9	8 7 6 5 4 3 2 1
	1 0 0	Bits 1-4			0 0 1 1 1 1 1 1
P	WSN	S37 # 10	S37 Octet No. 9	S37 Octet No. 8	SAL 374

6th Word

32	31 30 29	28 27 26 25 24 23 22 21	20 19 18 17 16 15 14 13	12 11 10 9	8 7 6 5 4 3 2 1
	1 0 1	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	Bits 5-8	0 0 1 1 1 1 1 1
P	WSN	Spare	Spare	S37 # 10	SAL 374

P Field:	Bit	11	10	9	Rate, bps
		0	0	0	Reserved
		0	0	1	600
		0	1	0	1200
		0	1	1	2400
		1	0	0	4800
		1	0	1	10500
		1	1	0	Reserved
		1	1	1	Reserved

Figure 9 – GSDB Word Sequence – SDU to SNU

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

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

SDU Equipment Identifier Code: 041 (HEX)

Bit	<u>Description</u>	Coding	
1	Label 172	0	
2	.	1	
3	.	1	
4	.	1	
5	.	1	
6	.	0	
7	.	1	
8	Label 172	0	
9	SDU SAL (307 for SDU #1 or 173 for SDU #2) (MSB)	1 <u>or</u> 0	
10	.	1 1	
11	.	0 1	
12	.	0 1	
13	.	0 1	
14	.	1 0	
15	.	1 1	
16	SAL (LSB)	1 1	
17	Inmarsat Aero	1	
18	Spare	0	
19	Iridium	X	
20	Global star	X	
21	ICO	X	
22	Spare	0	
23	Spare	0	
24	Spare	0	
25	Spare	0	
26	Spare	0	
27	Spare	0	
28	Spare	0	
29	Spare	0	
30	Spare	0	
31	Spare	0	
32	Parity	X	

Figure 10 – Label 172

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

For full details, reference ARINC Characteristic 761, Attachment 2, Item 2, which defines a satcom multi-bearer system (MBS), wherein the ARINC 761 SDU may support multiple satellite systems (e.g., Inmarsat and Iridium, or Inmarsat and Globalstar). This capability is also defined from the CMU perspective in ARINC Characteristic 758 (Supplement 2 and subsequent, including in Attachment 6, Table 6-16). Included in this capability is the MBS SDU's use of the ARINC 429 label 172 subsystem identifier word, transmitted at a nominal rate of 1 Hz on its output bus to the CMU (and EICAS/ECAM/EDU), to indicate the satellite systems through which it is capable of providing service. In ARINC Characteristic 761, label 172 thus has a unique definition and usage of bits 17-29 that are only defined as pad (zero) bits in the generic ARINC Specification 429 definition of label 172. (ARINC 758 has similar unique definitions for some of the bits in its label 172 outputs to the SDU and other air/ground data link equipment.)

The concept of an MBS SDU is beyond the scope of ARINC Characteristic 741. However, MBS/ARINC 761 SDUs can also be compatible with ARINC 741. The label 172 definition above is included here for such ARINC 741-compatible SDUs. Such SDUs will, at a minimum, set bit 17 to indicate support of Inmarsat Aero service, and may also set other bits in the Satellite System Type field as applicable to the specific SDU design.

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

Notes

1. Unless otherwise noted, field data bits are transmitted Least Significant Bit (LSB) first, and the Most Significant Bit is transmitted last.
2. HPA CONTROL bit 16 is used to turn the HPA on or off for HGA/LGA selection. The carriers off level should be as specified in Section 2.2.5.6.
3. PEAK/AVERAGE CODE 0000 has no explicit operation within the HPA. PEAK/AVERAGE is calculated from $(\Sigma V_i)^2/\Sigma V_i^2$ where V_i is the relative voltage of the i^{th} carrier. It is rounded to the nearest integer for reporting. If all carriers have the same power level, this is the same as the number of carriers.
4. RATE: 5-10 words per second.
5. Not used.
6. The HPA will initiate its Functional Test following receipt of one or more valid Command words having the SSM set to Functional Test. The HPA Functional Test will execute until its completion, at which time the HPA will automatically return to Normal Operation (even if Functional Test is still being received in the SSM). Following such completion of the Functional Test, the HPA will not reinitiate the Functional Test until after it receives one or more subsequent Normal Operation commands followed by one or more Functional Test commands via the SSM. The HPA will ignore any Command words with the SSM set to No Computed Data or Failure Warning.
7. The HPA shall indicate No Computed Data if no HPA Command Word is received from the SDU for one or more seconds. The HPA shall indicate Functional Test following initiation, and during execution, of its Functional Test, whether commanded by the SDU or by any other means such as power-on or a front panel test switch. Upon the completion of Functional Test, the HPA shall indicate Normal Operation if no failures were detected or Failure Warning if one or more failures were detected. Failure Warning shall also be indicated at any time outside of Functional Test when a monitored (or otherwise tested) parameter is in its failure state. A Failure Warning indication should persist until all conditions and parameters are subsequently re-tested by appropriate test and are found to be “OK.”
8. Reserved.
9. Bit 16 shall indicate that the HPA has received the corresponding command from the SDU. Any discrepancy between the commanded and actual carrier state may be ascertained by the SDU by examination of the Actual Power Out Field.
10. The actual power output reported by the HPA shall be the highest level measured since the previous report was transmitted. Bit 18 shall be set to 0 if, at any time during the reporting interval, the HPA RF input power is ≥ -32 dBm while the BSU is not muting the HPA. In this case, the Actual Power Out field will thus reflect the (highest) measured value for the reporting interval. Conversely, bit 18 shall be set to 1 if, during the entirety of the reporting interval, either or both of the following conditions are true at any given time: (A) the HPA RF input power is < -32 dBm or (B) the BSU is muting the HPA. In this case, the last reported output power shall be held and continue to be reported in the Actual Power Out field. Power cannot be more than 3 dB above 40 Watts.

    Use of the 16.5 to 27.5 dB less than 40W range is optional. The HPA shall only report actual output power down to the level where measurement accuracy is consistent with the required back-off setting accuracy as specified in Section 2.2.5 (i.e., ±0.5 dB down to 16.0 dB below 40W and ±1 dB for the optional extended range). If its Actual Power Out is at or below its limit of measurement accuracy, the HPA should output code 00100/001000 for “At/Below Measurable Range” in this field. In lieu of information to the contrary via the Actual Power Out field, the SDU should assume that an HPA not indicating usage of the optional extended backoff range has a usable Actual Power Out reporting range down to 16.0 dB less than 40 watts.

11. The SDI bits should be set to reflect the HPA’s application as defined in Note 19 of Attachment 1-4.
12. The maximum available RMS power is determined by the Linear HPA from the Peak/Average Input Power as well as other data. If the SDU wishes to add a carrier, it should send the Peak/Average ratio for the new rather than the current set of carriers.
13. A “1” state in bits 12 and/or 13 and/or 14 and/or 15 will not cause the Sign/Status Matrix to indicate a Failure Warning.
14. Only applicable to HGAs having self-test capability; all others will always be cleared to “OK.”
15. Reserved.
16. RATE: 5-10 words per second (not synchronized to HPA commands).
17. The SSM should be used as follows:

FUNCTIONAL TEST	Test in Progress (ignore DISCRETE field, invalid).
NORMAL OPERATION	No failures detected in ACU/BSU.
FAILURE WARNING	Failure(s) detected in the ACU/BSU and indicated in DISCRETE field; does not include failures in the LNA/Diplexer, HPR, HGA or Control bus input.
NO COMPUTED DATA	No BSU Control Word or no BSU Open Loop Steering Word has been received from the SDU for one or more seconds.

The ACU/BSU shall indicate Functional Test following initiation, and during execution, of its Functional Test, whether commanded by the SDU or by any other means such as power-on or a front panel test switch. Upon the completion of Functional Test, the ACU/BSU shall indicate Normal Operation if no failures were detected or Failure Warning if one or more failures were detected. Failure Warning shall also be indicated at any time outside of Functional Test when a monitored (or otherwise tested) parameter is in its failure state.

18. The SDI bits should be set to reflect the ACU/BSU's application as defined in Note 19 of Attachment 1-4.
19. The state “Functional Test” in the SSM will command the destination ACU/BSU to conduct a self-test and respond with the appropriate data. These data are included in the ACU/BSU MAINTENANCE WORD, which is output continuously at the rate specified.
20. While commanding the Functional Test mode, the SDU will continuously send the CONTROL WORD with the SSM set to “Functional Test.” The ACU/BSU will continue to perform the self-test until the test is completed. The ACU/BSU will then automatically return to normal operation. Functional test will not be re-initiated until after receipt of SSM fields containing normal operation followed by functional test.
21. The states “Failure Warning” and “No Computed Data” are not used and should be ignored.

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

22. When the Antenna System Select discrete is cleared to the LGA state, each ACU/BSU will turn-off the associated LNA. The SDU should turn off the associated HPA(s) via the Multi-Control ARINC 429 output bus (HPA COMMAND word, bit 16).
23. ARINC 429 labels 270 through 274 (octal) are reserved on all ACU/BSU ARINC 429 buses for testing and cross-talk.
24. Elevation data, bits 9-18, has a range of approximately +89.8 to -90 degrees. Bit 18 is used as the sign bit. A positive angle is considered upward toward the zenith. Resolution of angle is approximately 0.17 degrees.
25. Azimuth data, bits 19-29, has a range of approximately +179.8 to -180 degrees. Bit 29 is used as the sign bit. A positive angle is considered right of the nose reference. Resolution of the angle is approximately 0.17 degrees.
26. Data is encoded in BNR, 2's complement as defined in ARINC 429; with the exception of Note 24 above.
27. Reserved
28. Least Significant Bit is transmitted first in each data field.
29. Reserved
30. Same as Note 7 except that there is no application for the No Computed Data state, which therefore should not be used. The respective DISCRETES failure bit indications in the Maintenance Word shall persist as specified for the SSM Failure Warning indication in Note 7.
31. RATE: 15-25 words per second.
32. RATE: 10-20 words per second.
33. Reserved
34. The SDI bits should be set to the code of the HPA(s) intended to receive and process the Command Word.
35. The SDI bits should be set to the code of the ACU/BSU(s) intended to receive and process the Control Word.
36. The Antenna TX Gain field is used to report gain variations at different steering angles to the SDU. The SDU will use this information from the selected subsystem to vary the HPA gain accordingly so as to maintain the same effective transmitted power from position to position, except for changes commanded by the GES.
37. The HPA should indicate how many dB backoff it implements in this field. The SDU should utilize this information in its power control algorithm.
38. “If a parameter can only be tested in certain circumstances (e.g., HPA Output VSWR Failure [HPA Maintenance Word bit 12] while power is being transmitted, or LNA/Diplexer Failed [ACU/BSU Maintenance Word bit 20] while the LNA is switched on), the failure indication should persist until a subsequent test or until the next monitored result indicates that the status has changed to “OK.”
39. If a discrete can be set to 'Failed' upon non-compliance of either of two test states (e.g., HPR BIT indicates 'on' when it should be 'off' or 'off' when it should be 'on'), both test states must pass in order to indicate “OK.”
40. If the LNA was being commanded 'off' before performing a Functional Test, the LNA should only be turned 'on' momentarily (< 100 ms) during Functional Test.

ATTACHMENT 2
ARINC 429 LABELS AND WORD FORMATS USED IN THE
AVIATION SATELLITE COMMUNICATIONS SYSTEM

41. Same as Note 17 except that there is no application for the No Computed Data State, which therefore should not be used. The same requirements as for the Failure Warning indication apply to the respective Discretes failure bit indications in the Maintenance Word. Failure Warning and respective DISCRETES failure bit indications should persist until all conditions and parameters are subsequently re-tested by appropriate tests and are found to be “OK.”

ATTACHMENT 3
EQUIPMENT ENVIRONMENTAL CATEGORIES
(EUROCAE ED-140/RTCA DO-160C)

Environment Description	ED-14C DO-160c Section	Rack Mounted	Internal Airframe Mounted	External Airframe Mounted
Temperature/Altitude	4.0	A1 Note 3	A2 Note 3	E1
Temperature Variation	5.0	B	B	A
Humidity	6.0	A	A	C
Shock/Crash Safety	7.0	Note 1	Note 1	Note 1
Vibration	8.0	B	C	C
Explosion	9.0	X	X	X
Waterproofness	10.0	X	X	S
Fluids	11.0	X	X	F (de-ice)
Sand and Dust	12.0	X	X	D
Fungus	13.0	X	X	F
Salt Spray	14.0	X	X	S
Magnetic Effect	15.0	A	A	A
Power Input	16.0	E	E	E
Voltage Spike	17.0	A	A	A
Audio Susceptibility	18.0	E	E	E
Induced Signal	19.0	A	A	A
RF Susceptibility	20.0	U	U	Y
RF Emissions	21.0	A	A	A
Lightning	22.0	A2XX	K	XXE3 Note 2
Direct Lightning	23.0	X	X	1A, 1B, 2A Note 5
Icing	24.0	X	X	A Note 4

Notes:

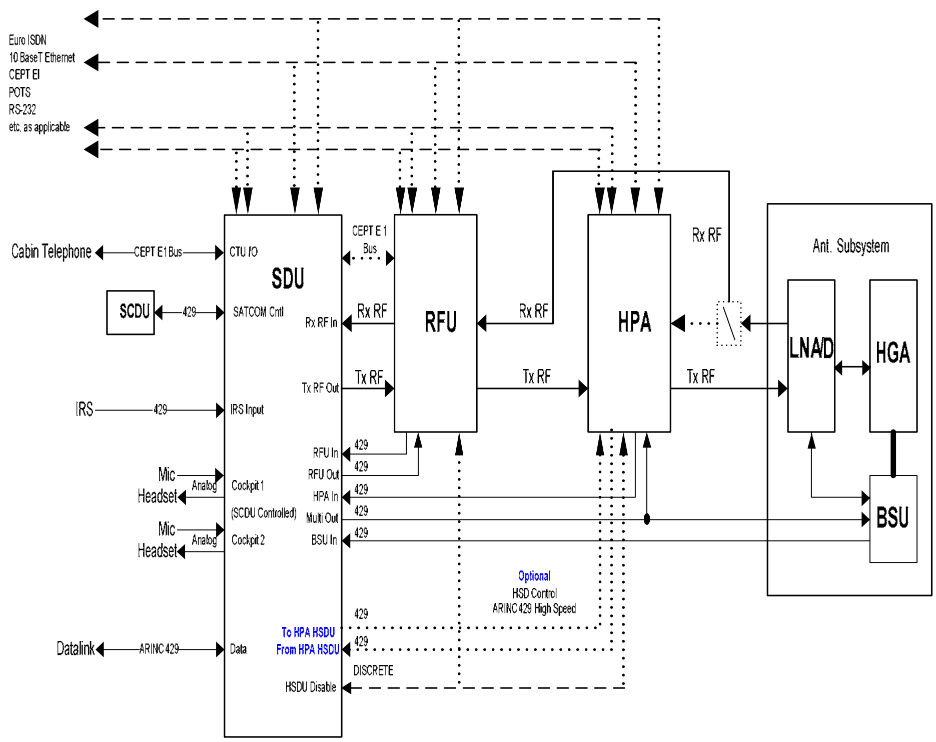
1. One category for all equipments.
2. The lightning test category will be dictated by the placement of the antenna on the aircraft and the recommendations from the airframe manufacturer. Antennas over six inches in height above the fuselage should be tested in a Zone 1 lightning category.
3. Decompression test is the maximum operating altitude of the aircraft.
4. This requirement can be satisfied by load analysis.
5. Test category dependent on the zone where the antenna is to be installed.

ATTACHMENT 4
WIRING PROVISIONS FOR INTERNAL HIGH SPEED DATA

Provisions have been made to accommodate the addition of high speed data (HSD) services such as Inmarsat Swift64 and SwiftBroadband within the existing SDU, RFU and HPA architecture defined by this characteristic. This attachment provides guidance for aircraft wiring to accommodate these higher speed services.

The specific interwiring to support HSD depends on the LRU which is chosen to host the HSD functionality. Various manufacturers may choose different LRUs to host the HSD function, depending on their pre-existing SDU, RFU and HPA implementations. As a result, a standardized interwiring scheme is not possible. This characteristic only defines the SDU, RFU and HPA rear connector pins to be set aside to allow the addition of HSD and provides general guidance on the interwiring necessary.

The following diagram provides an overview of the user interfaces and system interwiring additions necessary to support HSD functionality inside the various LRUs. A Type D diplexer/LNA (ARINC Characteristic 741, Part 1, Sections 2.2.4.3, 2.2.4.3.4, and ARINC characteristic 741, Part 2, Section 3.5.4.1.1) is required if SwiftBroadband services are provided. Contact the specific manufacturer to determine the specific interwiring details appropriate for their implementation.



Solid Lines = Existing ARINC 741
Dashed Lines = Additions to support High Speed Data
Dotted lines = Connections only to LRU containing High Speed Data

Figure 4-1 – ARINC 741 with Integrated High Speed Data

ATTACHMENT 4
WIRING PROVISIONS FOR INTERNAL HIGH SPEED DATA

Table 4-1 – Standard Interwiring for Internal High Speed Data

FUNCTION		SDU		RFU HSDU		HPA HSDU		OTHER	NOTES
Reserved Data Bus to RFU from SDU or Reserved Data Bus to **RFU** HSDU from SDU (ARINC 429)	A	MP9G	o-----------	TP1C			o		8, **79**
	B	MP9H	o-----------	TP1D			o		
Reserved Data Bus from RFU to SDU or Reserved Data Bus from **RFU HSDU to SDU (ARINC 429)**	A	MP9E	o-----------	TP1A			o		8, **79**
	B	MP9F	o-----------	TP1B			o		
Reserved SDU Crosstalk To other SDU or Reserved Data Bus from SDU to HPA HSDU (ARINC 429)	**A**	**MP12C**	o--			**TP2H**	o		**76, 77**
	B	**MP12D**	o--			**TP2J**	o		
Reserved SDU Crosstalk From other SDU or Reserved Data Bus from HPA HSDU to SDU (ARINC 429)	**A**	**MP12A**	o--			**TP2E**	o		**76, 77**
	B	**MP12B**	o--			**TP2F**	o		
Reserved Disable Discrete to HSDU function		MP13A	o-----------	TP5E	o-----------	TP3H	o		64, 75
Reserved Ethernet #1 (10 Base-T to User)	+	TP8A	o-----------	MP1K	o-----------	MP7A	o-----------	o	62, 63
	-	TP8B	o-----------	MP2J	o-----------	MP7B	o-----------	o	
Reserved Ethernet #1 (10 Base-T to User)	+	TP8C	o-----------	MP1J	o-----------	MP7C	o-----------	o	62, 63
	-	TP8D	o-----------	MP2K	o-----------	MP7D	o-----------	o	
Reserved Ethernet #2 (10 Base-T to User)	+	TP7C	o-----------	MP6K	o-----------	MP5A	o-----------	o	62, 63
	-	TP7D	o-----------	MP7J	o-----------	MP5B	o-----------	o	
Reserved Ethernet #2 (10 Base-T to User)	+	TP7E	o-----------	MP6J	o-----------	MP5C	o-----------	o	62, 63
	-	TP7F	o-----------	MP7K	o-----------	MP5D	o-----------	o	
Reserved ISDN #1 (S/T from User)	+	TP8E	o-----------	MP6F	o-----------	MP6A	o-----------	o	61, 63
	-	TP8F	o-----------	MP6E	o-----------	MP6B	o-----------	o	
Reserved ISDN #1 (S/T to User)	+	TP8G	o-----------	MP6E	o-----------	MP6C	o-----------	o	61, 63
	-	TP8H	o-----------	MP6F	o-----------	MP6D	o-----------	o	
Reserved ISDN #2 (S/T from User)	+	TP9E	o-----------	MP6B	o-----------	MP4G	o-----------	o	61, 63
	-	TP9F	o-----------	MP7A	o-----------	MP4H	o-----------	o	
Reserved ISDN #2 (S/T to User)	+	TP9G	o-----------	MP6A	o-----------	MP4J	o-----------	o	61, 63
	-	TP9H	o-----------	MP7B	o-----------	MP4K	o-----------	o	

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FUNCTION	SDU	RFU HSDU	HPA HSDU	OTHER	NOTES
Reserved Swift64 Forward ID Straps		MP4A ○	TP5F ○		65, 66, 67, **78**
		MP4B ○	TP5G ○		
		MP4C ○	TP5H ○		
		MP4D ○	TP5J ○		
		MP4E ○	TP5K ○		
		MP4F ○	TP6A ○		
		MP5A ○	TP6B ○		
		MP5B ○	TP6C ○		
		MP5C ○	TP6D ○		
		MP5D ○	TP6E ○		
		MP5E ○	TP6F ○		
		MP5F ○	TP6G ○		
		MP5G ○	TP6H ○		
		MP5H ○	TP6J ○		
		MP5J ○	TP6K ○		
		MP5K ○	TP7A ○		
		MP6C ○	TP7B ○		
		MP6D ○	TP7C ○		
		MP6G ○	TP7D ○		
		MP6H ○	TP7E ○		
		MP7C ○	TP7F ○		
		MP7D ○	TP7G ○		
		MP7G ○	TP7H ○		
		MP7H ○	TP7J ○		
Reserved Strap Option		MP1A ○			66
Reserved Strap Option		MP1B ○			
Reserved Strap Option		MP1C ○			
Reserved Strap Option		MP1D ○			
Reserved Strap Option		MP1E ○			
Reserved Strap Option		MP1F ○			
Reserved Strap Option		MP2A ○			
Reserved Strap Option		MP2B ○			
Reserved Strap Option		MP2C ○			
Reserved Strap Option		MP2D ○			
Reserved Strap Option		MP2E ○			
Reserved Strap Option		MP3A ○			
Reserved Strap Option		MP3B ○			
Reserved Strap Option		MP3C ○			
Reserved Strap Option		MP3D ○			
Reserved Strap Option		MP3E ○			
Reserved Strap Option (common)		MP3F ○			
Reserved Strap Option			TP4A ○		67
Reserved Strap Option			TP4B ○		
Reserved Strap Option			TP4C ○		
Reserved Strap Option			TP4D ○		
Reserved Strap Option			TP4E ○		
Reserved Strap Option			TP4F ○		
Reserved Strap Option			TP4G ○		
Reserved Strap Option			TP4H ○		
Reserved Strap Option			TP5G ○		
Reserved Strap Option			TP5H ○		
Reserved Strap Option			TP5G ○		
Reserved Strap Option			TP5K ○		
Reserved Strap Option			TP6G ○		
Reserved Strap Option			TP6H ○		
Reserved Strap Option			TP6J ○		
Reserved Strap Option			TP6K ○		
Reserved Strap Option (common)			MP7K ○		

