INCH-POUND

MIL-R-29583(AS)
1 July 1992

MILITARY SPECIFICATION

Radio Set, AN/ARC-210(V)

This specification is approved for use within the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. The radio set covered by this specification shall provide simplex two-way communication of normal and secure voice amplitude modulated (AM) or frequency modulated (FM) signals in the radio frequency (RF) bands defined as follows: 30.000 through 87.9875 Megahertz (MHz) (FM), 118.000 through 135.9975 MHz (AM), 136.000 through 155.9975 MHz (AM and FM), 156.000 through 173.9875 MHz (FM), and 225.000 through 399.9875 MHz (AM and FM). The radio set shall also provide variable AM and FM electronic counter-countermeasure (ECCM) mode(s) when used in conjunction with appropriate control device(s). In addition, the radio set shall provide a receive-only mode of operation of normal and secure voice from 108.000 through 117.9975 MHz (AM) and additional modes of operation as specified in 3.5.6. HAVEQUICK as described herein refers to HAVEQUICK and HAVEQUICK II. The receiver-transmitter (RT) shall provide capability for combinations of secure, non-secure, jam-resistant, and non-jam resistant voice and data communications for a variety of missions involving air-to-air and air-to-surface operations using direct and relayed communications as specified herein. For a complete description of the functions and capabilities of the radio set, refer to 3.5. The top-level functional flow of the AN/ARC-210(V) system is shown on figure 1.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Warfare Center Aircraft Division Lakehurst, System Requirements Department, Code SR3, Lakehurst, NJ 08733-5100 by using the self-addressed Standardization Document Approval Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5821

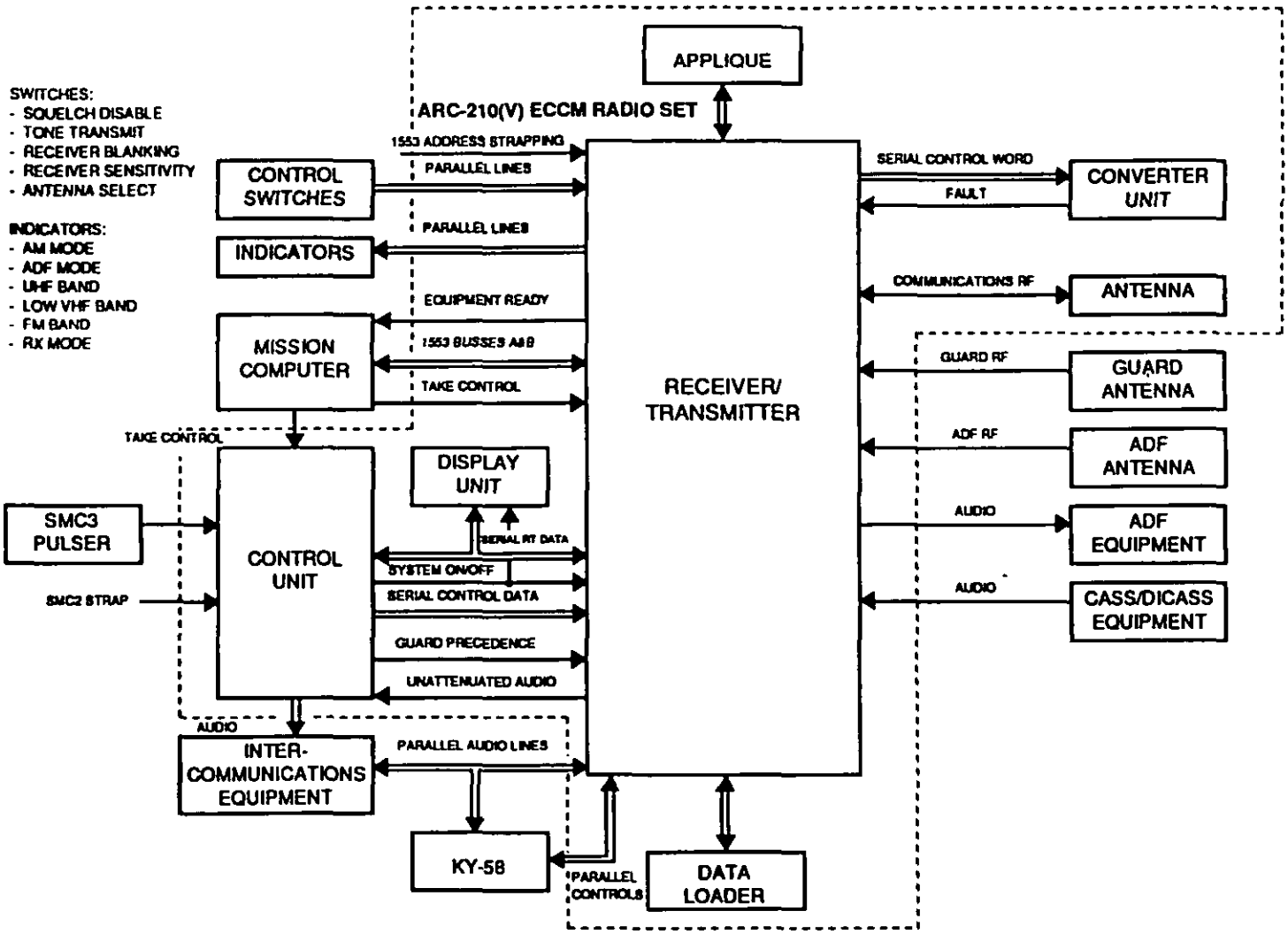


FIGURE 1. AN/ARC-210(V) System Block Diagram.

2. APPLICABLE DOCUMENTS

2.1 Government Documents.

2.1.1 Specifications, standards and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

QQ-P-416	Plating, Cadmium (electrodeposited)

MILITARY

MIL-C-172	Cases, Bases, Mounting and Mounts, Vibration (for use with electronic equipment in aircraft)
MIL-B-5087	Bonding, Electrical, and Lightning Protection, for Aerospace Systems
MIL-W-5088	Wiring, Aerospace Vehicle
MIL-E-5400	Electronic Equipment, Aerospace, General Specification for
MIL-A-5815	Antenna, Airborne, UHF-Band, General Specification for
MIL-E-6051	Electromagnetic Compatibility Requirements, System
MIL-C-6781	Control Panel; Aircraft Equipment, Rack or Console Mounted
MIL-P-7788	Panels, Information, Integrally Illuminated
MIL-A-8806	Acoustical Noise Level in Aircraft, General Specification for
MIL-E-17555	Electronic and Electrical Equipment, Accessories, and Provisioned Items (Repair Parts) Packaging

MIL-T-18303	Test Procedures; Preproduction. Acceptance and Life for Aircraft Electronic Equipment, Format for
MIL-N-18307	Nomenclature and Identification for Aeronautical Systems Including Joint Electronics Type Designated Systems and Associated Support Systems
MIL-S-19500	Semiconductor Devices, General Specification for
MIL-M-22179	Microphone, Dynamic M96(*)/A
MIL-I-22767	Intercommunication Stations LS-459(*)/AIC and LS-460(*)/AIC
MIL-A-23595	Amplifier, Audio Frequency
MIL-C-25050	Colors, Aeronautical Lights and Lighting Equipment, General Requirements for
MIL-S-25879	Switch, Coaxial, Radio Frequency Transmission Line, Type SA-521A/A
MIL-D-38402	Direction Finder Group, AN/ARA-50, General Specification for
MIL-M-38510	Microcircuits, General Specification for
MIL-C-38999	Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect (Bayonet, Threaded and Breech Coupling), Environmental Resistant, Removable Crimp and Hermetic Solder Contacts, General Specification for
MIL-C-39012	Connectors, Coaxial, Radio Frequency, General Specification for
MIL-H-46855	Human Engineering Requirements for Military Systems, Equipment and Facilities
MIL-N-49065	Night Vision Goggles, AN/PVS-5A
MIL-P-55110	Printed Wiring Boards, General Specification for
MIL-R-81493	Radio Set, AN/PRC-90
MIL-C-81774	Control Panel, Aircraft, General Requirements for

MIL-G-81665	Generator Transmitter Group, AN/ASA-76(U)
MIL-R-81877	Radio Sets AN/ARC-159 and AN/ARC-159(V)
MIL-R-85664	Receiver-Transmitter, Radio RT-1250A/ARC
MIL-L-85762	Lighting, Aircraft, Interior, AN/AVS-6 Night Vision Imaging System (NVIS) Compatible
MIL-S-85673	Switching Unit, SA-2498/ARC
MIL-C-85674	Control Units C-11628/ARC, C-10777A/ARC and C-11132/ARC and C-10320/ARC and C-10777/ARC

STANDARDS

FEDERAL

FED-STD-595	Colors Used in Government Procurement

MILITARY

MIL-STD-275	Printed Wiring for Electronic Equipment
MIL-STD-415	Test Provisions for Electronic Systems and Associated Equipment, Design Criteria for
MIL-STD-449	Radio Frequency Spectrum Characteristics, Measurement of
MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-462	Electromagnetic Interference Characteristics, Measurement of
MIL-STD-471	Maintainability Verification/Demonstration/Evaluation
MIL-STD-701	Lists of Standard Semiconductor Devices
MIL-STD-704	Aircraft Electric Power Characteristics
MIL-STD-781	Reliability Testing for Engineering Development, Qualification, and Production

MIL-STD-785	Reliability Program for Systems and Equipment Development and Production
MIL-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment
MIL-STD-2073-1	DoD Material Procedures for Development and Application of Packaging Equipment
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
MIL-STD-883	Test Methods and Procedures for Microelectronics
MIL-STD-965	Parts Control Program
MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment and Facilities
MIL-STD-1553	Aircraft Internal Time Division Command/Response Multiplex Data Bus
MIL-STD-1562	List of Standard Microcircuits
MIL-STD-1679	Weapon System Software Development
MIL-STD-2000	Standard Requirements for Soldered Electrical and Electronic Assemblies
MIL-STD-2074	Failure Classification for Reliability Testing
MIL-STD-2076	Unit Under Test Compatibility with Automatic Test Equipment, General Requirements for
MIL-STD-2077	General Requirements Test Program Sets
MIL-STD-2084	General Requirements for Maintainability of Avionic and Electronic Systems and Equipment

HANDBOOKS

MILITARY

MIL-HDBK-781	Reliability Test Methods, Plans, and Environment for Engineering Development, Qualification and Production

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from the DODSSP Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

ESD SPECIFICATIONS

CP-AD0-100B	Prime Item Development Specification - Have Quick Task 01
CP-ADO-100A	Prime Item Fabrication Specification - Have Quick Task 01

SPACE AND NAVAL WARFARE SYSTEMS COMMAND

ICD-GPS-060	GPS User Equipment - Precise Time and Time Interval (PTTI) Interface

JTC3A SPECIFICATION

9001C	Joint Technical Interface Specification for the VHF SINCGARS Waveform

NAVAL AIR SYSTEMS COMMAND (NAVAIR)

AR-29	Radio Frequency Spectrum Characteristic and Allocation
AS-4580	Antenna, AS-3191 NAVAIR Specification
AS-4613	General Specification for Application and Derating Requirements for Electronic Components
EI-764	Avionics Installation Instructions for Radio Set AN/ARC-210(V)

AD 1115	Electromagnetic Compatibility Design Guide for Avionics and Related Equipments

NATIONAL SECURITY AGENCY (NSA)

CSESD-14	Communication Security Equipment System Document for TSEC/KY-57/58
CSEEB-32	TSEC/KY-57/58 Communications Security Equipment Engineering Bulletin
DS-101	Interface Protocols for Electronically Keyable COMSEC Equipment/System
NACSIM 5100A	Compromising Emanations, Laboratory Test Requirements, Electromagnetics
NACSIM 5112	Nonstop Evaluation Techniques
ON477311	Prime Item Product Fabrication Specification for AN/CYZ-10 and AN/CYZ-10A

ARMY MATERIAL DEVELOPMENT AND READINESS COMMAND (DARCOM)

DARCOM P-706-410	Engineering Design Handbook for Electromagnetic Compatibility

ARMY AVIATION RESEARCH AND DEVELOPMENT COMMAND

ADS-23	Aircrew Station Lighting for Compatibility with Night Vision Goggle Use

(Limited copies the cited specifications, documents, publications and National Security Agency publications are available by formal application the Naval Air Systems Command, Code AIR-546M, Washington, D.C. 20361-5464)

(Information concerning specifications SCS-405 for the ID-1351/a type indicator, if required, may be obtained from the Army Electronics Command, Code DRSEL-VL-S, Fort Monmouth, New Jersey 07703)

(Copies of DARCOM publications are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

ELECTRONICS INDUSTRIES ASSOC. (EIA) STANDARD

RS-423-A Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits

AERONAUTICAL RADIO INCORPORATED (ARINC)

ARINC 716 Airborne VHF Communications Transceiver

(Copies of Electronics Industries Association (EIA) RS series specifications may be obtained from the Electronics Industries Association Engineering Department, Standards Orders, 2001 Eye Street, Washington, D.C. 20006.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents may also be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Preproduction. This specification makes provision for preproduction testing.

3.2 Parts and materials. In the selection of parts and materials, the prime considerations are fulfillment of performance requirements, size, weight, power, logistics supportability, and reliability assurance in a cost-effective design. For this program, the following definitions (RT & Applique only) apply:

(a) Military equivalent unscreened parts are those parts produced by a Qualified Products List (QPL) vendor on the same line as "fully screened" parts but without screening beyond the vendor's "normal process testing."

(b) Unscreened MIL-TEMP range parts are those parts procured from contractor qualified vendors with no "additional screening" beyond the vendors normal process testing.

The following criteria shall govern in parts and material selection:

(a) When possible, electronic functional subassemblies shall be implemented through the use of medium-scale integrated (MSI) and/or large-scale integrated (LSI) circuits. This does not preclude the use of very large-scale integrated (VLSI) circuits or very high speed integrated circuits (VHSIC) technology where appropriate. Unless otherwise approved by the

acquisition activity, two qualified sources shall be established for all parts. All second-source microelectronic devices and components shall be mechanically and electrically interchangeable.

(b) The selection and application of parts, materials, and processes shall be in accordance with MIL-E-5400. Specifications for all parts shall include quality assurance requirements consistent with those controlling specifications which shall be prepared in accordance with MIL-STD-965.

(c) Subassemblies shall be designed and fabricated to be repairable. Maximum economic standardization of parts and materials shall be exercised. Parts selection shall be made in the following order of precedence:

(1) a. For the RT-1556 and CD-17, the first order of precedance shall be military equivalent unscreened parts or unscreened MIL temperature range parts proven to be acceptable by environmental stress testing requirements of 3.2.4.2, and approved in accordance with 3.2.1.

b. For the C-11896/7/8 and ID-2428, the first order of precedance shall be military standard established reliability parts in accordance with MIL-E-5400. When discrete transistors and diodes are required, they shall be chosen and applied as specified in MIL-S-19500 and MIL-STD-701. Microelectronic devices shall be screened in accordance with MIL-STD-883, Class B, method 5004.

(2) MSI/LSI functions developed under this program to minimize component quantity and cost and maximize equipment reliability.

(3) Military standard established reliability parts (e.g., JAN-TX, ER).

(4) Other parts as listed on the qualified products list (QPL).

(5) Parts defined by Defense Electronics Supply Center (DESC) military drawings.

(6) Nonstandard parts.

3.2.1 Nonstandard parts and materials approval. Approval for the use of nonstandard parts and materials shall be obtained as specified in MIL-STD-965 (procedure 1) and in MIL-E-5400. Approval for the use of unscreened MIL temperature range parts in the RT-1556 and CD-17 shall be obtained from the Naval Air Systems Command (NAVAIR). Approval of nonstandard parts shall not be required for the following microelectronic devices:

(a) Devices listed in MIL-STD-1562.

(b) Devices available from at least two sources that are listed in the appropriate QPL of MIL-M-38510.

(c) devices procured to the requirements of MIL-M-38510 from a qualified source.

(d) Parts defined and purchased to "military drawings".

(e) Military equivalent unscreened parts proven to be acceptable by environmental stress testing requirements of 3.2.4.2.

3.2.2 Microelectronic modular assemblies. When used, microelectronic modular assemblies shall meet the requirements of MIL-STD-965 and MIL-STD-883. Maximum use shall be made of microelectronic assemblies and subassemblies that contain a maximum of MSI/LSI circuitry. Thick and thin film hybrids shall be used to the maximum feasible extent.

3.2.3 Modules. The electronic portions of the equipment shall be functionally modularized in accordance with MIL-STD-2084, Task 103, with the exception noted in 3.3.7.2. Conformal coatings, encapsulants, embedments, or potting material used with repairable modular assemblies containing microcircuits and discrete parts shall be readily removable without damage to the assembly. Test points shall not have conformal coating applied. All modules shall be identifiable by serial number and date code. Module sizes shall be chosen for minimum life cycle cost and consistency with field maintainability and reliability requirements.

3.2.4 Parts derating and application. All parts used shall be applied well within their ratings. The derating shall encompass the appropriate and meaningful application conditions such as voltage, current, power, temperature, mechanical fatigue, and duty cycle. Electronic and electromechanical parts shall conform to table I electronic parts derating for worst case electrical and environmental stress unless formal written approval is received from the acquisition activity prior to incorporation into the design. (See 6.2.2) Part level stress analysis shall be used to verify that all parameter stresses are within the derated values at worst case circuit and environmental conditions. The following limitations on parts usage shall apply:

Prohibited Application

(a) Non-hermetically sealed semiconductors
(b) Photo couplers (photo transistors)
(c) Microcircuit sockets
(d) Non-hermetically sealed wet tantalum capacitors.

3.2.4.1 Rescreening. The Contractor shall provide 100 percent rescreening of all active components such as but not limited to IC's, Hybrids, Semiconductors, etc. Active component parts screening shall consist of a functional check of critical parameters at the minimum and maximum operating temperatures specified for the part. This requirement does not apply to those military equivalent unscreened parts or unscreened MIL temperature range parts that are proven to be acceptable by environmental stress testing requirements of 3.2.4.2. of the equipment specification. Rescreening of active components shall not be required for those part types for which the contractor can provide documented evidence that the incoming defect rate is no greater than 100 Parts Per Million (PPM). For active components vendor rescreening shall be allowed subject to acquisition activity approval of a source inspection plan submitted by the contractor.

Table I. Electronic parts derating.

Transistors

Type	Derating Factor*	Parameter
Signal	.30	Power
(<5 W Rated)	.50	Current
	.60	Voltage
	110°C Max.[1/]	Junction temp.
POWER	.30	Power
(>5 W Rated)	.50	Current
	.60	Voltage
	110°C Max.[1/]	Junction temp.

Diodes

Type	Derating factor*	Parameter
General purpose/switching	.30	Power
	.50	PIV
	.50	Surge current
	.50	Forward current
Rectifier/SCR	.30	Power
	.50	PIV
	.50	Surge current
	.50	Forward current
Varactor	.50	Power
	.75	Breakdown voltage
	.75	Forward current
Zener	.30	Power
	.50	Forward current
	(Note 3)	Zener current
Reference	.30	Power
	.50	Forward current
	(Note 3)	Ref. Current

1. Trade-off studies must be prepared for customer approval for all cases where the average junction temperature exceeds 110°C at 71°C ambient. In no case shall the average junction temperature exceed 125°C at 71°C ambient for signal devices or +150°C at +71°C ambient for power devices.

2. Junction temperature for all diodes shall not exceed 110°C. Trade-off studies must be submitted for customer acceptance for all cases where the average junction temperature exceeds 110°C at +71°C ambient. In no case shall the average junction temperature exceed 125°C at +71°C ambient for signal devices, or 150°C at +71°C ambient for power devices.

3. Zener/reference current should be limited to no more than $I_z = 0.5(I_{z\,MAX} + I_{z\,MIN})$.

* Derating factor = $\frac{\text{maximum allowable stress}}{\text{rated stress}}$

Table I. Electronic parts derating - Continued.

Resistors

Type	Derating factor*	Parameter
Composition (RCR)	.50	Power
Film insulated (RLR)	.50	Power
Film (RNC, RNN, RNR, RMO)	.50	Power
Accurate wirewound (RBR)	.40	Power
Power wirewound (RWR)	.50	Power
Chassis wirewound (RER)	.50	Power
Variable wirewound (RTR)	.70	Current[4/]
Variable non-wirewound (RJR)		.70Current[4/]
All types	.70	Voltage

Capacitors

Type	Derating factor*	Parameter
Ceramic	.50	Voltage
Glass	.40	Voltage
MICA	.50	Voltage
Plastic or paper plastic	.50	Voltage
Solid tantalum (CSR, CWR)	.70[5/]	Voltage (DC & Ripple)
Aluminum (CVR)	.70[5/]	Voltage

4. Rated current (I_a) = $\frac{P \text{ max}}{R \text{ max}}$

5. Trade-off studies must be prepared for customer approval for all applications where the DC working voltage is between 50 percent and 70 percent.

6. Trade-off studies must be preapred for customer approval for each application where an aluminum electrolytic capacitor is required.

* Derating factor = $\frac{\text{maximum allowable stress}}{\text{rated stress}}$

Table I. Electronic parts derating - Continued.

Relays and switches

	Derating factor*	Parameter
Contact load type:		
Capacitive	.75	Contact current
Resistive	.75	Contact current
Inductive	.40	Contact current
All types	.90	Voltage

Inductive devices

Type	Derating factor*	Parameter
Transformers & inductors	Rated less 30°C	Hot spot temperature
coil, solenoid	.70	Current
	.60	Rated voltage for steady state conditions
	.90	Rated voltage with transients

Microcircuits and hybrids

Type	Derating factor*	Parameter
Digital	.80	Fanout/output current
C MOS Gate arrays	.85	Supply voltage
All other device	.75	Supply voltage
	110°C MAX.1/	Junction temp.
Linear, hybrid	.80	Supply voltage
Voltage regulator	.75	Output current
	.75	Power
	110°C MAX.1/	Junction temp.

* Derating factor = $\frac{\text{maximum allowable stres}}{\text{rated stress}}$

3.2.4.2 Unscreened parts (RT-1556 and CD-17). Where practical, the Contractor may utilize military equivalent unscreened parts or unscreened MIL temperature range parts meeting environmental stress screening requirements stated herein in lieu of screened military components. Unscreened microelectronic and semiconductor devices proposed for use in the RT-1556 and CD-17 shall be hermetically sealed and rated from -55°C to +125°C, at a minimum. Additional environmental stress screening shall be employed at the board, SRA and WRA levels to ensure adequate part quality. The Contractor

shall collect part failure rate data and shall monitor the modes of failure to identify any need for changes in screening methodology or part selection criteria. The Contractor shall maintain a parts list which cross-references the military-to-military equivalent unscreened parts used in the equipment.

3.2.4.3 Semiconductor maximum junction temperature. All semiconductor device assemblies will be designed and operated such that the maximum junction temperature does not exceed 110°C at a 71°C ambient temperature. Trade-off studies shall be submitted to NAVAIRSYSCOM for approval for any exceptions to the 110°C derating requirement. With written approval of NAVAIRSYSCOM semiconductors may operate at worst-case average junction temperatures of up to 125°C for signal-level devices and up to 150°C for power-level devices at 71°C ambient (power-level devices are defined as semiconductors with power rating above 5 watts or a forward current rating above 1 ampere). The average junction temperature is defined as the average of the junction temperatures of a device over the frequency band and duty cycle of the equipment. The junction temperature of all semiconductors will be verified during the part level stress analysis.

3.2.5 Tempest. Compromising emanations related to classified data being processed within the equipment will not exceed the specification limits of NACSIM 5100A and NACSIM 5112. For this equipment, emanating emissions are defined as RF transmissions of classified data while filling key or RF transmissions of digital frequency updates prior to transmission on that frequency.

3.3 Design and construction. Unless otherwise specified herein,the equipment shall conform to all the applicable requirements of MIL-E-5400 for design, construction, and workmanship.

3.3.1 Total weight. The maximum weights of the individual equipments, excluding external connectors and cables, shall not exceed the limits specified in 3.5. Cold plates and heat spreaders shall be used to the maximum extent possible without exceeding the allowed weight limit.

3.3.2 Reliability. The contractor shall conduct a reliability program using MIL-STD-785. On a reorder from a supplier who has earlier produced the equipment, the program used previously may be continued unless otherwise indicated in the contract or order. This program shall include provisions for assuring the reliability of the equipment or any portion thereof when supplied for use as a spare or repair part. It shall also incorporate specific provisions to protect devices from electrostatic discharge during all phases of production and use.

3.3.2.1 Operational stability. The equipment shall operate with satisfactory performance, continuously or intermittently, for at least the specified mean (operating) time between failures (MTBF) without readjustment of any controls that are inaccessible to the operator during normal use.

3.3.2.2 Operating life. The equipment shall have a total operating life of 20,000 hours with reasonable servicing and replacement of parts.

3.3.2.3 Reliability in mean time between failures. The equipment, including any built-in test (BIT) provisions, shall have a lower test mean (operating) time between failures (MTBF, θ_1 as defined by MIL-STD-781) as listed in table II when tested and accepted as in 4.2.4, 4.3.6, and 4.5.3.

3.3.3 Cabling and connections.

3.3.3.1 Cables and connectors. The equipment shall provide for the use of cables and connectors in accordance with MIL-E-5400. The design of connectors shall be such that improper assembly, mating, or installation is impossible. RF connectors shall meet the requirements of MIL-C-39012. Non-RF connectors shall meet the requirements of MIL-C-38999. All external connectors shall (1) be scoop-proof, (2) have cadmium plating finish in accordance with QQ-P-416 (over a suitable underplating) to withstand a 500 hour salt spray test, and (3) provide 360 degree circumferential grounding techniques for grounding prior to contact engagement. Use of connectors not covered by MIL-C-38999 and the additional requirements above shall require the prior approval of NAVAIR.

3.3.3.2 Interconnection cabling. The equipment shall be capable of operation using external wiring in accordance with MIL-W-5088. The primary radio interface shall be a dedicated data bus and shall be consistent with electromagnetic pulse (EMP), tempest and ECCM requirements, and with table II when tested and accepted as specified in 4.2.4, 4.3.6, and 4.5.3. The external wiring shall be unshielded, except that a minimum number of wires shall be shielded when necessary to meet interference control requirements. External cables and that portion of the connectors attached to the cables shall not be supplied as part of the equipment.

TABLE II. Reliability Requirements.

ITEM	MTBF, θ_1
RT-1556/ARC	500 Hours
CD-17/ARC-210(V)	1,000 Hours
C-11896/ARC	3,750 Hours
C-11897/ARC	3,750 Hours
C-11898/ARC	3,750 Hours
ID-2428/ARC	5,000 Hours

3.3.4 Human engineering. Equipment design shall use MIL-H-46855 as a design guide, the detail requirements of MIL-STD-1472, and specific criteria established herein. The equipment design shall minimize the requirement for unique or extensive training.

3.3.4.1 Design of equipment in crew station. Equipment designed for installation in the crew station shall incorporate the principles and criteria of MIL-C-81774.

3.3.4.2 Visual displays. When visual displays of the remote control or indicator are needed to provide the required performance, the following requirements apply. The display data shall meet the requirements stated herein. The input signals to the indicators shall be consistent with this requirement. The information displayed to the operator shall be limited to that which is necessary to perform the specific action or make the decisions required. Information shall be displayed only to the degree of specificity and accuracy needed to meet performance requirements. The information shall be presented in a directly usable form. Requirements for decoding, transposing, computing, interpolating, etc., shall be minimized. The data displayed, and the necessary markings and scales, shall be of sufficient size and shall have sufficient brightness and contrast so that the operator can readily detect, read, and understand the displayed data under all day and night viewing conditions. Control/display ratios used shall be adequate to ensure operator recognition of control changes on the displays. Necessary controls and adjustments shall be arranged for operator convenience and ease of use. Readjustment of controls or displays shall not be required when switching between ranges or modes. Control/display integration design shall be in accordance with 5.1 and 5.2.6.8.5 of MIL-STD-1472.

3.3.4.3 Control panels. All rack or console mounted radio sets, indicators, and control panels shall conform to the applicable requirements of MIL-C-81774 and MIL-C-6781.

3.3.4.3.1 Console-mounted equipment function marking. The indicators and console-mounted control panels shall be permanently and clearly marked to indicate the function of the equipment with which they are associated. Console-mounted control panels and indicators shall be identified by the abbreviation V/UHF (very/ultra high frequency) located on the front panel. The liquid crystal display of the indicator shall be the front panel. Indicator markings shall be lit when power is applied to the unit.

3.3.4.3.2 Control knobs and functions. The number of controls required to operate the equipment shall be held to a minimum consistent with performing all the functions required by the specification. Closely associated controls, such as knobs on concentric shafts, shall be easily identified by contrasting colors of black and grey. All knobs and switches shall be completetly accessible to a user wearing flight gloves.

3.3.4.4 Equipment lighting. Lighting for all control panels, visual displays, indicators, and radio sets shall be developed in accordance with the requirements of 3.3.4.4.1. Additionally, for cockpit mounted equipment, a second version of the remote control having lighting compatible with night vision goggles shall be developed in accordance with 3.3.4.4.2. Controls on both versions shall be identical. The only difference shall be in the lighting technique.

3.3.4.4.1 Standard lighting requirements. Panel or instrument lighting shall be adequate for day and night use. Lighting shall comply with MIL-P-7788, Class 1-R, 1-W or 1-BW, type IV, V or VI with 5 volt AC or DC, 28 volt AC or DC and 115 volt AC lighting systems installed. Only one lighting voltage shall be utilized at a given time. Separate input power pins shall be provided for the three lighting systems. Color of panel lighting shall be in accordance with MIL-C-25050 or 3.3.4.4.2, as selected from the following options by nomenclature assignment or by description on purchase orders, with the exceptions noted:

Control Radio set	Indicator Radio set	Required Lighting
C-11897/ARC C-11896/ARC C-11898/ARC	ID-2428/ARC	Navy Red Navy White Night Vision

Class (Short Name)	MIL-P-7788 Color per MIL-C-25050	Class
Navy Red	Type 1(F), IPL Red, Para. 3.1.2; Y Shall not be greater than 0.3282. Z Shall not be greater than 0.0026.	1-R
Navy White	Type 1(G), IPL White, Para. 3.1.7; X Shall not be less than 0.465 nor greater than 0.555. $y-y_o$ shall not be numerically greater than 0.015.	1-W
USAF White	TYPE 1(H), Blue-Filtered White	1-BW
ANVIS Green A	ANVIS Green per MIL-L-85762	

3.3.4.4.2 Night vision imaging system (NVIS) compatibility requirements. Lighting shall comply with MIL-P-7788 and with MIL-L-85762. The lighting shall be compatible with both NVIS Type I, Class A and Type II, Class B. The chromaticity shall be specified in 3.10.8 and the NVIS radiance shall be specified in MIL-L-85762, 3.10.9.

3.3.4.5 Acoustic noise generation. All vehicle installed equipment shall not generate acoustic noise in excess of the requirements of MIL-A-8806.

3.3.4.6 Exterior (touch) temperature. The equipment exterior (touch) temperature requirements are as follows:

While the equipment is being operated with natural convection between sea level and 25,000 feet at an air temperature of 25°C nominal on the pilot's side of the panel/display, the maximum surface temperature shall not exceed:

(a) 63°C for displays, lighted push button switches, control panels, and insulated toggle switches.

(b) 57°C for insulated pull/toggle switches

(c) 52°C for control knobs, other hand activated control devices, and non-insulated toggle switches.

3.3.4.7 Rain protection of console-mounted equipments. The portions of the console-mounted radios sets, indicators, and controls that are normally exposed when the equipment is mounted in a console shall meet the rain requirements of MIL-STD-810, method 506.2, Procedure II.

3.3.5 Interchangeability. Physical and functional inter-changeability shall exist for all units and replaceable assemblies, subassemblies, and parts.

3.3.6 Electromagnetic interference (EMI). The receiver-transmitter shall comply with MIL-STD-461, part 2 for class A1 equipment, except as modified in table III and herein. These requirements shall be met under all combinations of operating modes and frequencies of the receiver-transmitter.

3.3.6.1 Design guidelines. MIL-STD-461, part 1, 4.3 is modified by the following additions and deletions:

Add: NAVAIR AD-1115
DARCOM-P-706-410
MIL-E-6051

Delete: AFSC DH 2-5
AFSC DH 2-7
AMC PAMPHLET 706, 235
NAVELEX 01001, 106

3.3.6.2 Conducted and radiated emissions limits. The conducted and radiated emissions of the receiver-transmitter shall comply with the limits of the following requirements of MIL-STD-461:

a. CE01	c. CE06	e. RE01
b. CE03	d. CE07	f. RE02

3.3.6.3 Conducted and radiated susceptibility limits. The receiver-transmitter shall comply with the conducted and radiated susceptibility limits of the following requirements of MIL-STD-461:

a. CS01	f. CS06
b. CS02	g. RS01
c. CS03 (Upper test frequency limit of 1.5 GHz)	h. RS02
d. CS04 (Upper test frequency limit of 4 GHz)	i. RS03
e. CS05	j. CS11

Table III. Exceptions to MIL-STD-461B.

RE01	Radiated emissions, 30 Hz to 50 kHz Emissions in the 17 kHz to 19 kHz band up to 10 dB above limit. Remote control electroluminescent power supply 420 Hz (± 10%) switching frequency and it's harmonics up to 10 dB above limit. Radio emission of 3.5 kHz ± 10% up to 5 dB above limit.
RE02	Radiated emissions, 14 kHz to 10 GHz Transmit: Transmit frequency up to 35 dB above limit. Harmonics of transmit frequency up to 15 dB above limit. In the 14-17 kHz, 21-23 MHz and 37-39 MHz bands, up to 5 dB above limit. Receive: No exceptions.
CE03	Conducted emissions, 15 kHz to 50 MHz RT-1556/CD-17 - Broadband emissions - in the 15 kHz to 100 kHz band up to 20 dB above limit, except up to 25 dB above limit from 35 to 60 kHz in HAVE QUICK mode only. Narrowband emissions - up to 10 dB between 1.5 MHz and 3 MHz. Up to 5 dB between 35 MHz to 45 MHz. C-11896/7/8 Remote controls 28V Power line - Narrow band and broadband - up to 20 dB above limit between 500 kHz and 3 MHz. Lamp line - narrowband - up to 5 dB above limit between 15 MHz to 20 MHz. ID-2428 28V Power line - broadband - up to 8 dB above limit between 15 kHz to 20 kHz and up to 4 dB above limit from 1.8 MHz to 2.4 MHz. Narrowband - up to 4 dB above limit between 1.8 MHz and 2.4 MHz. Lamp line - narrowband up to 10 dB above limit between 30-50 MHz.
CE06	Conducted emissions, antenna, 10 kHz to 12.4 GHz Broadband - broadband emission measurements from 1 MHz and above. Narrowband - up to 10 dB at first injection frequency
CS01	Conducted susceptibility, power leads, 30 Hz to 50 kHz Transmit - S + N/N shall be at least 35 dB for susceptibility frequencies between 300 Hz TO 7000 Hz. Receive - No exceptions. SINCGARS operation - BIT error rate shall not degrade for input susceptibility levels of up to 2.1 VRMS for susceptibility frequencies between 1000 Hz TO 1400 Hz.

Table III. Exceptions to MIL-STD-461B - Continued.

CS02 This requirement shall apply to all neutrals and grounds whether or not they are internally returned to chassis.

CS04 Conducted susceptibility, receiver spurious, 30 Hz to 4 GHz
Limits as shown on figure 2 except spurious rejection limits for the following subharmonics shall be:

Subharmonic	Max. Level
Fo/2	-60 dBc
Fo/3 *	-30 dBm
Fo/4 *	-20 dBm
≤ Fo/5 *	-10 dBm

* For Fo/3, Fo/4, and Fo/5 below 27 MHz

In addition there shall be no more than 3 in band spurious responses that are 70 dBc or greater, and no more than 2 other responses that are less than 50 dBc. There shall be no more than 3 out-of-band responses less than 80 dBc, and no more than 7 other responses less than -5 dBm.

RS02 Radiated susceptibility, magnetic induction field, 400 Hz and spike
Transmit - For 400 Hz current wrapped around cable bundle, S+N/N shall be at least 38 dB.

Receive - No exceptions.

RS03 Radiated susceptibility, electric fields, 14 kHz to 33.2 GHz

Low level (Table IV)

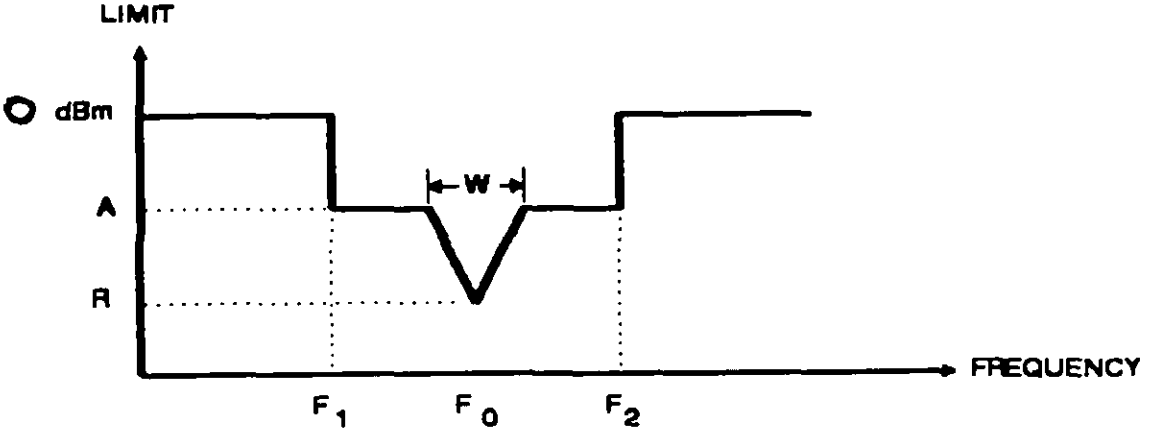
Receive - Susceptibility limit reduced to 2 V/M at first and second IF, and 50 V/M between 3.3 GHz to 3.5 GHz.

Transmit - No exceptions.

High level (Table V)

Transmit - S+N/N shall be at least 35 dB for frequencies from 219 MHz to 221 MHz.

Receive - No exceptions.



F_0 = RECEIVER TUNED FREQUENCY

F_1 = 27 MHZ: 10% BELOW LOWEST TUNABLE FREQUENCY OF RECEIVER BAND

F_2 = 440 MHZ: 10% ABOVE HIGHEST TUNABLE FREQUENCY OF RECEIVER BAND

W = BANDWIDTH BETWEEN THE 60 dB POINTS OF THE RECEIVER SELECTIVITY CURVE

LIMIT OF (A) IS 60 dB ABOVE THE INPUT LEVEL (R) REQUIRED TO PRODUCE THE STANDARD REFERENCE OUTPUT.

FIGURE 2. CS04 limits.

Table IV. Low Level RS03 Signals.

Frequency (MHz)[8/]	MODULATION				POWER DENSITY (MW/CM²) PEAK[5/]	AVE	FIELD INTENS (V/M) (REF)[6/]
0.0104-2	AM 90% 1 kHz SINE WAVE				-	-	10
2-30	AM 90% 1 kHz SINE WAVE				-	-	50
30-850	AM 90% 1 kHz SINE WAVE				-	-	10
215-225	PAM	20 µs	PW	200 PPS	.126	-	22
215-225	PAM	200 µs	PW	200 PPS	.126	-	22
400-450	PAM[1/]	4 µs [2/]	PW[3/]	300 PPS[4/]	.200	-	28
850-940	PAM	10 µs	PW	1000 PPS	0.316	-	35
850-940[7/]	PAM	125 µs	PW	300 PPS	0.316	-	35
940-1215	PAM	10 µs	PW	1000 PPS	0.106	-	20
1215-1365	PAM	10 µs	PW	3000 PPS	0.106	-	20
1365-2900	PAM	1 µs	PW	1000 PPS	0.160	-	25
2900-3100	PAM	3 µs	PW	1000 PPS	1.600	-	78
2900-3100[7/]	PAM	70 µs	PW	200 PPS	1.600	-	78
3100-3500	PAM	10 µs	PW	3000 PPS	3.180	-	110
3100-3500[7/]	PAM	50 µs	PW	3000 PPS	3.180	-	110
3500-9000	PAM	1 µs	PW	1000 PPS	0.636	-	50
9000-14000	PAM	0.2 µs	PW	1000 PPS	0.106	-	20
14000-18000	PAM	0.2 µs	PW	50000 PPS	0.106	-	20

NOTES:

1. Pulse amplitude modulation
2. Microseconds
3. Pulse width
4. Pulses per second
5. Peak power density for pam signals is defined as the power density measured by an average power measuring device if the generator is run CW; i.e., average power density within the pulse envelope.
6. Volts per meter equivalent shown for reference only.
7. Frequency ranges listed with more than one modulation shall be repeated as necessary to include all different modulations and/or field strength shown.
8. Operation not required for interference signals within ±10 percent or ±10 MHz, whichever is greater, of the tuned operating frequency.

Table V. High level RS03 signals.

Frequency (MHz)[7]	Modulation				Power Density (mw/CM²)[5]	Field Intens. (v/m) (Ref)[6]
2-30	AM 90% 1kHz SINE WAVE				0.66	50
220	PAM[1]	10 µs[2]	PW[3]	200pps[4]	10.6	200
220[8]	PAM	200 µs	PW	200pps	10.6	200
425	PAM	4 µs	PW	300pps	10.6	200
900	PAM	2 µs	PW	1000pps	10.6	200
900[8]	PAM	125 µs	PW	300pps	10.6	200
1250	PAM	10 µs	PW	3000pps	10.6	200
1350	PAM	5 µs	PW	3000pps	10.6	200
3000	PAM	3 µs	PW	1000pps	10.6	200
3000[8]	PAM	70 µs	PW	200pps	10.6	200
3300	PAM	10 µs	PW	3000pps	10.6	200
3300[8]	PAM	50 µs	PW	3000pps	10.6	200
3600	PAM	1 µs	PW	1000pps	10.6	200
5600	PAM	1 µs	PW	600pps	10.6	200
9100	PAM	0.5 µs	PW	1000pps	10.6	200
9375	PAM	0.2 µs	PW	1000pps	10.6	200
13900	PAM	0.2 µs	PW	50000pps	10.6	200
15500	PAM	0.2 µs	PW	50000pps	10.6	200
33200	PAM	250 µs	PW	2000pps	.013	7[9]

Notes:

1. Pulse amplitude modulation
2. Microseconds
3. Pulse width
4. Pulses per second
5. Peak power density for pam signals is defined as the power density as measured with an average power measuring device if the generator is run CW; i.e., Average power density within the pulse envelope.
6. Volts per meter equivalent shown only for reference.
7. The frequencies listed are approximate. System performance shall be demonstratable at any arbitrarily selected frequency within ±5 percent of the frequencies listed.
8. Frequency ranges listed with more than one modulation shall be repeated as necessary to include all different modulations shown.
9. Measured at a distance of 20 cm.

The receiver-transmitter shall exhibit no susceptibility as specified in 3.3.6.4.1a when subjected to an RS03 test to the limits of MIL-STD-461 and table IV. In addition, the receiver-transmitter shall exhibit no susceptibility in accordance with the criteria of 3.3.6.4.1b when subjected to signals at the levels of table V.

3.3.6.4 Susceptibility definition. The following criteria shall be applied to determine whether the radio is susceptible.

3.3.6.4.1 All modes. In addition, any degradation of performance as specified in 3.3.6.4.2 and 3.3.6.4.3 shall be considered an indication of susceptibility.

a. Any noncommanded change in the radio's control settings, panel indications, modes of operation, etc., shall be considered an indication of susceptibility. This requirement shall apply whether the change is transient (momentary) or nontransient (permanent) in nature. The inability to change radio frequency or modes of operation while exposed to the susceptibility signal shall be considered an indication of susceptibility.

b. Any degradation of ECCM performance shall be considered an indication of susceptibility. Degradation of ECCM performance is defined as abnormal breaks in communications between two systems in the same waveform.

3.3.6.4.2 AM and FM Receiver. Unless otherwise specified, the radio shall be considered susceptible if the radio's measured sensitivity is degraded by 6 dB or more during application of the susceptibility signal over the specified sensitivity.

3.3.6.4.3 AM and FM Transmit. Unless otherwise specified, the radio shall be considered susceptible if the modulated transmitter's output signal plus noise to noise ratio (S+N/N) degrades below that specified in 3.5.1.16.12 in the presence of the interfering signal. In addition, any change in transmitter output power greater than 1 dB shall be considered an indication of susceptibility.

3.3.6.5 Ground plane interference. All radio interface circuits shall be capable of specified performance while subjected to the following aircraft chassis noise between the interfacing weapons replaceable assemblies (WRA).

a. Three volts RMS from 320 Hz to 500 Hz. 1/

b. One volt RMS from 500 Hz to 20 MHz. 2/

c. +/- eight volt pulses, 70 µs wide at 100 PPS. 3/

1/ Not to exceed 150 mA RMS applied current.

2/ Not to exceed 150 mA RMS applied current for frequencies between 500 Hz and 50 kHz. Not to exceed 1 watt (CW) from a 50-ohm source for frequencies above 50 kHz.

3/ Not to exceed 15A peak current spikes, 10 µs rise time maximum and 1.0 s fall time maximum.

In addition to the susceptibility definitions of 3.3.6.4, 3.3.6.4.1, 3.3.6.4.2, and 3.3.6.4.3, the radio shall maintain intelligible communications during a "talk through" test with another radio set using a low-level signal (not to exceed 20 microvolts input to the receiver).

3.3.6.6 Grounding requirements. The grounding system between WRAs equipment shall be compatible and consistent with the following aircraft grounding scheme. All WRAs shall be grounded in such a manner as to prevent ground loops and common ground returns for signal and power circuits, provide effective shielding for signal circuits, minimize EMI, and protect personnel from electrical hazards.

3.3.6.6.1 Chassis grounds. A reference ground wire of minimum length connected internally to the WRA chassis shall be provided at a pin on each primary power connector. No circuit shall be allowed to utilize this wire as its primary return with the exception of the indicator which is to be pin for pin compatible with the ARC-182 indicator.

3.3.6.6.2 Shielding grounding. A separate connector pin shall be provided for each aircraft wire shield unless suitable grounding is provided in external cable backshells. The connector shield pins shall be grounded to the equipment chassis inside the WRA adjacent to the connector mounting and by the shortest means practical.

3.3.6.6.3 Component ground. All externally exposed metal parts, shield control shafts, switch handles, connectors, bushings, etc., shall be grounded to the chassis.

3.3.6.7 Bonding. A means of electrically bonding the equipment to the aircraft chassis shall be provided and shall comply with the requirements of MIL-B-5087. Bonding resistance between the bonding surface and all parts of the equipment case shall not exceed 2.5 milliohms.

3.3.6.8 Shielding gaskets. The use of materials resulting in severe dissimilar metal combinations with the interface shall be avoided for shielding gaskets and similar devices for RF application.

3.3.6.9 Emission control (EMCON). In all nontransmit modes of operation, the radio set shall not emit radiations exceeding -110 dBm/m^2 peak or average power density measured at one nautical mile. Said radiation shall include radiation from case or interconnecting cabling.

3.3.6.10 Frequency allocation data. Spectrum signature measurements in accordance with MIL-STD-449 shall be conducted to support frequency allocation.

3.3.7 Provisions for maintainability. The maintainability program, bit features, construction and packaging, provisions for test points, and other maintainability parameters shall be in accordance with MIL-STD-2084, as specified herein excluding tasks 102. The fault detection percentage requirement of MIL-STD-2084, requirement 104, shall be 95 percent minimum as specified herein. Radio and ECCM applique bit shall be mutually interactive and shall not require circuit familiarity to achieve fault isolation.

3.3.7.1 Compatibility with automatic test equipment (ATE). The equipment shall be compatible with the ATE for WRA testing and fault isolation to the faulty SRA in accordance with MIL-STD-2076. When required by the contract, ATE operational test program sets shall be furnished in accordance with MIL-STD-2077. If ATE operational test program sets exist for similar equipment and differences in equipment design affect the fault diagnosis procedure, then changes to the existing test program sets shall be prepared as part of the equipment changes in accordance with MIL-STD-2077.

3.3.7.2 Maintainability design requirements. MIL-STD-2084, requirement 103 applies as modified herein. All electrical and electronic circuits and parts shall be packaged on replaceable and repairable, plug-in modules. Circuit breakers, indicators, and other items that may logically be bolted, soldered, or otherwise more rigidly electrically and mechanically fastened to an equipment housing, shall not be considered modules. SRAs (shop replaceable assemblies), except the chassis assembly, shall be QRAs (quick replaceable assemblies) as defined in MIL-STD-2084. SRA arrangement shall be such that access to any SRA does not require the removal of adjacent SRAs or parts other than access panels, except for the modules comprising the synthesizer and main and guard receiver functions. These modules shall be removed from the chassis as a group and then further disassembled. RF connections between this group of modules shall be direct from module to module rather than through the chassis so as to not lessen reliability, operation, or performance. The use of a special tool for SRA removal is prohibited. All equipment that is not panel mounted shall have all connections made to the front of the unit. All panel mounted equipment connections shall be on the rear of the equipment.

3.3.7.2.1 Connector keying. Multipin WRA and SRA connectors shall be keyed to prevent the insertion of a connector or subassembly into an improper location within or on the equipment, and shall be legibly marked with reference designations.

3.3.7.2.2 Access panels. WRA access panels shall be retained by captive fasteners.

3.3.7.2.3 Service access. Devices requiring removal for inspection or servicing shall be retained by captive fasteners where feasible.

3.3.7.2.4 Adjustments. No adjustments or alignment shall be required at the organizational level, with the exception of display brightness adjustment for the remote control. No adjustments shall be required at the intermediate level as a result of removing or replacing modules. External adjustments of WRA functions are permitted at intermediate or depot level. Adjustment or alignment at any level of maintenance shall not require the removal of the part to be aligned or adjusted or removal of the hardware element to which it is attached.

3.3.7.2.5 Test point requirements. All test points shall be in accordance with MIL-STD-2084, requirement 105 and MIL-STD-415 to accommodate approved test equipment. Adequate test points shall be incorporated into the design to eliminate the need for extender devices, i.e., cards or cables. Their usage shall be physically safe and shall not distort the signal being

tested or otherwise affect equipment operation. They shall be capable of being shorted to ground without resulting in damage to the equipment, and shall be chosen to provide a straightforward, logical, step-by-step troubleshooting sequence. MIL-STD-2084 shall take precedence over MIL-STD-415 requirements. External test points and bit shall provide for SRA fault isolation. In cases of size or space limitations, access to external test points by the removal of a cover is permitted. The sub-SRA test points and related connector requirements of MIL-STD-2084 apply except where prohibited by space or performance considerations.

3.3.7.2.5.1 SRA test points. SRA test points shall be accessible while power remains applied to the SRAs. They shall become accessible with minimum removal of protective covers or enclosures. Each module supply voltage and supply common shall be made available at a test point. Internal test points not on test connectors for each SRA shall allow fault isolation to the sub-SRA level in accordance with MIL-STD-2084, requirement 105 (5.4 and table 105-II). For the synthesizer and receiver SRAs, test points shall be used to the maximum extent possible, consistent with available space and functional performance.

3.3.7.2.5.2 WRA test points. Test points shall be provided for verification for faulty equipments and isolation of faulty modules at the intermediate level and repair of equipments and modules at the depot level. Injection test points are not required in the built-in-test circuits.

3.3.7.2.5.3 Power supply test points. Accessible individual test points shall be provided on the equipment to measure the power supply voltages.

3.3.7.2.6 Fuses. The equipment may use replaceable fuses in lieu of circuit breakers. When fuses are used, a spare fuse shall be included. Access to the fuses shall be through removable cover plates or dust covers.

3.3.7.3 Operational readiness test (ORT). The equipment shall provide the operator or organizational maintenance technician, while airborne or on the ground, with performance/readiness test and fault (GO/NO-GO) indication. ORT shall be in accordance with MIL-STD-2084, requirement 104, (5.1 and table 104-1). Operation of ORT shall be both a manually energized and a continuous test mode of operation. Continuous monitoring shall detect gross failures including loss of synthesizer lock, power amplifier (PA) voltage reference (transmit mode), VSWR and PA temperature (transmit mode).

3.3.7.4 Built-In-Test (BIT) - BIT provisions shall be incorporated in the receiver-transmitter which provide fault detection and isolation of radio set failures. These provisions may be in conjunction with, but not necessarily a part of, the operational readiness test. Operation of BIT shall be a manually initiated test mode of operation. RF radiation is not permitted during BIT. Normal equipment performance may be interrupted during the manually initiated BIT sequence and, if necessary, switches may be used in series paths for purposes of introducing BIT stimuli or measuring equipment performance. Self-test of BIT is not required. The manually initiated BIT shall normally be an uninterrupted test with a resultant display of the

overall status. Initiated BIT shall include a single-step test mode whereby the results are displayed after each test. The operator shall be able to advance to the next step in the sequence when in the single-step mode. Fault detection, non-ambiguous WRA fault isolation and false alarm rates using manually initiated BIT shall be 95 percent minimum, 95 percent minimum, and 5 percent maximum, respectively. Failure of BIT circuitry shall not degrade normal performance. False BIT detection, during manually initiated BIT, shall not inhibit equipment operation.

The indicator BIT shall operate as follows during initiated BIT:

(a) Display the decimal point only when RT BIT is in progress.

(b) Display a reported WRA fault when BIT has been completed.

(c) Display all segments upon BIT completion if no WRA fault has been reported.

3.3.7.5 Organization level repair. The radio set shall have a mean time to repair (MTTR) of 15 minutes or less and a corrective maintenance time of not more than 25 minutes at the 95th percentile. An organizational-level corrective maintenance action includes the following:

(a) Verification of a fault in the radio set.

(b) Isolation of a fault to a WRA.

(c) Removal and replacement of a WRA (excluding aircraft access time).

(d) Verification of repair.

The equipment design shall be such that no ancillary test equipment is required to perform the organizational level corrective maintenance of (a) through (d) above within the specified MTTR.

3.3.7.6 Intermediate level repair.

3.3.7.6.1 Weapon replaceable assemblies(WRAs). WRAs shall have a MTTR of 20 minutes or less and a corrective maintenance time of not more than 40 minutes at the 95th percentile. Maintenance time consists of the time to accomplish the following:

(a) Verification of a fault in the WRA (excluding temperature stabilization time, if any).

(b) Isolation of the fault to the SRA (or small group of SRAs in accordance with MIL-STD-2084, table 105-I).

(c) Removal and replacement of the SRA.