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FUNCTION	SDU	RFU HSDU	HPA HSDU	OTHER	NOTES
Reserved CEPT E1	A ○	TP1E ○------------	MP5C --------------	○	
to SDU/User	B ○	TP1F ○------------	MP5D --------------	○	68
Reserved CEPT E1	A ○	TP1G ○------------	MP5A --------------	○	
from SDU/User	B ○	TP1H ○------------	MP5B --------------	○	68
Reserved SLIC #1	Tip ○	TP3G ○------------	MP4A --------------	○	
	Ring ○	TP3H ○------------	MP4B --------------	○	63, 69
Reserved SLIC #2	Tip ○	TP4J ○------------	MP4C --------------	○	
	Ring ○	TP4K ○------------	MP4D --------------	○	**63, 69**
Reserved SLIC #3	Tip ○	TP4G ○---		○	
	Ring ○	TP4H ○---		○	63, 69
Reserved SLIC #4	Tip ○	TP4J ○---		○	
	Ring ○	TP4K ○---		○	63, 69
Reserved RS-232 RxD to user	○	TP5A ○------------	MP2A ○------------	○	
Reserved RS-232 TxD from user	○	TP5B ○------------	MP2B ○------------	○	
Reserved RS-232 RTS from user	○	TP5C ○------------	MP2C ○------------	○	
Reserved RS-232 CTS to user	○	TP5D ○------------	MP2D ○------------	○	
Reserved RS-232 DTS from user	○	TP5F ○------------	MP2E ○------------	○	63, 70
Reserved RS-232 DSR to user	○	TP5G ○------------	MP2F ○------------	○	
Reserved RS-232 CD to user	○	TP5H ○------------	MP2G ○------------	○	
Reserved RS-232 RI to user	○	TP5J ○------------	MP2H ○------------	○	
Reserved RS-232 Signal ground	○	TP5K ○------------	MP2J ○------------	○	
Reserved RS-232 RxD to term	○	MP1G ○------------	MP1H ○------------	○	
Reserved RS-232 TxD from term	○	MP2G ○------------	MP1G ○------------	○	63, 71
Reserved RS-232 term signal ground	○	MP3G ○------------	MP1J ○------------	○	
Reserved for Failure discrete output	○	MP4G ○------------	MP1B ○------------	○	**72, 73**
Reserved HSD Ch 1 avail disc output	○	MP1H ○------------	MP1C ○------------	○	
Reserved HSD Ch 2 avail disc output	○	MP2H ○------------	MP1D ○------------	○	74
Reserved HSD Ch 3 avail disc output	○	MP3H ○------------	MP1E ○------------	○	
Reserved HSD Ch 4 avail disc output	○	MP4H ○------------	MP1A ○------------	○	
Reserved 429 Output A			TP3E ○		
B			TP3F ○		
Reserved 429 Input A			TP4J ○		
B			TP4K ○		
Reserved Weight On Wheels Discr. In			TP3G ○-----------	○	
HPA HSD Receiver RF Input			BP12 ○-----------	○	

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Notes

61. Electrical Interface conforms to the ISDN Basic Rate Interface (BRI) standards at the S/T (Euro) interface.

62. Electrical Interface conforms to IEEE 802.3 (10 Base-T).

63. Devices using the High Speed Data Ethernet, ISDN, or RS-232 interfaces must be wired only to the LRU that contains the HSD function. The LRU that contains this function is manufacturer-specific.

64. **W**iring **for this signal** must be installed to support inclusion of the HSD capability in either the RFU or HPA (but not both). In an HSD installation, an RFU or HPA that does not contain the HSD function must not interface to these **circuits** at **its** rear connector.

65. For multi-channel HSD operation in the RFU or HPA (where each channel requires its own Swift64 Forward ID), the additional channels' IDs are assumed to be tabularly derived from the single base channel's programmed ID. For SDU integration of HSD, this is likely to require an APM due to unavailability of spare program pins and the undesirability of airplane-unique ORTs.

66. RFU HSDU Configuration Pins definition and interpretation details are shown in Attachment 4, Tables 4-3A through 4-3I.

67. HPA HSDU Configuration Pins definition and interpretation details are shown in Attachment 4**,** Tables 4-4A **through** 4-4**D**.

68. For the RFU HSDU, the CEPT E1 primary-rate ISDN interface may be wired to the cabin (e.g., the ARINC 746 CTU) or a compatible port on the SDU. Strap option MP3D determines whether the protocol on this port is the telecommunications industry standard or as per ARINC 746. For the HPA HSDU, this interface is defined by ARINC 746. A CEPT E-1 interface to/from the cabin should only be connected to the RFU or HPA containing the High Speed Data function.

69. Subscriber line interface circuit (two-wire POTS [plain-old telephone service]).

70. DE-9-type RS-232 user interface (typically only used for test purposes).

71. Wired to a maintenance terminal or PC for specialized on-aircraft maintenance.

72. For the RFU HSDU, electrical characteristics are as per Attachment 1-4 Note 10 (i.e., current sink suitable for driving external 28VDC incandescent lamps). For the HPA **HSDU**, electrical characteristics are **either as per Attachment 1-4 Note 10, or suitable for driving the anode of an external LED with 10-25 mA from an HPA HSDU 5 Vdc source through a current-limiting resistor, returning to HPA HSDU common – consult the HPA HSDU manufacturer**.

73. Indicates that the HSD function has currently active failures that are preventing it from offering an HSD service in its defined user interface configuration.

74. These discretes indicate availability of HSD service on the respective channels. If the unit implements fewer than four channels, only the appropriate lower-numbered discretes will be pertinent and should be wired (e.g., only Ch 1 and Ch 2 for a two-channel unit).

75. Enable HSD function = open (100,000 ohms or more), disable HSD function = ground (10 ohms or less to DC ground).

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76. This HSD control/status wiring is required for some, but not all, HPA HSDUs – consult the SDU and HPA HSDU manufacturers. In an HSD installation not including an HPA HSDU, the HPA must not interface to these circuits at its rear connector. The protocol on this interface is manufacturer-specific. This SDU interface is also reserved for use as the cross-talk bus between two SDUs in a dual system; as such, use of this interface between the SDU and the HPA HSDU may preclude a dual satcom configuration.

77. The non-HSD HPA and the HPA HSDU utilize different electrical signal characteristics and functionality (ARINC 429 vs. 0-15V discrete) on pins TP2E, TP2F, TP2H and TP2J, with different interwiring requirements for those two applications. Aircraft wiring for non-HSD HPAs is obviously not adequate for HPA HSDUs, but aircraft wiring for HPA HSDUs that utilizes these particular circuits may not be electrically compatible with non-HSD HPAs and their affiliated SDUs. Consult the SDU, HPA and HPA HSDU manufacturers, and exercise appropriate caution.

78. This note only applies to HPA pins TP6A through TP7K (not to the RFU HSDU). Note that in Attachment 1-4, these pins are Reserved for ATE (automatic test equipment) for non-HSD HPAs. Such non-HSD HPA ATE circuits may not have been designed to be permanently grounded via aircraft wiring, as will be the case for some of the Swift64 Forward ID pins with the HPA HSDU. As a result, non-HSD HPAs may be electrically incompatible with Forward ID strapping on these pins, and equipment damage may result if such non-HSD HPAs are installed on aircraft wired for HPA HSDUs. Consult the HPA and HPA HSDU manufacturers, and exercise appropriate caution.

79. In a non-HSD installation, these circuits are wired between the SDU and RFU (if any) for classic RFU functions. For the case of an RFU HSDU, these circuits are used for HSD functions, as well as for any classic RFU functions that may remain. The protocol on this interface is manufacturer-specific.

Table 4-2 – SDU Configuration Pins Definition and Interpretation

Same as for the non-HSD SDU; reference Attachment 1-4C.

RFU HSDU CONFIGURATION PINS DEFINITION AND INTERPRETATION

RFU HSDU Configuration Straps

Note: When installing the RFU HSDU, SDU Configuration pin TP10G must be strapped to indicate that the RFU HSDU is installed, reference Attachment 1-4C, Table 1-4 (TP10G).

The electrical characteristics of these signals should be as specified in ARINC 741 Part 1, Attachment 1-4 Note 14. Pins assigned to bits required to take on binary 'one' state in a given code should be left open circuit. Pins assigned to bits required to take on binary 'zero' state in the code should be jumpered to pin MP3F, Discrete/Strap Common (taken from ARINC 741 Part 1, Attachment 1 – 4, Notes 14 and 38).

The RFU HSDU should determine its Swift64 base Forward ID from discrete inputs. The RFU HSDU should use this single id to determine the four Swift64 id pairs.

Table 4-3A – High Speed Data Forward ID Straps

ARINC 600 Pin	Signal Name
MP4A	FWD Address Bit 24 (LSB)
MP4B	FWD Address Bit 23
MP4C	FWD Address Bit 22
MP4D	FWD Address Bit 21
MP4E	FWD Address Bit 20
MP4F	FWD Address Bit 19
MP5A	FWD Address Bit 18
MP5B	FWD Address Bit 17
MP5C	FWD Address Bit 16
MP5D	FWD Address Bit 15
MP5E	FWD Address Bit 14
MP5F	FWD Address Bit 13
MP5G	FWD Address Bit 12
MP5H	FWD Address Bit 11
MP5J	FWD Address Bit 10
MP5K	FWD Address Bit 9
MP6C	FWD Address Bit 8
MP6D	FWD Address Bit 7
MP6G	FWD Address Bit 6
MP6H	FWD Address Bit 5
MP7C	FWD Address Bit 4
MP7D	FWD Address Bit 3
MP7G	FWD Address Bit 2
MP7H	FWD Address Bit 1 (MSB)

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Table 4-3B – High Ethernet Ports/HSD Channels Allocation

ARINC 600 Pin	Signal Name
MP1A	Ethernet Ports/HSD Channels Allocation
0 1	Segregated First-come, first-served

Table 4-3C – SwiftBroadband Enable

ARINC 600 Pin	Signal Name
MP1B	SwiftBroadband Enable
0 1	Enabled Disabled

Table 4-3D – Spare A429 Tx/Rx Speed Select

ARINC 600 Pin	Signal Name	High Speed A429 Bus	Low Speed A429 Bus
MP1C	Spare A429 O/P (TP2C/D) Speed Select	0	1
MP1D	Spare A429 I/P (TP2A/B) Speed Select	0	1

Table 4-3E – CEPT-E1 Operation

ARINC 600 Pin	Signal Name
MP3D	CEPT-E1 Operation
0 1	A746 Protocol disabled A746 Protocol enabled

Table 4-3F – User Interface Configuration

ARINC 600 Pin	Signal Name	Installed	Not Installed
MP1E	ISDN 1 Presence	0	1
MP1F	ISDN 2 Presence	0	1
MP2A	Ethernet 1 Presence	0	1
MP2B	Ethernet 2 Presence	0	1

Table 4-3G – Reserved Strap Options

The following pins should be reserved for future use and determination.

ARINC 600 Pin	Signal Name
MP2C	Reserved Strap Option 10
MP2D	Reserved Strap Option 11
MP2E	Reserved Strap Option 12
MP3A	Reserved Strap Option 13
MP3B	Reserved Strap Option 14
MP3C	Reserved Strap Option 15

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Table 4-3H – Strap Parity

ARINC 600 Pin	Signal Name
MP3E	Strap Parity

Pin MP3E should be used to detect false strapping of the following configuration pins:

MP1A to MP1F
MP2A to MP2E
MP3A to MP3D

This pin should cover the parity of the sixteen strap pins and the overall parity should be odd.

Table 4-3I – Discrete/Strap Common

ARINC 600 Pin	Signal Name
MP3F	Discrete/Strap Common

Pin MP3F should be used for 'grounding' the discretes and the straps.

HPA HSDU CONFIGURATION PINS DEFINITION AND INTERPRETATION

Table 4-4A – Reserved System Configuration Pins

ARINC 600 Pin	Signal Name
TP3J	Weight on Wheels Config.
TP4A	System Config 1
TP4B	System Config 2
TP4C	System Config 3
TP4D	System Config 4
TP4E	System Config 5
TP4F	System Config 6
TP4G	System Config 7

Contact the HPA HSDU manufacturer for specific usage of these pins.

Table 4-4B – Reserved I/O Program Pins

ARINC 600 Pin	Signal Name
MP5G	I/O Program #1
MP5H	I/O Program #2
MP5J	I/O Program #3
MP5K	I/O Program #4
MP6G	I/O Program #5
MP6H	I/O Program #6
MP6J	I/O Program #7
MP6K	I/O Program #8

Contact the HPA HSDU manufacturer for specific usage of these pins.

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Table 4-4C – Swift64 Forward ID Straps

ARINC 600 Pin	Signal Name
TP5F	FWD Address Bit 24 (LSB)
TP5G	FWD Address Bit 23
TP5H	FWD Address Bit 22
TP5J	FWD Address Bit 21
TP5K	FWD Address Bit 20
TP6A	FWD Address Bit 19
TP6B	FWD Address Bit 18
TP6C	FWD Address Bit 17
TP6D	FWD Address Bit 16
TP6E	FWD Address Bit 15
TP6F	FWD Address Bit 14
TP6G	FWD Address Bit 13
TP6H	FWD Address Bit 12
TP6J	FWD Address Bit 11
TP6K	FWD Address Bit 10
TP7A	FWD Address Bit 9
TP7B	FWD Address Bit 8
TP7C	FWD Address Bit 7
TP7D	FWD Address Bit 6
TP7E	FWD Address Bit 5
TP7F	FWD Address Bit 4
TP7G	FWD Address Bit 3
TP7H	FWD Address Bit 2
TP7J	FWD Address Bit 1 (MSB)

Table 4-4D – Discrete/Strap Common

ARINC 600 Pin	Signal Name
TP7K	Discrete/Strap Common

Pin TP7K should be used for 'grounding' the discretes and the straps.

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Table 4-5A – SDU HSDU Top Plug Connector Layout

	A	B	C	D	E	F	G	H	J	K
1	0-15 V Discrete Input	0-15 V Discrete Input	0-7 V Discrete Output	0-7 V Discrete Output	0-7 V Discrete Output	0-7 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output
2	Reserved Analog PBX Channel 1 Input Hi	Reserved Analog PBX Channel 1 Input Lo	Reserved Analog PBX Channel 1 Output Hi	Reserved Analog PBX Channel 1 Output Lo	Reserved Analog PBX Channel 2 Input Hi	Reserved Analog PBX Channel 2 Input Lo	Reserved Analog PBX Channel 2 Output Hi	Reserved Analog PBX Channel 2 Output Lo	o	o
3	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	0-28 V Discrete Output	Reserved MFR. Specific	Reserved MFR. Specific	Reserved MFR. Specific	Reserved MFR. Specific	Reserved MFR. Specific
4	o	o	o	o	o	o	o	o	o	o
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
6	Reserved Bus from HSDU (ARINC 429) A	Spare 429 Input B	Spare 429 Output A	Spare 429 Output B	± 15 V Discrete Output	o	± 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	Reserved Ethernet #2 from User +	Reserved Ethernet #2 from User -	Reserved Ethernet #2 to User +	Reserved Ethernet #1 to User -	± 15 V Discrete Input	± 15 V Discrete Output	± 15 V Discrete Input	± 15 V Discrete Output
8	Reserved Ethernet #1 from User +	Reserved Ethernet #1 from User -	Reserved Ethernet #1 to User +	Reserved Ethernet #1 to User -	Reserved ISDN #1 from User +	Reserved ISDN #1 from User -	Reserved ISDN #1 to User +	Reserved ISDN #1 to User -	o	o
9	Spare Discrete Input Config. Strap Type	Spare Discrete Input Config. Strap Type	o	o	Reserved ISDN #2 from User +	Reserved ISDN #2 from User -	Reserved ISDN #2 to User +	Reserved ISDN #2 to User -	o	o
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	Option AES ID 429 Input Bus Speed	Reserved For HSDU #1 Configuration	Option SDU Controller Type	Reserved For Strap Option	Option Call Light Activation
11	Option Strap Parity (Odd)	Option CCS Presence	Option IRS Config.	Option IRS Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.	Option HPA/ Antenna Subsystem Config.
12	Option CFDS Type	Option CFDS Type	Option CFDS Type	Reserved A/C ID or CFDS/SDU Config.	Option SDU/HSDU Config.	Option SDU Number	Option CMU #1 Config.	Option CMU #2 Config.	Option SCDU/ WSC #1 Config.	Option SCDU/ WSC #2 Config.
13	Option Priority 4 Calls To/From Cockpit	Option SCDU/ WSC Bus Speed	Option Light/ Chime Code	Option Light/ Chime Code	Option SCDU/ WSC #3 Config.	SDU CODEC 1 Wiring	SDU CODEC 1 Wiring	SDU CODEC 2 Wiring	SDU CODEC 2 Wiring	Cockpit Signaling Method
14	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE
15	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE	Reserved ATE

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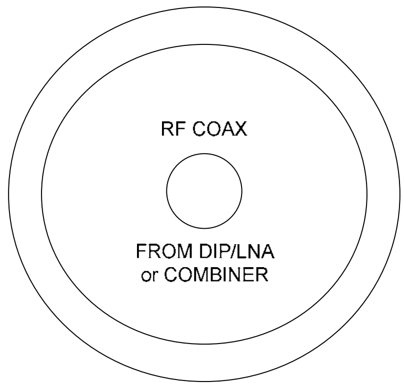
Table 4-5B - SDU HSDU Middle Plug Connector Layout

	A	B	C	D	E	F	G	H	J	K
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
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
3	Cabin Dig Voice/ Data Out CEPT-E1 A	Cabin Dig Voice/ Data Out CEPT-E1 B	Data From SCDU/WSC #1 A	Data From SCDU/WSC #1 B	Data From SCDU/WSC #2 A	Data From SCDU/WSC #2 B	Data From CMU #2 A	Data From CMU #2 B	Data To SCDU/WSC #1, #2, & #3 A	Data To SCDU/WSC #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
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 or Reserved for Disable Discrete to HSDU	Dual System Disable Discrete I/O
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
7	From Airborne Data Loader A	From Airborne Data Loader B	To Airborne Data Loader A	To Airborne Data Loader B	Reserved Data Bus To HSDU A	Reserved Data Bus To HSDU 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	Spare 429 Input A	Spare 429 Input B	CP Voice Call Light Output #1	CP Voice Mic On Input #1	CP Voice Call Light Output #2	CP Voice Mic On Input #2	Data From SCDU/WSC #3 A	Data From SCDU/WSC #3 B
9	Reserved Data To SNU/CPDF A	Reserved Data To SNU/CPDF B	Spare 429 Output A	Spare 429 Output B	Reserved Data Bus from RFU to SDU, or from HSDU to SDU A	Reserved Data Bus from RFU to SDU or from HSDU to SDU B	Reserved Data Bus to RFU from SDU or to HSDU from SDU A	Reserved Data Bus to RFU from SDU or to HSDU from SDU B	Unspec Function o A	Unspec Function o B
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
11	From Motion Sensor #1	Motion Sensor #1 Program Select	Place/End Call Discrete Input #1	Place/End Call Discrete Input #2	Reserved Unspec Program	Reserved Unspec Program	Strap Option	Reserved Unspec Program	Reserved Unspec Program	Reserved Unspec Program
12	Reserved Crosstalk From Other SDU or **HPA** HSDU (ARINC 429) A	Reserved Crosstalk From Other SDU or **HPA** HSDU (ARINC 429) B	Reserved Crosstalk To Other SDU or **HPA** HSDU (ARINC 429) A	Reserved Crosstalk To Other SDU or **HPA** HSDU (ARINC 429) B	o	o	Reserved Data From FMC #1 A	Reserved Data From FMC #1 B	Reserved Data From FMC #2 A	Reserved Data From FMC #2 B
13	Reserved for Disable Discrete To HSDU	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
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 4
WIRING PROVISIONS FOR INTERNAL HIGH SPEED DATA

Table 4-6A – RFU HSDU Top Plug Connector Layout



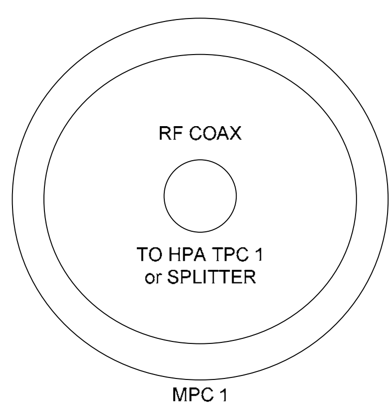
TPC 1

	A	B	C	D	E	F	G	H	J	K
1	429 DATA OUTPUT TO SDU A	429 DATA OUTPUT TO SDU B	429 DATA INPUT FROM SDU A	429 DATA INPUT FROM SDU B	CEPT E1 TO SDU/USER A	CEPT E1 TO SDU/USER B	CEPT E1 FROM SDU/USER A	CEPT E1 FROM SDU/USER B	UNSPEC RFU FUNCTION 3 A	UNSPEC RFU FUNCTION 3 B
2	SPARE 429 INPUT A	SPARE 429 INPUT B	SPARE 429 OUTPUT A	SPARE 429 OUTPUT B	SPARE DISCRETE INPUT #1	SPARE DISCRETE INPUT #2	SPARE DISCRETE INPUT #3	SPARE DISCRETE OUTPUT #1	SPARE DISCRETE OUTPUT #2	SPARE DISCRETE OUTPUT #3
3	UNSPEC RFU FUNCTION 4 A	UNSPEC RFU FUNCTION 4 B	UNSPEC RFU FUNCTION 5 A	UNSPEC RFU FUNCTION 5 B	UNSPEC RFU FUNCTION 6 A	UNSPEC RFU FUNCTION 6 B	SLIC #1 TIP	SLIC #1 RING	SLIC #2 TIP	SLIC #2 RING
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	SLIC #3 TIP	SLIC #3 RING	SLIC #4 TIP	SLIC #4 RING
5	RS-232 RxD TO USER	RS-232 TxD FROM USER	RS-232 RTS FROM USER	RS-232 CTS TO USER	HSU DISABLE DISC. INPUT	RS-232 DTS FROM USER	RS-232 DSR TO USER	RS-232 CD TO USER	RS-232 RI TO USER	RS-232 SIGNAL GROUND
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

ATTACHMENT 4
WIRING PROVISIONS FOR INTERNAL HIGH SPEED DATA

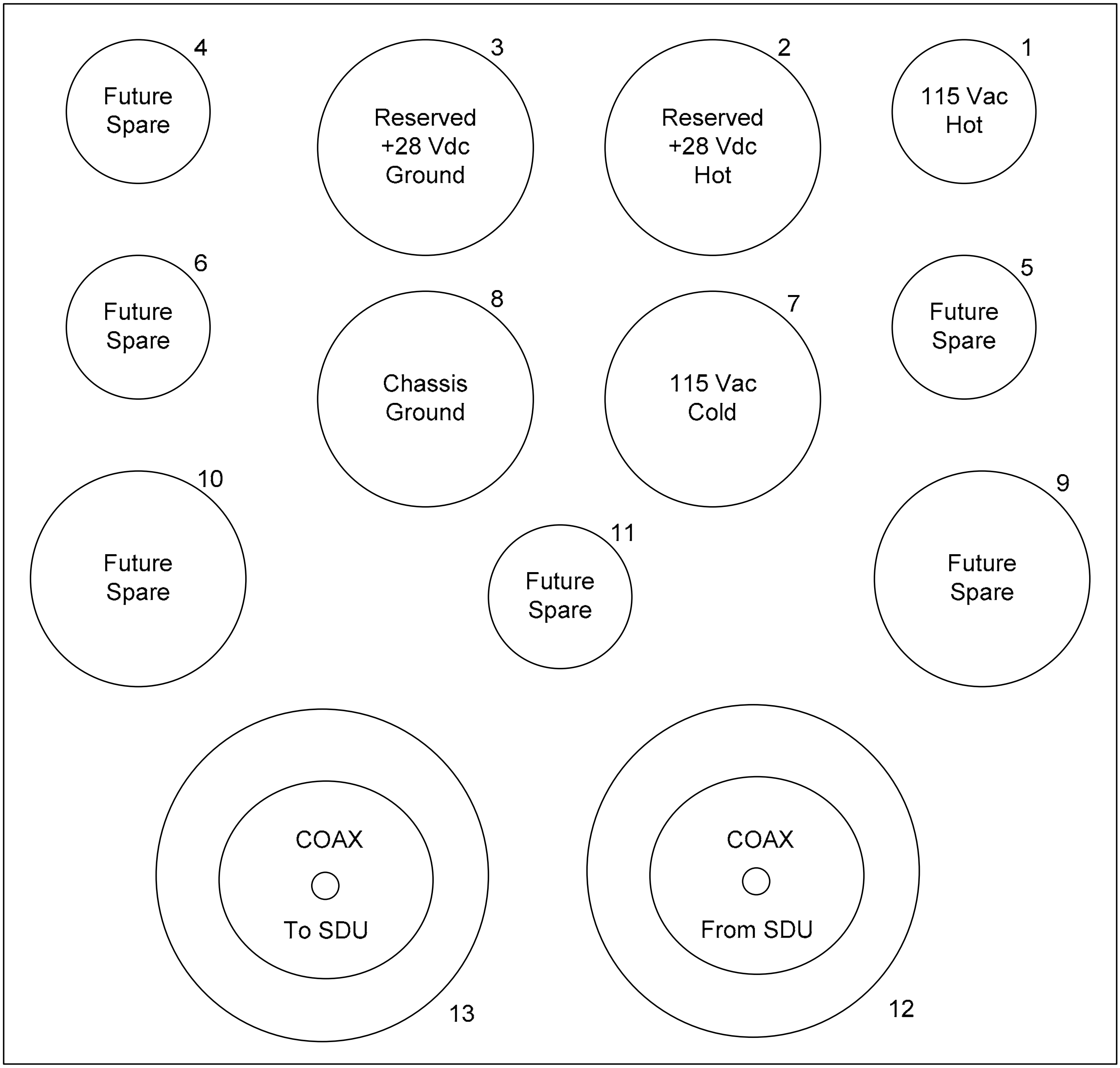
Table 4-6B – RFU HSDU Middle Plug Connector Layout

	A	B	C	D	E	F	G	H	J	K
1	STRAP ETHERNET PORTS/HSD CHANNELS ALLOCATION	STRAP BGAN ENABLE	STRAP SPARE A429 O/P SPEED SELECT	STRAP SPARE A429 I/P SPEED SELECT	STRAP ISDN1 PRESENCE	STRAP ISDN2 PRESENCE	RS-232 MAINT PORT TO USER	HSD CH 1 AVAILABLE DISCRETE OUTPUT	10BASE-T #1 TO USER +	10BASE-T #1 FROM USER +
2	STRAP ETHERNET 1 PRESENCE	STRAP ETHERNET 2 PRESENCE	RESERVED STRAP OPTION #10	RESERVED STRAP OPTION #11	RESERVED STRAP OPTION #12	o	RS-232 MAINT PORT FROM USER	HSD CH 2 AVAILABLE DISCRETE OUTPUT	10BASE-T #1 FROM USER -	10BASE-T #1 TO USER -
3	RESERVED STRAP OPTION #13	RESERVED STRAP OPTION #14	RESERVED STRAP OPTION #15	STRAP CEPT E1 OPERATION	STRAP PARITY	DISCRETE/ STRAP COMMON	RS-232 MAINT PORT SIGNAL GROUND	HSD CH 3 AVAILABLE DISCRETE OUTPUT	o	o
4	FWD ID BIT #24 (LSB)	FWD ID BIT #23	FWD ID BIT #22	FWD ID BIT #21	FWD ID BIT #20	FWD ID BIT #19	HSD FAILURE DISCRETE OUTPUT	HSD CH 4 AVAILABLE DISCRETE OUTPUT	o	o
5	FWD ID BIT #18	FWD ID BIT #17	FWD ID BIT #16	FWD ID BIT #15	FWD ID BIT #14	FWD ID BIT #13	FWD ID BIT #12	FWD ID BIT #11	FWD ID BIT #10	FWD ID BIT #9
6	ISDN S/T #2 TO USER +	ISDN S/T #2 FROM USER +	FWD ID BIT #8	FWD ID BIT #7	ISDN S/T #1 TO USER +	ISDN S/T #1 FROM USER +	FWD ID BIT #6	FWD ID BIT #5	10BASE-T #2 TO USER +	10BASE-T #2 FROM USER +
7	ISDN S/T #2 FROM USER -	ISDN S/T #2 TO USER -	FWD ID BIT #4	FWD ID BIT #3	ISDN S/T #1 FROM USER -	ISDN S/T #1 TO USER -	FWD ID BIT #2	FWD ID BIT #1 (MSB)	10BASE-T #2 FROM USER -	10BASE-T #2 TO USER -



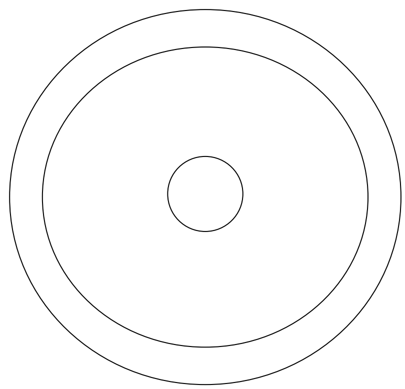
ATTACHMENT 4
WIRING PROVISIONS FOR INTERNAL HIGH SPEED DATA

Table 4-6C – RFU HSDU Bottom Plug Connector Layout



ATTACHMENT 4
WIRING PROVISIONS FOR INTERNAL HIGH SPEED DATA

Table 4-7A – HPA HSDU Top Plug Connector Layout

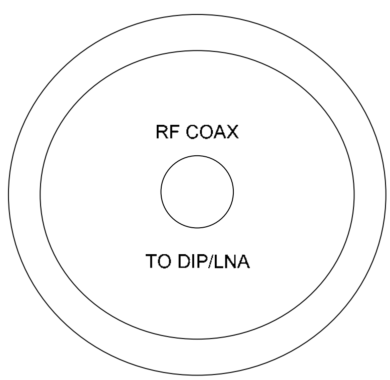


	A	B	C	D	E	F	G	H	J	K
1	INPUT MULTI-CTL A	INPUT MULTI-CTL B	OUTPUT HPA BITE A	OUTPUT HPA BITE B	FROM AIRBORNE DATA LDR A	FROM AIRBORNE DATA LDR B	TO AIRBORNE DATA LDR A	TO AIRBORNE DATA LDR B	DATA LOADER LINK A	DATA LOADER LINK B
2	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	Reserved 429 Output (HSD) A	Reserved 429 Output (HSD) B	FUTURE SPARE	Reserved 429 Input (HSD) A	Reserved 429 Input (HSD) B	FUTURE SPARE
3	TOP/PORT HPA (1) A	TOP/PORT HPA (1) B	STRB HPA (2) A	STRB HPA (2) B	Reserved 429 Output A	Reserved 429 Output B	Reserved Weight On Wheels (HSD)	Reserved HSD Disable Discrete	Reserved HSD Strap Option	o
4	Reserved HSD Strap Option	Reserved HSD Strap Option.	Reserved HSD Strap Option	Reserved HSD Strap Option	Reserved HSD Strap Option	Reserved HSD Strap Option	Reserved HSD Strap Option	Reserved HSD Strap Option	Reserved 429 Input A	Reserved 429 Input B
5	SDI #1	SDI #2	o	SDI COMMON	o	**FWD ID BIT #24 (LSB)**	**FWD ID BIT #23**	**FWD ID BIT #22**	**FWD ID BIT #21**	**FWD ID BIT #20**
6	**FWD ID BIT #19**	**FWD ID BIT #18**	**FWD ID BIT #17**	**FWD ID BIT #16**	**FWD ID BIT #15**	**FWD ID BIT #14**	**FWD ID BIT #13**	**FWD ID BIT #12**	**FWD ID BIT #11**	**FWD ID BIT #10**
7	**FWD ID BIT #9**	**FWD ID BIT #8**	**FWD ID BIT #7**	**FWD ID BIT #6**	**FWD ID BIT #5**	**FWD ID BIT #4**	**FWD ID BIT #3**	**FWD ID BIT #2**	**FWD ID BIT #1 (MSB)**	**DISCRETE/ STRAP COMMON**

ATTACHMENT 4
WIRING PROVISIONS FOR INTERNAL HIGH SPEED DATA

Table 4-7B - HPA HSDU Middle Plug Connector Layout

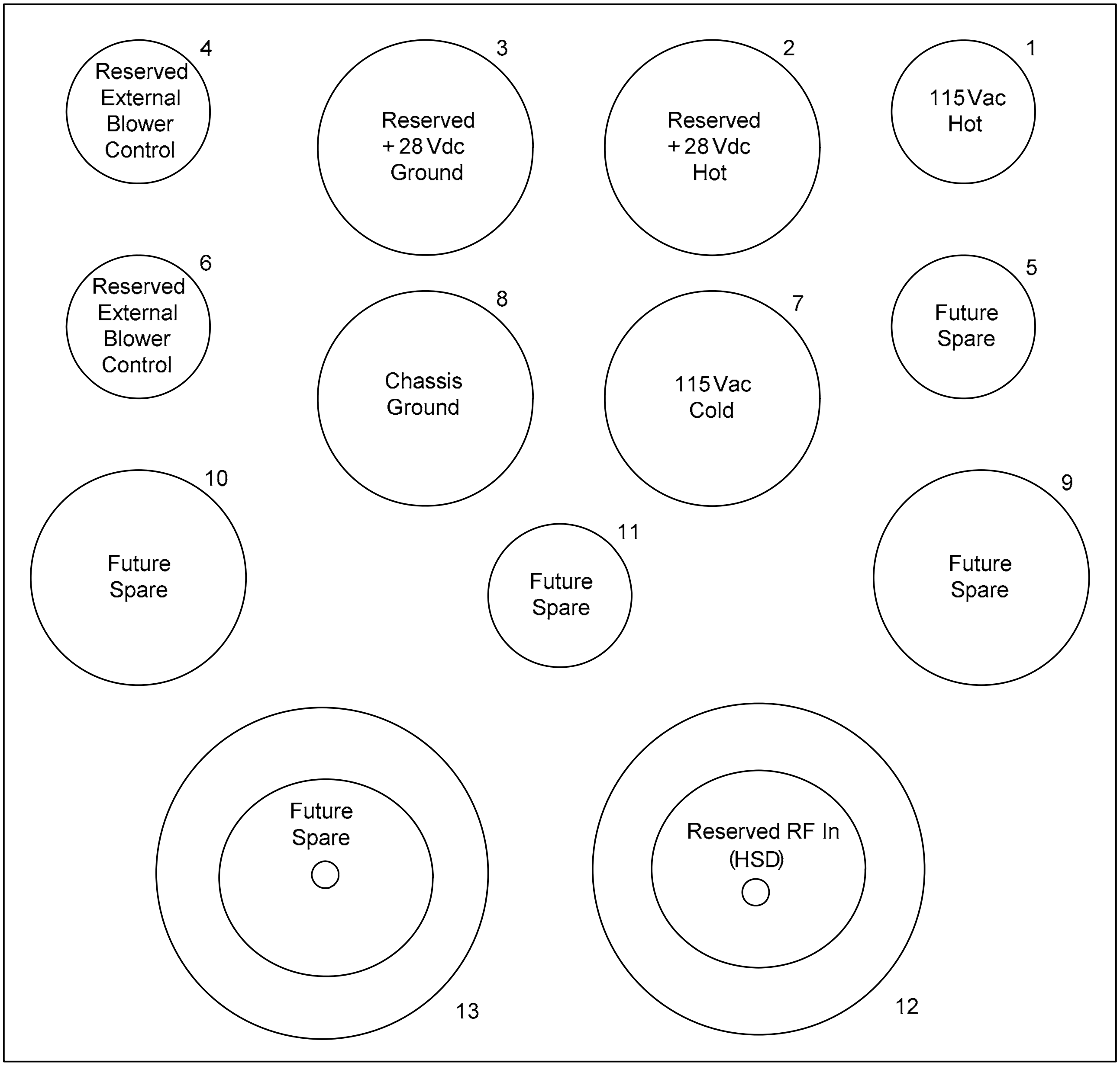
	A	B	C	D	E	F	G	H	J	K
1	Reserved HSD Ch. 4 Avail. Discr. Output	Reserved Fail Discrete Output (HSD)	Reserved HSD Ch. 1 Avail. Discr. Output	Reserved HSD Ch. 2 Avail. Discr. Output	Reserved HSD Ch. 3 Avail. Discr. Output	o	Reserved RS-232 TxD From Term. (HSD)	Reserved RS-232 RxD to Term. (HSD)	Reserved RS-232 Term. Signal Ground (HSD)	o
2	Reserved RS-232 RxD to User (HSD)	Reserved RS-232 TxD from User (HSD)	Reserved RS-232 RTS from User (HSD)	Reserved RS-232 CTS to User (HSD)	Reserved RS-232 DTS from User (HSD)	Reserved RS-232 DSR to User (HSD)	Reserved RS-232 CD to User (HSD)	Reserved RS-232 RI to User (HSD)	Reserved RS-232 Signal Ground (HSD)	o
3	o	o	o	o	o	o	o	o	o	o
4	Reserved SLIC #1 Tip (HSD)	Reserved SLIC #1 Ring (HSD)	Reserved SLIC #2 Tip (HSD)	Reserved SLIC #2 Ring (HSD	o	o	o	o	o	o
5	Reserved CEPT E-1 From User A	Reserved CEPT E-1 From User B	Reserved CEPT E-1 to User A	Reserved CEPT E-1 to User B	o	o	Reserved I/O Program (HSD)	Reserved I/O Program (HSD)	Reserved I/O Program (HSD)	Reserved I/O Program (HSD)
6	o	o	o	o	o	o	Reserved I/O Program (HSD)	Reserved I/O Program (HSD)	Reserved I/O Program (HSD)	Reserved I/O Program (HSD)
7	o	o	o	o	o	o	o	o	o	o



MPC1

ATTACHMENT 4
WIRING PROVISIONS FOR INTERNAL HIGH SPEED DATA

Table 4-7C – HPA HSDU Bottom Plug Connector Layout



APPENDIX 1
BIT-ORIENTED FAULT REPORTING PROTOCOL

Staff Note: The BIT-ORIENTED FAULT REPORTING PROTOCOL (Fault Summary Words 1-5 for SATCOM) in this Appendix will eventually be incorporated into ARINC Report 604. When incorporated, ARINC Report 604 will have precedence over this Appendix

BIT-ORIENTED FAULT REPORTING PROTOCOL
Table A7.21 – Fault Summary Word #1 for SATCOM

Bit No.	Function	Bit Status	
		1	0
1 2 3 4 5 6 7 8	Label 350 (Octal)		
9 10	SDI		
11	Satellite Data Unit	Failure	OK
12	Radio Frequency Unit	Failure	OK
13	HGA High Power Amp	Failure	OK
14	LNA to External HSDU1 Rx Path	Failure	OK
15	LGA High Power Amp	Failure	OK
16	Top/Port Diplexer/LNA	Failure	OK
17	Starboard Diplexer/LNA	Failure	OK
18	LGA Diplexer/LNA	Failure	OK
19	ACU or Top/Port BSU	Failure	OK
20	Starboard BSU	Failure	OK
21	Top/Port High Gain Antenna	Failure	OK
22	Starboard High Gain Antenna	Failure	OK
23	HPA to LGA VSWR	Failure	OK
24	High Power Relay	Failure	OK
25	System Configuration Pins	Error	OK
26	LNA to RFU Rx Path	Failure	OK
27	RFU to HPA Tx Path	Failure	OK
28	BITE Test Inhibit	Inhibit	Enable
29	Command Word Acknowledge	ACK	NAK
30 31	SSM		
32	Parity (Odd)		

Note:

1. "OK" status shall always be indicated for equipment not installed or data not used, as determined by the Satellite Data Unit system configuration pins or its design.

BIT-ORIENTED FAULT REPORTING PROTOCOL
Table A7.21 – Fault Summary Word #2 for SATCOM

Bit No.	Function	Bit Status 1	Bit Status 0
1 2 3 4 5 6 7 8	Label 351 (Octal)		
9 10	SDI		
11	CMC to SDU Bus	Inactive	OK
12	SCDU-1 to SDU Bus	Inactive	OK
13	Primary IRS to SDU Bus	Inactive	OK
14	CMU-1 to SDU Bus	Inactive	OK
15	CMU-2 to SDU Bus	Inactive	OK
16	SCDU-2 to SDU Bus	Inactive	OK
17	SCDU-3 to SDU Bus	Inactive	OK
18	FMC-1 to SDU Bus	Inactive	OK
19	SDU Crosstalk Input Bus	Inactive	OK
20	Secondary IRS to SDU Bus	Inactive	OK
21	HGA HPA to SDU Bus	Inactive	OK
22	Cabin Packet Data Funct (CPDF) to SDU Bus	Inactive	OK
23	LGA HPA to SDU Bus	Inactive	OK
24	ACU or Top/Port BSU to SDU Bus	Inactive	OK
25	Starboard BSU to SDU Bus	Inactive	OK
26	Radio Frequency Unit to SDU Bus (MP9E/F)	Inactive	OK
27	CTU to SDU Bus (CEPT-E1)	Inactive	OK
28	External HSDU #1 to SDU Bus	Inactive	OK
29	FMC-2 to SDU Bus	Inactive	OK
30 31	SSM		
32	Parity (Odd)		

Notes:

1. "Input Bus" and pin numbers are relative to the Satellite Data Unit.

2. "OK" status shall always be indicated for equipment not installed or buses not used, as determined by the Satellite Data Unit system configuration pins or its design.

3. An "Inactive Bus" report, if applicable, will supersede a data input "Failure" report.

BIT-ORIENTED FAULT REPORTING PROTOCOL
Table A7.21 – Fault Summary Word #3 for SATCOM

BIT ERROR RATE WORD Label 352				
PAR odd	SSM	SPARE	BIT ERROR RATE MSB LSB	LABEL 352
32	30 31	29 25	24 9	8 1
p	x x	00000	bbbbbbbbbbbbbbbb	01010111

Note: The use of this word is optional. The format is being defined only to document the word. The field "Bit Error Rate" indicates the number of raw bit errors detected since the last report was generated. The report should be generated every 3000 channel bits, at a 600 bps P-channel rate, this would be a new word every 5 seconds. The data will be in binary format (positive only), and range from 0 to 3000 maximum.

BIT-ORIENTED FAULT REPORTING PROTOCOL
Table A7.21 – Fault Summary Word #4 for SATCOM

Bit No.	Function	Bit Status	
		1	0
1 2 3 4 5 6 7 8	Label 353 (Octal)		
9 10	SDI		
11	SDU to RFU Bus (RFU TP1C/D) (Note 4)	Inactive	OK
12	SDU/RFU Input Bus MP9J/K (Notes 1, 4)	Inactive	OK
13	SDU/RFU Input Bus MP10A/B (Notes 1, 4)	Inactive	OK
14	SDU/RFU Input Bus MP10C/D (Notes 1, 4)	Inactive	OK
15	SDU/RFU Input Bus MP10E/F (Notes 1, 4)	Inactive	OK
16	SDU/RFU Input Bus MP10G/H (Notes 1, 4)	Inactive	OK
17	SDU/RFU Input Bus MP10J/K (Notes 1, 4)	Inactive	OK
18	SDU to HGA HPA Multi-Control Bus	Inactive	OK
19	HGA HPA Over Temperature	Over Temp	OK
20	SDU to LGA HPA Multi-Control Bus	Inactive	OK
21	SDU to ACU or Top/Port BSU Multi Control Bus	Inactive	OK
22	SDU to Starboard BSU Multi-Control Bus	Inactive	OK
23	Aircraft ID (ICAO Address) 429 Data to SDU	Failure	OK
24	Redundant Weight-on-Wheels Discretes	Failure	OK
25	(ICAO) Address Bits (straps)	Error	OK
26	Starboard BSU to Port BSU Crosstalk Bus	Inactive	OK
27	Port BSU to Starboard BSU Crosstalk Bus	Inactive	OK
28	External HSDU1 to HPA Tx Path	Failed	OK
29	LGA HPA Over Temperature	Over Temp	OK
30 31	SSM		
32	Parity (Odd)		

Notes:

1. Pin numbers are relative to the SDU.

2. "OK" status shall always be indicated for equipment not installed or buses not used, as determined by the Satellite Data Unit system configuration pins or its design.