(d) Verification of WRA repair.

3.3.8 Nomenclature and nameplates. Nomenclature assignments and nameplate approval for equipment and module identification shall be in accordance with MIL-N-18307. Nameplate location shall be as shown on figure 3.

3.3.8.1 Serial numbers. The acquisition activity will assign serial numbers for all the radios under contract or purchase order. The contractor shall sequentially serialize all radios which are delivered under contract.

3.3.9 Standard conditions. The following conditions shall be used to establish normal performance characteristics under standard conditions and for making laboratory bench tests; however, required field test shall be conducted under outside ambient conditions:

Temperature	Room ambient (25°C ± 10°C)
Altitude	Normal ground (-200 ft to +5000 FT with respect to mean sea level)
Vibration	None
Humidity	Room ambient up to 90 percent relative humidity (noncondensing)
Input power voltage	28 ± 0.5 Vdc

3.3.10 Service conditions. The equipment shall operate satisfactorily under any of the environmental service conditions or reasonable combination thereof as specified in MIL-E-5400 except as modified herein. The RT and applique shall be Class 2 equipment and the control and indicator shall be Class 1 equipment.

3.3.10.1 Sinusoidal vibration. Cockpit mounted equipment shall not require isolators or rear support and shall operate satisfactorily when subjected to vibration requirements of MIL-E-5400, curve IIIA. All other equipment shall operate satisfactorily when subjected to vibration requirements of MIL-E-5400, curve IVA, with isolators. Equipment designed for operation with isolators, but with them removed, shall operate satisfactorily when subjected to MIL-E-5400, curve IIIB vibration requirements.

3.3.10.2 Random vibration. The equipment shall operate satisfactorily when subjected to the random vibration test profile (see 4.3.5).

3.3.10.3 Rain. Console mounted equipment shall operate as specified when exposed to a dripping rain environment in accordance with MIL-STD-810, Method 506.2.

3.3.11 Warm-up-time. The time required for the equipment to warm up prior to operation shall be minimal and shall not exceed 10 seconds except that under cold conditions the remote control and indicator display shall be fully readable within 3 minutes of power on. Under service conditions, the transmit frequency accuracy shall be ±3 ppm within 10 seconds and shall meet the requirements of 3.5.1.11 within 5 minutes from power turn on.

3.3.12 Input electrical power.

3.3.12.1 Operating power. The equipment shall meet all applicable requirements of MIL-STD-704 and shall give specified performance when energized from the following power source having characteristics and limits as defined in MIL-STD-704. For equipments specified herein, the power required shall be 28 Vdc. Operating power requirements are given in table VI.

3.3.12.1.1 Applique power. The RT shall provide regulated power in accordance with table VI for use by the Applique.

TABLE VI. Operating power requirements.

Item	Equipment Designation	Power Source	Average Primary Power
Receiver-transmitter	RT-1556/ARC	28 Vdc	150 watts transmit[1/] 25 watts receive[1/]
Control, radio set	C-11896/ARC	28 Vdc	15 watts
	C-11897/ARC	28 Vdc	
	C-11898/ARC	28 Vdc	
Indicator, frequency/ channel	ID-2428/ARC	28 Vdc	10 watts
Applique	CD-17/ARC-210(V)	RT[2/], +5 Vdc	2.5 watts
		+12 Vdc	0.6 watts
		-12 Vdc	0.6 watts
		External Battery[3/] 12 - 15 Vdc	1.3 watts

Notes:
1. Receiver-Transmitter power does not include the applique.
2. The applique power is supplied by the RT.
3. Pin available at the RT interface connector, J5, to connect a battery to maintain applique clock for extended time periods when RT power is removed.

3.3.12.2 Lighting power. Input power for lighting for any lighted panel shall not require more than 5.0 watts.

3.3.12.3 Degraded performance. Degraded performance will be permitted for voltage transients with durations of 75 microseconds to 0.5 second during normal electric system operation. For voltage transients that cause an undervoltage condition per 3.3.12.5, the radio will be permitted to shut down for the transient period. Operation shall return to normal within 5 seconds with no resulting damage to the equipment. Loss of memory fill and/or time shall not occur.

3.3.12.4 Emergency voltage. During operation in the emergency steady state electric power condition as defined in MIL-STD-704, the system shall remain safe with performance characteristics as follows:

(a) RF power out: 2 watts minimum

(b) Receiver sensitivity: shall not degrade more than 6 dB below the sensitivity given in table VII.

(c) Audio output power: -6 dB from the standard setting.

(d) Frequency or net identification readouts and control functions shall be maintained.

(e) The RT shall be capable of supporting CD-17 ECCM Applique functions as specified in 3.5.6, and herein.

The emergency power source will impose an interval of zero voltage at the time of primary power loss for a period of not more than 30 seconds. The equipment is not required to perform during this period of power loss, but shall return to the performance specified above within two seconds after return to the emergency power conditions in accordance with MIL-STD-704. ECCM time shall be held for not less than seven seconds, without external battery, with sufficient accuracy such that normal ECCM functions resume when power is restored.

3.3.12.5 Undervoltage protection. The equipment shall not be damaged by voltages below the minimums specified in MIL-STD-704 and shall automatically resume normal operation in any mode within two seconds after the voltage returns within normal limits. If the undervoltage condition exceeds seven seconds, ECCM time may need to be refilled if external battery power in accordance with 3.3.12.7 is not being used.

3.3.12.6 Reverse polarity protection. The equipment shall be protected so that it will not be damaged by applications of reverse polarity voltages.

3.3.12.7 External battery power. The radio set shall be capable of accepting battery power to maintain the time reference within the Applique. The battery power shall be as specified in table VI.

3.3.13 Cooling.

3.3.13.1 Thermal conditions. The equipment shall operate satisfactorily under the thermal conditions described by MIL-E-5400, requirement 1, class II for the RT and class I for the control and indicator, without the requirement for auxiliary cooling.

3.3.13.2 Thermal paths. Every semiconductor device shall have an adequate conducted thermal path to the aircraft ambient environment if required to meet the junction temperature requirements of 3.2.4.

3.3.14 Safety. The safety design of all equipment shall be in accordance with MIL-E-5400.

3.3.15 Software. All computer programs (including firmware) within the equipment covered by this specification shall be developed in accordance with MIL-STD-1679.

3.3.16 Printed wiring boards. Printed wiring boards shall be in accordance with MIL-STD-275 and MIL-P-55110 with the following exceptions to MIL-STD-275 and MIL-P-55110 for one printed wiring board (PWB) located in the applique, CD-17, where functional requirements demand use of a material with low dielectric constant:

(a) Thermal stress requirements/testing shall be to a temperature of 475°F.

(b) Moisture and insulation resistance requirements/testing shall be limited to MIL-STD-275, quality conformance coupon segment "E" with a maximum resistance level of one megohm.

3.3.17 Manufacturing requirements. Unless otherwise specified herein, the equipment shall be manufactured in accordance with the manufacturing processes, workmanship, and quality assurance provisions of MIL-STD-454 (excluding Requirements 5 and 17 1a, b and c), MIL-STD-275, MIL-P-55110, MIL-STD-2000, and MIL-STD-1686.

3.4 Performance. Unless otherwise specified, values set forth to establish the requirements of satisfactory performance apply to performance under both standard and extreme service and input power conditions. When reduced performance under extreme conditions is acceptable, tolerances or values setting forth acceptable variations from the performance under standard conditions will be specified.

3.4.1 Operation. The equipment shall provide the functions and capabilities listed in 1.1 for operation in military fixed-wing aircraft and helicopters. Additionally, the equipment shall be compatible with the equipment listed in 6.7 and shall provide the operations specified in 3.5.

3.5 Detail requirements.

3.5.1 Radio Set AN/ARC-210(V). This section covers the basic detailed performance requirements of the AN/ARC-210(V) radio set.

3.5.1.1 Function. The radio set shall provide simplex two-way communication between tactical platforms in the frequency bands defined below. When fitted with ECCM applique CD-17/ARC-210(V), the radio set shall provide ECCM functions as specified below. Hereafter and for purposes of this specification, reference to HAVEQUICK is defined as HAVEQUICK and HAVEQUICK II. Half-duplex operation shall be possible when operating on the maritime channels or using specified preset channels.

(a) Low VHF (FM). 30.000 through 87.9875 MHz, FM, normal voice, secure voice, automatic direction finding (ADF) and 1020 Hz ±10 percent tone transmission (except in SINCGARS), squelch tone transmission, and SINCGARS as specified herein, and JTC3A specification 9001C including ICOM ERF reception and transmission (except 3.9.3.2 where it applies to base time).

(b) VHF (AM). 108.000 through 135.9975 MHz, AM, normal voice, secure voice, ADF, 1020 Hz ± 10 percent tone transmission. Transmit shall be inhibited from 108.000 through 117.9975 MHz.

(c) VHF (AM/FM). 136.000 through 155.9975 MHz, AM/FM, normal voice and secure voice. The FM mode shall be the standard mode. The operator may cause a change to the AM mode. Upon any change of the frequency controls when in the manual mode, the system shall revert to the FM mode. The system does not revert when in the preset mode. ADF and 1020 Hz ±10 percent tone transmission shall be provided.

(d) VHF (FM). 156.000 through 173.9875 MHz, FM, normal voice, secure voice.

(e) UHF (AM). 225.000 through 399.9875 MHz, AM, normal voice, secure voice, ADF, 1020 Hz ± 10 percent tone transmission, and HAVEQUICK ECCM as specified herein. The AM mode shall be the standard mode. The operator may cause a change to the FM mode. Upon any change of the frequency controls when in manual mode, the system shall revert to the AM mode. The system does not revert when in preset mode.

(f) UHF (FM). 225.000 through 399.9875 MHz, FM, normal voice, ADF, 1020 Hz ±10 percent tone transmission, secure voice, and HAVEQUICK ECCM as specified in 3.5.6. The FM mode shall be the non-standard mode of operation.

Additional capabilities of the radio set shall be as follows:

(g) Continuous monitoring of the guard frequency of 243.000 MHz (AM) in all bands except for the 108.000 through 155.9975 MHz band, where it shall be 121.500 MHz (AM), when in the main receiver-transmitter plus guard mode in accordance with 3.5.1.5.1,(c).

(h) The radio set shall interface and operate with the TSEC/KY-58 secure voice equipment with or without the ECCM applique. The applique shall provide for appropriate transmission security/communication security (TRANSEC/COMSEC) and privacy modes using internal and/or external devices defined by the national security agency (NSA), and identified herein. In the

HAVEQUICK mode of operation, the radio set shall key the KY-58 in manner that is compatible with all hop rates.

(i) Automatic relaying, whereby interconnection of two radio sets results in automatic transmission on one radio set of the signals being received by the other radio set (including HAVEQUICK and SINCGARS modes).

(j) Remote indicator shall display the radio set's operating frequency, preset channel number, net number, and the ECCM mode as defined below:

Mode	Frequency	Net Number	Channel	ECCM Mode
Preset/fixed frequency	X		X	
Preset/ECCM		X	X	X
Manual	X			
Maritime	X		X	

(k) Guard channel precedence operation, whereby an external control input automatically turns the radio on and tunes both the transmitter and main receiver to the 243.000 MHz (AM) guard frequency.

(l) Compatibility of the RT-1556/ARC receiver-transmitters with the time division multiplex (TDM) data bus in accordance with MIL-STD-1553B with minimum cycle time between RT messages of 50 milliseconds.

(m) Operation with AS-3191/A or AS-3238/A antennas, as well as with all other equipment listed in 6.7.

(n) An external take-control switch allows operation with one or more remote controls and/or the MIL-STD-1553B multiplex bus. The remote control shall have the capability to take control from the MIL-STD-1553B multiplex bus without the need for an external switch.

(o) Operation on adjacent 25 KHz channels using normal voice and baseband secure signals. 5 KHz tuning shall be provided over the range of 30.000 MHz to 399.985 MHz. 2.5 KHz tuning shall be provided over the range of 30.000 MHz to 399.9875 MHz when under MIL-STD-1553B control. This should not be construed to mean 2.5 KHz and 5 KHz channel bandwidths, but, rather, 2.5 KHz and 5 KHz tuning steps. In ECCM modes, provision for the use of 1.25 KHz tuning increments in all bands of operation shall be provided. This paragraph should not be construed to imply any increase in collocation capability as described elsewhere herein.

(p) Operation on a transmit channel offset from the receive frequency. Offset operation shall be possible for marine operation and on selected preset channels. Marine band offset channels in the 156.000 through 161.985 MHz range shall be able to be selected by a control pin on the J2 connector or by a switch on the control. In addition, at least five preset channels shall be capable of storing offset information or separate transmit and receive

frequencies anywhere within the limits of the radio set's frequency range. If offset information is not stored, radio operation shall be normal simplex.

(q) Pin selectable 7 dB minimum, 15 dB maximum, reduction in the sensitivity requirements specified in 3.5.1.15.1 in the 108-174 MHz range.

(r) Under no conditions shall the receiver-transmitter tune to frequencies which are below 30.000 MHz or above 400.000 MHz.

(s) CASS/DICASS, as specified herein.

(t) RF power turn-down when under control of the MIL-STD-1553B bus within the constraints of 3.5.1.16.1.3.

(u) SINCGARS cold start operation as described in JTC3A specification 9001C. When in SINCGARS cold start mode, the operator shall have the capability to electronically remote fill (ERF) ECCM parameters and to communicate via voice (not simultaneously). The cold start frequency shall be able to be set to any 25 kHz channel.

(v) The radio set shall be capable of sampling the SINCGARS preset cue frequency during synchronization search in the SINCGARS ECCM mode as specified in JTC3A specification 9001C. Both an audio and visual indication shall be given to the operator upon detection of energy on the cue channel. The cue channel shall be able to be set to any 25 kHz channel.

(w) Receiver scanning shall be able to be selected by either the remote control or MIL-STD-1553B bus. Four channels shall be scanned. The four scanned channels shall be channels 22 (command), 23, 24, and 25 of the non-AJ presets. The scanning sequence shall be the command, secondary 1, command, secondary 2, etc. Upon signal detection, the scanning sequence shall cease. Scanning shall resume approximately three seconds after channel activity ceases. If channel activity has been detected, any transmission shall be on that detected frequency. Once scanning has resumed, any transmission shall default to the command frequency.

3.5.1.2 Form factor. The form factors for individual items of equipment shall be as described in 3.5.2 through 3.5.5.

3.5.1.3 Weight. The weights of individual items of equipment shall be as specified in 3.5.2 through 3.5.6.

3.5.1.4 Contents. The radio set shall contain all solid state modular electronic circuits designed as required in 3.2.

3.5.1.5 Controls. The number of controls on the remote unit required to operate the radio set shall be held to a minimum consistent with performing all the functions defined in this specification. The frequency and channel selection information shall be in serial digital format such that the information transfer shall be accomplished by no more than two pairs of wires. Additional inputs shall be provided for ECCM control functions, as required.

3.5.1.5.1 Operational modes.

(a) Off. In this mode, input power shall be removed from the radio set. The switch shall control the input power, except for power control circuitry. The radio set shall contain a nonvolatile memory device that stores the manual frequency last tuned (if turned off in manual frequency selected mode), the preset channel number and frequency (if turned off in any preset frequency select mode), the guard frequency (if turned off in the guard frequency select mode) and the net number so that the radio will operate on the last selected frequency or channel when turned on again if no switch changes have been made. The system shall update to the last AJ mode within two seconds after the power is restored, if the power is removed for less than seven seconds. If power is removed for more than seven seconds and time is lost, the system shall indicate no fill. The system shall update to any new switch positions.

(b) Test. In this mode, a performance check shall be applied to the radio to verify the radio set's operation. The results of the BIT shall be indicated on the frequency/channel display. BIT results shall be reported on the MIL-STD-1553B data bus when requested by the bus. The radio shall interact with ECCM control equipments such that all mutual interfaces and functions are tested. BIT results shall not be corrupted by the presence of an on channel signal of -50 dBm or less. Radio and applique BIT shall be interactive and shall permit determination of system status. The applique shall be considered a module for fault isolation purposes.

While in the test mode, the radio set shall utilize a non-volatile memory device that stores the manual frequency last tuned, the preset channel number and frequency, the guard frequency, and the net number so that the system will return to operation as it was prior to the initialization of the test mode.

(c) Main receiver-transmitter plus guard (TR + G). In this mode, both the main receiver and the appropriate guard receiver shall be turned on and the operator shall be able to hear the audio output of both receivers simultaneously. The guard frequency selected shall be as specified in 3.5.1.1. The radio set shall have the same transmit-receive capabilities as defined in the main receiver-transmitter mode.

(d) Main receiver-transmitter (TR). In this mode, the main receiver shall be turned on and shall meet all the performance capabilities defined herein. The guard receivers shall be in the "off" condition. The transmitter shall be in the ready (key up) condition. The radio set shall be capable of transmitting and meeting all the performance capabilities defined in this specification when the external transmit switch is closed (key down).

(e) Automatic direction finding (ADF). In this mode, the main receiver-transmitter and the guard receiver shall operate as defined in 3.5.1.5.1(c). If the radio system is in the FM mode, except during SINCGARS operation, the main receiver AGC shall be enabled and the radio shall continue in the FM mode, but degraded operation may be allowed, upon activation of the ADF mode. The radio shall not go to the ADF mode if in a SINCGARS net. The

radio set shall be capable of operation with the associated ADF or equipment listed in 6.7. The main receiver shall be connected to the ADF, J3, port.

(f) Change preset (CHG PRST). In this mode, the preset channel number and preset channel frequency/ECCM net number to which the receiver-transmitter is tuned shall be displayed. The channel and frequency/net number shall be shown on the display specified in 3.5.1.8 chan freq/net/time display. It shall be possible to change and verify (but not load and operate) a new frequency/net number by use of the control specified in 3.5.1.5.7. Loading and operation on a new preset frequency/net number shall be accomplished by using the control specified in 3.5.1.5.8.

(g) Zeroize (ZRO). The RT shall provide a zeroize command to the applique for the purpose of clearing ECCM parameters.

(h) CASS/DICASS operation. With the function selector switch in the TR or TR+G position, the radio set shall operate in conjunction with the CASS/DICASS reference signal generator specified in MIL-G-81665 to transmit signals provided by the signal generator. The CASS/DICASS interface will provide the external transmit (key) switch operation at least 50 milliseconds prior to input of CASS/DICASS signals to the radio set.

(i) Preset and ECCM fill interface. The RT shall contain an interface which is compatible with the AN/CYZ-10 Data Transfer Device DS-101 interface. The RT interface shall be able to be paralleled with up to nine other ARC-210(V) RT's so that only one external loading point is required to provide fill data for each RT. The MIL-STD-1553B bus address strapping on the RT shall be used to designate specific RT's. The RT shall extract the fixed-frequency preset channel fill data from external loading device. The RT shall transfer HAVEQUICK and SINCGARS ECCM data to the CD-17 applique when the CD-17 is attached to the RT. The ECCM data may contain word(s)-of-the-day, hopset frequencies, TRANSEC variable(s), AJ preset net or identification numbers for up to 32 different RT's, and time.

(j) MIL-STD-1553B MUX preset fill. The RT shall accept single channel and AJ preset fill data via the MIL-STD-1553B control bus as specified in appendix C.

(k) RT control bus preset fill. The RT shall accept mode control and ECCM parameters via the C-11896/7/8 control bus as given in appendix A.

3.5.1.5.2 Frequency select modes. The remote control or MIL-STD-1553B bus shall initiate the functions described herein. The frequency select modes shall allow the operator to select emergency, guard, manual, or preset modes of frequency selection and ECCM mode. Provisions shall also be made so that operation in the 225.000 through 399.9875 MHz band is indicated by a ground on a pin on the J2 connector on the receiver-transmitter.

(a) UHF guard (emergency) (243). In this mode, the radio shall be turned on, the transmitter, and main and guard receivers shall be tuned to the 243.000 MHz (AM) guard channel. This mode shall have precedence over all other modes and, when in use, all other controls shall be inoperative.

(b) VHF guard (121). In this mode, the radio shall automatically tune the main and guard receivers and transmitter to the 121.500 MHz guard channel. When operating in this mode, the preset frequency selector control, as well as the manual frequency selector controls, shall be inoperative.

(c) Manual (MAN). This mode shall allow the operator to select rapidly and easily any one of the possible operating frequencies by use of the controls specified in 3.5.1.5.7. Any operating channel frequency selected shall be shown on the front panel using the display specified in 3.5.1.8. The transmitter, receivers, and receive audio shall be disabled (blanked) while changing frequencies.

(d) Preset (PRST). This mode shall allow the operator to select one of 25 simplex, one of 5 half-duplex, scan, cold-start, or one SINCGARS cue fixed frequency preset operating channels by use of the control specified in 3.5.1.5.7. The channel number (1 through 30) for the simplex or half-duplex channels and CU for the cue channel and the frequency of any operating channel selected shall be shown on the display specified in 3.5.1.8.1. For the half-duplex channels, the transmit frequency shall be displayed. The transmitter, receivers, and audio shall be disabled (squelched) while changing channels.

(e) Maritime Channels (MAR). This mode shall allow the operator to select one of 57 maritime operating channels (ship or shore station) by use of the control specified in 3.5.1.5.7. The channel number (1 through 28 and 60 through 88) of any operating channel selected shall be shown on the display specified in 3.5.1.8.1. The transmit frequency shall be displayed. The radio shall default to the ship station frequencies. The radio shall change between ship and shore operation when the load button is pressed. The channel assignments in the radio shall be:

Channel	Transmitting Frequency (MHZ) Ship Station	Shore Station	Channel	Transmitting Frequency (MHZ) Ship Station	Shore Station
1	156.050	160.650	60	156.025	160.625
2	156.100	160.700	61	156.075	160.675
3	156.150	160.750	62	156.125	160.725
4	156.200	160.800	63	156.175	160.775
5	156.250	160.850	64	156.225	160.825
6	156.300		65	156.275	160.875
7	156.350	160.950	66	156.325	160.925
8	156.400		67	156.375	156.375
9	156.450	156.450	68	156.425	156.425
10	156.500	156.500	69	156.475	156.475
11	156.550	156.550	70	156.525	156.525
12	156.600	156.600	71	156.575	156.575
13	156.650	156.650	72	156.625	
14	156.700	156.700	73	156.675	156.675
15	156.750	156.750	74	156.725	156.725
16	156.800	156.800	75	156.775	156.775
17	156.850	156.850	76	156.825	156.825
18	156.900	161.500	77	156.875	
19	156.950	161.550	78	156.925	161.525
20	157.000	161.600	79	156.975	161.575
21	157.050	161.650	80	157.025	161.625
22	157.100	161.700	81	157.075	161.675
23	157.150	161.750	82	157.125	161.725
24	157.200	161.800	83	157.175	161.775
25	157.250	161.850	84	157.225	161.825
26	157.300	161.900	85	157.275	161.875
27	157.350	161.950	86	157.325	161.925
28	157.400	162.000	87	157.375	161.975
			88	157.425	162.025

Channels 06, 08, 72, and 77 are not defined for shore stations. They are ship-to-ship or ship-to-air simplex channels.

In addition, the transmit/receive offset (if any) for each channel shall be selected as follows:

Transmit frequency (MHz)	Receive Offset (MHz)
156.000	0
156.025-156.275	+4.6
156.300	0
156.325-156.350	+4.6
156.375-156.875	0
156.900-157.425	+4.6
157.450-160.600	0
160.625-160.875	-4.6
160.900	0
160.925-160.950	-4.6
160.975-161.475	0
161.500-162.025	-4.6

The transmitter, receivers, and audio shall be disabled (blanked) while changing channels.

(f) Anti-jam (AJ). This mode shall allow the operator to select one of 25 preset ECCM channels, a SINCGARS cue channel, or a SINCGARS cold-start channel by use of the control specified in 3.5.1.5.7. The channel number (1 through 25) and the net number, the letters CU and the cue channel frequency, or the letters CS and the cold-start frequency of any operating ECCM channel selected shall be shown on the display specified in 3.5.1.8.1. The transmitter, receivers, and audio shall be disabled (blanked) while changing ECCM channels. ECCM modes shall be accomplished in accordance with 3.5.6 and JTC3A specification 9001C.

(g) Anti-jam/master (AJ/M). This mode shall allow the same capabilities as specified in 3.5.1.5.2(f) with the added function associated with a SINCGARS master net controller in accordance with 3.5.6 and JTC3A specification 9001C.

3.5.1.5.3 Ancillary modes. These modes shall be selectable with the cursor and pointer switches (specified in 3.5.1.5.9) when the proper frequency select mode is selected.

(a) Time. This mode shall be selectable in the SINCGARS ECCM mode to show the preset net time of month to the minute (DDHHMM) on the display specified in 3.5.1.8.1. It shall be possible to change and display (but not load and operate) a new net time by use of the control specified in 3.5.1.5.7. Loading and operation on a new net time shall be accomplished by using the control specified in 3.5.1.5.8. Loading a new net time shall zero the internal seconds and returns the condition that existed prior to entering the time mode.

(b) Global positioning satellite (GPS). This mode shall allow the receipt of time from a GPS receiver via the HAVEQUICK precise time and time interval (PTTI) interface as defined in ICD-GPS-060. When in ECCM, this mode may interrupt ECCM operation. If so, ECCM operation shall resume when commanded.

(c) Modulation (AM/FM). These modes shall be selectable in the PRST and MAN modes as specified in 3.5.1.1 when in the following bands:

VHF	136.000 - 155.9975 MHz	
UHF	225.000 - 399.9875 MHz	(HAVEQUICK and single channel modes)

Provisions shall be made so that an indication of AM or FM mode selection shall be available on J2 connector on the receiver-transmitter. AM operation shall be indicated by a ground capable of sinking 100 milliamperes and withstanding an open circuit voltage of 32 volts, and FM operation shall be indicated by an open circuit. All other frequency bands shall be automatically selected according to the following criteria and as specified in 3.5.6.

30.000 TO 87.9875 MHz.	FM
108.000 TO 135.9975 MHz	AM
156.000 TO 173.9875 MHz	FM

(d) Hopset (H) and lockout set (L). These modes shall be selectable in the SINCGARS ECCM mode to specify the type of information to be transferred during an ECCM remote fill (ERF).

(e) Send (SND) and receive (RCV). These modes shall be selectable to specify the direction of information transfer during an ERF or time-of-day operation. Selecting send and receive modes simultaneously shall initiate emergency time start operation. The SND and RCV modes are also used in presets 26 - 30 to indicate transmit or receive.

(f) Late net entry (LE). This mode shall be selectable in the SINCGARS ECCM mode to allow entry into an active net under time discrepancies as specified in JTC3A specification 9001C.

(g) Offset (OFST). This mode shall be selectable in the PRST and MAN modes to allow 5 kHz offsets from the 25 kHz base frequency. Offsets of 5 kHz, +10 kHz, -10 kHz, -5 kHz, and 0 kHz shall be selectable with successive operation of the control specified in 3.5.1.5.8. The offsets shall also have the capability to be stored in presets along with the base 25 kHz frequency.

3.5.1.5.4 AUDIO volume control (VOL). The audio volume control on the remote control shall allow the operator to adjust the audio power output level manually. With the unattenuated audio signal as specified in 3.5.1.15.4.5.5, this control shall provide either 250 milliwatts minimum across 600 ohms or 200 milliwatts minimum across 150 ohms (simultaneous outputs not required) under standard conditions in the full clockwise position. The attenuation shall increase at least 48 dB when rotating the control in the counter-clockwise position, but prior to reaching the full counter-clockwise position. In full counter-clockwise position, no audio shall be present. The attenuation change shall be perceived by the operator as uniform with the degree of rotation. The control shall adjust the audio output level of the main receiver, the guard receiver, the transmitter sidetone, and BIT tone.