3. An "Inactive Bus" report, if applicable, will supersede a data input "Failure" report.

4. Set this bit to “0” if the RFU is not installed or an HSDU is installed that uses the RFU form factor and wiring.

BIT-ORIENTED FAULT REPORTING PROTOCOL
Table A7.21 – Fault Summary Word #5 for SATCOM

Bit No.	Function	Bit Status	
		1	0
1 2 3 4 5 6 7 8	Label 354 (Octal)		
9 10	SDI		
11	SDU to External HSDU #1 Bus	Inactive	OK
12	Voice/Data Channel Module 1	Failed	OK
13	Voice/Data Channel Module 2	Failed	OK
14	Voice/Data Channel Module 3	Failed	OK
15	Voice/Data Channel Module 4	Failed	OK
16	Voice/Data Channel Module 5	Failed	OK
17	Voice/Data Channel Modules 6 and beyond	Note 2	Note 2
18	HPA to HGA VSWR	Failed	OK
19	LNA to SDU Rx Path (Note 3)	Failed	OK
20	SDU to HPA Tx Path (Note 3)	Failed	OK
21	External HSDU #1	Failed	OK
22	SDU to External HSDU #1 Disable discrete	Failed	OK
23	External HSDU #1 APM/CDM/FID Straps	Failed	OK
24	External HSDU #2 to SDU Bus	Inactive	OK
25	SDU to External HSDU #2 Bus	Inactive	OK
26	External HSDU #2	Failed	OK
27	SDU to External HSDU #2 Disable discrete	Failed	OK
28	External HSDU #2 APM/CDM/FID Straps	Failed	OK
29	Shop Faults Mode Supported	Yes	No
30 31	SSM		
32	Parity (Odd)		

Notes:

1. “OK” status should always be indicated for equipment not installed or busses not used, as determined by the Satellite Data Unit system configuration pins or its design.

2. Logic “1” state = one or more of channel modules 6 and beyond have failed;
Logic “0” state = all of channel modules 6 and beyond are OK.

3. Label 350 bits 26 and 27 are used in systems which include an RFU; systems that do not include an RFU (e.g., certain ARINC 761 configurations) use these Label 354 bits and the Label 350 bits to indicate failures, for compatibility with legacy as well as appropriately updated maintenance systems. (Documentation for legacy maintenance systems may require explanatory notes regarding SATCOM systems that assert Label 350 bits 26 or 27, but do not include RFUs; for such systems, the pertinent LRU is the SDU, not the RFU. Updated maintenance systems can check for Label 350 bit 26 AND Label 354 bit 19 being set, or for Label 350 bit 27 AND Label 354 bit 20 being set, and if true, suppress the Label 350-triggered failure text (containing “RFU”) in favor of the Label 354-triggered failure text (containing “SDU” instead of “RFU”).

BIT-ORIENTED FAULT REPORTING PROTOCOL
Table A7.21 – Fault Summary Word #6 for SATCOM

Bit No.	Function	Bit Status	
		1	0
1 2	Label 355 (Octal)		
3 4 5			
6 7 8			
9 10	SDI		
11	LNA to external HSDU2 Rx Path	Failed	OK
12	External HSDU2 to HPA Tx Path	Failed	OK
13	External HSDU1 Ethernet Port	Inactive	OK
14	External HSDU2 Ethernet Port	Inactive	OK
15	SDU to RFU HSDU Disable Discrete (Note 2)	Failed	OK
16	Straps for RFU HSDU (Note 2)	Failed	OK
17	RFU HSDU Fail (Note 2)	Failed	*OK*
18	SDU to RFU HSDU Bus (Note 2)	Inactive	OK
19	RFU HSDU Channel #1 Fail (Note 2)	Failed	OK
20	RFU HSDU Channel #2 Fail (Note 2)	Failed	OK
21	RFU HSDU Channel #3 Fail (Note 2)	Failed	OK
22	RFU HSDU Channel #4 Fail (Note 2)	Failed	OK
23	RFU HSDU to SDU Bus (Note 2)	Inactive	OK
24	LNA to RFU HSDU Rx Path (Note 2)	Failed	OK
25	RFU HSDU to HPA Tx Path (Note 2)	Failed	OK
26	RFU HSDU Ethernet Port 1 (Note 2)	Inactive	OK
27	RFU HSDU Ethernet Port 2 (Note 2)	Inactive	OK
28	Reserved for External HSDU 1 to SDU Tx Path (Note 3)	Failed	OK
29	Reserved for External HSDU 2 to SDU Tx Path (Note 3)	Failed	OK
30 31	SSM		
32	Parity (Odd)		

Notes:

1. “OK” status should always be indicated for equipment not installed or busses not used, as determined by the Satellite Data Unit system configuration pins or its design.

2. RFU HSDU for Label 355 bits 15-27 refers to a High Speed Data Unit LRU that conforms in general to the wiring and form factor of a Radio Frequency Unit.

3. Intended for SDUs with internal high power amplifiers but external HSDUs.

BIT-ORIENTED FAULT REPORTING PROTOCOL
Table A7.21 – Fault Summary Word #7 for SATCOM

Bit No.	Function	Bit Status	
		1	0
1 2	Label 357 (Octal)		
3 4 5			
6 7 8			
9 10	SDI		
11	SDU HSDU Channel Module #1	Failed	OK
12	SDU HSDU Channel Module #2	Failed	OK
13	SDU HSDU Channel Module #3	Failed	OK
14	SDU HSDU Channel Module #4	Failed	OK
15	Reserved for ARINC 781 External HPA	Failed	OK
16	Reserved for ARINC 781 External HPA to Antenna VSWR	Failed	OK
17	Reserved	Inactive	*OK*
18	Reserved	Inactive	OK
19	Reserved	Inactive	OK
20	Reserved	Inactive	OK
21	Reserved for ARINC 781 Antenna to SDU Data Bus	Inactive	OK
22	Reserved for ARINC 781 SDU to Antenna Data Bus	Inactive	OK
23	Reserved for SDU Over Temperature (Note 2)	Over Temp	OK
24	Reserved for SDU to Antenna VSWR (Note 2)	Failed	OK
25	Reserved for SDU to ARINC 781 External HPA Tx Path	Failed	OK
26	Reserved for SDU to ARINC 781 External HPA Data Bus	Inactive	OK
27	Reserved for SDU Configuration Module	Failed	OK
28	Reserved for SDU to SCM Data Bus	Inactive	OK
29	Reserved for SCM to SDU Data Bus	Inactive	OK
30 31	SSM		
32	Parity (Odd)		

Notes:

1. "OK" status should always be indicated for equipment not installed or busses not used, as determined by the Satellite Data Unit system configuration pins or its design.

2. Intended for SDUs with internal high power amplifiers defined in ARINC 761 and ARINC 781.

BIT-ORIENTED FAULT REPORTING PROTOCOL
Table A7.21 – Fault Summary Word #8 for SATCOM

Bit No.	Function	Bit Status 1	Bit Status 0
1 2 3 4 5 6 7 8	Label 360 (Octal)		
9 10	SDI		
11	HPA HSDU FID Straps	Failed	OK
12	HPA HSDU Ethernet Port 1	Inactive	OK
13	HPA HSDU Ethernet Port 2	Inactive	OK
14	HPA HSDU Channel #1	Failed	OK
15	HPA HSDU Channel #2	Failed	OK
16	HPA HSDU Channel #3	Failed	OK
17	HPA HSDU Channel #4	Failed	OK
18	HPA HSDU to SDU Bus	Inactive	OK
19	LNA to HPA HSDU Rx Path	Failed	OK
20	SDU to HPA HSDU Bus	Inactive	OK
21	HPA HSDU APM/CDM	Failed	OK
22	SDU to HPA HSDU Disable Discrete Output	Failed	OK
23	Reserved for ARINC 781 USIM #1	Failed	OK
24	Reserved for ARINC 781 USIM #2	Failed	OK
25	Reserved for ARINC 781 USIM #3	Failed	OK
26	Reserved for ARINC 781 USIM #4	Failed	OK
27	Reserved for External ARINC 781 HPA to SDU Data Bus	Inactive	OK
28	Reserved for External ARINC 781 HPA Over Temperature	Over Temp	OK
29	RFU HSDU APM/CDM (Note 2)	Failed	OK
30 31	SSM		
32	Parity (Odd)		

Notes:

1. "OK" status should always be indicated for equipment not installed or busses not used, as determined by the Satellite Data Unit system configuration pins or its design.

2. RFU HSDU refers to a High Speed Data Unit LRU that conforms in general to the wiring and form factor of a Radio Frequency Unit.

BIT-ORIENTED FAULT REPORTING PROTOCOL
Fault Summary Word #9 for SATCOM

Bit No.	Function	Bit Status	
		1	0
1	Label 361 (Octal)		
2			
3			
4			
5			
6			
7			
8			
9	SDI		
10			
11	Reserved for ARINC 781 SDU Fiber Ethernet Port #1	Inactive	OK
12	Reserved for ARINC 781 SDU Fiber Ethernet Port #2	Inactive	OK
13	Reserved for ARINC 781 SDU Fiber Ethernet Port #3	Inactive	OK
14	Reserved for ARINC 781 SDU Fiber Ethernet Port #4	Inactive	OK
15	Reserved for ARINC 781 SDU Fiber Ethernet Port #5	Inactive	OK
16	Reserved for ARINC 781 SDU Size 22 Pins Ethernet Port #1	Inactive	OK
17	Reserved for ARINC 781 SDU Size 22 Pins Ethernet Port #2	Inactive	OK
18	Reserved for ARINC 781 SDU Size 22 Pins Ethernet Port Spare	Inactive	OK
19	Reserved for ARINC 781 SDU Quadrax Ethernet Port #3	Inactive	OK
20	Reserved for ARINC 781 SDU Quadrax Ethernet Port #4	Inactive	OK
21		Failed	OK
22		Failed	OK
23		Failed	OK
24	SDU HSDU Ethernet Port #1	Inactive	OK
25	SDU HSDU Ethernet Port #2	Inactive	OK
26	SDU HSDU Ethernet Port #3	Inactive	OK
27	SDU HSDU Ethernet Port #4	Inactive	OK
28		Failed	OK
29		Failed	OK
30	SSM		
31			
32	Parity (Odd)		

Notes:

1. “OK” status should always be indicated for equipment not installed or busses not used, as determined by the Satellite Data Unit system configuration pins or its design.

APPENDIX 2
ACRONYMS

ABPSK	Aviation Binary Phase Shift Keying
ac	Alternating Current
ACARS	Aircraft Binary Phase Shift Keying
ACFT	Aircraft
ACU	Antenna Control Unit
ADSU	Automatic Dependent Surveillance Unit
AES	Aircraft Earth Station
AGC	Automatic Gain Control
AMS	Audio Management System
ANT	Antenna
AQPSK	Aviation Quadrature Phase Shift Keying
APM	Aircraft Personality Module
ATE	Automatic Test Equipment
ATLAS	Abbreviated Test Language for All Systems
ATR	Air Transport Radio Racking System
BER	Bit Error Rate
BITE	Backward Interworking Telephony Event
BNR	Binary
BP	Bottom Plug
bps	Bits Per Second
BSU	Beam Steering Unit
C/N_0	Carrier-to-Noise Ratio
CCIR	International Radio Consultative Committee
CCITT	International Telegraph and Telephone Consultative Committee
CCS	Cabin Communication System
CDM	Configuration Data Module
CDU	Control Display Unit
CEPT	Conference of European Postal and Telecommunications Administration
CFDS	Centralized Fault Display System
CMU	Communication Management Unit
CODEC	Coder/Decoder
COMB	Combiner
CPD	Cabin Packet Data
CPDF	Cabin Packet-Mode Data Function
CRC	Cyclic Redundancy Check

APPENDIX 2
ACRONYMS

CTU	Cabin Telecommunications Unit
dB/K	Decibel Kelvin
dB	Decibel
dBc	Decibel below single carrier level
dBHz	Decibel Hertz
dBi	Decibel relative to isotropic
dBic	Decibel relative to isotropic, circular polarization
dBK	Decibel Kelvin
dBm	Decibel relative to one milliwatt
dBW	Decibel Watts
dc	Direct Current
DIU	Data Interface Unit
DLS	Direct Link Service
DPX	Diplexer
DU	Diplexer Unit
ECAM	Electronic Centralized Aircraft Monitoring
EIA	Electronic Industries Association
EICAS	Engine Instrument and Crew Alerting System
EIRP	Effective Isotropic Radiated Power
EMI	Electromagnetic Interference
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FID	Forward Identification
FMC	Flight Management Computer
FMS	Flight Management System
G/T	Gain/Temperature
GES	Ground Earth Station
GLONASS	Global Orbiting Navigation Satellite System
GND	Ground
GPS	Global Positioning System
GSDB	GES Specific Data Broadcast
HEX	Hexadecimal
HGA	High Gain Antenna
HPA	High Power Amplifier
HPR	High Power Relay

APPENDIX 2
ACRONYMS

HSDU	High Speed Data Unit
ICAO	International Civil Aviation Organization
IF	Intermediate Frequency
INS	Inertial Navigation System
IRS	Inertial Reference System
kg/hr	Kilogram Per Hour
kHz	Kilohertz
LED	Light Emitting Diode
LGA	Low Gain Antenna
LICI	Link Interface Control Information
LIDU	Link Interface Data Unit
LNA	Low Noise Amplifier
LRU	Line Replacement Unit
LSB	Least Significant Bit
LSDU	Link Service Data Unit
LSU	Lone Signal Unit
M/S	microsecond
MA	milliampere
MCDU	Multi-Purpose Control Display Unit
MCU	Modular Concept Unit
MHz	megahertz (10^6 Hz)
mm	Millimeter
MP	Reference Number for a message sent on P-Channel
MSB	Most Significant Unit
MU	Management Unit
ORT	Owner Requirements Table
PBX	Private Branch Exchange
PDU	Protocol Data Unit
PEP	Peak Envelope Power
PTR	Printer
PTT	Push-to-Talk
RAM	Random Access Memory
RF	Radio Frequency
RFDU	Radio Frequency Distribution Units
RFU	Radio Frequency Unit

APPENDIX 2
ACRONYMS

RMP	Radio Management Panel
RMS	Root-Mean-Square
ROM	Read Only Memory
RSVD	Reserved
RX	Receive
SAL	System Address Label
SATCOM	Satellite Communications
SCDU	Satellite Control Display Unit
SDI	Source Destination Identifier
SDL	Specification and Description Language
SDU	Satellite Data Unit
SMART	Standard Modular Avionics Repair and Test System
SNU	Satellite News Unit
SPLTR	Splitter
SRU	Shop Replaceable Unit
SSM	Sign Status Matrix
SSR	Secondary Surveillance Radar
STBD	Starboard
TBD	To Be Defined
TDMA	Time Division Multiple Access
TFTS	Terrestrial Flight Telephone System
TIFU	Terminal Interface Function Unit
TP	Top Plug
TX	Transit
UTC	Universal Time Coordinate
V	Volts
Vac	Volts Alternating Current
Vdc	Volts Direct Current
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio
W	Watts
WOW	Weight-On-Wheels
WSC	Williamsburg SDU Controller
WSCI	Williamsburg SDU Controller Interface

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SUPPLEMENT 1
TO
ARINC CHARACTERISTIC 741
AVIATION SATELLITE COMMUNICATION SYSTEM
PART 1
AIRCRAFT INSTALLATION PROVISIONS

Published: November 15, 1988

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: September 22, 1988

A. PURPOSE OF THIS DOCUMENT

This supplement introduces several text changes to the main body of the documents. Substantial updates were also made to the Standard Interwiring and Notes Applicable to the Standard Interwiring.

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document, **blue bold** will indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 741 PART 1 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

1.1 Purpose of this Characteristic

Minor revision to reflect title change.

1.2 Relationship of this Document to ARINC Characteristics 597 and 724

Paragraph and Commentary added to take into account needs of aircraft not equipped with ACARS.

1.4 Airborne Avionics Configurations

Sentences added to second and third paragraphs concerning antenna gains needed to support Phase I and Phase II services respectively.

1.5.1 Satellite Data Unit (SDU)

The word “AvSat” is deleted from the second paragraph. Delete third sentence: “The SDU also contains antenna beam steering control logic.”

1.5.2 Radio Frequency Unit (RFU)

Editorial revisions made for consistency with revisions to other paragraphs.

1.5.7 High Gain Antennas (HGA)

References to 9 dBic gain deleted.

1.5.7.1 Dual Side Mounted HGA

Attachment reference corrected. (Should be 1-8.)

1.5.8 Keyhole Antennas

Attachment reference corrected. (Should be 1-8.)

1.5.9 Antenna Control Unit (ACU)

New section added to describe ACU needed for mechanically steered antennas.

1.5.10 Beam Steering Unit (BSU)

New section added to describe BSU needed for electronically steered antennas.

1.6 Interchangeability

Section revised completely. Commentary added.

2.2.1.2 Connectors

Editorial correction: “coaxial” substituted for “antenna” in fifth line.

2.2.2 Radio Frequency Unit (RFU)

Commentary deleted. (Information added to spec material in later sections.)

2.2.2.2 Connectors

RFU connector changed from shell size 1 to shell size 2. Insert types changed also.

2.2.2.4 RFU Power Output

New section added by this Supplement.

2.2.2.5 Harmonics, Spurious and Noise

New section added by this Supplement.

2.2.2.6 RFU Linearity

New section added by this Supplement.

2.2.3 Radio Frequency Distribution Units (RFDU)

Section revised to reflect decision not to define dimensional standards for the splitter, combiner and High Power Relay and to change the High Power relay control input connector.

2.2.4 Diplexer/LNA

New section made up of material (some of it revised by this Supplement) previously located in Sections 2.3.2 “High Gain Receive Antenna System”, 2.3.3 “High Gain Transmit Antenna System”, 2.3.4 “Low Gain Antenna (LGA) Receive Antenna System” and 2.3.5 “LGA Transmit Antenna System”.

2.2.4.1 Diplexer/LNA VSWR

Material from previous Section 2.3.2.8.2 revised completely.

2.2.4.2 Noise Figure/Gain

Material from previous Section 2.3.2.10.1 revised completely.

2.2.4.3 Diplexer/LNA: Antenna to LNA Output Port

Title of previous Section 2.2.2.10.3 changed for added clarity, text revised and Commentary added.

2.2.4.4 Diplexer/LNA: Transmit Port to Antenna Port and Transmit Port to LNA Output Port

Title of previous Section 2.3.3.7 changed for added clarity and text revised.

2.2.4.5 LNA Output Power

Text of previous Section 2.3.2.10.2 (unchanged).

2.2.4.6 Diplexer/LNA Connectors

Material from previous Section 2.3.2.10.5 modified for consistency with Diplexer/LNA form factor drawing in Attachment 1-9.

2.2.4.7 Diplexer/LNA Form Factor

Title of previous Section 2.3.2.10.6 changed from "Form Factor". Text unchanged.

2.2.4.8 Diplexer/LNA On/Off Control

New Section added by this Supplement.

2.2.5 High Power Amplifier (HPA)

New Section made up of material (some of it revised by this Supplement) previously located in Sections 2.3.3.11 and 2.3.5.7.

2.2.5.1 Harmonics, Spurious and Noise

Material from previous Section 2.3.3.11.1 revised completely.

2.2.5.2 Output Power Stability

Title and text of previous Section 2.3.3.9 changed for improved clarity. Commentary added.

2.2.5.3 Noise Figure

Material from previous Section 2.3.3.11.2 (unchanged).

2.2.5.4 VSWR

Material from previous Section 2.3.3.11.3 (unchanged).

2.2.5.5 HPA Connectors

Connector insert types changed in material from previous Section 2.3.5.8.1.

2.2.5.6 Form Factor

Material from previous Section 2.3.3.11.5 (unchanged).

2.2.6 Coaxial Cable Losses

New Sections made up of material previously embedded in Sections 2.2.2, 2.3.3.11 and 2.4.5.7.

2.3.1 (Antenna) Coverage

Text of note following first paragraph amended for improved clarity and references to 9 dBic gain deleted. Text of sub-paragraph c) amended to acknowledge gain loss in zenith cone. Commentary added.

2.3.2.4 Receive System Figure of Merit (G/T)

Values related to 9 dBic gain antenna deleted. “/LNA”, added between “diplexer” and “should” in first sentence. Commentary added.

2.3.2.6 Steering Control

Paragraph and Commentary added to existing text to cover the subject of “open loop” steering.

2.3.2.8.1 Receive Antenna VSWR

Title changed for improved clarity.

2.3.2.9 Discrimination

Words “in longitude” added and phrase “for all steering angles up to plus or minus 45° deleted to improve clarity.

2.3.2.10.4 Diplexer Receive Filter Dimensions

This section deleted. The subject is covered elsewhere.

2.3.3.9 EIRP Stability

This section deleted.

2.3.3.10 Beam Steering Unit

Section and subsequent sub-sections renumbered as a consequence of moving Diplexer/LNA spec material to new Section 2.2.4. The term “beam steering unit” substituted for “phase shifter” throughout. Text amended for improved clarity.

2.3.3.10.1 Beam Steering Unit Connectors

The term “beam steering unit” substituted for “phase shifter” throughout. Text amended for improved clarity.

2.3.3.11 Antenna Control Unit (ACU)

New section added by this Supplement.

2.3.3.12 HGA Connectors and form Factor

Title changed and Section revised to define connector type on antennas connected directly to the Diplexer/LNA.

2.3.4.4 Receive System Figure of Merit (G/T)

Text amended and Commentary added.