3.5.1.5.5 Squelch off control (SQ OFF). The remote control shall allow the operator to disable the squelch circuit on the main receiver only. In the "off" condition, the squelch circuit shall be disabled to allow receiving of main receiver signals regardless of carrier to noise characteristics. The applique shall take precedence over all radio squelch functions when in an ECCM mode.

3.5.1.5.6 Display dimming. The illumination intensity of the displays on the remote control and indicator specified in 3.5.1.8.1 shall be controlled from a main console mounted dimming control. In addition, the remote control unit shall have provisions for individually controlling the illumination intensity of its displays when extended from its mounting holder.

3.5.1.5.7 Channel/frequency control (CHAN/FREQ). One selector control shall be provided on the radio set control for selecting and displaying any of the following:

(a) Available 25 kHz frequency channels.

(b) 25 fixed frequency simplex preset channels.

(c) 5 fixed frequency half-duplex preset channels.

(d) 25 ECCM mode presets.

(e) SINCGARS cold-start ECCM channel. The control shall indicate the letters "CS" in lieu of a channel number.

(f) SINCGARS cue ECCM channel. The control shall indicate the letters "CU" in lieu of a channel number.

(g) 57 Maritime VHF channels.

(h) Scan mode

This control shall be able to be used in conjunction with the manual/AJ mode control and the change preset mode control to enter or change any of the fixed frequency preset frequencies, the SINCGARS cue frequency, or the SINCGARS cold-start frequency. The control shall be able to enter a HAVEQUICK net

number in any undefined or previously defined ECCM channel. The CHAN/FREQ control shall be used to enter SINCGARS time, HAVEQUICK WOD, HAVEQUICK II MWODs and HAVEQUICK and II training net frequencies. The last entered WOD shall be stored in the radio set control. There is no requirement for the last entered WOD to be stored in non-volatile memory in the radio set control. In a WOD entry mode, the previously stored WOD will be displayed (unless there has been an interruption of power to the radio set control) one element at a time. The CHAN/FREQ shall be able to change any of the displayed WOD elements.

3.5.1.5.8 Load/offset (LOAD/OFST). The load/offset control shall be used to transfer changed or new preset data to the radio when in the change preset mode. This control shall be used to increment the manual frequency by ±5 kHz or ±10 kHz from the 25 kHz base frequency selected by the control specified in 3.5.1.5.7.

3.5.1.5.9 Cursor and pointer controls. These controls shall select the column and row of the functions shown on the ancillary mode display. The ancillary functions as specified in 3.5.1.5.3 shall be organized in columns on the radio set control display, the cursor control shall move a bar under the selected column. The pointer control will move the pointer to the items within the selected column on the display. Only those ancillary functions applicable to the selected operational and frequency modes shall be shown on the display.

3.5.1.5.10 Main and guard receiver squelch level controls. Screwdriver adjustable squelch level controls shall be accessible to maintenance personnel without opening the radio. The squelch shall not require readjustment due to variations in radio temperature, humidity, or altitude.

3.5.1.5.11 Take control function. The RT shall accept control data from 1 or 2 controls. The remote control shall be capable of interfacing with 1 or 2 RTs via the take control, SMC2, and SMC3 functions. A pin shall be provided on each control or control equipped radio that shall, when grounded, disable that control and allow another control to operate the radio unit. (See publication EI-764, drawings 16 and 18, note 6.) The transmitter and receivers shall be disabled while changing frequencies when this function is selected.

3.5.1.5.12 Relay switching unit. Provision shall be made to retain compatibility with the C-11628/ARC relay switching unit in accordance with MIL-C-85674, as well as with the relay switching unit SA-2498/ARC in accordance with MIL-S-85673.

3.5.1.6 Preset channel memory device. The memory device shall be a nonvolatile type so that power line interruptions or any combination of environmental conditions shall not cause a loss or change of preset channel or preset capability when power is off. EMP transients shall not alter or erase the memory device.

3.5.1.7 Frequency chart. When specified in the ordering data, a frequency chart shall be provided for maintenance personnel or the operator to

record the channel frequency for each and all of the preset channels. The chart is to show the preset channel numbers sequentially and to provide space to record the associated frequencies. The surface of the chart shall be durable so that pencil entries can be clearly recorded and erased a minimum of 1000 times. The chart shall be approximately 3 by 5 inches. A separate chart shall be packaged with each radio set and radio set control. This chart shall have an adhesive backing suitable for mounting elsewhere in the cockpit. Once affixed to a clean dry surface, the chart shall remain unaffected by sunlight, humidity, rain, heat, or cold, as appropriate to an aircraft installation. Chart adhesive shall be suitable to effect initial adhesion at temperatures down to at least 0°C and shall remain in adhesion over the entire environmental range of the equipment.

3.5.1.8 Visual and audio indication.

3.5.1.8.1 Channel frequency/net/time display. A six-place frequency display shall be provided on the radio set control or indicator to display the operating radio frequency and ECCM indication. This display shall be easily read in full (direct or indirect) sunlight. A decimal shall be used to identify the MHz position to three significant digits (e.g., 225.000). The SINCGARS net number shall be displayed using 4 digits in the form "FXXX". The HAVEQUICK net number shall be displayed using 6 digits in the form XXX.XXX. For preset channel number display, one or two digits shall be utilized. The display shall be arranged horizontally in a centrally located position on the control or indicator, as appropriate. When indicated by the applique, reception of a signal on the cue frequency shall be designated by the letter "C" on the display. In AJ mode, the following shall be displayed for invalid or missing fill parameters.

(a) If a channel is selected for which no waveform (SINCGARS or HAVEQUICK) has been defined, the following will occur:

1. The selected channel number will show in the two-digit channel designator.
2. Dashes will occur in the six display digits for frequency.
3. The rest of the display icons will be blanked.

(b) SINCGARS channel has been defined, but no time has been loaded:

1. Channel designator will indicate the selected channel.
2. The frequency display will show "NO FILL".
3. The "S" icon will be lit for SINCGARS.
4. The "TIME" icon will be lit.
5. The rest of the display will be blank.

(c) SINCGARS channel and time have been loaded, but TRANSEC variable is missing:

1. Channel designator will indicate the selected channel.
2. The word "NO SEC" will show in the frequency display.
3. The "S" icon will be lit for SINCGARS.
4. The rest of the display will be blank.

(d) SINCGARS channel, time, and TRANSEC variable have been loaded, but the remaining fill is invalid:

1. Channel designator will indicate the selected channel.
2. The frequency display will show "NO FILL".
3. The "S" icon will be lit for SINCGARS.
4. The "H" and "L" icons will be lit.
5. The rest of the display will be blank.

(e) A HAVEQUICK channel has been loaded, but time is missing:

1. Channel designator will indicate the selected channel.
2. The frequency display will show "NO FILL".
3. The "HQI" icon will be lit for HAVEQUICK or "HQII" icon for HAVEQUICK II.
4. The "TIME" icon will be lit.
5. The rest of the display will be blank.

(f) A HAVEQUICK channel with MWOD and time have been loaded, but the operational day has not been loaded (HQI or HQII):

1. Channel designator will indicate the selected channel.
2. The word "NO DAY" will show in the frequency display.
3. The "HQI" or "HQII" icon will be lit for HAVEQUICK.
4. The rest of the display will be blank.

(g) A HAVEQUICK channel, time, and operational day have been loaded, but any other required fill parameters are missing or invalid:

1. Channel designator will indicate the selected channel.
2. The word "NO FILL" will show in the frequency display.
3. The "HQI" icon will be lit for HAVEQUICK or "HQII" for HAVEQUICK II.
4. The rest of the display will be blank.

The displays shall be such that the digits can be easily read from a distance of 3.0 feet at any angle up to at least 30° from the display centerline perpendicular to the surface of the control or indicator panel. Additionally, the radio set shall provide serial data output to operate the display of the remote control unit as specified in 3.5.5 and/or remote indicators as specified in 3.5.3. In ECCM mode(s), the display shall indicate the ECCM preset in use. The radio set control display lighting shall not cause blooming of the amplifier image when turned down to the fully dimmed condition (see 3.3.4.4.2).

3.5.1.8.2 Audio indication. The RT shall provide an audio tone having a frequency of 1000 Hz ±25 percent and a duration of 0.3 ±0.2 seconds for the following conditions:

(a) Applique indicating receipt of the cue signal.

(b) A WOD element entered on the radio set control.

(c) Applique acknowledgement of a MWOD date verify.

(d) Applique acknowledgement of a successful load of a WOD (the RT shall provide two consecutive audio indications for a WOD load).

(e) Applique acknowledgement of a successful date load.

The initial source for items c through e shall be the radio set control or the MIL-STD-1553B bus. The RT shall accept commands from the MIL-STD-1553B bus to either enable or disable the audio indication function.

3.5.1.9 Duty cycle. The RT-1556/ARC shall have at least a seventeen percent transmit duty factor of up to one minute transmit at maximum 71°C ambient without forced air. The contractor shall specify cooling air and cold-plate characteristics required to provide a continuous transmit capability. For extended periods of transmit operation (in excess of seventeen percent duty cycle), a thermal sensing circuit(s) shall automatically limit the power dissipation of the transmitter to maintain safe operating temperatures and prevent damage to the unit. The receiver-transmitter shall contain a thermal circuit for protection against the overheating of the transmitter power amplifiers. If, the transmitter power amplifiers become overheated, the thermal protective circuit shall reduce the dissipated power of the power amplifiers so that no damage occurs to any component part and the radio set satisfactorily operates again when the temperature of the power amplifier is returned to normal. The available RF power output under extended time transmission shall be 2 watts minimum. Thermal and voltage standing wave ratio (VSWR) sensing shall turn down power in accordance with 3.5.1.16.1.1 and 3.5.1.16.1.2.

3.5.1.10 Electrical connections. Connections to the external circuits shall be provided as specified in 3.5.2 through 3.5.5. All circuits connected to pins for indication purposes shall be capable of sinking a 100 milliampere current and withstanding the 28V supply line in the open circuit case. If used, relays shall not be presumed to have internal diode transient clamps.

3.5.1.11 Transmit frequency accuracy. The transmitter frequency (relative to the selected operating frequency) shall not exceed the following frequency error tolerances in parts per million (PPM):

(a) Initial accuracy: $\pm$ 1.0 PPM

(b) Long-term stability: $\pm$ 1.0 PPM/Year

The frequency error shall be no greater than $\pm$ 1.0 PPM (initial delivery data) and $\pm$ 2.0 PPM (one year after the initial delivery date). An adjustment capability shall be retained for a period of eight years after the initial delivery date such that an adjustment resolution (relative to the selected operating frequency) of $\pm$ 1.0 part in 10^9 is provided. In FM, typical shift from tuned center frequency caused by the DC offset shall be $\pm$500 Hz or less and worst case shall be $\pm$1 kHz or less.

3.5.1.12 Channel changing time.

3.5.1.12.1 Transceiver frequency transition time - AJ mode. Provisions shall be made to allow the frequency data word to be loaded into the RT one hop transition period previous to the actual use of the frequency data. The transceiver frequency transition time is defined as the time from when the RT is directed by the applique to change frequency to when the synthesizer is within 1000 Hz of the new frequency. This time shall not exceed 85 microseconds. Transmit on/off keying and waveshaping shall be a function of the ECCM algorithm used and shall be determined by the applique and as specified in 3.5.1.16.6.

3.5.1.13 Spontaneous channel change. When operating, there shall be no spontaneous change of channel when the equipment is subject to any combination of environmental conditions or electrical inputs. Turning the radio off or disconnecting all power shall not cause a change in frequency or display when the radio is turned back on.

3.5.1.14 Antenna circuits. Three antenna ports shall be provided. The function of these ports shall be communication (J1), guard (J4), and ADF (J3). The main receiver shall normally be connected to the communication antenna port, J1. In the ADF mode, the main receiver shall be connected to the ADF antenna port, J3. There shall be a guard receiver antenna select control available at the receiver-transmitter interface connector, J5. When this control input is an open circuit, the guard receiver input shall be connected in parallel with, and shall follow, the main receiver input. When the guard receiver antenna select control is grounded, the guard receiver RF input shall, in all modes, be connected to the guard antenna port J4. The transmitter, in all cases shall be connected to the communication antenna port, J1. The receivers shall be isolated during transmission so that no damage or degradation in performance results from using a common antenna. No damage shall occur to any part of the receiver-transmitter when the transmitter is operated with the RF output short-circuited, open-circuited, or terminated in any complex impedance.

3.5.1.14.1 External antenna switch. The radio set shall provide control of an external antenna switch SA-521/A (MIL-S-25879) or an appropriate equivalent to switch between the appropriate antennas. A ground shall be provided on this pin only when in the ADF mode. This pin shall be open circuited in all other conditions.

3.5.1.15 Receiver characteristics. Unless otherwise specified, the following receiver characteristics shall apply to both the main and the guard receiver. All signal levels (dBm) assume a nominal receiver input impedance of 50 ohms.

In an EMC system installation, the main receiver shall, in all cases, be connected to the communication antenna port regardless of mode.

3.5.1.15.1 Sensitivity. The receivers shall produce a SINAD of not less than 10 dB at the normal voice output of the receiver when demodulating the signals defined in table VII, for ambient temperatures to +71°C. For

ambient temperatures from +71°C, to +85°C, the sensitivity may be reduced by no more than 1 dB from the RF input levels defined in table VII. For ambient temperatures from +85°C to +95°C, the sensitivity may be reduced by no more than 3 dB from the RF input levels defined in table VII.

TABLE VII. Sensitivity.

Frequency	Signal level	Mode	Modulation
30.000 - 87.9875 MHz	-108 dBm	FM	1 kHz at ± 2.4 kHz deviation
108.000 - 155.9975 MHz	-103 dBm	AM	1 kHz at 30 percent modulation
136.000 - 173.9875 MHz	-108 dBm	FM	1 kHz at ± 2.4 kHz deviation
225.000 - 399.9875 MHz	-103 dBm	AM	1 kHz at 30 percent modulation
225.000 - 399.9875 MHz	-108 dBm	FM	1 kHz at ± 2.4 kHz deviation

(a) 30.000-87.9875 MHz FM band: a signal level of -108 dBm, frequency modulated by 1 kHz and with ± 2.4 kHz deviation, shall produce a SINAD, (S+N+D)/(N+D) value of not less than 10 dB measured at the output of the receiver while maintaining the level within the requirements of the audio gain control level of 3.5.1.15.4.2.

(b) 108.000-155.9975 MHz AM band: a signal level of -103 dBm amplitude modulated 30 percent at 1 kHz shall produce a SINAD value of not less than 10 dB while maintaining the level within the requirements of the audio gain control level of 3.5.1.15.4.2 at the output of the receiver. The exception to the above is that when the main receiver is tuned to within ±5.0 percent of the guard frequency (121.500 MHz), the sensitivity of the main receiver and guard receiver shall be at least -97 dBm to produce a SINAD value of not less than 10 dB at the receiver output while maintaining the level within the requirements of the audio gain control level of 3.5.1.15.4.2.

(c) 136.000-173.9875 MHz FM band: a signal level of -108 dBm frequency modulated by 1 kHz and with ± 2.4 kHz deviation shall produce a SINAD value of not less than 10 dB at the output of the receiver while maintaining the level within the requirements of the audio gain control level of 3.5.1.15.4.2.

(d) 225.000-399.9875 MHz band: in the AM mode, a -103 dBm signal modulated 30 percent at 1 kHz shall produce a SINAD value of not less than 10 dB while maintaining the level within the requirements of the audio gain

control level of 3.5.1.15.4.2 at the output of the receiver. In the FM mode, a -108 dBm signal deviated ±2.4 kHz by a 1 kHz sine wave shall produce a SINAD value of not less than 10 dB. When the main receiver is tuned to within 235 to 251 MHz, the sensitivity of the main receiver and guard receiver shall be at least -97 dBm in the AM mode or -102 dBm in the FM mode to produce a SINAD value of not less than 10 dB at the output of the receiver while maintaining the level within the requirements of the audio gain control level of 3.5.1.15.4.2.

3.5.1.15.2 Selectivity. The main receiver shall incorporate filters so that the receiver, in narrow band voice operation, shall obtain a minimum 10 dB SINAD when changing the input RF frequency ± 10 kHz from the tuned frequency with an RF input as specified in table VII. The guard receiver shall obtain a minimum 6 dB SINAD. The design and location of the filters shall be such that they can be replaced at the intermediate maintenance level with filters having different bandwidth characteristics. Standard bandwidths are as follows:

(a) Main receiver narrowband for normal voice and baseband secure:

Bandwidth: ± 17.5 kHz min. At 6 dB points referenced to tuned frequency

± 38 kHz max. At 52 dB points referenced to tuned frequency.

(b) Main receiver wideband for ECCM and diphase secure:

Bandwidth: ± 34 kHz min. At 6 dB points referenced to tuned frequency

± 85 kHz max. At 52 dB points referenced to tuned frequency.

(c) Guard receiver:

Bandwidth: ± 14.0 kHz min. At 6 dB points referenced to tuned frequency

± 40.0 kHz max. At 60 dB points referenced to tuned frequency

Note: For both the main and guard receivers, the passband ripple shall not exceed 3 dB.

3.5.1.15.2.1 Adjacent channel reception. The main receiver shall be capable of rejecting normal and FM secure voice signals from another AN/ARC-210(V) or AN/ARC-182(V) radio set with a center frequency separation of 50 kHz in the narrowband mode. The second ARC-210(V) or ARC-182(V) shall be attenuated such that its input level to the unit under test is -67 dBm.

3.5.1.15.3 Squelch. The main and guard receivers shall have squelch circuits that operate in the normal voice mode for both AM and FM (guard receiver is AM only). The squelch circuits shall be capable of being disabled by the ECCM applique. Receiver output shall be enabled only when the received signal is capable of producing a SINAD greater than 5 dB. An adjustment shall be provided to set the squelch operating point in the range of 5 to 15 dB. The squelch circuits shall prohiBIT receiver output when the SINAD falls below 3 dB. Squelch circuitry shall be compatible with the climax offset carrier system as described in ARINC 716. The guard receiver squelch shall be compatible with the swept and pulsed tone modulation of the AN/PRC-90 as defined in MIL-R-81493 as well as SARBE 5. The squelch shall be insensitive to a pulse having a width of 18 microseconds and repetition rate of 300 PPS up to an interfering level of -65 dBm. A method of disabling squelch shall be provided for the main receiver to permit receiver output regardless of SINAD. AN/ARC-210(V) squelch circuitry shall not be locked up by the swept modulation waveform of the AN/PRC-90.

3.5.1.15.3.1 Squelch attack/release times. Squelch attack time shall not exceed 30 milliseconds for the main receiver and 40 milliseconds for the guard receiver. Squelch release time shall not be less than 100 milliseconds nor greater than 175 milliseconds. Both attack and release times are to be measured at an input signal level of -90 dBm.

3.5.1.15.3.2 Squelch hysteresis. Squelch hysteresis is the difference between the squelch opening and closing points defined in terms of normal audio output SINAD. This difference shall be greater than or equal to 2 dB and less than or equal to 6 dB. Temperature and humidity variations shall not cause the radio to unsquelch, but may alter the hysteresis within the prescribed limites.

3.5.1.15.4 Main and guard receiver audio outputs. The audio output requirements described below shall be met with maximum audio output (250 milliwatts minimum across 600 ohms) unless otherwise required.

3.5.1.15.4.1 Normal audio output. The main and guard receivers shall have a common audio output. The audio output of the guard receiver shall be in phase with the audio output of the main receiver in accordance with 3.5.1.15.4.5.3. This common output shall be the narrowband output of the main receiver and shall be available on two output pins. One output pin shall provide a level of 250 milliwatts across 600 ohms with an RF input of -53 dBm modulated 30 percent AM or $\pm$ 2400 Hz FM. The other output pin shall provide a level of 200 milliwatts across 150 ohms with an RF input of -53 dBm modulated 30 percent AM or $\pm$ 2400 Hz FM. Only one of these output pins may be used at a given time.

3.5.1.15.4.2 Audio gain/level control. The AGC or automatic level control (ALC) shall maintain the main and guard receiver audio output level to within $\pm$ 3 dB over the following RF input ranges when referenced from -53 dBm:

(a) AM: -103 to +7 dBm

(b) FM: -108 to +7 dBm

In addition, for a constant -53 dBm RF input, the audio level change shall not exceed 2 dB when changing from band to band or between main and guard receivers.

3.5.1.15.4.3 AGC/ALC performance. The receiver AGC/ALC circuitry shall have time constant(s) that are consistent with the modes and waveforms specified herein in addition to waveforms specified for the ECCM applique. Sequential independent AGC/ALC circuits shall not be employed due to potential adverse interactions in the flight environment from rapidly varying signals. Nothing herein shall be construed to preclude sharing AGC/ALC circuits between transmit and receive. Nothing herein shall be construed to preclude variable rate AGC/ALC and/or a digitally based AGC/ALC system.

3.5.1.15.4.4 Audio output protection. The receivers shall operate as specified after the audio outputs have been subjected to both open circuit, short circuit, or any intermediate return loss and phase angle between those values.

3.5.1.15.4.5 Normal audio output detail requirements.

3.5.1.15.4.5.1 Bandwidth. The normal audio output frequency response shall be within +1, -3 dB relative to a 1000 Hz reference for frequencies from 300 to 3000 Hz. Frequencies of 150 Hz (or below) shall be attenuated at least 37 dB relative to the 1000 Hz reference. Frequencies of 8000 Hz (or above) shall be attenuated at least 25 dB relative to the 1000 Hz reference.

3.5.1.15.4.5.2 Normal audio output impedances. The normal audio output impedance shall be suitable for operation into 150 and 600 ohm loads. These outputs shall be floating with respect to chassis ground. External grounding of one of the output leads shall have no adverse effects on receiver performance. Two output lines shall be available at pins on the external connector for the 150 or 600 ohm loads, but only one of these output pins may be used at any given time.

3.5.1.15.4.5.3 Normal audio output phase. The phase relationships of the audio outputs of the guard receiver and the main receiver at the radio output terminals shall be maintained so as to limit the total variation of the combined audio output to $\pm$ 3 dB when the input signals to the main and guard receivers are modulated 30 percent or more in AM (main and guard) or $\pm$ 2.4 kHz deviation or more (main) in FM and when using the narrowband receiver filter.

3.5.1.15.4.5.4 Normal audio output distortion. Total harmonic distortion at the normal audio output when terminated by either 150 or 600 ohms shall not exceed 5 percent with 30 percent modulation or $\pm$ 2.4 kHz deviation and 8 percent with 90 percent modulation or $\pm$ 7.2 kHz deviation over the RF input range when the audio level is adjusted to the maximum levels required, with the exception that for RF input ranges from 0 dBm to + 7 dBm, distortion shall not exceed 10 percent with 30 percent modulation or 20 percent with 90 percent modulation.

3.5.1.15.4.5.5 Unattenuated audio output. In addition to the normal audio output loaded into 150 or 600 ohms, an unattenuated normal audio output shall be provided on a separate pin on the external connector. With the 150 or 600 ohms output properly terminated, the unattenuated output level shall be 6.5 ±1.0 volts RMS when loaded with 1000 ohms ± 10 percent for an RF input of -53 dBm modulated 30 percent AM or deviated ± 2.4 kHz FM at 1.0 kHz. The frequency response shall be as specified in 3.5.1.15.4.5.1. Total harmonic distortion shall not exceed 5 percent with 30 percent modulation or ±2.4 kHz deviation and 8 percent with 90 percent modulation or ±7.2 kHz deviation over the RF input range when the audio level is adjusted to the maximum levels required, with the exception that for RF input ranges from 0 dBm to +7 dBm, distortion shall not exceed 10 percent with 30 percent modulation or 20 percent with 90 percent modulation. The unattenuated audio output shall be able to drive an adjustable 150 ohm or 600 ohm output circuit in the remote control. Only one audio output circuit will be loaded at one time, either the normal audio output in the receiver-transmitter or the unattenuated audio output in the remote control.

3.5.1.15.4.5.6 Retransmit audio output. In addition to the normal audio output loaded into 150 or 600 ohms and an unattenuated normal audio output, a retransmit audio output shall be provided on a separate pin on the external connector. With the 150 or 600 ohms output properly terminated, the retransmit output level shall be 6.5 ±1.0 volts RMS when loaded with 1000 ohms ± 10 percent for an RF input of -53 dBm modulated 30 percent AM or deviated ± 2.4 kHz FM at 1.0 kHz. The frequency response shall be as specified in 3.5.1.15.4.5.1. Total harmonic distortion shall not exceed 5 percent with 30 percent modulation or ±2.4 kHz deviation and 8 percent with 90 percent modulation or ±7.2 kHz deviation over the RF input range when the audio level is adjusted to the maximum levels required, with the exception that for RF input ranges from 0 dBm to +7 dBm, distortion shall not exceed 10 percent with 30 percent modulation or 20 percent with 90 percent modulation. With only one audio output circuit loaded, either the normal audio output in the receiver-transmitter or the unattenuated audio output in the remote control, the retransmit output shall be provided.

3.5.1.15.4.5.7 ECCM audio output. Audio output in the HAVEQUICK mode shall conform to the requirements of 3.5.1.15.4. In other ECCM digital modes such as SINCGARS, the radio set's output audio level shall be within ±2 dB of the radio set's audio output in the non-ECCM mode at the same radio set audio level control setting when audio level is within the compressor range as specified in 3.5.1.15.4.5.7.

3.5.1.15.4.5.8 Audio compressor. A compressor shall be incorporated to prevent clipping of the output audio at high modulation indices. The compressor shall begin to take effect between 25 to 35 percent AM or ±2000 to ±2800 Hz FM deviation.

3.5.1.15.5 AM internal noise level. The (S+N)/N (modulated to unmodulated) ratio of the main and guard receivers shall not be less than 30 dB when a -53 dBm signal modulated 80 percent at 1.0 kHz is applied, and when the audio output is adjusted to 250 milliwatts across 600 ohms or 200 milliwatts across 150 ohms without external blanking.

3.5.1.15.6 FM noise quieting. An RF signal of -70 dBm, deviated ±2.4 kHz by 1.0 kHz, shall produce an (S+N)/N ratio of not less than 33 dB for the main receiver without external blanking.

3.5.1.15.7 Receiver blanking. The receiver shall be blanked to minimize the effects of externally generated pulse noise and internally generated noise due to the ECCM function. Operation of the blanking circuits shall not require application of operator intervention or action. Blanking shall occur upon the application of the ECCM applique generated pulse or the external pulse as specified in 3.5.1.15.7.1. The receiver blanking function shall be implemented using pulse shaping (e.g., rise and fall time control) designed to minimize the noise generated by the blanking function. Blanking action shall not degrade the squelch performance specified in 3.5.1.15.3.1. The receiver audio shall incorporate a sample and hold circuit or such circuits as necessary to improve audio signal-to-noise ratio.

3.5.1.15.7.1 External blanking. The receiver shall be capable of being blanked with the application of an external EIA RS-423 blanking signal having a maximum width of 20 microseconds and a maximum duty cycle of 0.6 percent. The receiver shall be blanked so that a SINAD ratio of not less than 20 dB is obtained under the following conditions:

(a) Normal signal of -53 dBm modulated 80 percent in the AM mode or ±6400 Hz deviation in the FM mode at 1000 Hz is applied to the receiver input.

(b) Interfering on-channel signal, having a pulse width of 10 s and a repetition rate of 200 PPS at +7 dBm (pulse starts 5 microseconds following application of blanking pulse).

3.5.1.15.8 Cross modulation. A SINAD of at least 6 dB shall be attained with an on-channel signal of -103 dBm modulated 30 percent and a 30 percent modulated off-channel signal (delta F>1 MHz) at -33 dBm for the guard receiver and -28 dBm for the main receiver.

3.5.1.15.9 Channel interference. With a -43 dBm unmodulated carrier signal on any channel and no signal on any other channel, the quieting measured on any other channel greater than 300 kHz away shall not exceed that produced on the channel for a signal of -110 dBm (squelch disabled) for the main receiver in the AM or FM mode and the guard receiver in the AM mode. For frequencies 100 to 300 kHz away, a -63 dBm unmodulated signal shall not produce quieting greater than that provided by an on-channel signal of -110 dBm.

3.5.1.15.10 RF intermodulation. In narrowband or wideband mode, at any tuned channel, with a RF input set to give 10 dB SINAD with a 1 kHz modulation at 30 percent AM or ± 2.4 kHz FM deviation, a second unmodulated RF signal 500 kHz from the tuned channel and a third RF signal, modulated 400 Hz 30 percent AM or ± 2.4 kHz FM deviation 1 MHz from the tuned channel, the SINAD shall not be reduced to less than 6 dB with the second and third RF signals 60 dB above the first, on-channel signal. When the on-channel RF signal is increased by 26 dB, the SINAD shall not be reduced to less than 6 dB with the second and third RF signals set 43 dB above the first, on-channel signal. When the

on-channel RF signal is increased to 46 dB above the original level, the SINAD shall not be less than 6 dB with the second and third RF signals set 30 dB above the on-channel RF signal.

3.5.1.15.11 Intermediate frequency rejection. The IF rejection of the main and guard receivers shall be as specified in tables VIII and IX.

TABLE VIII. Main receiver IF rejection.

Minimum rejection (dB)			
1st IF (Note)	2nd IF (110.56 MHz)	3rd IF (20.14 MHz)	4th IF (420 kHz)
80	80 *	90	90

Note: First IF frequency may vary over the approximate range of 1272.3-1273.6 MHz.

* Within ±15 MHz from 110.56 MHz, the requirement shall be 65 dB.

TABLE IX. Guard receiver IF rejection.

Frequency (MHz)	1st IF Rejection, Min (22.415 MHz)	2nd IF Rejection, Min (500 kHz)
121.5 MHz	80 dB	80 dB
243.0 MHz	80 dB	80 dB

3.5.1.15.12 Image and spurious rejection. The requirements of 3.3.6.3, 3.3.6.4, and table III shall apply. Image rejection limits for the main receiver shall be 80 dB for the first, second, and third IF images, and 70 dB for the fourth IF image. At 121.500 MHz and 243.000 MHz, the guard receiver shall have at least 60 dB image rejection relative to the response to the desired signal.

3.5.1.15.12.1 Internal spurious. Degradation, as specified in 3.3.6.4.2 and 3.3.6.4.3, of the sensitivity of the main or guard receivers and/or squelch breaks (with squelch adjusted to open at 8 dB SINAD) due to internal spurious shall be limited to no more than 50 channels out of the 11,960 channels available. The complete list of degraded channels shall be reported to the procuring activity and the frequencies and sensitivity levels of these channels shall be listed in handBooks and support documentation.

3.5.1.15.13 AGC recovery and blocking. It shall be possible to obtain 10 dB SINAD with the minimum input specified in table VII not later than 0.25 second after a +13 dBm on channel signal has been removed from both the main and guard receivers. Blocking shall not occur for on channel signals up to +7 dBm. Blocking is defined as a 3 dB or greater reduction of the 250 milliwatts audio output level across 600 ohms or 200 milliwatts across 150 ohms.

3.5.1.15.14 Input signal protection. The main and guard receivers shall not be damaged by inputs (on or off channel) with the average RF powers defined below and/or the peak RF powers defined below having a maximum pulse width of 50 µs and duty cycle not to exceed one percent.

RF Frequency	Average RF Power	Peak RF Power
Less than 225 MHz	+27 dBm	+47 dBm
225-400 MHz	+30 dBm	+50 dBm
Greater than 400 MHz	+37 dBm	+57 dBm

3.5.1.15.15 Regeneration. The interstage parasitic coupling and overall sideband gain of the main and guard receivers shall be controlled so that no evidence of instability shall occur at any level of gain. Coupling of spurious signal products between the main and guard receivers shall be minimized.

3.5.1.15.16 Receiver audio amplitude variation (FM). The main receiver shall be limited so that the audio output shall not vary more than 3 dB when the RF input signal, with ±2.4 kHz FM deviation at 1.0 kHz, is varied from the sensitivity level (see 3.5.1.15.1) up to +7 dBm.

3.5.1.15.17 Main receiver characteristics. The main receiver shall meet all the requirements of 3.5.1.15 through 3.5.1.15.16 plus the following, when the receiver-transmitter is in the transmit/receive, transmit/receive plus guard, or ADF mode.

3.5.1.15.17.1 Wideband audio outputs. The main receiver shall have two wideband audio outputs in addition to the normal audio output: one shall be used with TSEC/KY-58 secure voice and/or ECCM systems, and the other shall be used with ADF systems. Signals for these outputs shall not pass through the radio's internal squelch circuits and shall be operative at all times when in the receive mode.

3.5.1.15.17.2 Wideband audio output impedances. The radio output impedance for the TSEC/KY-58 shall be 20K ohms maximum unbalanced and shall provide the outputs specified in 3.5.1.15.17.3 through 3.5.1.15.17.5 when operated into an unbalanced 20K ohms or higher impedance load. The output impedance for the ADF system shall be 20K ohms maximum at 1.0 kHz and shall provide the outputs specified in 3.5.1.15.17.3 through 3.5.1.15.17.6 when operated into a 20K ohm ± 10 percent resistive load.

3.5.1.15.17.3 Wideband audio output levels. The output level (e.g., TSEC/KY-58) shall be 0.250 volt root mean square (RMS) minimum to 8.3 volts RMS maximum across 20K ohms with the input RF signal modulated 90 percent (AM) or deviated ± 7.2 kHz (FM) at 1.0 kHz. The output level to the ADF system shall be 4.0 volts peak-to-peak minimum across 20K ohms with an RF input of -53 dBm modulated 90 percent (AM) at 1.0 kHz.

3.5.1.15.17.4 Wideband audio output responses. The receiver wideband audio output shall be within +2 to -4 dB of the 1.0 kHz reference level for modulating signals between 30.0 Hz and 25.0 kHz. The frequency response of the ADF audio shall be within ±2 dB of the 1.0 kHz reference level for modulating signals between 50.0 Hz and 10.0 kHz.

3.5.1.15.17.5 Wideband audio output distortion. Total harmonic distortion at the receiver wideband audio outputs shall not exceed 8 percent for ± 7.2 kHz deviation (FM) at 1.0 kHz sinusoid with signal levels up to +5 dBm or 8 percent for 90 percent modulation (AM) with signal levels to 0 dBm. For signal levels from 0 to +5 dBm, the distortion shall not exceed 20 percent for 90 percent modulation (AM). (Note: this requirement does not apply to KY-58 signals.)

3.5.1.15.17.6 Wideband audio output phase. The ADF audio output shall not be more than 20° out of phase with the negative portion of the RF signal modulation envelope when the RF signal is modulated 30 percent at 200 Hz. (That is, the audio output shall be 180° ± 20° with respect to the modulating signal). The ADF audio output shall be between +45° and +135° out of phase with the negative portion of the RF signal modulation envelope when the RF signal is modulated 30 percent at 5,680 Hz.

3.5.1.15.17.7 Frequency shift keying (FSK) and minimum shift keying (msk) operations. The receiver shall have an FSK/MSK output that shall be DC coupled and capable of operating from zero to eighty thousand BITs per second when appropriate filters are installed. (Refer to 3.5.1.15.2 for the standard filters and conditions for replacement.)

3.5.1.15.18 Guard receiver characteristics. The requirements of 3.5.1.15.17 do not apply to the guard receiver. The guard receiver shall be capable of operation on fixed frequencies of 121.500 and 243.000 MHz and shall be able to receive AM normal voice and pulsed tone in accordance with the requirements of 3.5.1.15.3. The guard receiver shall be connected to the antenna input in accordance with 3.5.1.14. Both the main and guard receivers shall be able to receive signals simultaneously when the radio set is in the receive condition. The guard receiver shall meet the following requirements when in the transmit/receive plus guard and the ADF modes:

3.5.1.15.18.1 Low level guard audio output. A separate line shall be provided for a low level guard receiver output. The level shall be between 0.15 v and 0.45 v RMS into a 600 ohm ± 10 percent resistive load at -53 dBm input level, 30 percent AM at 1.0 kHz. This guard receiver output is for use with the TSEC/KY-58. With a reference input of -53 dBm 30 percent AM modulated 1.0 kHz, the frequency response shall be within +1 to -3 dB from 500 to 3,500 Hz and distortion at 1.0 kHz shall not exceed 5 percent. It

shall be possible for this output level to be increased to over 2.75 v RMS by an adjustment available at the intermediate level of maintenance. Under service conditions, the distortion shall not exceed 10 percent.

3.5.1.15.18.2 Guard precedence operation. The radio set shall make provision for guard precedence frequency selection from an external switch. This mode, which is intended for emergency use, is activated by closing an external switch (not included in the radio set) to provide an electrical ground on an assigned pin. When this switch is closed, the controls on the remote control shall be disabled, the radio turned on, the transmitter and main and guard receivers tuned to 243.000 MHz (AM). Activation of this mode shall take precedence over any other mode of operation selected.

3.5.1.16 Transmitter characteristics.

3.5.1.16.1 Modulated power output. The transmitter shall be turned off during ECCM fill from an external data loader, transfer of frequency from the CD-17 applique to the RT and external frequency busses, and frequency transition periods.

3.5.1.16.1.1 FM power. Under all service conditions except as defined below, the RF power output shall not be less than 15 watts and not more than 23 watts over the frequency ranges of 30.000 to 87.9875 MHz, 136.000 to 173.9875, and 225.000 to 399.9875 MHz. From 22 to 18 VDC input, the RF power output may decrease from 15 watts to not less than 2 watts. From greater than 55°C to 71°C ambient, the RF power output may decrease 3 dB relative to the power level at 55°C: from greater than 71°C to 95°C ambient, it may decrease 6 dB relative to the power level at 55°C.

3.5.1.16.1.2 AM power. Under all service conditions except as defined below, the RF power output shall not be less than 10 watts and not more than 15 watts with an unmodulated carrier over the frequency ranges of 118.000 to 155.9975 MHz and 225.000 to 399.9875 MHz. From 22 to 18 VDC input, the RF power output may decrease from not less than 10 watts to 2 watts. From greater than 55°C to 71°C ambient, the RF power output may decrease 3 dB relative to the power level at 55°C; from greater than 71°C to 95°C ambient, it may decrease 6 dB relative to the power level at 55°C.

3.5.1.16.1.3 Transmit power control. Power turn-down tables shall be able to be replaced by command(s) from the MIL-STD-1553B bus. Power turn-down tables shall default to those stored as a part of the normal initialization when primary supply power is applied. The MIL-STD-1553B bus command(s) shall be able to reduce the RF output power referenced to the values in the table stored upon initialization in at least seven steps to a maximum of 0.15 watts in the AM mode and 0.23 watts in the FM mode.

3.5.1.16.2 Transmitter RF termination. The transmitter shall meet the specified power output performance requirements with an RF termination of 50 ohms nominal (1.05:1 maximum VSWR)at all phase angles, except as modified by 3.5.1.16.3.1.

3.5.1.16.3 Transmitter output circuit. The transmitter shall operate as specified after being subjected to either an open or short circuit load impedance or any intermediate load impedance.

3.5.1.16.3.1 Mismatch power output. The transmitter shall meet the power output requirements of 3.5.1.16.1 for normal and low voltage and temperature conditions when operated into a load as specified in 3.5.1.16.2. For other VSWR loads, the transmitter shall not turn down any additional amount than that shown in table X. For any combination of VSWR, temperature and low voltage, the power output shall be not less than 2 watts.

TABLE X. Mismatched power output.

VSWR	Nominal Turn-down	Maximum Turn-down
1:1 to < 1.3 : 1	0 dB	-0.6 dB
1.3:1 to < 1.5 : 1	-0.4	-1.0
1.5:1 to < 2.0 : 1	-1.2	-1.8
2.0:1 to < 2.5 : 1	-1.9	-2.3
2.5:1 to < 3.0 : 1	-1.9	-2.8
Above 3:1	N/A	-7.0

3.5.1.16.4 Tone transmissions.

3.5.1.16.4.1 Squelch tone. In the 30.000 to 87.9875 MHz VHF (FM) band, a squelch keying tone shall be transmitted along with the normal voice modulation. The tone shall be 150 Hz ±3 Hz and shall deviate the transmitter output ± 3 kHz ± 0.5 kHz. The tone shall be inhibited during secure voice and ECCM transmissions or when deselected by an external control.

3.5.1.16.4.2 Tone. The transmitter modulator circuit shall include a tone generator for the AM mode only with a 1020 Hz ± 10 percent Hz audio tone on any AM channel. Modulation shall be not less than 60 and not more than 90 percent. A separate connector pin shall be provided for tone activation. The tone shall be transmitted by grounding this pin.

3.5.1.16.4.3 CASS/DICASS input characteristics. A separate audio input shall be provided for CASS or DICASS signals to be transmitted. The CASS/DICASS interface shall provide the external transmit (key) switch actuation at least 50 milliseconds prior to input of CASS/DICASS signals to the receiver-transmitter.

3.5.1.16.4.3.1 CASS/DICASS input impedance. The input impedance presented by the radio set to the CASS/DICASS signal generator shall be 100 ohms ± 5 percent resistive,

3.5.1.16.5.3.2 CASS/DICASS signal levels. The CASS/DICASS input shall be designed for 0.5 volt RMS (closed circuit) input signals.

3.5.1.16.4.3.3 CASS/DICASS input frequency range. The CASS/DICASS input shall be designed for input signals between 1 kHz and 50 kHz.

3.5.1.16.4.4 CASS/DICASS modulation characteristics. CASS/DICASS signal modulation of the transmitter RF carrier output shall have the following characteristics.

3.5.1.16.4.4.1 Percent modulation. Under standard conditions, the percent modulation shall be between 85 and 100 percent for a 0.5 volt RMS (1 kHz) closed circuit signal at the CASS/DICASS input. Under environmental conditions, the percent modulation shall not be less than 70 percent.

3.5.1.16.4.4.2 Carrier fidelity. With a constant CASS/DICASS input voltage of 0.5 volt RMS closed circuit adjusted to any frequency between 1 kHz and 50 kHz, the demodulated signal voltage shall be within $\pm$ 2 dB.

3.5.1.16.4.4.3 Modulation distortion. With a CASS/DICASS input voltage of 0.5 volt RMS closed circuit adjusted to any frequency between 1 kHz and 50 kHz, the demodulation signal total harmonic distortion shall not exceed 10 percent.

3.5.1.16.4.4.4 Intermodulation distortion. The demodulated level of the sum and difference frequencies of two equal level .175 volt RMS (open circuit) discrete (non-harmonically related) modulating CASS/DICASS signals shall be 25 dB below either modulating signal.

3.5.1.16.4.4.5 Phase linearity. The phase response of the modulating frequency shall be linear with frequency within $\pm$ 15 degrees throughout the 1 kHz to 50 kHz spectrum. In addition, the phase versus frequency slope shall not exceed 3.5 degrees per Hz.

3.5.1.16.5 Transmit precedence. Activating the transmit keyline shall cause transmission through communications antenna port as specified in 3.5.1.14.

3.5.1.16.6 RF carrier turn-on/off characteristics. In ECCM modes, transmit turn-on and turn-off times and waveforms shall conform to the standard of the system being used. Where this characteristic is not specified for a system, the criterion of maximum practical spectral confinement shall be used to select an appropriate characteristic. This shall be controlled by the applique. The radio shall be capable of shaping the transmit turn-on and turn-off utilizing a digital signal provided by the applique. The transmit ALC shall be able to be programmed during ECCM functions with priority given to the thermal cutback circuitry.

3.5.1.16.6.1 RF carrier turn-on time. The RF carrier shall reach 90 percent of the required output level after actuation of the applicable transmit (key) line within the following ranges:

(a) ECCM. Spectral splatter shall be minimized for the hop rate employed. The capability of reaching full power shall be achieved in less than 10 percent of the total frequency transition interval used by a particular mode.

(b) All Other Modes - (70 milliseconds maximum). For transmission of ERF, TOD, and resynchronization, RF power output shall be delayed at least 45 milliseconds from the TX mode indicator signal in J5.

3.5.1.16.7 Transmitter sidetone. In the AM mode (normal voice), a transmitter sidetone shall be developed by sampling a portion of the modulated transmitter output carrier. The sidetone signal shall be introduced into the audio so as to appear at the radio output terminals along with the main receiver audio. In the AM mode, the sidetone shall be reduced if the PA power is reduced. In the FM mode, the sidetone shall be obtained by sampling the input audio. Sidetone in ECCM mode(s) shall be consistent with the ECCM waveform and its characteristics. An applique interface for muting sidetone shall be provided for use with ECCM modes.

3.5.1.16.7.1 Sidetone level. With a 1000 Hz signal at the audio input at a closed-circuit voltage level which will produce a 30 percent modulation in the AM mode or ± 1.87 kHz deviation in the FM mode, the sidetone output at the main receiver shall be 6 dB ±1 dB (6±2 dB SINCGARS) less than the output as specified in 3.5.1.15.4.1 and 3.5.1.15.4.5.5. An internal pot shall be provided to permit adjustment (except in the SINCGARS mode) of the sidetone level from 1 to 10 dB below the preceding standard level. In either AM, FM, or ECCM(voice) modes, the sidetone shall be gated off if a PA or synthesizer fault occurs, and shall automatically be restored when the fault is not present.

3.5.1.16.8 AM/FM operation.

3.5.1.16.8.1 Audio input impedances. The normal voice audio input impedance shall be 175 ohms ± 25 percent balanced or unbalanced. The secure voice and ECCM audio input impedance shall be 2.0K ohms ± 25 percent balanced or unbalanced. The retransmit audio input impedance shall be 1.0K ohms ± 10 percent balanced or unbalanced.

3.5.1.16.8.2 Amplitude modulation. The amplitude modulation of the RF output for the normal voice, secure voice, and retransmit inputs shall have the following characteristics.

3.5.1.16.8.2.1 Modulation percentage. Under standard conditions, the average modulation percentage shall be linear with at least 80 percent upward and between 85 and 100 percent downward for a 0.5 v RMS (1.0 kHz) (either automatic or by internal adjustment) closed-circuit signal at the normal voice audio input, a 6.5 v RMS (1.0 kHz) closed-circuit signal at the retransmit audio input, or a 12 v peak-to-peak 16 KBPS closed-circuit signal at the secure voice audio input. The average modulated output power shall be at least 1.30 times the unmodulated output power. Under environmental conditions, the average percent modulation shall not be less than 65 percent upward and between 80 and 100 percent downward. The average modulated output

power shall be at least 1.20 times the unmodulated output power for all environmental conditions.

3.5.1.16.8.2.2 Carrier fidelity. With a constant normal voice audio input voltage of 0.5 v RMS closed-circuit voltage adjusted to any frequency between 0.5 and 3.5 kHz, the demodulated audio voltage shall be within +1 dB, -3 dB of the demodulated audio voltage resulting from a 0.5 v RMS closed-circuit 1.0 kHz audio input. With a constant retransmit audio input voltage of 6.5 v RMS closed-circuit adjusted to any frequency between 0.3 and 3.5 kHz, the demodulated audio voltage shall be within +1 dB, -3 dB of the demodulated audio voltage resulting from a 6.5 v RMS closed-circuit 1.0 kHz audio input. With a constant secure voice audio closed-circuit of 12 ± 1 v peak-to-peak (P-P) adjusted to any frequency between 10 Hz and 21.3 kHz per CSESD-14, the demodulated audio voltage shall be within +1, -3 dB of the demodulated output at 1.0 kHz modulation.

3.5.1.16.8.2.3 Distortion. With a normal voice audio input of 0.5 v RMS closed-circuit or a retransmit audio input of 6.5 volts RMS closed-circuit adjusted to any frequency between 0.3 and 3.5 kHz, the demodulated audio harmonic distortion shall not exceed 5 percent. Under service conditions, the distortion shall not exceed 8 percent. Distortion for the secure voice audio input is specified as spectral containment in 3.5.1.16.11.1.

3.5.1.16.8.2.4 Incidental frequency modulation. In the AM mode with the RF carrier amplitude modulated at least 75 percent upward and 90 percent downward at 1.0 kHz, the peak frequency deviation arising from incidental frequency modulation of the transmitter shall not exceed ± 2.4 kHz.

3.5.1.16.8.3 Frequency modulation characteristics. The frequency modulation of the RF output for the normal voice, secure voice, and retransmit inputs shall have the following characteristics.

3.5.1.16.8.3.1 Deviation. An audio signal of 0.25 to 1.5 v RMS (closed-circuit) (either automatic or internal adjustment) applied to the normal voice audio input or an audio signal of 6.5 v RMS (closed-circuit) applied to the retransmit audio input shall produce an FM modulated transmitter RF output signal with a deviation of ± 5.6 kHz ± 0.5 kHz. An audio signal of 12.0 v peak-to- peak ± 1.0 v (closed-circuit) applied to the secure voice input shall produce an FM modulated transmitter output signal with a deviation of ± 5.6 kHz ± 0.5 kHz. The RT shall have a pin on an external connector such that, when grounded, a 2.1 v RMS 1 kHz signal into the wideband audio input shall produce ±20 kHz ±2 kHz carrier deviation when the transmitter is keyed and in the FM mode.

3.5.1.16.8.3.2 Audio frequency response. With a constant normal voice audio input voltage of 0.25 to 1.5 v RMS (closed-circuit) (either automatic or internal adjustment) adjusted to any frequency between 300 and 3,500 Hz, the deviation shall remain constant at ± 5.6 kHz ± 1.0 kHz symmetrical about the carrier frequency. With a constant retransmit audio input voltage of 6.5 v RMS (closed-circuit) adjusted to any frequency between 0.3 and 3.5 kHz, the deviation shall remain constant at ± 5.6 kHz ± 1.0 kHz symmetrical about the carrier frequency. With a constant secure voice audio input voltage of 12 ± 1

volts peak-to-peak (closed-circuit) adjusted to any frequency between 0.0 and 25 kHz, the deviation shall remain constant at ± 5.6 kHz ± 1.0 kHz symmetrical about the carrier frequency.

3.5.1.16.8.3.3 Modulation distortion. With any audio input frequency specified in 3.5.1.16.8.3.2 for the normal voice and retransmit inputs and with the audio input adjusted for ± 5.6 kHz deviation, the distortion shall not exceed 5 percent. Distortion for the secure voice audio input is specified as spectral containment in 3.5.1.16.11.1.

3.5.1.16.8.3.4 Deviation capability. The receiver-transmitter shall be capable of FM/FSK/MSK deviation in accordance with 3.5.1.16.9.

3.5.1.16.8.3.5 Incidental AM. With maximum deviation (± 5.6 kHz), the incidental amplitude modulation of the carrier shall not exceed 4 percent.

3.5.1.16.8.4 Premodulation filters. The receiver-transmitter shall incorporate filters or audio waveshaping prior to modulation to allow 50 kHz adjacent channel operation between AN/ARC-210(V) type radio sets in the normal and baseband secure modes and 100 kHz adjacent channels spacing in the diphase secure mode. Additional filtering or audio signal waveshaping shall be provided as required to support ECCM operation in accordance with 3.5.6.

3.5.1.16.9 FSK AND MSK operation. The transmitter shall be capable of transmitting FSK and MSK. The transmitter shall be capable of continuous phase frequency shift keying with a minimum deviation capability of ± 4 kHz and a maximum deviation capability of ± 35 kHz for operation at data rates from zero to eighty thousand bits per second. The wideband input shall be DC coupled. Deviation shall be selected by the applique as appropriate for the ECCM mode chosen. The applique shall be able to modify synthesizer modulation as a function of AJ mode selected. This shall be down loaded initially with mode select and then stored in the radio.

3.5.1.16.10 Microphone bias voltage. The normal voice audio input shall provide bias voltage and current to operate an amplifier (type AM-3597C/A) associated with a dynamic microphone or an LS-460B intercommunication set. The voltage supplied shall be not less than 16 VDC with an external 1.0K ohm resistive load. Under emergency power conditions, the voltage supplied shall be not less than 12 VDC with an external 1.0K ohm resistive load.

3.5.1.16.11 Transmit noise floor. For carrier frequencies from 30 to 88 MHz, the transmitter broadband noise level shall be no more than -115 dBm/Hz at any frequency more than 10 percent, but less than 30 percent removed from the carrier. Above 30 percent, the noise level shall be no more than -120 dBm/Hz. For carrier frequencies above 88 MHz, the transmit broadband noise level shall be no more than -117 dBm/Hz at any frequency greater than 10 percent, but less than 15 percent, or (if less than the percentage) greater than 10 MHz, but less than 15 MHz from the carrier frequency. Above 15 percent or 15 MHz (whichever is less), the transmit broadband noise level shall be no more than -120 dBm/Hz.

3.5.1.16.11.1 Transmit energy spectrum. For narrowband modes, 99 percent of the normal and baseband secure voice transmitted energy shall be contained within the operating 25 kHz channel. In SINCGARS, 95 percent of the transmitted energy shall be contained within the operating 25 kHz channel.

3.5.1.16.11.2 Transmitter spurious. Transmitter spurious outputs greater than 600 kHz from the carrier shall be at least 80 dB below the carrier except there shall be no more than two spurious responses less than 60 dB below the carrier and no more than an additional 10 spurious responses less than 70 dB below the carrier. Spurious outputs from 300 kHz to 600 kHz of the carrier shall be at least 66 dB below the carrier. From 150 to 300 kHz from the carrier, spurious outputs shall be down at least 55 dB below the carrier.

3.5.1.16.11.3 Transmitter harmonics. The transmitter harmonics shall be in accordance with MIL-STD-461B except for the harmonics specified in table XI.

TABLE XI. Transmitter harmonic limits.

Frequency Band	Harmonic Level (dBc) 4th	5th	6th	7th
30-88 MHz	-66	-55	-66	-66
118-174 MHz	-66	-66	-66	-66
225-400 MHz	-66	-66	-66	-66

3.5.1.16.12 Noise modulation of transmitter.

(a) AM - The noise on the unmodulated carrier shall be 40 dB below the detected audio voltage of a carrier modulation of 90 percent at 1 kHz for the bandwidths specified in 3.5.1.15.4.5.1.

(b) FM - The noise of the unmodulated carrier shall be 40 dB below the detected audio voltage of a 1.0 kHz tone having a deviation of ± 7.2 kHz for the bandwidths specified in 3.5.1.15.4.5.1.

3.5.1.16.13 Transmitter keying. The transmit key line shall key the transmitter when voltages from ground to ± 5 v are applied. An open circuit or a voltage above 6.0 VDC on the key line shall cause the radio to operate in receive mode. The transmitter keying characteristics shall conform to the requirements of 3.5.1.16.6.