2.3.4.6 Antenna VSWR

Section renumbered (was 2.3.4.6.1) and VSWR on transmit relaxed from 1.5:1 to 2:1.

2.3.4.6.2 Diplexer/LNA VSWR

Section deleted. (Topic now covered in Section 2.2.4.1.)

2.3.4.7 Rejection Ratio

This section deleted. The subject is covered elsewhere.

2.3.4.8 Diplexer/Low Gain Amplifier LNA

Section (and its subsections) deleted as a consequence of moving Diplexer/LNA spec material to new Section 2.2.4.

2.3.5.5 Output Power Capability

Title changed for improved clarity. Text revised as a consequence of HPA power output change.

2.3.5.7 High Power Amplifier (HPA)

Section (and its subsections) deleted as a consequence of moving HPA spec material to new Section 2.2.5.

2.8.3 High Power Amplifier (HPA)

Cooling and dissipation figures revised.

2.8.4 Antenna Control Unit (ACU)

New section added by this Supplement.

Attachment 1-1 - General Configuration Overview

Block diagram updated to reflect adoption of “Communications Management Unit” term.

Attachment 1-2 - Avionics Block Diagram

Configuration block diagrams amended and supplemented where appropriate. “Phase Shifter” unit renamed “Beam Steering Unit”.

Attachment 1-3 - Standard Interwiring

The standard interwiring extensively revised.

Attachment 1-4 - Notes Applicable to Standard Interwiring

Notes extensively revised.

Attachment 1-7 - Splitter, Combiner and HP Relay Form Factor

Attachment deleted.

Attachment 1-9 - Diplexer/LNA Assembly Form Factor

Form factor revised.

Attachment 1-11 - High Gain Antenna Form Factor

"9 DBI" deleted from title. Maximum thickness of conformal phase array antenna (including radome) changed from "0.59" to "1.00" max.

Footprint for 9 dBic low profile array deleted.

Footprint for 12 dBic low profile antenna will be changed.

Attachment 1-12 - Beam Steering Unit with RF Cable Pendant

Title changed to recognize term "beam steering unit". "Alternate A" added to title.

New diagrams added showing concepts of beam steering unit mounted (i) close to antenna unit ("Alternate B") and (ii) remote from it ("Alternate C").

Attachment 1-13 - 0 dBic Antenna Form Factor

Footprints for conformal and blade 0 dBic antennas revised.

Attachment 2 - ARINC 429 Word Formats for Aviation Satellite Communications System

New attachment introduced by this Supplement.

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SUPPLEMENT 2
TO
ARINC CHARACTERISTIC 741
AVIATION SATELLITE COMMUNICATION SYSTEM
PART 1
AIRCRAFT INSTALLATION PROVISIONS

Published: June 28, 1991

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: August 30, 1990

A. PURPOSE OF THIS DOCUMENT

This supplement introduces extensive detail changes and text additions to the main body of the document. Substantial updates and corrections were also made to the Standard Interwiring and Notes Applicable to Standard Interwiring. In addition, several Attachments were added and/or updated.

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document, **blue bold** will indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 741 PART 1 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

1.1 Purpose of this Characteristic

Editorial changes were made.

1.2 Relationship of this Document to ARINC Characteristics 597 and 724

Editorial changes were made.

1.3 Function of Equipment

1.4 Airborne Avionics Configurations

Editorial changes were made.

1.5.1 Satellite Data Unit (SDU)

Editorial changes were made.

1.5.2 Radio Frequency Unit (RFU)

An editorial change was made.

1.5.3.2 Combiner

An editorial change was made.

1.5.4 Diplexer/Low Noise Amplifier (LNA)

Editorial changes were made.

1.5.5 High Power Amplifier

An editorial change was made.

1.5.7 High Gain Antenna (HGA)

Editorial changes were made.

1.5.8 Keyhole Antennas

Editorial changes were made and a provision to reserve spare pins for the RFU was removed.

1.5.9 Antenna Control Unit (ACU)

An editorial change was made.

1.6 Interchangeability

Editorial changes were made and references were added for additional interchangeability standards.

2.2.1 Satellite Data Unit (SDU)

Twenty pins (rows 14 and 15) of the TP insert are now reserved for Automatic Test Equipment (ATE). Editorial Changes were also made.

2.2.1.2 Connectors

A reference to Attachment 1-5 was added.

2.2.1.3 Form Factor

An editorial change was made.

2.2.2.2 Connectors

A reference to Attachment 1-6 was added.

2.2.2.3 Form Factor

An editorial change was made.

2.2.2.4 RFU Power Out

The single carrier RFU output was changed from “+15 dBm ±1 dB” to “+15 dBm ±2 dB.” In addition, an RFU output parameter was added for delivering multiple carriers such that the total RMS output capability should not be less than 15 dBm, and the actual RMS output should not exceed 17 dBm.

2.2.2.5 Harmonics, Spurious and Noise

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

2.2.2.6 RFU Linearity

A commentary was added to indicate that a 2 dB degradation in the HPA intermodulation output is implied when it is driven by an RFU having the characteristics shown.

2.2.2.7 Noise Figure

This is a new section.

2.2.3 Radio Frequency Distribution Units (RFDU)

Editorial changes were made.

2.2.3.1 Splitter Connectors

A reference to Attachment 1-3, which calls out the connector types for the splitter, was added.

2.2.3.2 Combiner Connectors

New material and a reference to Attachment 1-3 was inserted to call out the connector types for the combiner.

2.2.3.3.1 HPR Preferred Connectors

Editorial changes were made.

2.2.4.3 Diplexer/LNA: Antenna Port to LNA Output Port

An editorial change was made.

2.2.4.4 Diplexer/LNA: Transmit Port to Antenna Port and Transmit Port to LNA Output Port

In the first table of frequency versus rejection parameters, a transmit port to antenna port rejection parameter of “80 dB” was added for the “1559 to 1565 MHz” frequency range. A “decreasing” rejection parameter was added for the “1585 to 1626.5 MHz” frequency range. An “increasing” parameter was added for the “1660.5 to 1735 MHz” frequency range. The transmit port to antenna port rejection parameter of “50 dB” was changed to “15 dB” for the “12000 to 18000 MHz” frequency range.

Similarly, in the second table of frequency versus rejection parameters, 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 parameters have changed. A rejection parameter of “80 dB” was added for the “1559 to 1565 MHz” frequency range and a “40 dB” rejection parameter was added for the “1585 to 1626.5 MHz” frequency range.

2.2.4.5 LNA Output Power

Editorial changes were made.

2.2.4.7 Diplexer/LNA Form Factors

An editorial change was made.

2.2.5 High Power Amplifier (HPA)

The HPA parameters and associated notes have been extensively rewritten.

2.2.5.1 Harmonics, Spurious and Noise

The maximum power output parameter of any harmonic measured at the HPA output port has been modified to be no greater than “0 dBW” in the frequency band from “0 to 12000 MHz” and no greater than “-35 dBW” in the “12000 to 18000 MHz” frequency band.

2.2.5.2 EIRP Stability

An editorial change was made.

2.2.5.4 VSWR

The maximum allowable VSWR at the input and output of the HPA was changed from “1.5:1” in both instances to “2.0:1” for the input and “1.25:1” for the output. A note was also added.

2.2.5.5 HPA Connectors

This section was rewritten to include a reference to Attachment 1-10, to accommodate signal connections and a size 1 coaxial connector in the top and middle inserts, and to provide for power/coaxial interconnection in the bottom insert.

2.2.5.6 Form Factor

An editorial change was made.

2.2.6.1 Loss Between RFU and HPA

A sentence was added to indicate that the measurement should be taken from the output of the RFU and include the connectors and splitter assembly.

2.2.6.2 Total LOSS HPA and Antenna

A commentary was added.

2.2.6.4 Loss Between LNA and RFU

A new section was added to indicate that the total loss between the LNA output and the RFU input should not exceed 25 dB, including the cable, combiner and connectors.

2.3.1 Antenna Coverage Volumes

The title changed from “Coverage” to “Antenna Coverage Volume.” In addition this section was rewritten and subdivided into the three new sections that follow.

2.3.1.1 Ideal Antenna Coverage Volume

This is a new section which was derived from Section 2.3.1.

2.3.1.2 Achieved Antenna Coverage Volume

This is a new section which was derived from Section 2.3.1. The nominal coverage volume is defined and the minimum coverage volumes for which the required performance is expected of the low gain and high gain antennas are included.

2.3.1.3 Satellite Discrimination

This is a new section that indicates a 13 dB discrimination value between satellites spaced 45 degrees or more.

2.3.2 High Gain Antenna (HGA) Receive System

(HGA) was added to the section heading.

2.3.2.4 Receive System Figure of Merit (G/T)

The commentary was expanded to indicate that the figure of merit should be met at room temperature. High and low temperature values were added for the antenna (skin temperature), BSU (if in RF path), Diplexer/LNA and interconnecting RF cables.

2.3.2.6 Steering Control

New material was added for maintaining the antenna receive beam on a wanted satellite. In addition, provisions were added for steering control signals from the SDU via an ARINC 429 bus.

2.3.6.1 Closed Loop Steering

A place holder was added for a section to be written.

2.3.2.8 Receive Antenna VSWR

The first occurrence of 2.3.2.8 “VSWR” was deleted. VSWR is now stated with respect to a 50 ohm characteristic reference impedance for all antenna beam pointing angles over the receive frequency band.

2.3.2.9 Discrimination

An editorial addition was made.

2.3.3 High Gain Antenna (HGA) Transmit System

(HGA) was added to the heading. The minimum HGA transmit antenna gain of 12 dBic within the achieved antenna coverage volume was added.

2.3.3.2 Polarization

An editorial change was made.

2.3.3.5 Steering Control

An editorial change was made.

2.3.3.6 Transmit Antenna VSWR

VSWR is now stated 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

“Peak Envelope Power (PEP) may exceed 150 watts due to the presence of multiple carriers” was added.

2.3.3.8 Discrimination

Editorial changes and additions were made.

2.3.3.9 HGA Connectors and Form Factor

A reference to Attachment 1-11 was deleted. References to Attachments 1-3 and 1-4 for interwiring details for the HGA were added.

2.3.3.10 Beam Steering Unit (BSU)

Editorial changes were made.

2.3.3.10.1 Beam Steering Unit Connectors

For BSUs intended for installation in the RF signal path, the TNC RF connector for the connector to the Diplexer/LNA was changed from a “type male” to a “type female.” In addition, material was added concerning the connector type to be used for GSUs whose design does not require installation in the direct RF signal path.

2.3.3.10.2 BSU Size and Form Factor

The reference was changed from “Attachment 1-12” to “Attachments 1-7A, 1-7B and 1-7C.”

2.3.3.11 Antenna Control Unit (ACU)

Editorial changes were made.

2.3.4.1 Frequency of Operation

An editorial change was made.

2.3.4.2 Polarization

An editorial change was made.

2.3.4.3 Axial Ratio

The axial ratio was further defined for all frequencies of operation to be less than 20 dB for elevation angles in the range of 5 to 45 degrees and less than 6.0 dB for elevation angles in the range of 45 to 90 degrees.

2.3.4.4 Receive System Figure of Merit (G/T)

The overall receive system figure of merit was modified to provide an exception of -28 dB/K at ±20 degrees from zenith with power up to 60 watts (i.e., 17.8 dBW). It was also noted that the PEP may exceed 150 watts. The commentary was expanded.

2.3.4.6 Receive Antenna VSWR

VSWR is now stated with respect to a 50 ohm characteristic impedance over the receive frequency band.

2.3.5 Low Gain Antenna (LGA) Transmit System

(LGA) was added to the section heading. This section provides new material in its entirety.

2.3.5.1 Frequency of Operation

An editorial change was made.

2.3.5.2 Polarization

An editorial change was made.

2.3.5.4 Transmit Antenna VSWR

VSWR is now stated with respect to a 50 ohm characteristic impedance over the transmit frequency band.

2.3.5.5 Output Power Capability

"The PEP may not exceed 150 watts due to the presence of multiple carriers" was added.

2.3.5.6 LGA Form Factor

This section was previously Section 2.3.5.10.

2.3.6 Antenna Positioning Data

This is a new section that indicates where the receive antenna positioning data is derived.

2.4 Standard Interwiring

Editorial changes were made.

2.5.1 Primary Power Input

Editorial changes were made.

2.6 System Functions and Signal Characteristics

An editorial change was made.

2.8.1 SDU

The airflow rate provided to the modem in the aircraft installation was changed from "11 kg/hr" to "33 kg/hr." The SDU dissipation was changed from "50 W" to "150 W."

2.8.2 Radio Frequency Unit (RFU)

An editorial change was made.

2.8.3 High Power Amplifier (HPA)

An editorial change was made.

2.8.4 Antenna Control Unit (ACU)

An editorial change was made.

2.8.5 Beam Steering Unit (BSU)

This is a new section that indicates the BSU size and cooling requirements.

3.0 System Performance

This new section contains the following new subsections:

3.1 Transmitter Equipment Performance

3.2 Receiver Equipment Performance

4.0 System ATE Design

This new section contains the following new subsections:

4.1 General

4.2 Unit Identification

4.2.1 Use of ATLAS Test Language

4.3 Built-In Test Equipment

4.3.1 BITE Display

4.3.2 Fault Monitor

4.3.3 Self-Test Initiation

4.3.4 Monitor Memory Output

ATTACHMENT 1-1 - GENERAL CONFIGURATION OVERVIEW

This attachment was expanded to include CMU interfaces with the ADSU, FMS and Mode S Data Link R/T. The INS is now shown as a direct interface with the SDU rather than the CMU. The High Power Amplifier (HPA) and LNA/Diplexer were also added to the diagram.

ATTACHMENT 1-2 - AVIONICS BLOCK DIAGRAMS

All of the diagrams have been redrawn with some editorial changes. A new diagram labeled Top Mounted Array Configuration Dual High Gain Antenna System was added. The last two diagrams labeled Antenna Sub-system Interfaces (Excluding RF) Single HPA Case and Dual HPA Case were replaced with three new diagrams. The new diagrams are labeled Antenna Subsystem Control Interfaces (RF Excluded) Top-Mounted Antenna Configuration, Side-Mounted Phased-Array Configuration and Side Mounted Phase-Array Configuration With High Power Relay Option.

ATTACHMENT 1-3 - STANDARD INTERWIRING

Substantial updates and corrections were made to the Standard Interwiring to reflect Subcommittee review and industry comments. This attachment was replaced in its entirety.

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

This attachment was added.

ATTACHMENT 1-4 - NOTES APPLICABLE TO STANDARD INTERWIRING

Miscellaneous revisions were made to the Standard Interwiring notes to correspond with the changes to Attachment 1-3. The BSU-Up/Down Codes, HPA and BSU SDI bits Code Tables are also updated. Additional notes are included to describe the

MD-11 Satellite Communications System Circuit Breakers arrangement and to reference new Attachments 1-4C and 1-4D.

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

This attachment was added.

ATTACHMENT 1-4B - BSU/HPR WIRING DIAGRAMS

The BSU/HPR wiring diagrams were replaced.

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

This attachment was added.

ATTACHMENT 1-4D - STRAP OPTION PINS DEFINITION AND INTERPRETATION

This attachment was added.

ATTACHMENT 1-5 - SDU FORM FACTOR

The SDU Form Factor attachment has been replaced.

ATTACHMENT 1-6 - RFU FORM FACTOR

The RFU Form Factor attachment has been replaced and the index code was changed from “04” to “03.”

ATTACHMENT 1-7 - BEAM STEERING UNIT (BSU)

The Splitter, Combiner and HP Relay Form Factor was removed. Alternate A, B and C Beam Steering Unit Form factors were added. The rear connector configuration for the 2MCU package is also depicted.

ATTACHMENT 1-8 - TYPICAL HIGH GAIN ANTENNA COVERAGE

New coverage region drawings were incorporated for the High Gain Antenna variants.

ATTACHMENT 1-9 - LNA/DIPLEXER FORM FACTOR

A tolerance changes was made to the right side of the diagram.

ATTACHMENT 1-10 - HIGH POWER AMPLIFIER FORM FACTOR

The HPA Form Factor attachment has been replaced.

ATTACHMENT 1-11 - HIGH GAIN ANTENNA FORM FACTORS

Minor revisions were made to the Conformal Phased Array High Gain Antenna. This changes the center connector mounting scheme from a three-hole to four-hole arrangement. New material is incorporated to clarify the various antenna form factor drawings.

ATTACHMENT 1-12 - BSU INTERCONNECTION CONFIGURATIONS

A place holder was added for a new Attachment 1-12A Beam Steering Unit which is expected to show an antenna configuration with the RF passing through the BSU.

ATTACHMENT 1-12A - BEAM STEERING UNIT (SIDE MOUNTED ANTENNA) "CONFIGURATION A"

This is a new figure.

ATTACHMENT 2 - ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

Numerous changes and additions were made to the ARINC 429 labels and word formats used in the aviation satellite communications system.

ATTACHMENT 3 - EQUIPMENT ENVIRONMENTAL CATEGORIES

A new attachment was added.

ATTACHMENT 4 - ATTACHMENT REFERENCE GUIDE

A new attachment was added.

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SUPPLEMENT 3
TO
ARINC CHARACTERISTIC 741
AVIATION SATELLITE COMMUNICATION SYSTEM
PART 1
AIRCRAFT INSTALLATION PROVISIONS

Published: June 28, 1991

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: November 7, 1990

A. PURPOSE OF THIS DOCUMENT

This supplement introduces several text changes to the main body of the document. Substantial updates were also made to the Standard Interwiring and Notes Applicable to Standard Interwiring. The Top, Bottom and Middle Plug Connector Layouts were added. The ARINC 429 Labels and Word Formats Used in the Aviation Satellite Communications System were also revised.

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document, **blue bold** will indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 741 PART 1 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

1.2 Relationship of this Document to ARINC Characteristics 597 and 724

An additional reference was added to the last sentence of the first paragraph.

1.5.8 Keyhole Antennas

A change was made to indicate that pins are not currently reserved for keyhole antennas.

1.6 System Performance

The section was renamed from “Interchangeability” to “System Performance.”

1.6.1 Transmitter Equipment Performance

This was formerly Section 3.1. New material was added concerning antenna gain reporting and the SDU response to the HPA to maintain a given EIRP. Also, Section 2.2.5.2 EIRP Stability was moved to the end of this section.

1.6.2 Receiver Equipment Performance

This was formerly Section 3.2.

1.7 Interchangeability

This was formerly Section 1.6. The last two sentences were added. They provide additional references.

1.8 Regulatory Approval

This was formerly Section 1.7.

2.2.2.5 Harmonics, Spurious and Noise

While transmitting an unmodulated, continuous carrier at an output power of +15 dBm, the composite spurious and noise output (including phase noise) at the output of the RFU in any 4 kHz band was changed from “-83 dBc” to “-55 dBc” for the frequency range of 0 - 1530 MHz. The exclusion for the bandwidth about the carrier frequency and harmonics in the 1559 - 18000 MHz frequency range was changed from ±10 kHz” to “±35 kHz.”

2.2.5 High Power Amplifier (HPA)

The back-off stability was changed from “±1 dB” to “±2 dB” for the HPA Type 1. The HPA Type 2 value was changed from “±3 dB” to “N/A.” A Gain Stability parameter was added for both HPA types. They are “N/A” and “±2 dB” for the HPA Type 1 and 2 respectively.

2.2.5.1 Harmonics, Spurious and Noise

While transmitting an unmodulated, continuous carrier at an output power of (i.e., +16 dBw), the composite spurious and noise output (including phase noise) at the output of the HPA in any 4 kHz band was changed from “-83 dBc” to “-55 dBc” for the frequency range of 0 - 1530 MHz. The exclusion for the bandwidth about the carrier frequency and harmonics in the 1559 - 18000 MHz frequency range was changed from “±10 kHz” to “±35 kHz.”

2.2.5.2 Noise Figure

This was formerly Section 2.2.5.3.

2.2.5.3 VSWR

This was formerly Section 2.2.5.4.

2.2.5.4 HPA Connectors

This was formerly Section 2.2.5.3.

2.2.5.5 Form Factor

This was formerly Section 2.2.5.6.

2.2.6.2 Total Loss HPA and Antenna

A change was made to the last sentence of the commentary.

2.3.1.3 Satellite Discrimination

This section was deleted.

2.3.2.6 Steering Control

New material was introduced concerning the antenna pointing accuracy and to establish the maximum allowable peak-to-peak RF phase discontinuities due to antenna beam switching.

2.3.3.10.1 Beam Steering Unit Connectors

Minor editorial changes were made.

2.3.3.10.2 BSU Size and Form Factor

Further references were added.

2.3.4.4 Receive System Figure of Merit (G/T)

Editorial changes were made. Also, “60 watts” was changed to “80 watts” and “17.8 dBW” was changed to “19.0 dBW.”

2.3.5.3 Axial Ratio

The axial ratio was refined to indicate the values at different elevation angles.

2.3.5.5 Output Power Capability

“60 watts” was changed to “80 watts” and “17.8 dBW” was changed to “19.0 dBW.”

2.8.2 Radio Frequency Unit (RFU)

11 kg/hr was changed to 22 kg/hr and 50 W was changed to 100 W.

2.8.3 High Power Amplifier (HPA)

Minor editorial changes were made.

2.8.5 Beam Steering Unit (BSU)

The airflow rate, pressure drop and heat dissipation parameters were added for the 2MCU BSU. Non-2MCU BSUs should be designed to function without forced air cooling.

2.10 System ATE Design

This is a new section heading.

2.10.1 General

This was formerly Section 4.1.

2.10.2 Unit Identification

This was formerly Section 4.2.

2.10.3 Built-In Test Equipment

This was formerly Section 4.3.

2.10.3.1 BITE Display

This was formerly Section 4.3.1.

2.10.3.2 Fault Monitor

This was formerly Section 4.3.2.

2.10.3.3 Self-Test Initiation

This was formerly Section 4.3.3.

2.10.3.4 Monitor Memory Output

This was formerly Section 4.3.4.

2.10.3.5 Use of Automatic Test Equipment

This is a new section to replace the former Section 4.2.1, Use of ATLAS Test Language.

3.0 System Performance

This section was moved to the end of Section 1.

4.0 System ATE Design

This section was moved to the end of Section 2.