3.5.1.17 Automatic relaying operation. In the T/R or T/R plus guard mode, the main receiver and transmitter of the receiver-transmitter shall operate in an automatic relaying mode (both normal and secure voice) when used in conjunction with another AN/ARC-210(V), AN/ARC-182(V), or AN/ARC-159(V),

receiver-transmitter plus C-11628/ARC receiver-transmitter control and SA-2498/ARC switching unit or other appropriate external interface switching circuitry. No special switch position shall be provided on the remote control's panel to indicate the relay mode of operation. On pins of the J2 connector of the receiver-transmitter, the receiver-transmitter shall provide the following inputs, outputs, and controls that allow the receiver-transmitter to be used for automatic relaying in the T/R or T/R plus guard mode:

(a) Main receiver audio outputs
(b) Retransmit audio inputs
(c) Relay trigger voltage (squelch indication)
(d) Transmit control (T/R control line).

A signal on the receiver selected frequency applied to the antenna circuit of either receiver-transmitter at a level sufficient to open the receiver squelch circuit shall cause the other receiver-transmitter to generate automatically and emit an appropriately modulated radio frequency carrier wave at that unit's rated power on its selected frequency. Removal of the actuating receiver signal shall cause the cessation of the generated carrier. When the actuated signal is 3 dB or more above the level required for relaying as described above, the generated carrier shall reach 90 percent of the rated power level within 60 milliseconds after the actuating signal is applied and the system shall be returned to standby conditions within the minimum practical time after the actuating signal is removed. Overall R/T delays shall not cause noticeable loss of syllable(s). The receiver-transmitters shall perform relay functions on any two RF channels in any of the frequency bands (see 3.5.1.1), provided a frequency separation of at least 10 MHz exists between the two channels with an isolation of 50 dB (60 dB, ARC-159) between the two antenna ports and spurious frequencies are not used. The receiver-transmitter shall provide the necessary I/O signals to provide relay and relay monitor in the HAVEQUICK and SINCGARS modes.

3.5.1.18 TSEC/KY-58 operation. In the T/R or T/R plus guard mode, the radio set shall operate in conjunction with the TSEC/KY-58 speech security equipment specified in publications CSEEB-13, CSESD-14, and CSEEB-32. Specific radio circuits required for secure voice operation in the AM or FM mode shall be activated by biasing a designated pin as required on the radio connector. When required (for diphase secure operation), actuating the pin shall switch the receiver IF to the wide bandpass. In AM mode, the radio shall be capable of baseband and diphase operation; in FM mode, baseband only. As a minimum requirement, in the FM mode the baseband secure voice signals shall be contained in the 25 kHz channel spacing by use of binary continuous phase FM. In the AM mode, the baseband secure voice signals shall be contained in the 25 kHz channel spacing.

3.5.1.19 Frequency hopping. Provisions shall be made to allow the RT to frequency hop under applique control for HAVEQUICK, SINCGARS, and future ECCM modes which are consistent with the tuning time of the RT as specified in 3.5.1.12.1.

3.5.2 Receiver-transmitter. The RT-1556/ARC shall provide the specified receiver-transmitter functions.

3.5.2.1 Function. The RT-1556/ARC receiver-transmitter shall provide all the functions and capabilities specified in 3.5.1.1. However, control of the modes or functions and display of the radio frequency or preset channel number shall not be provided within but rather be remotely controlled and displayed by the units specified in 3.5.5 and 3.5.3, or the platform computer via the interface specified in 3.5.2.10.

3.5.2.2 Form factor. The receiver-transmitter form factor of the RT-1556/ARC shall be as shown in figure 3. The receiver-transmitter shall contain provisions to allow the unit to be reversed in its mounting base.

3.5.2.3 Weight. The weight of the RT-1556/ARC without the applique shall not exceed 10.0 pounds.

3.5.2.4 Color. The exterior color of the receiver-transmitter shall be lusterless black. Painted surfaces shall be in accordance with FED-STD-595, Color No. 37038.

3.5.2.5 Contents. The receiver-transmitter shall be a self-contained unit suitable for mounting outside the cockpit area. It shall consist of all solid state modular electronic circuit design, except for one electromechanical relay, and shall have the module and assembly requirements specified in 3.5.1, but deleting the control/indicator assemblies for control of functions and modes or display of frequency and channel, and including instead a TDM data bus adapter module required for compatibility with the unit specified in 3.5.5 or the platform computer.

3.5.2.6 Controls. Control for normal and ECCM operation of the receiver-transmitter shall be located in the computer interface for the platform or on the control specified in 3.5.5. Control information to the receiver transmitter shall be transferred from the computer interface via a MIL-STD-1553B bus and from the remote control via a separate data bus.

3.5.2.7 ECCM control. The RT-1556/ARC shall provide interfaces for use by the CD-17/ARC-210(V) ECCM applique. When in any ECCM mode, all ECCM control functions shall be generated in the CD-17/ARC-210(V). These shall include:

(a) Transmitter keying
(b) Frequency selection
(c) Squelch control (SINCGARS)
(d) AGC control of time constants
(e) Transmit ALC turn-down and waveshaping control

3.5.2.7.1 Applique interface. The interface between the radio and the ECCM applique CD-17/ARC-210(V) shall use one connector. Appendix D specifies the interfaces required between the radio and the applique. The radio shall provide the following information to the applique:

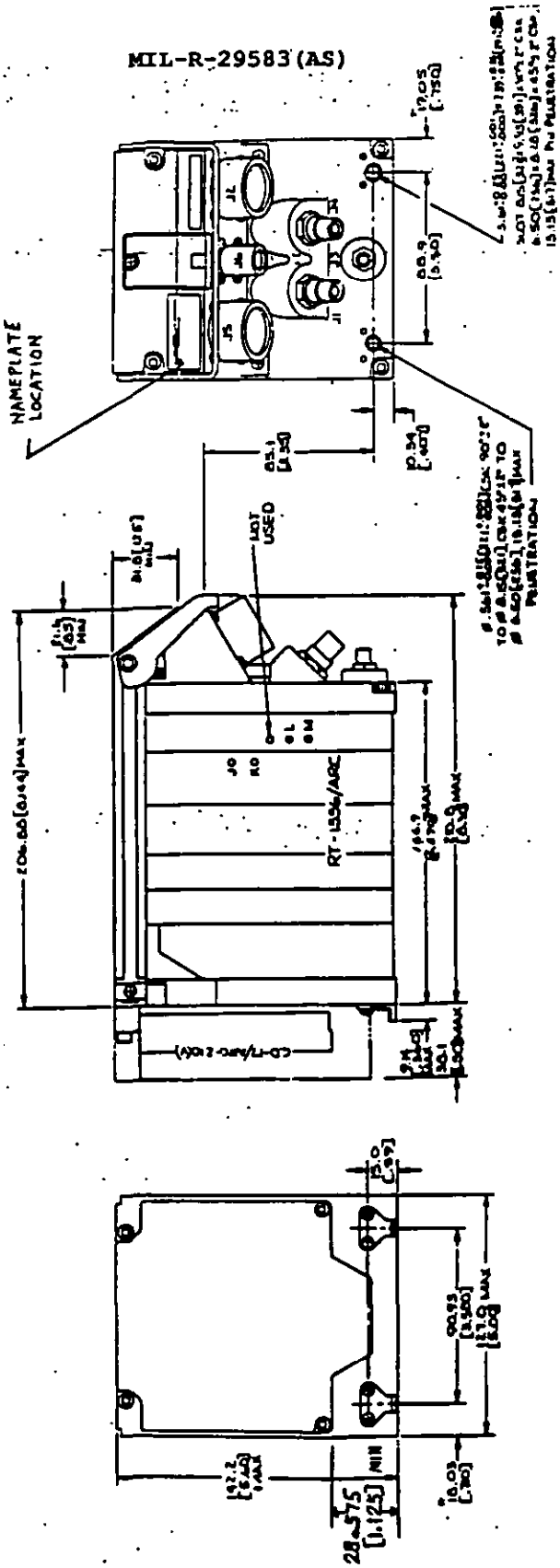


FIGURE 3. Form factor for the RT-1556/ARC.

(a) ECCM preset initialization data
(b) Wideband receiver audio
(c) Preset zeroize
(d) Channel approximate signal level
(e) Frequency
(f) Transmitter keying

The applique shall provide the following information to the radio:

(a) High speed control bus
(b) Frequency change strobe
(c) Transmit/receive blanking
(d) Transmit/receive switching
(e) Mode select
(f) Bandwidth select
(g) Narrowband and wideband data
(h) Digital transmit windowing parameters
(i) Digital AGC control
(j) BIT information
(k) Transmit and receive frequency

3.5.2.7.2 Platform interface. The radio shall contain the control and information platform interfaces as specified in Appendix D.

3.5.2.8 Preset channel memory device. The preset memory devices shall be located in the receiver-transmitter and in the applique.

3.5.2.9 Frequency/channel display. A frequency/channel display shall be provided on the remote control and the indicator.

3.5.2.10 Electrical connections. Connections to external circuits shall be in accordance with table XII.

3.5.2.11 TDM data bus interface. The receiver-transmitter shall interface with the aircraft TDM data bus as described in MIL-STD-1553B. The receiver-transmitter shall incorporate the required input/output circuitry necessary for compatibility with two types of implementation:

(a) Subsystem serial interconnection with the control units described in 3.5.5 as specified in appendix A.

(b) Subsystem dual (redundant) driver/receiver interconnection directly to a MIL-STD-1553B multiplex data bus. The adapter module specified in 3.5.2.5 shall contain the necessary circuitry for control of the receiver-transmitter using shielded twisted pairs of cables and electrical and word format described in MIL-STD-1553B, except that response time to valid transmit data command shall be between the limits of 4 and 7 micro-seconds using the test conditions specified in MIL-STD-1553B, 4.3.3.8. The receiver-transmitter shall be able to be connected to either MIL-STD-1553B bus by either the direct or transformer method as specified in MIL-STD-1553B. The message structure shall be as specified in appendix C.

TABLE XII. Connections to external circuits.

Reference Designation	Receptacle Type	Function
J1	TNC M39012/31-0001	Communications antenna
J2	Bendix 21-529017-200	Control
J3	Specialty Connector Co. Inc. 23JS110-1	ADF antenna
J4	Specialty Connector Co. Inc. 24 JS147-1	Guard antenna
J5	D38999/20WE35AC	Control
J6	D38999/20WA35PN	Power

3.5.2.12 Tuned antenna and filter interface. The receiver-transmitter shall provide frequency data for use by a tuned antenna and/or external filter as defined in appendix B.

3.5.3 Indicator, frequency-channel, ID-2428/ARC.

3.5.3.1 Function. The indicator shall provide remote display of the radio set's operating conditions reported by the receiver-transmitter on the RT data output serial interface in accordance with the table provided in 3.5.1.1.(j). For frequency, the display shall indicate six digits with decimal point in the form of FFF.FFF. The indicator shall incorporate BIT as specified in 3.3.7.4.

Signal characteristics of the J2, J5, and J6 connectors shall be in accordance with appendix D. Connector J4 shall be provided with captive protective covers.

3.5.3.2 Form factor. The form factor shall be as shown in figure 4.

3.5.3.3 Weight. The weight of the indicator shall not exceed 1.1 pounds.

3.5.3.4 Contents. The indicator shall be one self-contained unit suitable for cockpit mounting. The frequency display shall have six positions, as specified in 3.5.1.8.

3.5.3.5 Controls. There shall be no front panel controls on the indicator.

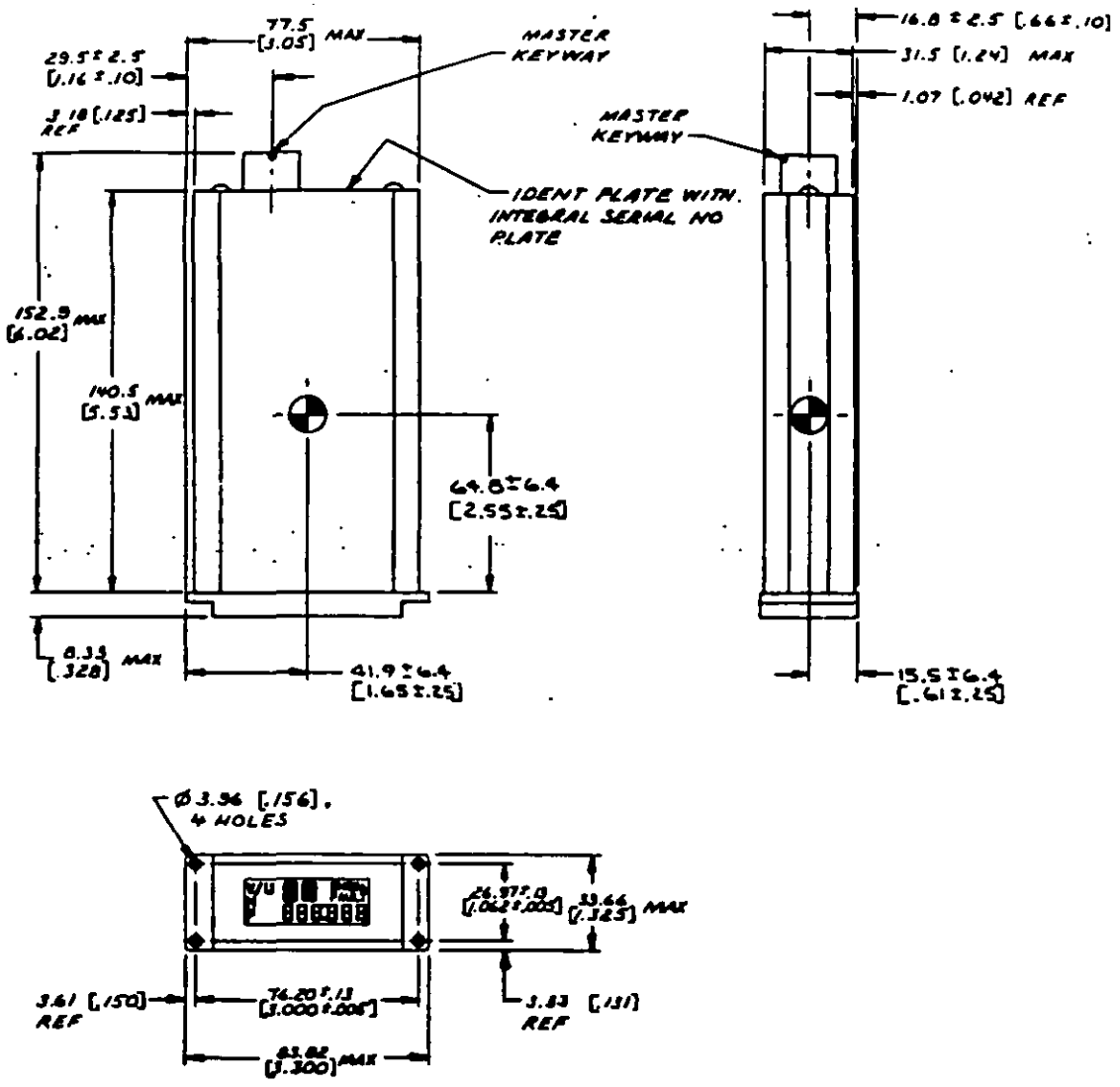


FIGURE 4. Form factor for the ID-2428/ARC.

3.5.3.6 Electrical connections. Connections to external circuits shall be provided on a receptacle as follows:

Reference Designation	Receptacle Type (or approved equivalent)	Function
J1	Bendix P/N TBP00RW-11-35P	Main/power

Signal characteristics of the J1 connector shall be in accordance with appendix D.

3.5.4 Mounting bases, electrical equipment for receiver-transmitter.

3.5.4.1 Mounting base, electrical equipment MT-4935/ARC (isolated mount). An isolating mount in accordance with MIL-C-172 shall be designed to secure the RT-1556/ARC receiver-transmitter to an airframe structure outside the cockpit area. Pins at the rear and positive self-locking thumbscrew fasteners in accordance with MS 14108, MS 14109, or equivalent at the front shall be provided for solidly securing the RT unit to the mount.

3.5.4.1.1 Form factor. The form factor of the mount shall be as shown in figure 5.

3.5.4.1.2 Weight. The weight of the mount shall not exceed 3.2 pounds.

3.5.4.1.3 Grounding path resistance. The resistance from any electrical grounding contact point between the radio and the mount to any grounding contact point between the mount and the airframe shall not exceed 2.5 milliohms.

3.5.4.2 Mounting base, electrical equipment MT-6567/ARC (hard mount). A hard (solid) mounting in accordance with MIL-C-172 shall be designed to secure the RT-1556/ARC receiver-transmitter rigidly to an airframe structure outside the cockpit area. Pins at the rear and positive self-locking thumbscrew fasteners in accordance with MS 14108, MS 14109, or equivalent at the front shall be provided for solidly securing the RT unit to the mount.

3.5.4.2.1 Form factor. The form factor of the mount shall be as shown in figure 6.

3.5.4.2.2 Weight. The weight of the mount shall not exceed 2.6 pounds.

3.5.4.2.3 Grounding path resistance. The resistance from any electrical grounding contact point between the radio and the mount to any grounding contact point between the mount and the airframe shall not exceed 2.5 milliohms.

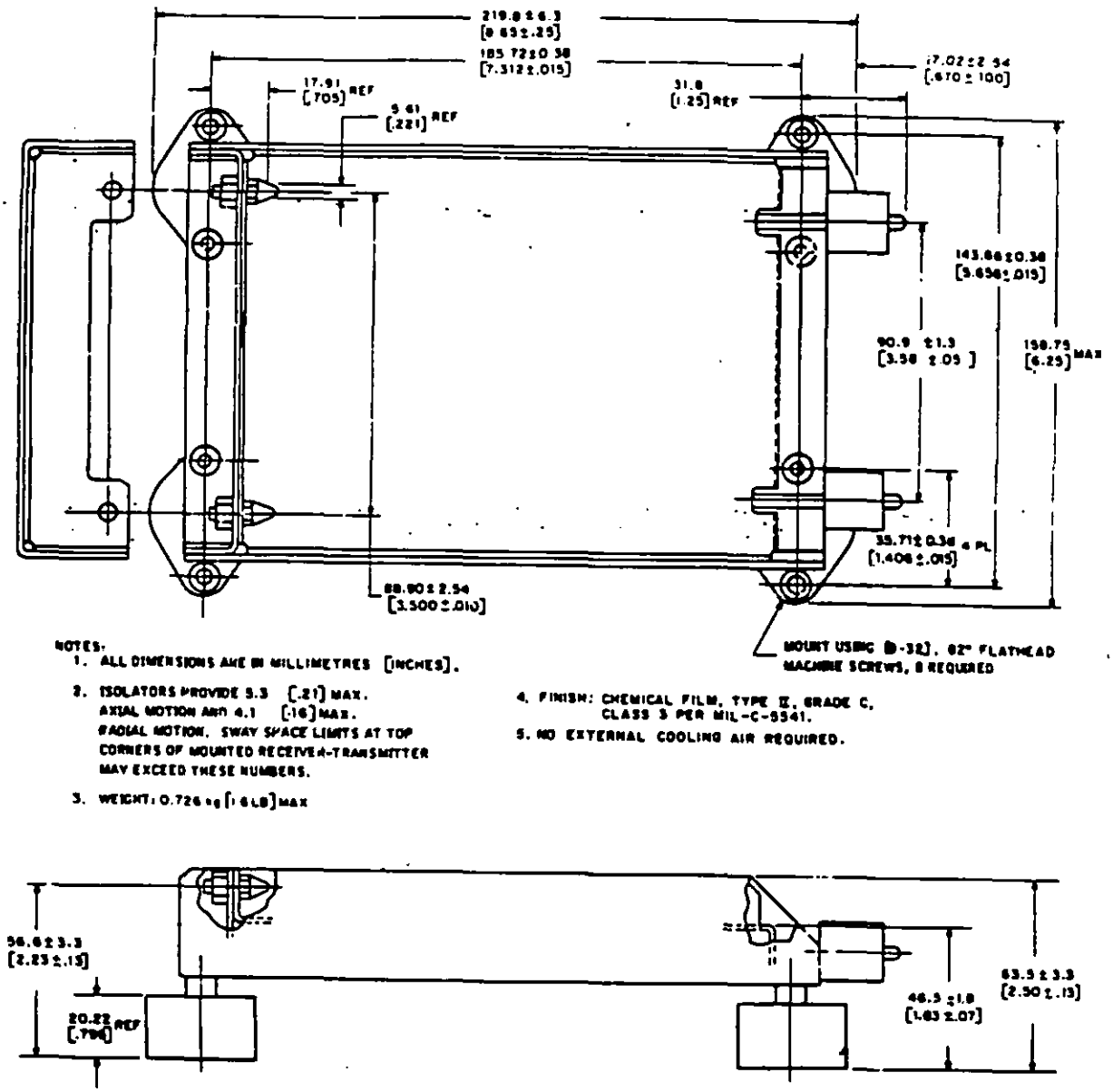


FIGURE 5. Form factor for the MT-4935/ARC mount.

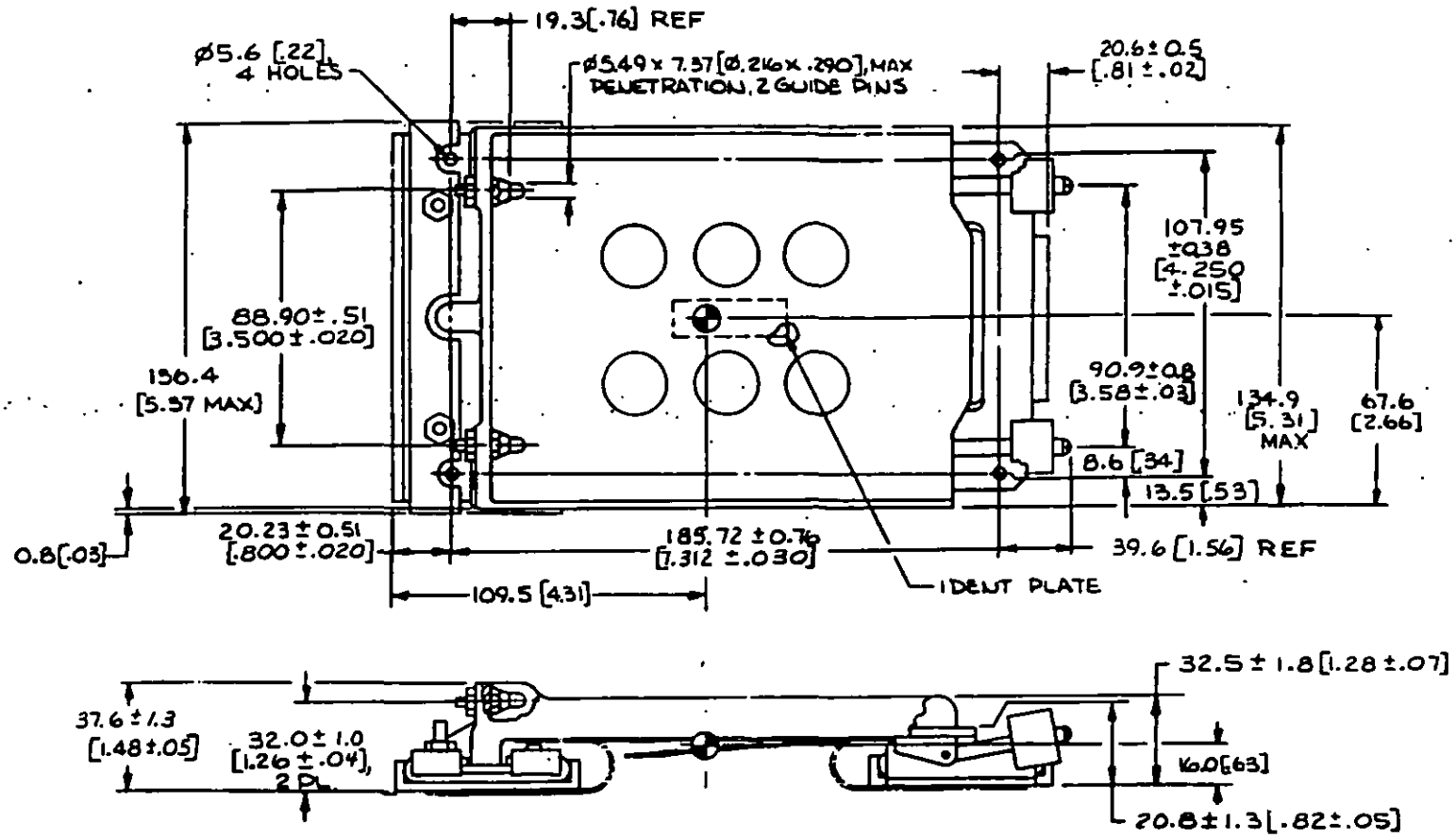


FIGURE 6. Form factor for the MT-6567/ARC mount.

3.5.5 ECCM controls, radio set, C-11896/ARC, C-11897/ARC, and C-11898/ARC.

3.5.5.1 Function, ECCM controls C-11896/ARC, C-11897/ARC, and C-11898/ARC. The C-11896/ARC, C-11897/ARC, and C-11898/ARC shall provide the interface/internal circuitry to allow an interface with the RT-1556/ARC and to allow simultaneous control of two RTs of any combination of the RT-1556/ARC as specified in 3.5.5.1.1. These controls shall allow the RT-1556/ARC to perform ECCM functions in accordance with 3.5.6 and appendix F when the CD-17/ARC ECCM applique is included in the system configuration. They shall also allow non-ECCM operation of the RT-1556/ARC whether or not the ECCM applique is included in the system configuration. The controls shall also provide functions in accordance with applicable requirements of 3.5.

3.5.5.1.1 Control of two RTs with one control. The SMC 2 and SMC 3 mode and take control lines on the control and the take control and 1553B address A0 lines on the RT along with an external pulsing device shall allow one control unit to provide command data to two RT'S. For this function, the state of the respective lines will be:

SMC 2:	Grounded
Take control (on control):	Open-circuit
Take control (on RT):	Grounded
1553B A0:	Grounded for RT1 Open-circuit for RT2
SMC 3:	Momentary low-high-low pulse. The SM3 pulse characteristics will be:
Rise time:	100 microseconds
Fall time:	100 microseconds
Pulse duration:	30 ms ± 3 ms for RT 1 80 ms ± 3 ms for RT 2
Output impedance:	1000 ohms maximum
Low level:	0 ± 5.0 volts
High level:	Open-circuit

A 30 ms pulse on the SMC3 line shall cause the control to assume command of RT1. An 80 ms pulse shall cause the control to assume command of RT2.

3.5.5.2 Form factor. The form factor of the C-11896/ARC, C-11897/ARC, and C-11898/ARC shall be as shown in figure 7, and shall be in accordance with the requirements of MIL-C-6781, type 1.

3.5.5.3 Weight. The weights of the C-11896/ARC, C-11897/ARC, and C-11898/ARC shall each not exceed 2.5 pounds.

3.5.5.4 Contents. The controls shall be one self-contained unit suitable for cockpit mounting. It shall include the control/indicator assemblies for control of functions and modes or display of frequency and channel.