ATTACHMENT 1-2 - AVIONICS BLOCK DIAGRAMS

All references to ADS were removed.

ATTACHMENT 1-3 - STANDARD INTERWIRING

This attachment was replaced in its entirety. Substantial updates and corrections were made to the Standard Interwiring to reflect Subcommittee review and industry comments.

ATTACHMENT 1-4 - NOTES APPLICABLE TO STANDARD INTERWIRING

This attachment was replaced in its entirety. Substantial updates and corrections were made to the Notes Applicable to Standard Interwiring to correspond with the changes to Attachment 1-3.

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

This attachment was replaced in its entirety. Substantial updates and corrections were made to the System Configuration Pins Definitions and Interpretation. The Strap Option Definition and Interpretation, formerly contained in Attachment 1-4D, is now included in this attachment.

ATTACHMENT 1-4D - STRAP OPTION PINS DEFINITION AND INTERPRETATION

This material was moved to Attachment 1-4C.

ATTACHMENT 1-5A - SDU TOP PLUG CONNECTOR LAYOUT

New attachment.

ATTACHMENT 1-5B - SDU MIDDLE PLUG CONNECTOR LAYOUT

New attachment.

ATTACHMENT 1-5C - SDU BOTTOM PLUG CONNECTOR LAYOUT

New attachment.

ATTACHMENT 1-6A - RFU TOP PLUG CONNECTOR LAYOUT

New attachment.

ATTACHMENT 1-6B - RFU MIDDLE PLUG CONNECTOR LAYOUT

New attachment.

ATTACHMENT 1-6C - RFU BOTTOM PLUG CONNECTOR LAYOUT

New attachment.

ATTACHMENT 1-10A - HPA TOP PLUG CONNECTOR

New attachment.

ATTACHMENT 1-10B - HPA MIDDLE PLUG CONNECTOR

New attachment.

ATTACHMENT 1-10C - HPA BOTTOM PLUG CONNECTOR

New attachment.

ATTACHMENT 1-11A - HIGH GAIN ANTENNA FORM FACTOR FOR THE CONFORMAL PHASED ARRAY HIGH GAIN ANTENNA 19.55 X 22.36 INCHES

Replacement attachment.

ATTACHMENT 2 - ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

Extensive changes were made to the tables and notes.

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SUPPLEMENT 4
TO
ARINC CHARACTERISTIC 741
AVIATION SATELLITE COMMUNICATION SYSTEM
PART 1
AIRCRAFT INSTALLATION PROVISIONS

Published: June 1, 1992

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: October 8-10, 1991

A. PURPOSE OF THIS DOCUMENT

This supplement introduces changes made to the aircraft installation provisions at the Satellite Systems Subcommittee meeting August 27-29, 1991 and adopted at the AEEC General Session in October 1991.

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document, **blue bold** will indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 741 PART 1 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

1.1 Purpose of this Characteristic

An editorial change was made.

1.2 Relationship of this Document to ARINC Characteristics 597 and 724

Editorial changes were made.

1.5.8 Keyhole Antennas

Editorial changes were made.

1.6.1 Transmitter Equipment Performance

An editorial change was made and the last paragraph was deleted. Information was also added concerning SDU monitoring and control of the HPA, closed loop steering control via an ARINC 429 bus, and maintaining transmitted beam performance with aircraft attitude rates of at least 7.5 degrees per second.

1.6.2 Receiver Equipment Performance

Information was added concerning closed loop steering control via an ARINC 429 bus, and maintaining received beam performance with aircraft attitude rates of at least 7.5 degrees per second.

2.2.1.2 Connectors

Editorial changes were made.

2.2.3.3.1 HPR Preferred Connectors

The HPR preferred connector types were changed.

2.2.4.3 Diplexer/LNA: Antenna Port to LNA Output Port

The rejection from the antenna port to the LNA output port changed from 40 dB to 60 dB for the 1350 to 1459 MHz and 1660.5 to 18000 MHz frequency ranges.

2.2.4.4 Diplexer/LNA: Transmit Port to Antenna Port and Transmit Port to LNA Output Port

Editorial changes were made.

2.2.5 High Power Amplifier (HPA)

The maximum heat dissipation for the HPA Type 2 was changed from “200 W” to “250 W”. The 0 dB Back-off was changed from “60 W Max.” to “80 W Max.” for both the HPA Type 1 and Type 2. The carrier spacing for two carriers was added to Note 2. The Linear HPA gain range was added to the additional notes.

2.2.5.4 HPA Connectors

Editorial changes were made.

2.2.5.6 HPA Muting

A new section on HPA Muting was added.

2.2.6.5 Loss Between SDU and RFU

A new section on SDU/RFU cable loss was added.

2.3.2.6 Steering Control

The first paragraph was edited to clarify the antenna pointing accuracy. The second paragraph was deleted. A new paragraph was added, before the commentary, to define the relationship between the current beam and an adjacent beam.

2.3.2.6.1 Closed Loop Steering

This section was deleted.

2.3.2.10 Phase Discontinuity

A new section on phase discontinuity was added.

2.3.3.7 Output Power Capability

The output power capability was changed from “80 W (i.e., 19.0 dBW)” to “60 W (i.e., 17.8 dBW)”.

2.3.3.9 HGA Connectors and Form Factor

The connector type was changed from a “TNC type male connector” to an “N-Type female connector”.

2.3.3.10.1 Beam Steering Unit Connectors

Editorial changes were made.

2.3.3.12 Phase Discontinuity

A new section on phase discontinuity was added.

2.3.4.3 Axial Ratio

The staff note was deleted.

2.3.4.4 Receive System Figure of Merit (G/T)

An editorial change was made. “80 W (i.e., 19.0 dBW)” was changed to “60 Watts (i.e., 17.8 dBW)”.

2.3.5.3 Axial Ratio

The staff note was deleted.

2.3.5.5 Output Power Capability

“80 W (i.e., 19.0 dBW)” was changed to “60 Watts (i.e., 17.8 dBW)”.

2.3.6 Antenna Positioning Data

“IRS Input #1” was changed to “Primary IRS Input” and “IRS Input #2” was changed to “Secondary IRS Input”.

2.7 Environmental Conditions

“DO-160B” was changed to “DO-160C”.

2.8.3 High Power Amplifier (HPA)

Editorial changes were made and “200 W” was changed to “250 W”.

2.8.5 Beam Steering Unit (BSU)

An editorial change was made.

2.10.3.5 Use of Automatic Test Equipment

An editorial change was made.

ATTACHMENT 1-2 - ANTENNA SUBSYSTEM CONTROL INTERFACES (RF EXCLUDED) SIDE MOUNTED PHASED ARRAY CONFIGURATION WITH HIGH POWER RELAY OPTION

Note 2 was added.

ATTACHMENT 1-3 - STANDARD INTERWIRING

The standard interwiring was extensively revised.

ATTACHMENT 1-4 - NOTES APPLICABLE TO STANDARD INTERWIRING

The notes applicable to the standard interwiring were extensively revised.

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

The system configuration pins definition and interpretation was extensively revised.

ATTACHMENT 1-5A - SDU TOP PLUG CONNECTOR LAYOUT

The SDU top plug connector layout was revised to reflect the changes made to the standard interwiring.

ATTACHMENT 1-5B - SDU MIDDLE PLUG CONNECTOR LAYOUT

The SDU middle plug connector layout was revised to reflect the changes made to the standard interwiring.

ATTACHMENT 1-6A - RFU TOP PLUG CONNECTOR LAYOUT

The RFU top plug connector layout was revised to reflect the changes made to the standard interwiring.

ATTACHMENT 1-8 - TYPICAL HIGH GAIN ANTENNA COVERAGE ELECTRONICALLY STEERED T BLADE

This is a new attachment introduced by this Supplement.

ATTACHMENT 1-10A - HPA TOP PLUG CONNECTOR LAYOUT

The HPA top plug connector layout was revised to reflect the changes made to the standard interwiring.

ATTACHMENT 1-11 I-1 - HIGH GAIN ANTENNA FORM FACTOR PHASED ARRAY ANTENNA (19.55 X 23.00) FAIRING FORM FACTOR (30.25 X 35.00)

This is a new attachment introduced by this Supplement.

ATTACHMENT 1-11 I-2 - CONNECTOR INTERFACE ANTENNA SEAL DETAIL

This is a new attachment introduced by this Supplement.

ATTACHMENT 1-12 C - BEAM STEERING UNIT (BSU) “ANTENNA CONFIGURATION C”

This is a new attachment introduced by this Supplement.

ATTACHMENT 2 - ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

Attachment 2 has been extensively revised. The notes have also been reorganized into a notes section at the end of the attachment with references annotated near the appropriate bit fields.

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SUPPLEMENT 5
TO
ARINC CHARACTERISTIC 741
AVIATION SATELLITE COMMUNICATION SYSTEM
PART 1
AIRCRAFT INSTALLATION PROVISIONS

Published: March 31, 1994

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: October 19, 1993

A. PURPOSE OF THIS DOCUMENT

This supplement introduces changes primarily in the areas of Standard Interwiring, Notes Applicable to Standard Interwiring, System Configuration Pins Definition and Interpretation, Connector Layouts and the ARINC 429 Labels and Word Formats used in the Aviation Satellite Communications System. A new Type B - diplexer/LNA characteristic is also defined. The Type B diplexer/LNA offers protection of GPS, GLONASS and TFTS receivers from unwanted interference from SATCOM transmissions. The old diplexer/LNA characteristics have also been retained as the Type A - diplexer/LNA. The Type A - diplexer/LNA offers protection of GPS receivers only. The concept of a SATCOM Switching Unit is introduced in Sections 1.5.11 and 2.2.7 as well as Attachments 1-2 and 1-14.

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document, **blue bold** will indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC741 PART 1 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

1.1 Purpose of This Characteristic

Section updated to briefly describe other parts of ARINC Characteristic 741.

1.3 Function of Equipment

“1530 MHz” was changed to “1525 MHz” to reflect WARC spectrum reallocations.

1.5.11 SATCOM Switching Unit

[TBD]

2.2.1.1 SDU Size

A commentary was added to accommodate alternative approaches for combining the 4 MCU RFU and 6 MCU SDU into a single 10 MCU or 6 MCU unit.

2.2.2.5 Harmonics, Spurious and Noise

The allowable composite spurious and noise output of the RFU in any 4 kHz band was further defined. The allowable composite spurious and noise output of the RFU in any 1 MHz band was added. Additional commentary was added. These changes were made to help protect GLONASS and TFTS receivers from unwanted interference from SATCOM transmissions. Frequency changes were also made to reflect WARC spectrum reallocations from “1530 - 1559 MHz (29 MHz)” to “1525 - 1559 MHz (34 MHz)”.

2.2.2.6 RFU Linearity

The RFU linearity was changed to limit the degradation in the HPA to 1 dB.

2.2.2.7 Noise Figure

Text was added to meet the overall system requirements for the receiver dynamic range which is specified in this document as well as the RTCA MOPS and the INMARSAT SDM. See also changes to Section 2.2.6.4. A commentary was also added to alert manufacturers and installers to the potential for interference from out of band sources causing an apparent degradation of the receiver system performance.

2.2.4.3 Diplexer/LNA

Sections 2.2.4.3 and 2.2.4.4 have been combined into Section 2.2.4.3. Section 2.2.4.3 is now subdivided into Sections 2.2.4.3.1 and 2.2.4.3.2 to reflect that there are two different Diplexer/LNA electrical characteristics. One, Type A - Diplexer/LNA, offers protection for GPS receivers while the other, Type B, offers protection for GPS, GLONASS and TFTS receivers.

2.2.4.3.1 Type A- For Protection of GPS Only

This section was formerly in Sections 2.2.4.3 and 2.2.4.4. This section provides the Diplexer/LNA electrical characteristics for protecting GPS receivers against unwanted interference from SATCOM transmissions.

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

This section provides new Diplexer/LNA electrical characteristics for protecting GPS, GLONASS and TFTS receivers against unwanted interference from SATCOM transmissions. The new electrical characteristics include changing “1530 - 1559 MHz (29 MHz)” to “1525 - 1559 MHz (34 MHz)” to reflect WARC spectrum reallocations.

2.2.4.4 Reserved

The diplexer/LNA characteristics formerly in Section 2.2.4.4 have been merged into Section 2.2.4.3.1. Section 2.2.4.4 is now reserved to avoid renumbering subsequent sections.

2.2.4.5 LNA Output Power

A commentary was added to alert manufacturers and installers to the potential for interference from out of band sources causing an apparent degradation of the receiver system performance.

2.2.4.7 Diplexer/LNA Form Factors

References are now made to two form factors. One for the Diplexer/LNA that provides protection for GPS receivers only and one that provides protection for GPS, GLONASS and TFTS receivers.

2.2.5 High Power Amplifier (HPA)

The 3rd, 5th, 7th and higher order Carrier-to-Intermodulation (C/IM) products are now specified to reduce SATCOM interference to GLONASS and TFTS receivers. The back-off adjustment was changed. New notes [6, 7, 8 and 9] were added. In the second paragraph of additional notes, a 25 db or greater gain reduction was added for transmit frequencies above 2000 MHz and below 1150 MHz.

2.2.5.1 Harmonics and Spurious

Noise was deleted from the Section title. Frequency changes were made to reflect WARC spectrum reallocations from “1530 - 1559 MHz (29 MHz)” to “1525 - 1559 MHz (34 MHz)”. The allowable spurious output from the HPA in any 1 MHz band was added. Additional commentary was added. These changes were made to help protect GLONASS and TFTS receivers from unwanted interference from SATCOM transmissions.

2.2.5.2 Noise Figure

The noise figure was changed to allow a 1 dB degradation for every 1 dB of gain backoff without increasing the output noise density of the HPA.

2.2.5.6 HPA Muting and Carriers Off Level

The section header was changed. This section was modified to be consistent with the RTCA MOPS and INMARSAT SDM. The requirements are now stated in terms of absolute power rather than a level below the rated HPA output power.

2.2.6.4 Loss Between LNA and RFU

“SDU” was changed to “LNA” in the title. The total loss between the LNA output and the RFU input was changed from “25 dB” to “fall within the range 6 to 25 dB”. See also changes to Section 2.2.2.7. A commentary was also added to alert manufacturers and installers to the potential for interference from out of band sources causing an apparent degradation of the receiver system performance.

2.2.7 SATCOM Switching Unit

[TBD]

2.3.2.1 Frequency of Operation

“1530 MHz” was changed to “1525 MHz” to reflect WARC spectrum reallocations.

2.3.3.13 L-Band System Physical Isolation

This is a new section recommending 40 dB physical isolation between the SATCOM and GNSS antenna and 70 dB physical isolation between the SATCOM and TFTS antenna.

2.3.3.14 Antenna Intermodulation

This is a new section.

2.3.3.14.1 Antenna Intermodulation in SATCOM Receive Band

This is a new section.

2.3.3.14.2 Antenna Intermodulation Products Which Fall in the GNSS Band

This is a new section.

2.3.4.1 Frequency of Operation

“1530 MHz” was changed to “1525 MHz” to reflect WARC spectrum reallocations.

2.3.5.7 L-Band System Physical Isolation

This is a new section recommending 40 dB physical isolation between the SATCOM and GNSS antenna and 70 dB physical isolation between the SATCOM and TFTS antenna.

ATTACHMENT 1-1A - SAMPLE DUAL SATCOM INSTALLATION

This is a new Attachment.

ATTACHMENT 1-2 - AIRBORNE AVIONICS BLOCK DIAGRAMS SIDE MOUNTED PHASED ARRAY CONFIGURATION

This diagram was deleted.

ATTACHMENT 1-2 - SIDE-MOUNTED PHASED ARRAY CONFIGURATION DUAL SYSTEM: HIGH GAIN AND LOW GAIN

This diagram was deleted.

ATTACHMENT 1-2 - ANTENNA SUBSYSTEM CONTROL INTERFACES (RF EXCLUDED) SIDE- MOUNTED PHASED ARRAY CONFIGURATION

This diagram was deleted.

ATTACHMENT 1-2 - TYPICAL SATCOM REDUNDANT ARCHITECTURE

This is a new diagram.

ATTACHMENT 1-3 - STANDARD INTERWIRING

The standard interwiring was revised. In particular, SDU pins TP2A through TP2K, TP5A through TP7K, TP8A, TP9A, TP9B, TP10D, MP1A through MP1D, MP1G, MP1H, MP1J, MP1K, MP3G through MP4B, MP4J, MP4K, MP5E, MP5F, MP6E, MP6F, MP6G, MP6H, MP7E, MP7F, MP9A, MP9B, MP11C, MP11D and MP13A were revised. In addition, the RFU and HPA Reserved ATE pins TP7A through TP8K were changed to be TP6A through TP7K because pins TP8A through TP8K do not exist on the RFU and HPA Top Plug connector. The dual HPA interwiring for HPA pins TP3A, TP3B, TP3C and TP3D was deleted. The Extended SDI Program Pins were further defined to allow various antenna mounting angles. The HP Relay was deleted from the Side Mounted Phased Array Configuration.

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

“TP3A and TP3B” were specified for the HPA mute function and interwiring requirements were specified as 15 ohms max. An associated note was added. The 115 Vac max. current was changed from “1.0A” to “2.0”.

ATTACHMENT 1-4 - NOTES APPLICABLE TO STANDARD INTERWIRING

The notes applicable to the standard interwiring were revised. Note 3 was revised to accommodate the SDU reception of the 24-bit ICAO SSR Mode S Address from the CMU. Note 19 was updated to show the various antenna mounting angles offset from zenith. The BSU-Up/Down Code Pin C is now defined for HGA configurations with a single port as well as dual RF ports and the pin should always remain in the binary “zero” (open circuit) state. A commentary was added explaining the reallocation of the Steering Inhibit pins E and F to the pin programming of the BSU mounting angle. In addition, “All Call” was changed to “RESERVED” under the HPA

SDI Code and the BSU SDI Code meaning columns, and “HGA HPA Starboard” was changed to “Unused” under the HPA SDI Code column. Note 44 was changed to not used. Note 46 was changed in its entirety. Notes 47, 48, 49, 50, 51 and 52 were added.

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

The system configuration pins definition and interpretation was revised. TP10A was changed from “Aircraft ID input (ARINC 429) Presence (pins MP4A, MP4B)” to “Availability of ARINC 429 SSR Mode S address (AES ID) from 429 ports”. TP10D was changed from “reserved for strap option” to “429 bus speed to/from CMU #1/#2” and a new logic table was added to accommodate the change. CMU #2 was deleted from the title of the TP13B logic table. In addition, the TP11E through TP11K logic table was revised. “Top/Port HPA” was changed to “HGA HPA”, the “Starboard HPA” column was deleted, and codes “110111” and “010111” were redefined.

ATTACHMENT 1-5A - SDU TOP PLUG CONNECTOR LAYOUT

The SDU top plug connector layout was revised to reflect the changes made to the standard interwiring.

ATTACHMENT 1-5B - SDU MIDDLE PLUG CONNECTOR LAYOUT

The SDU middle plug connector layout was revised to reflect the changes made to the standard interwiring.

ATTACHMENT 1-6A - RFU TOP PLUG CONNECTOR LAYOUT

The RFU top plug connector layout was revised to reflect the changes made to the standard interwiring.

ATTACHMENT 1-6B - RFU MIDDLE PLUG CONNECTOR LAYOUT

The RFU middle plug connector has only seven rows, therefore row 8 was deleted.

ATTACHMENT 1-9A - TYPE A - DIPLEXER/LNA FORM FACTOR FOR GPS ONLY

This was formerly Attachment 1-9. The Type A - diplexer/LNA affords protection of GPS only.

ATTACHMENT 1-9B - TYPE B - DIPLEXER/LNA FORM FACTOR FOR PROTECTION OF GPS, GLONASS AND TFTS

This is the new form factor. The Type B - diplexer/LNA affords protection of GPS, GLONASS and TFTS.

ATTACHMENT 1-10A - HPA TOP PLUG CONNECTOR LAYOUT

The HPA top plug connector layout was revised to reflect the changes made to the standard interwiring.

ATTACHMENT 1-10B - HPA MIDDLE PLUG CONNECTOR LAYOUT

The HPA middle plug connector has only seven rows, therefore row 8 was deleted.

ATTACHMENT 1-13 - LOW GAIN ANTENNA

Notes were added to the diagram indicating that the rake angle is “typical”, the upper and lower airfoil lengths are “maximum” and that some antennas may not require all mounting holes. The maximum height note was deleted.

ATTACHMENT 1-14 SATCOM SWITCHING UNIT REAR CONNECTOR CONFIGURATION

[TBD]

ATTACHMENT 2 - ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

Attachment 2 has been revised as follows:

In the HPA Command - SDU to HPA Word the SDI Code field bit code “10” was changed from “HGA HPA Port/Top” to “HGA HPA” and bit code “11” was changed from “HGA HPA Starboard” to “Unused

In the HPA Status - HPA to SDU Word bits 12 to 15 were changed from “Reserved” to “HPA Backoff Range” and a new table was added. The Actual Power Out field was expanded. The SDI CODE field bit code “00” was changed from “ALL CALL” to “RESERVED”, bit code “10” was changed from “HGA HPA Port/Top” to “HGA HPA” and bit code “11” was changed from “HGA HPA Starboard” to “Unused”. The HPA Control Table for bit 16 was reformatted.

In the HPA Maintenance Word - HPA to SDU the SDI CODE field bit code “00” was changed from “ALL CALL” to “RESERVED”, bit code “10” was changed from “HGA HPA Port/Top” to “HGA HPA” and bit code “11” was changed from “HGA HPA Starboard” to “Unused”.

In the ACU/BSU Status Word ACU/BSU to SDU the SDI CODE field bit code “00” was changed from “ALL CALL” to “RESERVED”.

In the ACU/BSU Maintenance Word - ACU/BSU to SDU the SDI CODE field bit code “00” was changed from “ALL CALL” to “RESERVED”.

The Closed Loop Steering Word - SDU to ACU/BSU was made optional for test purposes.

The GSDB Word Sequence - SDU to SNU was added.

Notes 2, 10, 11, 13 and 18 were expanded. In Notes 7 and 17, information on the Failure Warning indication was modified. In Note 17, the first sentence, “The ACU/BSU shall indicate No Computed Data if no ACU/BSU Command Word is received from the SDU for one or more seconds.”, was deleted. In Note 29, a new sentence was added to indicate an optional Signal Quality test word. In Note 30, information concerning the Failure Warning indication was added. Note 37 was added.