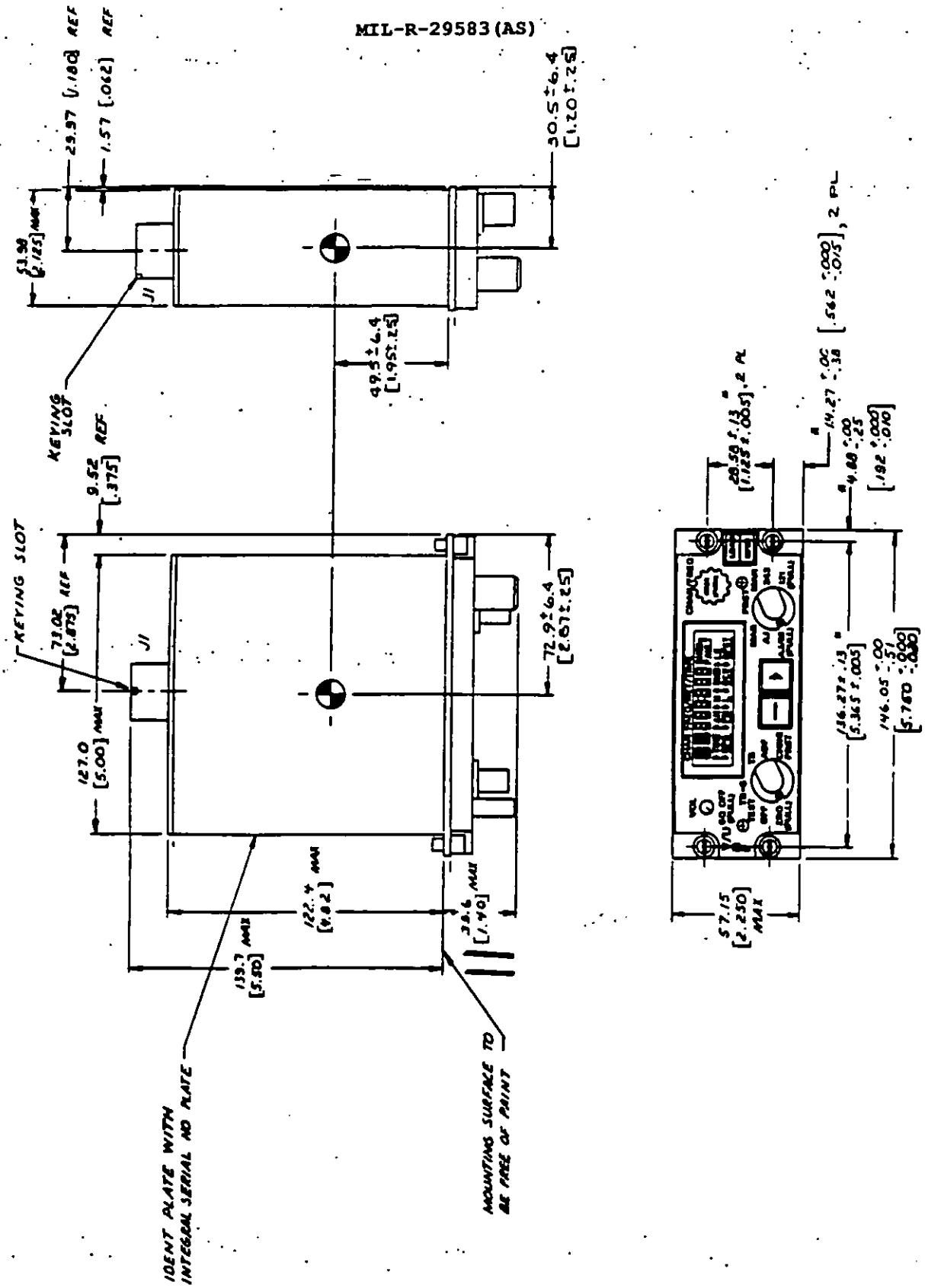


FIGURE 7. Form factor for the C-11896/7/8/ARC control.

3.5.5.5 Controls. The front panel controls shall consist of mode switches, display cursor switches, frequency/channel control switch, a load switch, and a volume/squelch switch.

3.5.5.6 Electrical connections. Connections to external circuits shall be provided on a receptacle as follows:

Reference Designation	Receptacle Type (or approved equivalent)	Function
J1	Bendix P/N TVPO2RW-15-35P	Main/power

Signal characteristics of the J1 connector shall be in accordance with appendix D.

3.5.6 CD-17/ARC applique.

3.5.6.1 Function. The CD-17/ARC countermeasures frequency controller, hereafter called the applique, shall provide control of the AN/ARC-210(V) radio set during electronic counter-countermeasures (ECCM) operations. The applique shall provide ECCM frequency control, control of transmit and receive parameters as they apply to ECCM operations, detection and decoding of waveforms, generation and encoding of ECCM waveforms and all processing not provided by the AN/ARC-210(V) radio set. The hop rate, pseudo-random hop frequency selection, allowed frequency tables, and function timing are controlled in the applique. Since the AN/ARC-210(V) shall support SINCGARS V, HAVEQUICK I, HAVEQUICK II, and in addition, will be required to support future ECCM waveforms, the applique shall be modularized to accommodate pre-planned product improvement (P^3I) growth.

3.5.6.2 Weight. The total weight of the applique shall not exceed 2.2 pounds.

3.5.6.3 Primary RT/applique interface. The primary radio/applique interface shall be a dedicated data bus consistent with electromagnetic pulse (EMP), tempest, and ECCM requirements when tested and accepted under the requirements of 4.0. The dedicated bus shall be controlled by the RT in normal modes, and by the applique in ECCM modes. All other subsystems shall act as remote terminals.

3.5.6.4 Built-in-test (BIT). BIT provisions shall be incorporated in the applique to provide a go/no-go indication to the RT-1556 of the applique readiness. These provisions may be in conjunction with, but not necessarily a part of, the fault isolation features. The operation of the performance/readiness test provision shall be a manually energized test mode of operation. RF radiation is not permitted during performance readiness tests. Normal equipment performance may be interrupted during the manually-initiated BIT sequence. Self-test of the BIT is not required.

3.5.6.5 Message formatting and processing. The applique shall be capable of performing all message formatting and processing for the following ECCM modes as specified herein.

3.5.6.5.1 HAVEQUICK I. In this mode, the applique shall implement message formats and processing, as described in specification CP-ADO-100A and CP-ADO-100B, to allow complete interoperability and required performance between AN/ARC-210(V) and any other HAVEQUICK radio.

3.5.6.5.2 HAVEQUICK II. In this mode, the applique shall implement message formats and processing as described in specification CP-ADO-100A and CP-ADO-100B, to allow complete interoperability and required performance between AN/ARC-210(V) and any other HAVEQUICK II radio.

3.5.6.5.3 SINCGARS. In this mode, the applique shall implement voice communications as described in JTC^{3}A specification 9001C (except paragraph 3.5.1.1.8) to allow complete interoperability and required performance between AN/ARC-210(V) and any other SINCGARS radio.

3.5.6.6 Error detection and correction. The applique shall provide appropriate error detection and correction processing compatible with required message formats and ECCM modes.

3.5.6.7 Bit interleaving. The applique shall provide appropriate bit interleaving compatible with required message formats and ECCM modes.

3.5.6.8 Timing. The applique shall accept and maintain time synchronization in all ECCM modes.

3.5.6.8.1 Time maintenance. The applique shall be capable of maintaining a unique time for each ECCM net preset. Up to 25 different, separate, synchronous or asynchronous time bases shall be maintained, if required, to allow rapid communications in any 25 ECCM nets. Once time synchronization is achieved, an active applique shall maintain synchronization with sufficient accuracy to allow communications in any of the ECCM nets after a period of up to a minimum of six hours after an active time update without further radio communication or external time input. Time maintenance during abnormal input power conditions is as specified in 3.3.12.

3.5.6.8.2 Internal applique time reference. The applique shall contain an accurate time reference that shall be utilized for all time keeping functions required while operating in any of the ECCM modes. The time reference shall have a warm-up time of not greater than ten seconds and accuracy of four parts in ten million or better under service conditions. Long term stability (aging) without readjustment shall be not greater than eight parts in ten million.

3.5.6.9 TRANSEC. The applique shall perform the TRANSEC functions necessary for compatibility with the ECCM modes.

3.5.6.10 RT interfaces. All interface will be with the RT. There shall be one dedicated multipin connector containing all audio, control, frequency, mode, and power signals as specified in appendix D. In addition, there shall be a capability for an RF interface connector between the applique and the RT. Operation in a non-ECCM mode or failure of the applique shall allow non-ECCM plain and secure voice communication without mechanical or electrical reconfiguration of the system.

3.5.6.10.1 ECCM remote fill. The applique shall be able to perform the electronic remote fill (ERF) function as specified in JTC'A 9001C, except section 3.9.3.2 is modified as follows: individual net times shall be calculated from time received by ERF on each net and stored in nonvolatile memory as time offsets from base time. Base time is the sum of the current time of the internal clock and the master time offset previously stored in nonvolatile memory. Master time offset was the relative difference, at time of storage, between the internal clock and reference time established by HAVEQUICK TOD reception, by fill of UTC time from GPS, or by an emergency start. As part of this function, the applique shall provide the preset net identification and hop-set or lockout-set data to the RT to transmit. Alternately, the applique shall be capable of ERF transmission to and reception from any SINCGARS radio designed to JTC'A 9001C. Lockouts that are received via an ERF shall be automatically stored in the proper lockout location based on the series (1-8) of the lockout received.

3.5.6.10.2 Tuning frequency. The applique shall provide tuning frequency to the RT. The RT will accept the frequency and provide the formatting for other equipment such as tunable antennas or filters. The applique design shall be such that no frequency hop information is transferred outside of the applique during the active transmission of the RT.

Dependent upon the timing requirements of the ECCM algorithm, the frequency will be sent to the RT one hop interval before needed. Alternately, for ECCM waveforms having a long switch interval, the same frequency may be sent twice consecutively, with a 20 microsecond minimum delay between the two, during the switch interval prior to the dwell interval using that frequency. All equipment associated with the AN/ARC-210(V) system can tune to the first of two frequencies within 85 microseconds of the start of the reception of the second frequency in the set.

3.5.6.10.3 Voice/data. The applique shall be able to receive external voice and 16 kbps data for processing and transmission. The interface with the RT shall also output voice and 16 kbps data after it has been received and processed.

3.5.6.10.4 COMSEC. When operating in the secure mode, the applique shall provide an interface with the RT to receive encrypted voice and data through the COMSEC encryption device specified for each ECCM mode for transfer to the appropriate platform source. Only "black" encrypted voice and data shall pass through the applique.

3.5.6.10.5 Universal coordinated time (UTC). The applique shall provide an interface with an external onboard UTC reference in the HAVEQUICK system format and definition as shown on figure 8 and in table XIII.

3.5.6.10.6 Loader-oscillator interface. The applique shall provide an interface through the RT for an external data loader-oscillator to allow loading of preset and net information as required by each ECCM mode. The applique shall provide the loading function to allow transfer of the required preset data from the fill device and verification of the load fill. The applique shall be able to accept ECCM mode information, through the RT, from the AN/CYZ-10 Data Transfer Device DS-101 interface. The RT shall have the capability to accept a HAVEQUICK MWOD or a SINCGARS TRANSEC variable (having either ICOM or Non-ICOM parity) via the AN/CYZ-10. The SINCGARS TRANSEC variable shall be stored as the Cold Start TRANSEC variable.

3.5.6.11 Net structuring. The applique shall control TRANSEC frequency selection, dwell length selection, message preamble generation and recognition, message formatting, time synchronization and other parameters as required to allow communication on different networks provided in the appropriate ECCM operational mode.

3.5.6.12 Initialization. The applique shall be capable, via the RT, of accepting SINCGARS TRANSEC variables, HAVEQUICK word(s)-of-the-day, time, WOD/MWODS, net number/identification, and other required initialization data automatically from an external fill device. No manual insertion of fill data shall be required. However, a provision shall be made to manually enter HAVEQUICK WOD/MWODS, HAVEQUICK net numbers, SINCGARS "wrist-watch" time, SINCGARS cue frequency, or SINCGARS cold-start frequency.

The applique shall be capable of storing all fill data in a non-volatile memory while power is applied. All required ECCM data, except time, shall be stored in a non-volatile memory so that the data is maintained during primary aircraft power-off conditions. Time shall be maintained for at least seven seconds during primary power-off conditions. The applique shall have provisions for an external battery to provide power to maintain time beyond the seven seconds.

The applique shall be capable of storing up to 25 preset fill data sets. The 25 sets may be selected from a combination of TRANSEC variables, a HAVEQUICK undated WOD, or dated MWODS (up to six). In MWOD mode, the applique shall automatically switch over to the new WOD at midnight. If the radio is transmitting or receiving in MWOD mode at midnight and there is no new WOD defined for the next day, the applique shall continue to use the previous day's WOD. Unique preset channels shall be defined for the SINCGARS cue frequency and cold-start frequency. The applique shall be able to accept via the RT a new cold-start frequency or cue frequency from the radio set control or the MIL-STD-1553B bus.

Power line interruption of duration less than seven seconds or any combination of environmental conditions shall not cause a loss of fill data memory. The applique shall be able to zeroize/erase the fill data memory upon receipt of a zeroize command over the serial data bus from the RT.

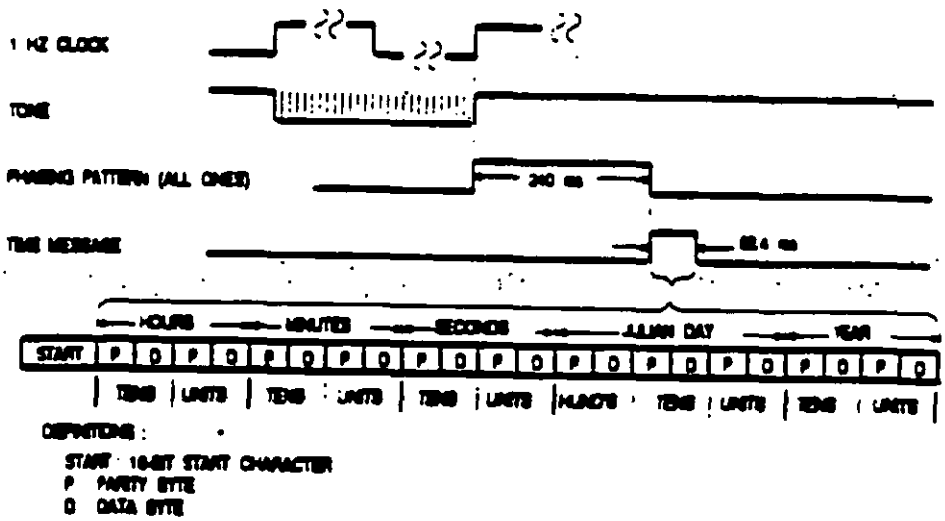


FIGURE 8. Time-of-day format.

CHARACTER	PURPOSE	CONTENTS	NOTES
START (1,2)	START OF MESSAGE	0001000111101110	START CHARACTERS WITH LOW PROBABILITY OF PARTIAL CORRELATION
3	TENS OF HOURS	4 PARITY, 4 DATA BITS	8,4,2,1 BCD*
4	UNITS OF HOURS	4 PARITY, 4 DATA BITS	8,4,2,1 BCD*
5	TENS OF MINUTES	4 PARITY, 4 DATA BITS	8,4,2,1 BCD*
6	UNITS OF MINUTES	4 PARITY, 4 DATA BITS	8,4,2,1 BCD*
7	TENS OF SECONDS	4 PARITY, 4 DATA BITS	8,4,2,1 BCD*
8	UNITS OF SECONDS	4 PARITY, 4 DATA BITS	8,4,2,1 BCD*
9	HUNDREDS OF DAY	4 PARITY, 4 DATA BITS	8,4,2,1 BCD*
10	TENS OF DAY	4 PARITY, 4 DATA BITS	8,4,2,1 BCD*
11	UNITS OF DAY	4 PARITY, 4 DATA BITS	8,4,2,1 BCD*
12	TENS OF YEAR	4 PARITY, 4 DATA BITS	8,4,2,1 BCD*
13	UNITS OF YEAR	4 PARITY, 4 DATA BITS	8,4,2,1 BCD*

* MOST SIGNIFICANT BIT FIRST

TABLE XIII. Time-of-day character definition.

CHARACTER	HEXIDECIMAL CODE
0	00
1	E1
2	72
3	93
4	B4
5	55
6	C6
7	27
8	D8
9	39

TABLE XIII. Time-of-day character definition - Continued.

The initialization information to be entered shall include, but is not limited to the following:

HAVEQUICK	SINCGARS	Description
Word(s)-of-the-day	TRANSEC Variable	PN initialization parameter
Time-of-day	Net time	Determines PN
Net number	Hopset, lockout set	Determines valid frequency table

The six HAVEQUICK MWODS shall be stored using a FIFO implementation. When a HAVEQUICK MWOD is entered via the remote control, or AN/CYZ-10, and this MWOD has the same date tag as an MWOD that is currently stored in the FIFO, this "new" MWOD shall overwrite the existing "old" MWOD that has the same date tag and shall be stored in the FIFO in the same location that the "old" MWOD was stored. When a HAVEQUICK MWOD is entered via the remote control, MIL-STD-1553B, or AN/CYZ-10, into an applique that has 6 MWODS stored and this MWOD does not have the same date tag as any of the 6 stored MWODS, the oldest MWOD shall be removed from the MWOD FIFO and the new MWOD shall be added to the MWOD FIFO as the newest MWOD.

3.5.6.13 Built-in-test. The applique shall provide BIT capability with fault detection and isolation to the SRA level. The applique shall interact with the associated radio sets and control such that all mutual interface and functions consistent with required performance levels are tested. BIT shall detect the non-availability of any ECCM mode initiated. Built-in-test equipment and self-contained BIT diagnostics shall be capable of being initiated from either the AN/ARC-210(V) control or from a controlling computer over the aircraft MIL-STD-1553B control bus via the AN/ARC-210(V) RT unit. Applique BIT results and status shall be transferred to the AN/ARC-210(V) RT unit for display on the associated control unit and/or indicator unit of failure and ECCM mode unavailability information. No radio transmission shall be made while the BIT is being exercised.

3.5.6.14 Display and control requirements. The applique through the RT, shall accept and process control information from the operator control and shall provide required information for display to the operator. A minimal amount of control operation shall be required of the operator for applique operation. Selection of the ECCM net by the operator shall automatically set all of the applique parameters required for operation in that net.

3.5.6.15 Automated data transfer. The applique/RT-1556 shall provide for automatic data transfer to and from the AN/CYZ-10. No integration other than insertion of the data loader into the external interface receptacle shall be required of the operator.

3.5.6.16 HAVEQUICK Time-of-Day (TOD). The radio shall have the capability to initially load the HAVEQUICK TOD using RF over-the-air, GPS hardwire, or emergency time start. Subsequent HAVEQUICK TOD updates shall be performed using RF over-the-air, GPS hardwire, or emergency time start.

3.5.6.17 SINCGARS Base Time. The radio shall have the capability to initially load the SINCGARS base time (including the mission day) using RF over-the-air, GPS hardwire, or emergency time start. If RF over-the-air or GPS hardware is used, the SINCGARS base time shall be equal to the received time and the SINCGARS mission day shall be equal to the least significant two digits of the three digit day-of-year. If the emergency time start is used, the SINCGARS base time and the mission day shall be equal to zero. Subsequent updates of the SINCGARS base time shall be accomplished by manual remote control entry. After initial loading of the SINCGARS base time, subsequent RF over-the-air time receipts, GPS hardwire time receipts, or emergency time starts shall not effect the SINCGARS base time.

4. QUALITY ASSURANCE PROVISIONS

This section establishes the requirements for system and development test and evaluation, and specifies the criteria for verification of system performance and design characteristics of the system and equipment. Testing to be conducted under this section shall be in accordance with applicable portions of those specifications and standards cited in this specification, and in accordance with Government approved test plans and procedures. The testing requirements specified herein shall be in addition to factory inspections and tests conducted under the contractor's quality assurance program as required by the statement of work. Provisions of this section apply to all equipments defined in this specification.

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the government. The government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements. The contractor shall be responsible for analyzing and reporting the results of all inspections and tests and shall deliver all the results in accordance with the applicable CDRL item.

4.1.1 Responsibility for compliance. All items shall meet all requirements of section 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor the responsibility of ensuring that all products or supplies submitted to the government for acceptance comply with all requirements of the contract. Sampling inspection, as a part of manufacturing operations, is an acceptable practice to ascertain

conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the government to accept defective material.

4.1.2 Classification of tests. Items covered by this specification shall be subjected to the following tests to determine compliance with all applicable requirements:

(a) Design approval tests (see 4.2)

(b) Preproduction (first article) tests (see 4.3)

(c) Initial production tests (see 4.4)

(d) Acceptance tests (see 4.5)

4.1.1.1 Government verification. All quality assurance operations performed by the contractor shall be subject to government verification at any time. Verification will consist of, but not be limited to:

(a) Surveillance of operations to determine that practices, methods, and procedures of the quality control system are being properly applied;

(b) Government product inspection to measure quality of product to be offered for acceptance; and

(c) Government production inspection of delivered products to assure compliance with all requirements of this specification.

Failure of the contractor to promptly correct any deficiencies which are discovered or identified, shall be cause for the government to suspend acceptance until corrective action has been taken.

4.1.1.2 Waiver of government inspection. The Government reserves the right to waive Government inspection. If Government inspection is waived, the contractor shall furnish certified test data complying with the forms of the approved test plans and test procedures and providing the results or readings obtained during the inspection and tests required by the applicable contract specifications. The test data must:

(a) Demonstrate that the equipment meets the requirements of this specification.

(b) Include the statement: "This certifies that this unit fully meets all technical requirements of this specification."

(c) Be dated and signed by an authorized official of the contractor.

4.1.1.3 Government furnished equipment (GFE). When GFE is used in the system, qualification of the GFE shall be presumed to have been accomplished. The GFE integrated into the system shall be qualified as part of this portion of the complete system. All equipment covered by this specification shall be

qualified either as individual configuration item (CI) or system per approved test procedures.

4.2 Design approval tests. When required by the acquisition activity, design approval tests shall be conducted by the contractor on equipment representative of the production equipments to be supplied under the contract and shall be accomplished under the approved test procedures of 4.6. The Government representative and the acquisition activity shall be advised when tests are to be conducted so that representatives may witness them when so desired. Contractors not having adequate test facilities shall obtain the services of a commercial testing laboratory acceptable to the Government.

4.2.1 Design approval test data. The contractor shall submit all data collected in conducting these tests to the acquisition activity for review.

4.2.2 Scope of tests. Design approval tests shall include all those deemed necessary by the acquisition activity to determine that the equipment meets all the requirements of this specification, other applicable specifications, and the contract. The tests shall also include environmental tests in accordance with MIL-STD-810 except as modified in 4.3.2.1.1 through 4.3.2.1.10, an electromagnetic compatibility test in accordance with MIL-STD-461B, notice 2, as modified in 4.3.4, a reliability development test, and a maintainability demonstration test.

4.2.3 Design approval. The acquisition activity shall approve this test sample upon satisfactory completion of all tests.

4.2.4 Reliability development growth test. When required by the acquisition activity, a reliability development test (RDT) shall be conducted in accordance with MIL-STD-2068. RDT environment shall be in accordance with figures 9 and 10. Each equipment shall have successfully completed the normal WRA burn-in prior to the start of RDT. Not more than six equipment systems shall be put on test. The cumulative equipment operating time shall be at least 10,000 hours. No unit shall be operated for less than one half the average operating time of all samples on test or 750 hours, whichever is greater. Built-in test shall be monitored throughout RDT in accordance with MIL-STD-2084, section 13, requirement 104.

4.2.4.1 Test mission profile. RDT test conditions of figures 9 and 10 reflect a mission profile based upon MIL-STD-781, paragraph 5.

4.2.4.1.1 Temperature cycle. The RDT temperature cycle shall be as shown on figure 9. The temperature cycle rate of change shall be NLT 5°C/minute.

4.2.4.1.2 Random vibration. The RDT random vibration shall be applied as shown on figure 9 using the profile on figure 10.

4.2.4.1.3 Power on-off cycle. Power to the equipment under test shall be cycled as defined on figure 9.

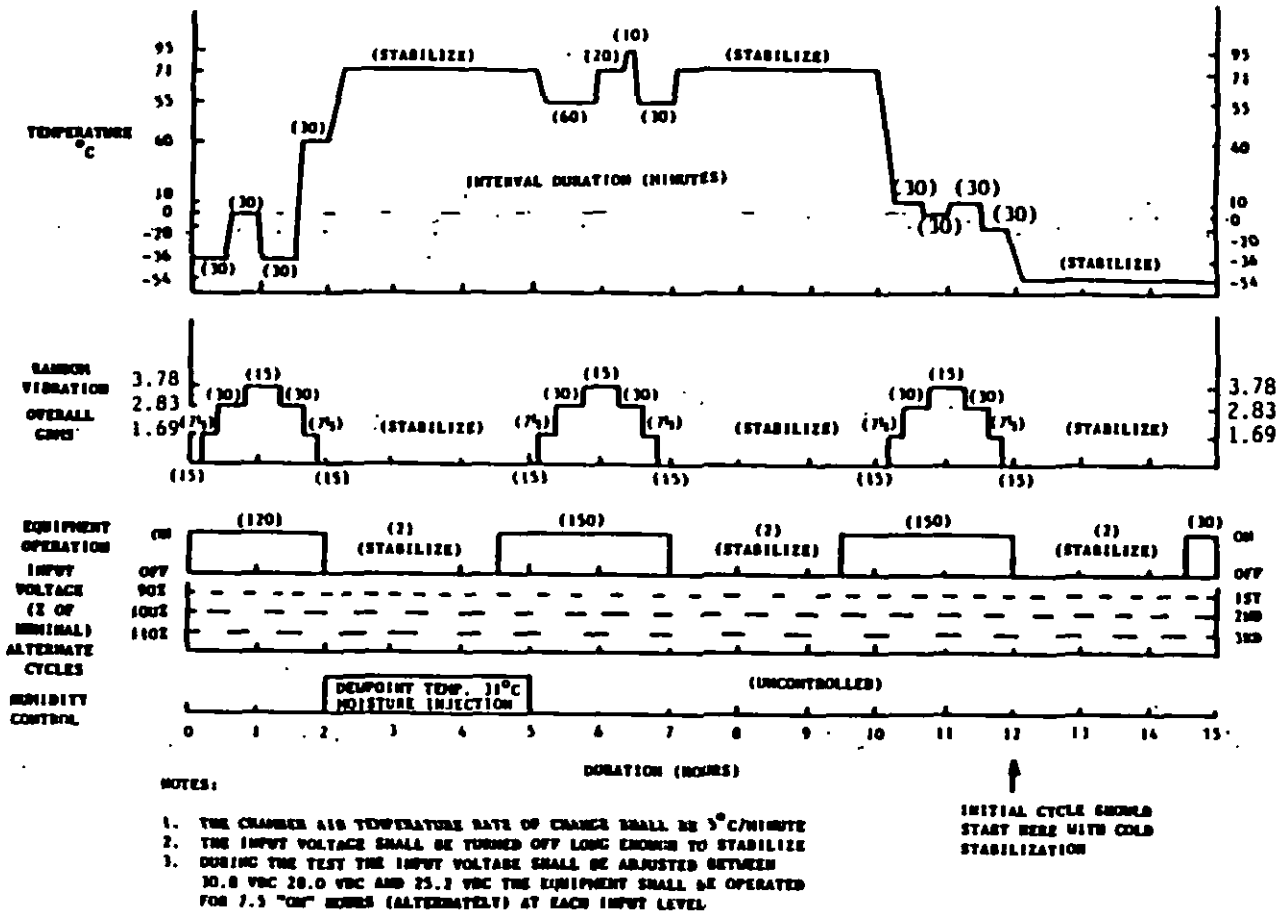


FIGURE 9. RDT/RQT test cycle.