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

Direct Lightning and Icing have been added to the Equipment Environmental Categories Table. In addition, updates were made to the Temperature/Altitude, Temperature Variation, Humidity, Vibration, Waterproofness and RF Susceptibility categories.

APPENDIX 1 - BIT-ORIENTED FAULT REPORTING PROTOCOL

This Appendix serves as a placeholder for new material that is expected to be eventually incorporated into ARINC Report 604 Appendix 7 Bit-Oriented Fault Reporting Protocol, Table A7.21 Fault Summary Words #1, #2, #3, #4 and #5 for SATCOM.

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SUPPLEMENT 6
TO
ARINC CHARACTERISTIC 741
AVIATION SATELLITE COMMUNICATION SYSTEM
PART 1
AIRCRAFT INSTALLATION PROVISIONS

Published: December 30, 1994

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: October 20, 1994

A. PURPOSE OF THIS DOCUMENT

This supplement primarily introduces changes to the Radio Frequency Unit (RFU), Diplexer/Low Noise Amplifier (LNA), High Power Amplifier (HPA), coaxial cable loss, and High Gain Antenna (HGA) intermodulation Products which fall in the GNSS band areas of the interchangeability standards. A new Low Gain Antenna (LGA) system configuration was added. Changes are also introduced to the standard interwiring, notes applicable to the standard interwiring and related connector layouts. The system configuration pins definition and interpretation was updated to include definition of new pins for the Cabin Packet-mode Data Function (CPDF) (installed or not installed), 429 bus speed of AES ID input (high or low speed), and priority 4 calls to/from the cockpit (allowed or inhibited). In Attachment 2, the ARINC 429 labels and word formats were labeled with individual figure numbers, the SAL for the GSDB word sequence was corrected, and the notes section was revised.

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document, **blue bold** will indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 741 PART 1 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

1.5.11 SATCOM Switching Unit

Section deleted.

2.2.2.5 Harmonics, Discrete, Spurious and Noise

The word Discrete was added to the title. The composite harmonics, discrete, spurious and noise output tables were combined into one table and revised. In the note, “3 kHz” was changed to “35 kHz”.

2.2.2.7 Noise Figure

In the additional commentary, the sentences were rearranged to provide the rationale before the statement.

2.2.4.3.1 Type A - For Protection of GPS Only

The commentary was revised to note that although use of the Type A diplexer/LNA may not provide sufficient interference protection for GLONASS receivers on the same aircraft, it should provide such protection for nearby aircraft as GLONASS moves frequencies below 1610 MHz. In the Antenna Port to LNA Output Table, “1459 MHz” was changed to “1450 MHz” and “60 dB” was changed to “75 dB” in two places. In the Transmit Port to Antenna Port Table, new rejection values were added between 1605 and 1626.5 MHz.

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

In the Transmit Port to Antenna Port Table, “1602 MHz” was changed to “1598 MHz” and “1616 MHz” was changed to “1610 MHz”.

2.2.4.5 LNA Output Power

In the additional commentary, the sentences were rearranged to provide the rationale before the statement.

2.2.5 High Power Amplifier (HPA)

In notes 2 and 7, “34 MHz” was changed to “14 MHz” and example carrier frequencies were added.

In note 4, the words “...input drive level and operating...” were added.

In notes 8 and 9, example carrier frequencies were added.

2.2.5.1 Harmonics, Discrete, Spurious and Noise

The words “Discrete” and “and Noise” were added to the title. The composite harmonics, discrete, spurious and noise output tables were combined into one table and revised. Note 2 was deleted and note 3 was renumbered as note 2.

2.2.6.4 Loss Between LNA and RFU

May not was changed to does not in the commentary. In the commentary, the sentences were rearranged to provide the rationale before the statement.

2.2.7 SATCOM Switching Unit

Section deleted.

2.3.3.14.2 Antenna Intermodulation Products Which Fall in the GNSS Band

The HGA Intermodulation level was established tentatively at -115 dBm as referenced to the output port of an 'external 1/4 wave monopole GNSS antenna' due to the wide variations in antenna/airframe configurations.

ATTACHMENT 1-2 - ANTENNA CONFIGURATION

Figure 1 - A new note 3 was added.

Figure 3 - A new note 3 was added.

Figure 8 - The typical SATCOM Redundant Architecture diagram was deleted and replaced with a Low Gain Antenna System diagram.

ATTACHMENT 1-3 - STANDARD INTERWIRING

Changes to SDU pins:

TP1A/B changed from “0-5V” to “0-15V”. TP1C/D/E/F changed from “0-5V” to “0-7V”. A new note 53 was added to TP2J/K. The word “Aux” was added to TP5A. Editorial changes were made to TP6E through TP7K.

TP10E changed from “Reserved for Strap Option” to “Strap Option”. MP1E/F changed to “Reserved Data Bus from Cabin Packet Data (ARINC 429)” and notes 7 and 54 were annotated. A new note 55 was added to MP4A. MP9A/B changed to “Reserved Data Bus to SNU and/or CPDF”.

Changes to HPA pins:

TP2A - TP2D, TP2F/G and TP2J/K changed to future spare.

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

No changes were made.

ATTACHMENT 1-4 - NOTES APPLICABLE TO STANDARD INTERWIRING

In note 3, a commentary was added. In note 40, additional text on the use of appropriate fail-safe logic or the assumption of the on-ground state was added. Note 49 was revised to indicate that the optional output port may be used for Cabin Packet-Mode Data (CPD). Notes 53, 54 and 55 were added.

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

On the TP11E-K definition box, one configuration was changed and Note 6 was annotated. TP10E, Cabin Packet-mode Data Function (CPDF); TP10F, 429 Bus Speed of AES ID Input; and TP13A, Priority 4 Calls to/from Cockpit definition boxes were added. New notes 6 and 7 were added.

ATTACHMENT 1-5A - SDU TOP PLUG CONNECTOR LAYOUT

The SDU top plug connector layout was revised to reflect changes to the standard interwiring.

ATTACHMENT 1-5B - SDU MIDDLE PLUG CONNECTOR LAYOUT

The SDU middle plug connector layout was revised to reflect changes to the standard interwiring.

ATTACHMENT 1-10A - HPA TOP PLUG CONNECTOR LAYOUT

The HPA top plug connector layout was revised to reflect the changes made to the standard interwiring.

ATTACHMENT 1-14- SATCOM SWITCHING UNIT REAR CONNECTOR CONFIGURATION

Attachment deleted.

ATTACHMENT 2- ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYTEM

In general the titles were moved to the bottoms of the pages for each word and figure numbers were assigned for easier referencing.

In Figure 3, **HPA MAINTENANCE WORD - HPA to SDU**, note 30 was annotated on the Discretes Table and a new note 38 was annotated on bit 12, Output VSWR.

In Figure 5, **ACU/BSU STATUS WORD - ACU/BSU to SDU**, note 17 was annotated on the Sign/Status Matrix.

In Figure 6, **ACU/BSU MAINTENANCE WORD - ACU/BSU to SDU**, note 17 was annotated on the Discretes Table. New note 39 was annotated on bit 17, High Power

Relay (HPR) Status and new notes 38 and 40 were annotated on bit 20, LNA/Diplexer.

In Figure 9, **GSDB WORD SEQUENCE - SDU to SNU**, the SAL was corrected in all six words.

In the NOTES Section, notes 7, 17 and 30 were amended and notes 38, 39, 40, and 41 were added.

APPENDIX 1 - Bit-Oriented Fault Reporting Protocol

This Appendix serves as a placeholder for new material that is expected to be eventually incorporated into ARINC Report 604 Appendix 7 Bit-oriented Fault Reporting Protocol, Table A7.21 Fault Summary Words #1, #2, #3, #4 and #5 for SATCOM. Label 350, Bits 23, 26 and 27 have been revised. Label 351 Bits 22 and 28 have been revised. Label 354, Bit 18 was revised.

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SUPPLEMENT 7
TO
ARINC CHARACTERISTIC 741
AVIATION SATELLITE COMMUNICATION SYSTEM
PART 1
AIRCRAFT INSTALLATION PROVISIONS

Published: December 8, 1995

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: October 31, 1995

A. PURPOSE OF THIS DOCUMENT

This supplement introduces changes to the HPA Specification and the interwiring.

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document, **blue bold** will indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 741 PART 1 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

2.2.4.3.2 TYPE B - FOR PROTECTION OF GPS, GLONASS AND TFTS

A reference in the commentary was corrected.

2.2.5 High Power Amplifier (HPA)

Added an alternate 6-tone Intermodulation Specification to demonstrate the acceptable linearity of the Type 2 (Linear) HPA.

2.3.3.14.2 Antenna Intermodulation Products Which Fall in the GNSS Band

Editorial changes.

2.8.3 High Power Amplifier (HPA)

Changed the airflow rate from “44 kg/hr” to “55 kg/hr”. This was done to accommodate a Supplement 4 change to the HPA output power from “200” to “250” watts.

ATTACHMENT 1-3 - STANDARD INTERWIRING

SDU pin TP10K was changed from “Reserved” to “(Call Light Activation)”. SDU pins MP11C and MP11D were changed from “Call Cancel” to “Place/End Call”. New note 56 was added to SDU pins MP2A through MP2H, MP8E through MP8H, MP11C, MP11D, MP14A, MP14B, and MP14C.

ATTACHMENT 1-4 - NOTES APPLICABLE TO STANDARD INTERWIRING

Additional text added to notes 11 and 46. New note 56 was added.

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

Added Strap Option Assignment TP10K, “Call Light Activation”.

ATTACHMENT 1-5A - SDU TOP PLUG CONNECTOR LAYOUT

Changed TP10K from “Reserved for Strap Option” to “Option Call Light Activation”.

ATTACHMENT 2 - ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

Figure 3. HPA Maintenance Word - HPA to SDU.

Changed the RF power input Discrete bit 14 to allow BITE to monitor for RFU to HPA cable faults under all operational conditions with RF power inputs as low as -32 dBm.

NOTES.

Revised note 10.

APPENDIX 2 - ACRONYMS

New appendix added.

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SUPPLEMENT 8A
TO
ARINC CHARACTERISTIC 741
AVIATION SATELLITE COMMUNICATION SYSTEM
PART 1
AIRCRAFT INSTALLATION PROVISIONS

Published: February 6, 1997

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: October 22, 1996

A. PURPOSE OF THIS DOCUMENT

This supplement introduces updates to the Type A Diplexer, HPA, Antenna Intermodulation, Standard Interwiring and Applicable Notes, System Configuration Pins Definition and Interpretation for the CFDS, and the ARINC 429 Label and Word Format for the ACU/BSU Status Word - ACU/BSU to SDU

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document, **blue bold** will indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 741 PART 1 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

2.2.4.3.1 Type A Diplexer - For Protection of GPS and GLONASS

Title changed. Revised the Transmit Port to Antenna Port electrical characteristics to meet the RTCA minimum requirements.

2.2.5 High Power Amplifier (HPA)

Revised electrical characteristics to meet the RTCA/DO-210A minimum requirements.

2.2.5.1 Harmonics, Discrete, Spurious and Noise

Revised electrical characteristics to meet the RTCA/DO-210A minimum requirements.

2.3.3.1.4 Antenna Intermodulation

Commentary was added.

ATTACHMENT 1-3 - STANDARD INTERWIRING

Note 30 was removed from the interwiring notes column for SDU pins MP1J/K.

ATTACHMENT 1-4 - NOTES APPLICABLE TO STANDARD INTERWIRING

Note 3 was revised to indicate that the 24-Bit ICAO Address data is available on labels 214 and 216 as well as labels 275 and 276.

Note 13 was revised to include on and off hold time guidelines for the chime discrete and a reference to ORT item n, which governs the operation of the chime discrete.

Note 30 was changed to Not Used.

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

Changed the interpretation of the TP12 CFDS bit pattern “0 1 1” from “Undefined” to “Reserved for Honeywell CAIMS”.

ATTACHMENT 2 - ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

Figure 5 ACU/BSU STATUS WORD - ACU/BSU to SDU Changed Bit 19 from “Reserved” to “Antenna Type”.

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SUPPLEMENT 9 TO ARINC CHARACTERISTIC 741 AVIATION SATELLITE COMMUNICATION SYSTEM PART 1 AIRCRAFT INSTALLATION PROVISIONS

Published: November 19, 1997

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: October 16, 1997

A. PURPOSE OF THIS DOCUMENT

Draft supplement 9 introduces updates to remove or change references to ARINC Characteristic 741 Parts 3 and 4, revisions to the Harmonics, Discrete, Spurious, and Noise specifications for the RFU and HPA, and the addition of the modified Type A diplexer/LNA specifications to protect GPS and GLONASS.

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document, **blue bold** will indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 741 PART 1 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

1.1 Purpose of this Characteristic

Deleted references to Parts 3 and 4. Deleted STAFF NOTE referencing Part 5.

1.2 Relationship of this Document to ARINC Characteristic 597 , 724B, and 758

Changed Section title. Deleted “(when installed)” and “subsequent parts” from first paragraph. Changed reference to “Part 3” to be “Part 2.” Deleted references to 597A and 724A. Added references to ARINC Characteristic 758.

1.5.1 Satellite Data Unit (SDU)

Deleted reference to ARINC Characteristic 724A.

1.8 Regulatory Approval

Added references to RTCA MOPS and MASPS as well as ICAO SARPs.

2.2.2.5 Harmonics, Discrete, Spurious, and Noise

Revised table to provide additional protection to TFTS.

2.2.4.3 Diplexer/LNA Types

Section title changed and commentary added.

2.2.4.3.1 Type A - For Protection of GPS Only

Commentary deleted.

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

Commentary deleted.

2.2.4.3.3 Modified Type A Diplexer - For Protection of GPS and GLONASS

Added new section.

2.2.5.1 Harmonics, Discrete, Spurious, and Noise

Revised table to provide additional protection to TFTS. Added note.

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SUPPLEMENT 10
TO
ARINC CHARACTERISTIC 741
AVIATION SATELLITE COMMUNICATION SYSTEM
PART 1
AIRCRAFT INSTALLATION PROVISIONS

Published: December 24, 2003

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: August 25, 2003

A. PURPOSE OF THIS DOCUMENT

This supplement revises the Type A Diplexer transmit port to antenna port specifications for Protection of GPS only. Commentary added for the HPA Harmonics, Discrete Spurious, and Noise. Attachment 1-4C, System Configuration Pins Definition and Interpretation, was revised. Updates were also made to the Equipment Environmental Lightning category (DO-160C Section 22) for the Rack and External Airframe Mounted. The Bit-oriented fault reporting protocol was updated. Editorial revisions are also included.

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document, **blue bold** will indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 741 PART 1 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

1.5.11 High Speed Data Unit (HSDU)

Added new section.

2.2.2.5 Harmonics, Discrete Spurious and Noise

Editorial revisions.

A note was added to identify levels not applicable for intermodulation products.

2.2.4.3.1 Type A Diplexer – For Protection of GPS Only

Title changed. Revised Transmit Port to Antenna Port specifications to reflect actual diplexer designs for protection of GPS only.

2.2.5.1 Harmonics, Discrete Spurious and Noise

Editorial revisions and commentary Item 3 added.

A note was added to identify levels not applicable for intermodulation products.

2.3.2.9 Discrimination

Editorial correction of from “450” to “45°.”

2.8.1 SDU

Editorial correction of temperature from “400C” to “40^{o}C.”

2.8.2 Radio Frequency Unit (RFU)

Editorial correction of temperature from “400C” to “40^{o}C.”

2.8.3 High Power Amplifier (HPA)

Editorial correction of temperature from “400C” to “40^{o}C.”

2.8.4 Antenna Control Unit (ACU)

Editorial correction of temperature from “400C” to “40^{o}C.”

2.8.5 Beam Steering Unit (BSU)

Editorial correction of temperature from “400C” to “40^{o}C.”

ATTACHMENT 1-3 - STANDARD INTERWIRING

Reserved SDU pins for interfacing to one or more optional High Speed Data Units (HSDU). Editorial revisions and corrections.

ATTACHMENT 1-4 - NOTES APPLICABLE TO STANDARD INTERWIRING

Changed note 18 to Not Used. Editorial revisions to Note 27. Added Notes 57, 58 and 59.

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

Attachment revised. Configuration Pins TP10G, TP11A, and TP12E signal assignments revised to accommodate a High Speed Data Unit (HSDU). Tables revised or added accordingly. Note 3 expanded. Notes 8 and 9 added.

ATTACHMENT 1-5A - SDU TOP PLUG CONNECTOR LAYOUT

Updated to reflect standard interwiring revisions.

ATTACHMENT 1-5B - SDU MIDDLE PLUG CONNECTOR LAYOUT

Updated to reflect standard interwiring revisions.

ATTACHMENT 1-6 – RFU FORM FACTOR

Corrected diagram by swapping the Top and Middle Plug inserts.

ATTACHMENT 1-9A - TYPE-A DIPLEXER/LNA FORM FACTOR FOR PROTECTION OF GPS ONLY

Revised Diplexer/LNA Dimensions to allow a common form factor to be used for Aero-H and Aero-I systems.

ATTACHMENT 3 - EQUIPMENT ENVIRONMENTAL CATEGORIES (EUROCAE ED14C/RTCA D0-160C)

Revised the Lightning category (DO-160C Section 22) for the Rack and External Airframe Mounting.

APPENDIX 1 - BIT - ORIENTED FAULT REPORTING PROTOCOL

Revised Table A7.21 Fault Summary Word #2 for SATCOM bit #28 from “Spare” to “HSDU #1 to SDU bus.”

Revised Table A7.21 Fault Summary Word #5 for SATCOM. Bits 11 and 19 through 28 were changed from “Spares” to functions in support of HSDU #1 or HSDU #2. Added notes 2 and 3.

APPENDIX 2 – ACRONYMS

Added new acronyms.

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SUPPLEMENT 11
TO
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AVIATION SATELLITE COMMUNICATION SYSTEM
PART 1
AIRCRAFT INSTALLATION PROVISIONS

Published: May 19, 2006

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: January 16, 2006

A. PURPOSE OF THIS DOCUMENT

This supplement refers to a new Williamsburg SDU Controller Interface (WSCI) defined in ARINC Characteristic 741, Part 2. Numerous references to the “MCDU or SCDU” have been replaced with references to “SCDU/WSC.”

The Type B diplexer/LNA specifications were deleted. A reference to a new Type D Diplexer, contained in ARINC Characteristic 781, for use with SwiftBroadband High Speed Data was added. Also, concerning the Diplexer/LNA form factor, the title of Attachment 1-9A was revised and Attachment 1-9B was deleted.

Updates have been made to the Standard Interwiring and Notes, and associated Connector Layouts. The “System Configuration Pins Definition and Interpretation” was updated for selecting the “SDU Controller Type” and the HPA/Antenna Subsystem Configuration table was updated.

Attachment 2, Figure 8 (Closed Loop Steering Word - SDU to ACU/BSU) and related notes were removed and archived in this set of change descriptions for possible future use.

Attachment 4 Wiring Provisions for Internal High Speed Data was added. The former Attachment 4 was renumbered to be Attachment 5. Appendix 1 “Bit Oriented Fault Reporting Protocol” was updated to support external High Speed Data Units.

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document, **blue bold** will indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 741 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

1.5.11 High Speed Data Unit

Revised to include reference to SwiftBroadband and noted provisions in Appendix 1 for bit oriented fault reporting for external HSDUs.

2.2.4.3 Diplexer/LNA Types

Deleted third paragraph.

Added reference to ARINC 741, Part 2, Section 3.5.4.1.1 for frequency management techniques.

Added a new paragraph at end of the section to address the need for Type D diplexers for installations that support SwiftBroadband high-speed data services.

2.2.4.3.2 Type B

Revised the section title and replaced all of the existing text and tables with a new paragraph indicating that the Type B diplexer/LNA never progressed beyond the concept stage.

THE FOLLOWING MATERIAL, WHICH WAS DELETED FROM SECTION 2.2.4.3.2, IS CONSIDERED “OBSOLETE”” AND IS ARCHIVED FOR POSSIBLE FUTURE USE.

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

Antenna Port to LNA Output

The rejection from the antenna port to the LNA output port relative to the 1525 to 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
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
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
1675.0	to	12000.0	> 50 dB
12000.0	to	18000.0	> 15 dB

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

THIS ENDS THE ARCHIVED MATERIAL.

2.2.4.3.4 Type D - For use with SwiftBroadband High Speed Data

Added section referring to ARINC Characteristic 781 for the details of the Type D diplexer.

2.2.4.7 Diplexer/LNA Form Factors

Revised section to indicate that the form factor in Attachment 1-9A is for the Type A, Modified Type A, and Type D Diplexer/LNAs.

ATTACHMENT 1-1 - GENERAL CONFIGURATION OVERVIEW

Replaced “C.D.U.” with “SCDU”.

ATTACHMENT 1-1A - SAMPLE DUAL SATCOM INSTALLATION

Changed “SCDU” to “SCDU/WSC” in six places.

ATTACHMENT 1-3 - STANDARD INTERWIRING

Changed function for pin TP10H from “Reserved for Strap Option” to “Strap Option.”

Changed “SCDU” to “SCDU/WSC” under the function column for pins MP3C/D, MP3E/F, MP3J/K and MP8J/K.

Changed the function for pins MP8C/D from “Reserved Data Bus from RMP (ARINC429)” to “Spare 429 Input” and added reference to new note 60.

Changed the function for pins MP9C/D from “Reserved Data Bus to RMP (ARINC429)” to “Spare 429 Output” and added reference to new note 60.

ATTACHMENT 1-4 - NOTES APPLICABLE TO STANDARD INTERWIRING

Revised Note 25 to refer to the Williamsburg SDU Controller Interface (WSCI) as defined in Attachment 2F-42.1 of ARINC 741 Part 2.

Added new note 60.

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

Changed “MCDU/SCDU” to “SCDU/WSC” in numerous places. Changed TP10H from “Reserved for Strap Option” to “SDU Controller Type” and added a new definition table for TP10H.

For TP10G added “(or RFU HSDU)” in two places. Revised note 8 by referring to the installation of an RFU HSDU (as described in Attachment 4.

Revised Table 1-4 (TP11E-K) HPA/Antenna Subsystem Configuration. Revisions include the addition of three new columns titled “Decimal Code”, “NON-TYPE D LNA/DIPLEXER”, and “TYPE D LNA/DIPLEXER” and their accompanying decimal codes, definitions, and interpretations. Added sentence to Note 3. Added new Note 10.

ATTACHMENT 1-5A - SDU TOP PLUG CONNECTOR LAYOUT

Changed “MCDU/SCDU” to “SCDU/WSC” in four places. Changed “Reserved for Strap Option” to “Option SDU Controller Type” for pin TP10H.

ATTACHMENT 1-5B - SDU MIDDLE PLUG CONNECTOR LAYOUT

Changed “SCDU” to “SCDU/WSC” in eight places.

Changed pins MP8C/D from “Reserved Data from RMP” to “Spare 429 Input.”

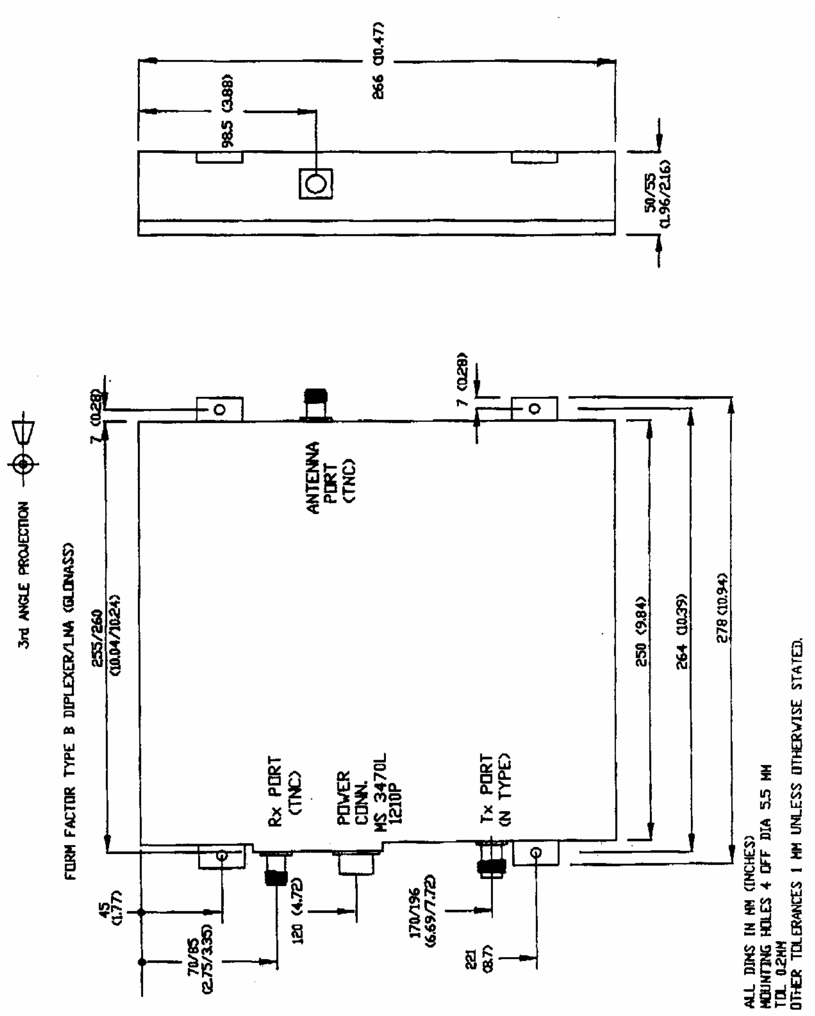
Changed pins MP9C/D from “Reserved Data to RMP” to “Spare 429 Output.”

ATTACHMENT 1-9A - TYPE A, MODIFIED TYPE A, and TYPE D - DIPLEXER/LNA FORM FACTOR

Revised section title only from “TYPE A DIPLEXER/LNA FORM FACTOR FOR PROTECTION OF GPS ONLY”.

ATTACHMENT 1-9B - TYPE B - DIPLEXER/LNA FORM FACTOR FOR PROTECTION OF GPS, GLONASS AND TFTS

ATTACHMENT 1-9B HAS BEEN DELETED AND IS ARCHIVED BELOW AS “OBSOLETE” FOR POSSIBLE FUTURE USE.



THIS ENDS THE ARCHIVED MATERIAL.

ATTACHMENT 1-10A – HPA TOP PLUG CONNECTOR LAYOUT

Changed pin labels for TP2E and TP2H to be same as interwiring labels.

ATTACHMENT 2 – ARINC 429 LABELS AND WORD FORMATS USED IN THE AVIATION SATELLITE COMMUNICATIONS SYSTEM

Changed “SAT” to “SAL” in the 2nd, 4th, and 6th words.

FIGURE 8 AND NOTES 27, 29, AND 33 HAVE BEEN DELETED AND ARCHIVED BELOW IN THIS SET OF CHANGE DESCRIPTIONS FOR POSSIBLE FUTURE USE. FIGURE 8 AND NOTES 27, 29 AND 33 ARE NOW MARKED AS RESERVED FOR FUTURE USE.

BIT	32	31 30	29 28 27 26 25	24 23 22 21 20 19 18 17	16 15 14 13 12 11 10 9	8 7 6	5 4 3	2 1
Function	P	SSM	Disc	Undefined	C+N Data	Label 153 [28] [31] [33] [27]		
						1 1 0	1 0 1	1 0
						3	5	1

SDU Equipment Identifier Code: 041 (HEX)

Sign/Status Matrix		
BITS		Coding
31	30	
0	0	Failure Warning
0	1	No Computed Data
1	0	Functional Test
1	1	Normal Operation

Discretes		Values	
BIT	Description	0	1
25	Reserved		
26	Carrier Lock Signal	Unlock	Lock
27	Bit Sync Signal	Unlock	Lock
28	Frame Sync Signal	Unsync	Sync
29	Rx Carrier Freq Status	Freq Search	Freq Found

C+N Data [29]	
BIT 16 - 9	Coding
00000000	Lowest C+N
11111111	Highest C+N

While the OPEN LOOP STEERING WORD’s SSM contains “No Computed Data” or is absent for 1 second or more, the ACU/BSU should operate in Closed Loop Mode. If the next received CLOSED LOOP STEERING WORD’s discrete “RX Carrier Frequency Status” is cleared to “SEARCH,” the ACU/BSU will set the Operational Status field in the ACU/BSU STATUS WORD to “Omnidirectional” and operate its HGA in Omnidirectional mode. It should then proceed to follow the sequence outlined in Note 33. If the “RX Carrier Frequency Status” discrete in the CLOSED LOOP STEERING WORD is set to “FOUND” and Bit Sync is also indicated, the ACU/BSU will set the Operational Status Field in the ACU/BSU Status Word to “Closed Loop Tracking Mode Active” and enter that mode, bypassing the satellite acquisition sequence outlined in the commentary accompanying the ACU/BSU Status Word.

Figure 8 – Closed Loop Steering Word – SDU to ACU/BSU (Signal Quality – SDU Multicontrol Output) Optional Word for Test Purposes

Notes:

27. The ACU/BSU should operate in the Closed Loop mode when the SDU Open Loop Steering Word is either not received for one second after receipt of the last Open Loop Steering Word or when the SSM of that word indicates "No Computed Data."

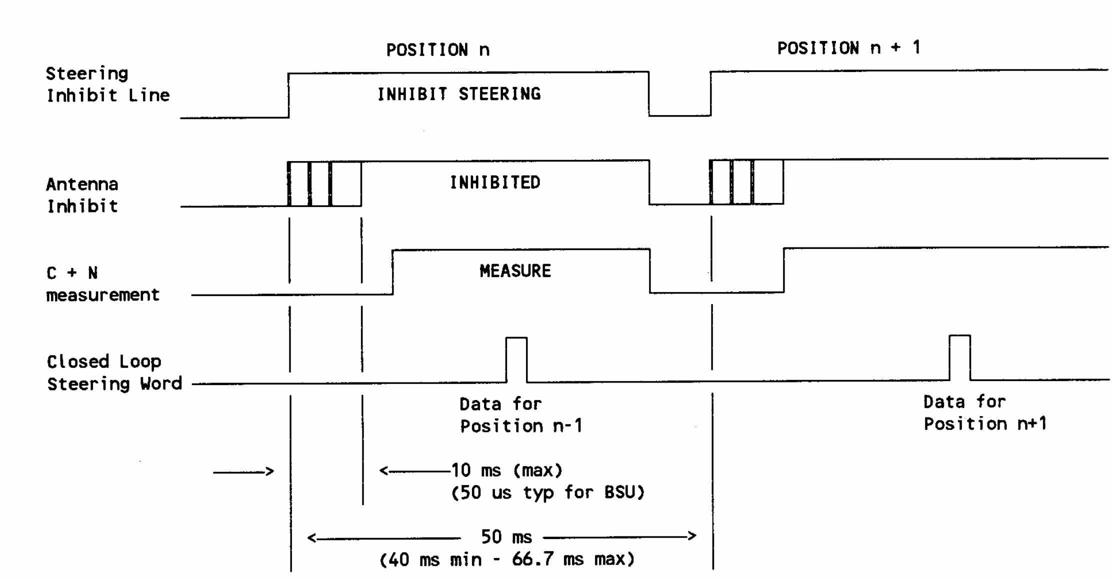
29. The C+N Data field is defined as the carrier plus noise (C+N) level as determined by the demodulator and is an eight bit BNR field which represents the RSS value of the demodulator, the square root of the sum of I^2 and Q^2 integrated over approximately a 40 ms time period. Note: The SDU will inhibit beam steering during this 40 ms period to assure a single beam position is observed. Alternatively an optional Signal Quality Test word providing an indication of Carrier-to-Noise ratio can be provided.

33. When the SSM of the OPEN LOOP STEERING WORD contains "No Computed Data," the ACU/BSU will check the CLOSED LOOP STEERING WORD's discrete "RX Carrier Frequency Status" bit's state. If that discrete is cleared to "SEARCH," the ACU/BSU will set the Operational Status (OP.) field in the ACU/BSU STATUS WORD to "Omnidirectional," and set the HGA it controls to the Omnidirectional mode. The SDU will mute the HPA(s) during the ensuing Closed Loop Acquisition Mode. When the SDU is ready for the ACU/BSU to begin the satellite acquisition sequence, it will send "FOUND" in the "RX Carrier Frequency Status: discrete of the CLOSED LOOP STEERING WORD.

    When the ACU/BSU detects that the SDU has FOUND the desired frequency's carrier, it will immediately change the state "Omnidirectional" mode in the STATUS WORD's Operational Status Field to "Acquisition Mode Active."

    While in the "Acquisition Mode Active" state, the ACU/BSU will move the beam when not inhibited by the "Steering Inhibit" discrete line from the SDU. The ACU/BSU must actually inhibit beam steering within no more than 10 ms after the Inhibit state has been set on the "Steering Inhibit" discrete line.

    Every 50 ms (nominally), the beam may be stepped to the next position. For each of these positions, the SDU will deliver one CLOSED LOOP STEERING WORD, with a carrier + noise (C+N) measurement for the <u>previous</u> beam position. The following timing diagram shows a typical sequence.



ACQUISITION MODE TIMING

After all beam positions have been scanned, the ACU/BSU will position the beam to the angle with the highest C+N. The ACU/BSU will assume this is the angle which will provide the greatest signal strength on the desired frequency. The ACU/BSU will then place the state “Acquisition Complete” in the Operational Status code of the STATUS WORD.

After the SDU indicates Carrier Lock, Bit Sync, and Frame Sync in the CLOSED LOOP STEERING WORD, the Operational Status code will display “Closed Loop Tracking Mode Active” indefinitely until the SDU replaces the state “No Computed Data” in the Sign Status Matrix of the OPEN LOOP STATUS WORD with “Normal Operation,” causing the ACU/BSU to resume Open Loop operation.

If the ACU/BSU discovered the “RX Carrier Frequency Status” discrete set to FOUND when it checked the CLOSED LOOP STEERING WORD along with Carrier Lock and Bit Sync, it will bypass the acquisition sequence outlined above, and immediately set the Operational Status field to “Closed Loop Tracking Mode Active,” and enter that mode.

THIS ENDS THE ARCHIVED MATERIAL.

Added Figure 10 - Label 172

ATTACHMENT 4 – WIRING PROVISIONS FOR INTERNAL HIGH SPEED DATA

Added new attachment. The former Attachment 4 has been renumbered.

ATTACHMENT 5 – ATTACHMENT REFERENCE GUIDE

This was formerly Attachment 4.

APPENDIX 1 - BIT-ORIENTED FAULT REPORTING PROTOCOL

Revised the following Tables:

- Table A7.21 Fault Summary Word #1 for SATCOM
- Table A7.21 Fault Summary Word #2 for SATCOM
- Table A7.21 Fault Summary Word #4 for SATCOM
- Table A7.21 Fault Summary Word #5 for SATCOM

Added the following Tables for External High Speed Data Units:

- Table A7.21 Fault Summary Word #6 for SATCOM
- Table A7.21 Fault Summary Word #7 for SATCOM
- Table A7.21 Fault Summary Word #8 for SATCOM
- Table A7.21 Fault Summary Word #9 for SATCOM

APPENDIX 2 - ACRONYMS

Added new acronyms.

AERONAUTICAL RADIO, INC.
2551 Riva Road
Annapolis, Maryland 24101-7435

SUPPLEMENT 12
TO
ARINC CHARACTERISTIC 741
AVIATION SATELLITE COMMUNICATION SYSTEM
PART 1
AIRCRAFT INSTALLATION PROVISIONS

Published: December 1, 2006

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: October 11, 2006

A. PURPOSE OF THIS DOCUMENT

This supplement primarily provides corrections or updates to Section 1.4 Airborne Avionics Configurations to refer to ARINC 781 for pertinent additional information regarding SwiftBroadband, Section 2.2.5.1 Harmonics, Discrete, Spurious and Noise to be consistent with RTCA DO-201D, and Attachment 1-4C, Table 1-4 (TP11E-K) HPA/Antenna Subsystem Configuration to add the ARINC 781 High Gain Antenna (HGA).

B. ORGANIZATION OF THIS SUPPLEMENT

In the past, changes introduced by a supplement to an ARINC Standard were identified by vertical change bars with an annotation indicating the change number. Electronic publication of ARINC Standards has made this mechanism impractical.

In this document **blue bold** text is used to indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 741, PART 1, INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

1.4 Airborne Avionics Configurations

Added reference to ARINC Characteristic 781 for pertinent additional information regarding SwiftBroadband.

2.2.5.1 Harmonics, Discrete, Spurious and Noise

Updated section to be consistent with RTCA DO-210D.

ATTACHMENT 1-3 – STANDARD INTERWIRING

Added note 62 to SDU pin TP15A, RFU pin TP7A, and HPA pin TP7A

Added note 61 to SDU pins MP12B and MP12D and changed “HSDU” to be “HPA HSDU” in the function names.

Added notes to HPA pins TP2E, TP2F, TP2H, and TP2J.

Deleted Future Spare HPA pins TP6A through TP6K.

ATTACHMENT 1-4 – NOTES APPLICABLE TO STANDARD INTERWIRING

Added notes 61 and 62.

ATTACHMENT 1-4C – SYSTEM CONFIGURATION PINS DEFINITION AND INTERPRETATION

Updated Table 1-4 (TP11E-K) - HPA/Antenna Subsystem Configuration to include the ARINC 781 High Gain Antenna (HGA).

ATTACHMENT 4 – WIRING PROVISIONS FOR INTERNAL HIGH SPEED DATA

In Figure 4-1 – ARINC 741 with Integrated High Speed Data changed the following:

- “To HSDU 1/2/3” was changed to be “To HPA HSDU”.
- “From HSDU 1/2/3” was changed to be “From HPA HSDU”.
- “HSDU Control ARINC 429High Speed” was changed to “Optional HSDU Control ARINC 429High Speed”.

In Table 4-1 – Standard Interwiring for Internal High Speed Data changed the following:

- Added RFU in the RFU and HPA column names and in the function name for SDU pin MP9H. Also, deleted note 64 and added new note 79 for SDU pin MP9H.
- Added RFU HSDU to SDU (ARINC 429) to SDU pin MP9F. Also, deleted note 64 and added new note 79 for SDU pin MP9F.
- Added SDU pins MP12C, MP12D, MP12A, MP12B and accompanying notes 76 and 77.
- Added new note 78 for RFU HSDU pins MP4A through MP7H and HPA HSDU pins TP5F through TP7J
- Added new notes 63 and 69 for RFU HSDU pins TP4J and TP4K and HPA HSDU pins MP4C and MP4D.
- Deleted notes 63 and 71 and replaced them with notes 72 and 73 for RFU HSDU pin MP4G and HPA HSDU pin MP1B.

In the notes section:

- Revised notes 64, 67, and 72.
- Added new notes 76, 77, 78, and 79.

Added Table 4-4C – Swift64 Forward ID Straps.

Added Table 4-4D – Discrete/Strap Common.

Made revisions to Tables 4-5B and 4-7A.

ARINC Standard – Errata Report

1. Document Title

ARINC Characteristic 741P1-12: *Aviation Satellite Communication System Part 1 Aircraft Installation Provisions*
Published: December 1, 2006

2. Reference

Page Number: ______ Section Number: _______________ Date of Submission: _______________

3. Error

(Reproduce the material in error, as it appears in the standard.)

4. Recommended Correction

(Reproduce the correction as it would appear in the corrected version of the material.)

5. Reason for Correction *(Optional)*

(State why the correction is necessary.)

6. Submitter (Optional)

(Name, organization, contact information, e.g., phone, email address.)

Please return comments to fax +1 410-266-2047 or standards@arinc.com

Note: Items 2-5 may be repeated for additional errata. All recommendations will be evaluated by the staff. Any substantive changes will require submission to the relevant subcommittee for incorporation into a subsequent Supplement.

[To be completed by IA Staff]

Errata Report Identifier: _______________ **Engineer Assigned:** ___________________________

Review Status: ____

ARINC IA Project Initiation/Modification (APIM)

1.0 Name of Proposed Project **APIM #:** _____

(Insert name of proposed project.)

2.0 Subcommittee Assignment and Project Support

2.1 Identify AEEC Group

(Identify an existing or new AEEC group.)

2.2 Support for the activity

Airlines: *(Identify each company by name.)*

Airframe Manufacturers:

Suppliers:

Others:

2.3 Commitment for resources *(Identify each company by name.)*

Airlines:

Airframe Manufacturers:

Suppliers:

Others:

2.4 Chairman: (Recommended name of Chairman.)

2.5 Recommended Coordination with other groups

(List other AEEC subcommittees or other groups.)

3.0 Project Scope *(why and when standard is needed)*

3.1 Description

(Insert description of the scope of the project. Use the following symbol to check yes or no below. ☒)

3.2 Planned usage of the envisioned specification

New aircraft developments planned to use this specification yes ❑ no ❑

Airbus: *(aircraft & date)*

Boeing: *(aircraft & date)*

Other: *(manufacturer, aircraft & date)*

Modification/retrofit requirement yes ❑ no ❑

Specify: *(aircraft & date)*

Needed for airframe manufacturer or airline project yes ❑ no ❑

Specify: *(aircraft & date)*

Mandate/regulatory requirement yes ❑ no ❑

Program and date: *(program & date)*

Is the activity defining/changing an infrastructure standard? yes ❑ no ❑

Specify *(e.g., ARINC 429)*

When is the ARINC standard required?
______*(month/year)*__________

What is driving this date? _______*(state reason)*_____________________

Are 18 months (min) available for standardization work? yes ❑ no ❑

If NO please specify solution: _________________

Are Patent(s) involved? yes ❑

If YES please describe, identify patent holder: _________________

3.3 Issues to be worked

(Describe the major issues to be addressed.)

4.0 Benefits

4.1 Basic benefits

Operational enhancements yes ❑ no ❑

For equipment standards:

a. Is this a hardware characteristic? yes ❑ no ❑

b. Is this a softwareware characteristic? yes ❑ no ❑

c. Interchangeable interface definition? yes ❑ no ❑

d. Interchangeable function definition? yes ❑ no ❑

If not fully interchangeable, please explain: _________________

Is this a software interface and protocol standard? yes ❑ no ❑

Specify: _________________

Product offered by more than one supplier yes ❑ no ❑

Identify: *(company name)*

4.2 Specific project benefits

(Describe overall project benefits.)

4.2.1 Benefits for Airlines

(Describe any benefits unique to the airline point of view.)

4.2.2 Benefits for Airframe Manufacturers

(Describe any benefits unique to the airframe manufacturer's point of view.)

4.2.3 Benefits for Avionics Equipment Suppliers

(Describe any benefit unique to the equipment supplier's point of view.)

5.0 Documents to be Produced and Date of Expected Result

5.1 Meetings and Expected Document Completion

The following table identifies the number of meetings and proposed meeting days needed to produce the documents described above.

Activity	Mtgs	Mtg-Days (Total)	Expected Start Date	Expected Completion Date
Document a	*# of mtgs*	*# of mtg days*	*mm/yyyy*	*mm/yyyy*
	*# of mtgs **	*# of mtg days **		
Document b	*# of mtgs*	*# of mtg days*	*mm/yyyy*	*mm/yyyy*
	*# of mtgs **	*# of mtg days **		

** Indicate unsupported meetings and meeting days, i.e., technical working group or other ad hoc meetings that do not requiring IA staff support.*

6.0 Comments

(Insert any other information deemed useful to the committee for managing this work.)

For IA Staff use

Date Received: _____________ IA Staff Assigned: ___________

Estimated Cost: _____________

Potential impact: ______

*(**A**. Safety **B**. Regulatory **C**. New aircraft/system **D**. Other)*

Forward to committee(s) (AEEC, AMC, FSEMC): _____________ Date Forwarded:_____________

Committee resolution: _______

*(**0** Withdrawn **1** Authorized **2** Deferred **3** More detail needed **4** Rejected)*

Assigned Priority:______ Date of Resolution:_________________

*(**A** High - execute first **B** Normal - may be deferred.)*

Assigned to SC/WG:_________________