	W_2 G^2/HZ	W_1 G^2/HZ	W_o G^2/HZ	12-2000 HZ G RMS
LEVEL 1	0.08	0.02	0.008	3.78
LEVEL 2	0.04	0.01	0.004	2.83
LEVEL 3	0.016	0.004	0.0016	1.69

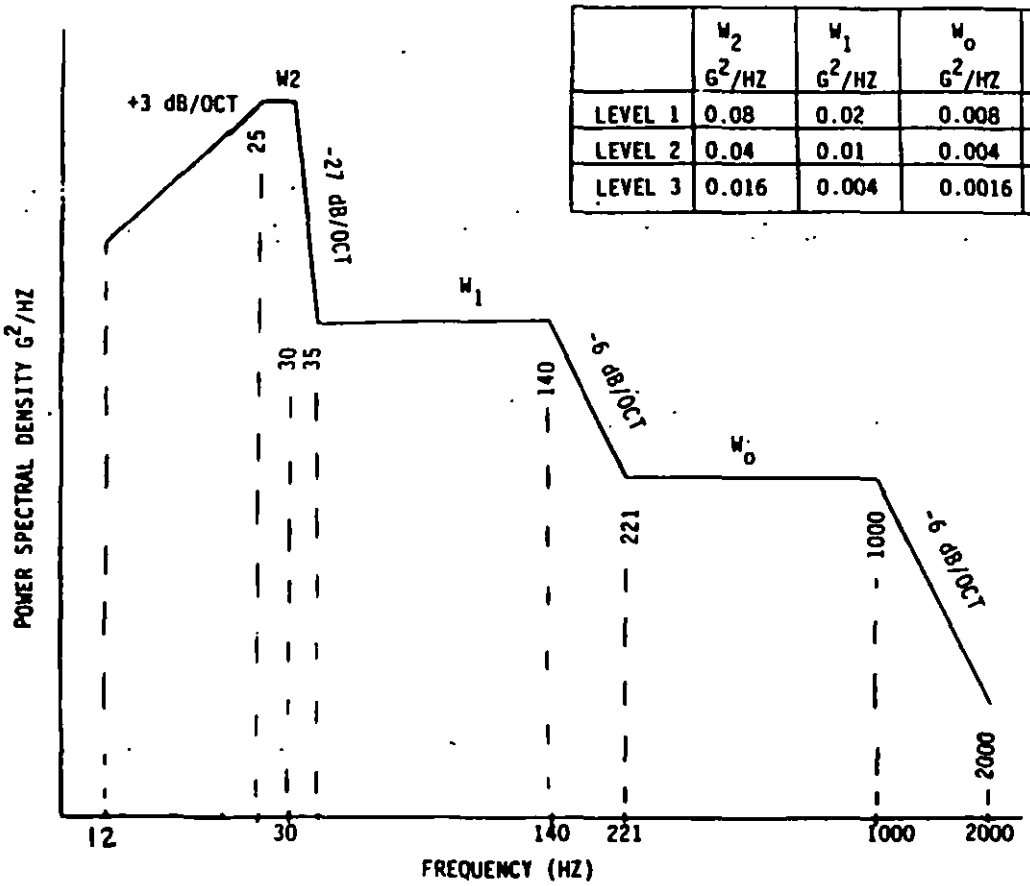


FIGURE 10. RDT/RQT vibration envelope.

4.2.4.1.4 Input voltage cycle. During the test, the input voltage shall be adjusted between 30.8 VDC, 28.0 VDC, and 25.2 VDC. The equipment shall be operated for 7.5 "On" hours (alternately) at each input voltage level.

4.2.4.1.5 Humidity insertion. A humidity dewpoint temperature of 31°C or greater shall be attained during the first three hours of the normal day as shown on figure 9.

4.2.5 Maintainability testing.

4.2.5.1 Initial bit assessment tests. When required by the acquisition activity, this test shall be conducted in accordance with MIL-STD-471 on each WRA. The purpose of this test is to identify at the earliest possible time any problems in the design regarding the built-in test capabilities of each WRA. These initial bit assessment tests shall verify compliance, for each WRA, with the requirements of 3.3.7.3 and 3.3.7.4, built-in-test (BIT). The ability of the functional (end-to-end) diagnostic program to detect and identify the failure shall be verified utilizing equipment test points as specified in MIL-STD-2076 and MIL-STD-2084, requirement 105. The status of the individual initial BIT assessment tests shall be available for inspection by the acquisition activity.

4.2.5.2 Maintainability demonstration. When required by the acquisition activity, the equipment shall be subject to a maintainability demonstration of the intermediate level requirements of 3.3.7.6.1 in accordance with MIL-STD-471, test method 9.

4.2.6 Tempest. The equipment shall be tested or analyzed to demonstrate compliance with the requirements of 3.2.5. A tempest test report shall be prepared by the contractor and submitted to the acquisition activity for approval.

4.3 Preproduction (first article) tests. Preproduction tests shall be conducted by the contractor on equipment representative of the production equipments to be supplied under the contract. These tests shall be accomplished under the approved procedure of 4.6. The Government representative and the acquisition activity shall be advised when tests are to be conducted so that representatives may witness them when so desired. Contractors not having adequate test facilities shall obtain the services of a commercial testing laboratory acceptable to the Government.

4.3.1 Preproduction (first article) test reports. The contractor shall submit all data collected in conducting these tests to the acquisition activity for review.

4.3.2 Scope of tests. Preproduction tests shall include all those deemed necessary by the acquisition activity to determine that the equipment meets all the requirements of this specification, other applicable specifications, and the contract. Preproduction tests also shall include environmental tests in accordance with the procedures of MIL-STD-810, except as modified in 4.3.2.1.1 through 4.3.2.1.10, an electromagnetic compatibility

test in accordance with MIL-STD-461B, part 2 as modified in 4.3.4, and a production reliability acceptance test.

4.3.2.1 Environmental tests. The equipment shall be tested to demonstrate compliance with the environmental requirements of 3.3.10. At the conclusion of the environmental tests, the equipment shall meet the requirements of 3.5.

4.3.2.1.1 Temperature-altitude. The equipment shall be tested in accordance with 4.3.2.1.1.1 through 4.3.2.1.1.4 below.

4.3.2.1.1.1 Pretest performance record (reference run). Prior to testing, the equipment shall be operated under standard ambient conditions (see 3.3.9) and a record made of all data necessary (including high and low input voltage/frequency conditions as applicable) to determine compliance with required performance. This data shall provide the criteria for checking satisfactory performance of the test item either during, or at the conclusion of the test, or both, as required.

4.3.2.1.1.2 Installation and check of test item in/on test facility. The equipment, with appropriate instrumentation, shall be installed in/on the test facility in a manner approximating service use. The equipment shall be operated and checked as required in 4.3.2.1.1.1 and such data recorded as is necessary to verify that the operational and performance characteristics have not been altered during installation in/on the test facility.

4.3.2.1.1.3 Temperature measurements. Thermocouples or equivalent temperature sensors shall be installed such that a thermal profile of the equipment may be developed. The measurement points shall be:

(a) One or more sensors in the ambient air within each major unit.

(b) On the largest transformer or inductor (except radio frequency inductors) or other large mass in each major unit.

(c) On the component(s) where the highest operating temperature is expected, except for vacuum tubes.

(d) On the component(s) whose temperature rise is likely to limit equipment performance.

4.3.2.1.1.4 Test Procedure. The test item shall be placed in the test chamber in accordance with 4.3.2.1.1.2, making connections and attaching instrumentation as necessary. In general, the testing schedule outlined in table XIV shall be followed. When changing chamber conditions from those required for any step to those required for any other step, in the sequence given in table XIV or in any sequence, the rates of temperature and pressure changes may be the maximum attainable by the chamber, but these rates shall not exceed 1° C (1.8° F) per second for airborne equipment (10° C (18° F) per minute for ground equipment) and 0.5 inch of mercury per second.

TABLE XIV. Test chamber conditions for temperature-altitude tests.

CLASS	STEP	1a	1b	2	3	4	5	6	7	8	9	10	11	12	13	14
1	TEMP (°C) ALT (FT) TIME	OMIT	-57 ATM 2 HR	-54 ATM . . .	-54 50,000 . . .	-10 ATM . . .	85 ATM 16 HR	55 ATM 4 HR	71 ATM 30 MIN	OMIT	30 40,000 4 HR	47 40,000 30 MIN	20 50,000 4 HR	35 50,000 30 MIN	OMIT	STANDARD AMBIENT CONDITIONS
1A	TEMP (°C) ALT (FT) TIME	OMIT	-57 ATM 2 HR	-54 ATM . . .	-54 30,000 . . .	-10 ATM . . .	85 ATM 16 HR	55 ATM 4 HR	71 ATM 30 MIN	OMIT	48 20,000 4 HR	64 20,000 30 MIN	40 30,000 4 HR	57 30,000 30 MIN	OMIT	
2	TEMP (°C) ALT (FT) TIME	OMIT	-57 ATM 2 HR	-54 ATM . . .	-54 70,000 . . .	-10 ATM . . .	95 ATM 16 HR	71 ATM 4 HR	95 ATM 30 MIN	OMIT	38 50,000 4 HR	60 50,000 30 MIN	10 70,000 4 HR	35 70,000 30 MIN	OMIT	
3	TEMP (°C) ALT (FT) TIME	OMIT	-62 ATM 2 HR	-54 ATM . . .	-54 80,000 . . .	-10 ATM . . .	125 ATM 16 HR	95 ATM 4 HR	125 ATM 30 MIN	150 ATM 10 MIN	60 50,000 4 HR	90 50,000 30 MIN	-10 100,000 4 HR	20 100,000 30 MIN	45 100,000 10 MIN	
4	TEMP (°C) ALT (FT) TIME	OMIT	-62 ATM 2 HR	-54 ATM . . .	-54 80,000 . . .	-15 ATM . . .	150 ATM 16 HR	125 ATM 4 HR	150 ATM 30 MIN	250 ATM 10 MIN	90 50,000 4 HR	115 50,000 30 MIN	25 100,000 4 HR	50 100,000 30 MIN	155 100,000 10 MIN	

Step 1 - With the item non-operating, adjust the chamber conditions to those specified for step 1 in table XIV. The test item temperature shall be stabilized and maintained for at least 2 hours. Where it is possible without changing the temperature condition, a visual inspection of the test item shall be made to determine whether or not deterioration which would impair future operation has occurred.

Step 2 - With the item non-operating, adjust the chamber conditions to those specified in step 2 in table XIV. After the test item temperature has stabilized, the test item shall be turned on at the lowest specified input voltage. The test item shall operate satisfactorily within the specified warm-up time. The test item shall then be turned off and restabilized at the temperature specified for step 2 in table XIV. The operation shall be repeated 2 more times (See Notes (a) and (b)). The chamber temperature shall be maintained at the temperature specified for step 2 in table XIV. Operation of the test item shall be continued, and during this period shall be checked to determine satisfactory operation and results recorded.

Step 3 - With the test item non-operating, permit the test item to stabilize at the temperature specified in step 3 of table XIV. The test item shall then be turned on and the altitude adjusted to that specified. Upon reaching the specified altitude, an operational and performance check shall be made at the highest specified input voltage and the result recorded.

Note (a) - Satisfactory operation within the specified warm-up time shall be determined by checking to see if the visual or aural presentation or other performance characteristics appear normal.

Note (b) - All characteristics which are likely to be affected by low temperatures shall be checked first. Should the time required to check the test item exceed 15 minutes beyond the warm-up time, the test item shall again be stabilized at the temperature specified for step 2 in table XIV and the operational check continued.

Step 4 - With the test item non-operating, adjust the chamber conditions to those specified for step 4 in table XIV. After test item temperature has stabilized the test chamber door shall be opened and frost permitted to form on the test item. The door shall remain open long enough for the frost to melt but not long enough to allow the moisture to evaporate. (See Note (c)). The chamber door shall be closed and the test item turned on at the highest specified input voltage to see if it operates satisfactorily within the specified warm-up time. The test item shall be turned on and off at least three times. (See Notes (a) and (d).)

Step 5 - With the test item non-operating, adjust the chamber conditions to those specified for step 5 in table XIV. The chamber temperature shall be stabilized and maintained for at least 16 hours. At the conclusion of this period the test item shall, when practicable, be visually inspected to determine the extent of any deterioration.

Step 6 - With the test item non-operating, adjust the chamber conditions to those specified for step 6 in table XIV. After the chamber conditions and

the test item temperature have stabilized, turn the test item on at the highest specified input voltage and permit it to operate continuously for 4 hours. Thermocouple readings of the test item shall be recorded at least every 30 minutes. At the end of the specified period of operation, and still at the specified chamber conditions, continue to operate the test item until it has been checked for satisfactory operation and results recorded.

Note (c) - When the chamber door is opened it is intended that frost will form; however, should the relative humidity of the air be such that frost will not form, artificial means shall be used to provide the relative humidity necessary to have frost form.

Note (d) - After completion of the cold test (steps 1, 2, 3, and 4), and prior to starting the high temperature tests, a reference run shall be made in accordance with 4.3.2.1.1.1. The reference run shall be made at the highest specified input voltages and data obtained compared with that of the reference run made prior to step 1.

Step 7 - With the test item non-operating, adjust the chamber conditions to those specified for step 7 in table XIV. After the chamber conditions and the test item temperature have stabilized, the test item shall be operated at the highest specified input voltage for four time periods as specified by table XIV. Each of the four periods of operation shall be followed by a 15 minute off period. The test item shall be checked for satisfactory operation during the first and last period of operation and results recorded. The thermocouple readings of the test item shall be recorded at least every 10 minutes.

Step 8 - With the test item non-operating, adjust the chamber conditions to those specified for step 8 in table XIV. After the chamber conditions and the test item temperature have been stabilized, the test item shall be operated for four 10 minute periods at the highest specified input voltage. Each of the four periods of operation shall be followed by a 15 minute off period. The test item shall be checked for satisfactory operation during the first and last periods of operation and the results recorded. Thermocouple readings of the test item shall be recorded at the beginning and end of each operating period.

Step 9 - With the test item non-operating, adjust the chamber temperature to that specified for step 9 of table XIV. After the test item temperature has stabilized, the test item shall be turned on at the highest specified input voltage and the altitude shall be adjusted to that specified. Following altitude stabilization, the test item shall be operated at the highest specified input voltage for 4 hours. Thermocouple readings of the test item shall be recorded at least every 30 minutes. At the end of the specified operating period, continue to operate the test item until it has been checked for satisfactory operation and results recorded.

Step 10 - With the test item non-operating, adjust the chamber temperature to that specified for step 10 of table XIV. After the test item temperature has stabilized, the test item shall be turned on at the highest specified input voltage and the altitude shall be adjusted to that specified.

Following altitude stabilization, the test item shall be operated at the highest specified input voltage for four time periods as specified by table XIV. Each of the four periods of operation shall be followed by a 15 minute off period. The test item shall be checked for satisfactory operation during the first and last period of operation and results recorded.

Step 11 - With the test item non-operating, adjust the chamber temperature to that specified for step 11 of table XIV. After the test item temperature has stabilized, the test item shall be turned on at the highest specified input voltage, and the altitude shall be adjusted to that specified. Following altitude stabilization, the test item shall be operated at the highest specified input voltage for 4 hours. Thermocouple readings of the test item shall be recorded at least every 30 minutes. At the end of the specified operating period, continue to operate the test item until it has been checked for satisfactory operation and results recorded.

Step 12 - With the test item non-operating, adjust the chamber temperature to that specified for step 12 of table XIV. After the test item temperature has stabilized, the test item shall be turned on at the highest specified input voltage and the altitude shall be adjusted to that specified. Following altitude stabilization, the test item shall be operated at the highest specified input voltage for four time periods as specified by table XIV. Each of the four periods of operation shall be followed by a 15 minute off period. The test item shall be checked for satisfactory operation during the first and last period of operation and results recorded.

Step 13 - With the test item non-operating, adjust the chamber temperature to that specified for step 13 of table XIV. After the test item temperature has stabilized, the test item shall be turned on at the highest specified input voltages and the altitude shall be adjusted to that specified. Following altitude stabilization, the test item shall be operated at the highest specified input voltage for four 10 minute periods. Each of the four periods of operation shall be followed by a 15 minute off period. The test item shall be checked for satisfactory operation during the first and last period of operation and results recorded.

Step 14 - With the test item operating, adjust the chamber conditions to standard ambient conditions. When the chamber and test item conditions have stabilized, an operational and performance check shall be made on the test item and results compared with the data obtained in 4.3.2.1.1.1.

Note (e) - To expedite the stabilization of the test item temperatures, chamber temperatures other than those specified in table XIV may be used.

Note (f) - The steps listed herein include certain essential test points on the operational requirements curves specified in MIL-E-5400. These curves define the required temperature-altitude operational envelopes for the applicable classes of equipment. In addition to the essential test points listed, any combination of conditions, in any sequence, within the design limitation envelopes as defined by the class of equipment or as modified by the equipment specification, may be chosen as additional operational test points.

Note (g) - Following those steps where a change in temperature at low pressure is specified, the pressure may be increased to ambient before changing the temperature and then returned to the specified altitude following temperature stabilization.

4.3.2.1.2 Humidity. The equipment shall be tested in accordance with MIL-STD-810, method 507.2 procedure III, except that the equipment shall be non-operating during exposure and shall be tested within one hour of completion of the tenth cycle.

4.3.2.1.3 Salt fog. The equipment shall be tested in accordance with MIL-STD-810, method 509.2 procedure I.

4.3.2.1.4 Shock. For shock testing, the shock pulse shape, amplitude, and time duration shall be as specified on figures 11 and 12.

4.3.2.1.4.1 Functional shock. The equipment shall perform as specified and shall not be damaged while being subjected to the basic design test of MIL-STD-810, method 516.3, procedure I.

4.3.2.1.4.2 Crash hazard. The equipment shall not break free of its mountings nor exhibit any failure of the mounting arrangement when subjected to the shock test as specified in MIL-STD-810, method 516.3, procedure V.

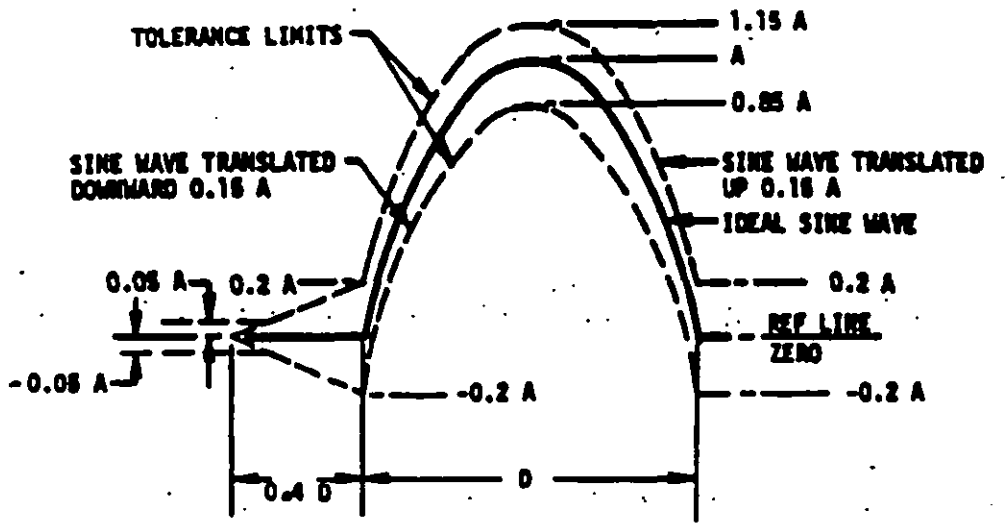
4.3.2.1.5 Vibration.

4.3.2.1.5.1 Sinusoidal vibration. The equipment shall operate as required when exposed to the sinusoidal vibration test specified in 4.3.2.1.5.2 through 4.3.2.1.5.11.

4.3.2.1.5.2 Method of attachment. The test specimen shall be attached directly to the vibration table or to an intermediate structure which is so designed as to be capable of transmitting the specified magnitudes of vibration to the points of specimen attachment throughout the required test frequency range.

4.3.2.1.5.3 Transducer mounting. The input monitoring transducer(s) shall be rigidly attached to the vibration table or to the intermediate structure if used at or as near as possible to the attachment point(s) of the test specimen.

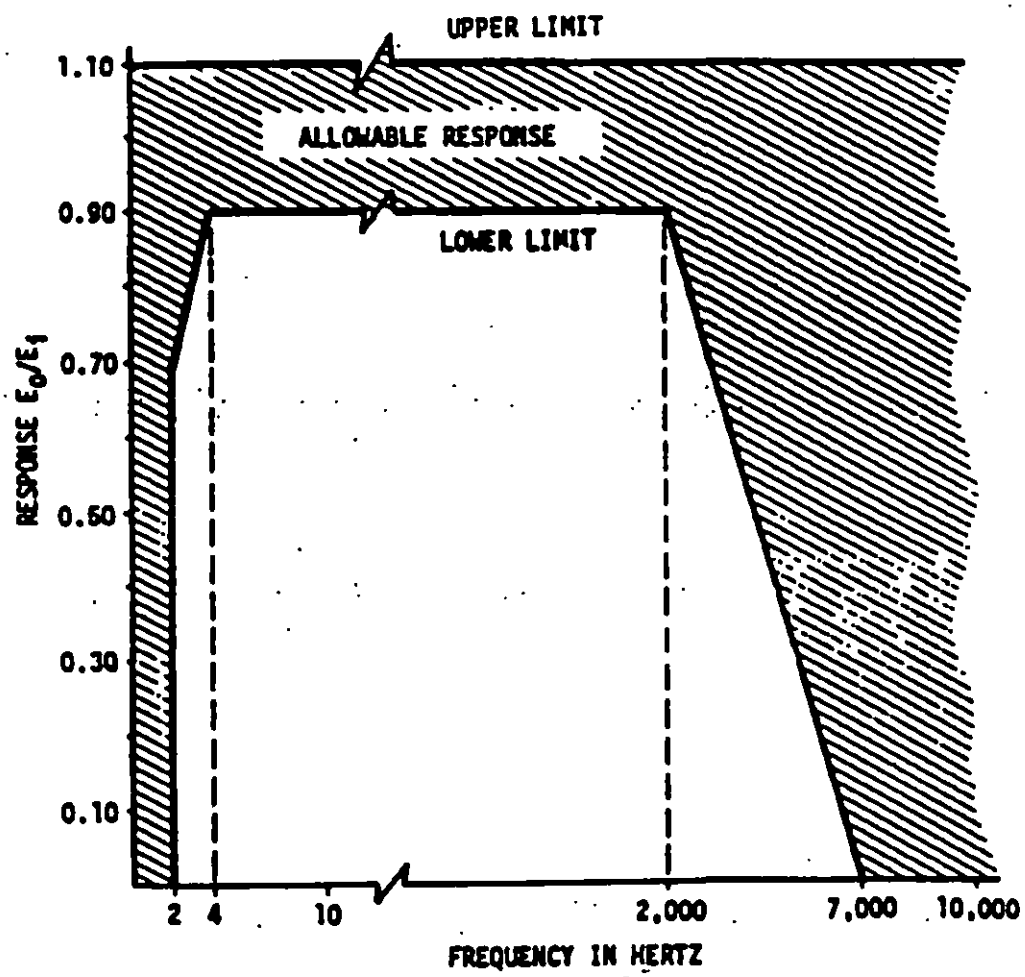
4.3.2.1.5.4 Input control. The vibratory levels of the specified test curve shall be maintained at the points of specimen attachment or as indicated in 4.3.2.1.5.3. For large test specimens having appreciable distance between attachment points, a transducer shall be used to monitor the input at each point. Regardless of the number of input transducers used, the average value of the absolute scalar magnitudes of all input transducer levels, monitored continuously and simultaneously, shall be that of the specified test curve. A tracking filter may be used in the control loop as necessary to maintain proper control accuracy when the control signal is noisy.



PART	TEST	PEAK VALUE (A) G'S	NOMINAL DURATION (D) MS (ALL TESTS)
I	BASIC DESIGN	15	11 ±1
II	CRASH SAFETY	30	11 ±1

The oscillogram shall include a time about 1D long with a pulse located approximately in the center. The acceleration amplitude of the ideal half sine pulse is A and its duration is D. Any measured acceleration pulse which can be contained between the broken line boundaries is acceptable. The instrumentation utilized to measure the above shock pulse shall have the frequency response as shown in figure 12.

FIGURE 11. Half Sine Shock Pulse Configuration and its Tolerance Limits.



The specified frequency response shall be obtained with the input and output circuits of the instrumentation system terminated by the input/readout devices used during the test.

FIGURE 12. Instrumentation System Frequency Response.

4.3.2.1.5.5 Resonant modes. A resonant mode shall be considered to be any frequency-dependent mechanical disturbance which can be detected visually, aurally or by means of other sensing devices. A resonant mode exists at any frequency at which the ratio of specimen response level to input level is at a peak such that both an increase and a decrease in the excitation frequency will produce a decrease in the specimen response level. The disturbance may also exhibit itself as an erratic sharp waveform, and in the specimen as erratic operation, deviation from required performance, or complete malfunction.

4.3.2.1.5.6 Weight compensation. Unless otherwise specified for items weighing more than 80 pounds, the vibratory acceleration may be reduced by 1g for each 20 pound increment of weight over 80 pounds. However, the vibratory acceleration shall in no case be less than 50 percent of the specified curve level. When a test item performance test is required during the vibration test and the duration of the performance test is greater than the duration of the vibration test, the performance test shall be abbreviated accordingly.

4.3.2.1.5.7 Sweep rate. For cycling tests, the rate of frequency change shall be logarithmic and shall be such that a complete cycle (5-500-5; 5-55-5) hertz (Hz) or (5-2000-5) Hz, will consume 15 or 20 minutes, respectively.

4.3.2.1.5.8 Increments. For cycling tests where a complete cycle is (5-55-5) Hz and logarithmic cycling is not available, the test shall be performed in three increments with the following linear rates. The cycle (5-15-5) Hz shall take 7 minutes, the cycle (15-25-15) Hz shall take 3 minutes, and the cycle (25-55-25) Hz shall take 5 minutes.

4.3.2.1.5.9 Cross talk. The transverse motion of the input monitoring point(s) shall be minimized, and shall be limited to 100 percent of the input motion.

4.3.2.1.5.10 Operational requirements. The equipment shall be operating during the vibration tests. The equipment shall provide specified performance during all steps except where noted.

4.3.2.1.5.11 Procedure. The equipment shall be mounted in accordance with 4.3.2.1.5.2. The mounting shall simulate service installation including all vibration mounts and other holding devices.

Step 1 - Resonance Survey. Resonant modes of the equipment shall be determined by varying the frequency of applied vibration slowly through the specified range along one of the three major mutually perpendicular axes at amplitudes not exceeding those for which the equipment is to be tested (See Note (a)).

Step 2 - Resonance Dwell Vibration. The equipment shall be vibrated along with the selected axis at each of the resonant mode frequencies determined in step 1 and at the amplitude indicated by figure 13 (See Note (a)). The time duration shall be as specified in table XV. During each resonant mode, a performance check shall be made and the results recorded. At

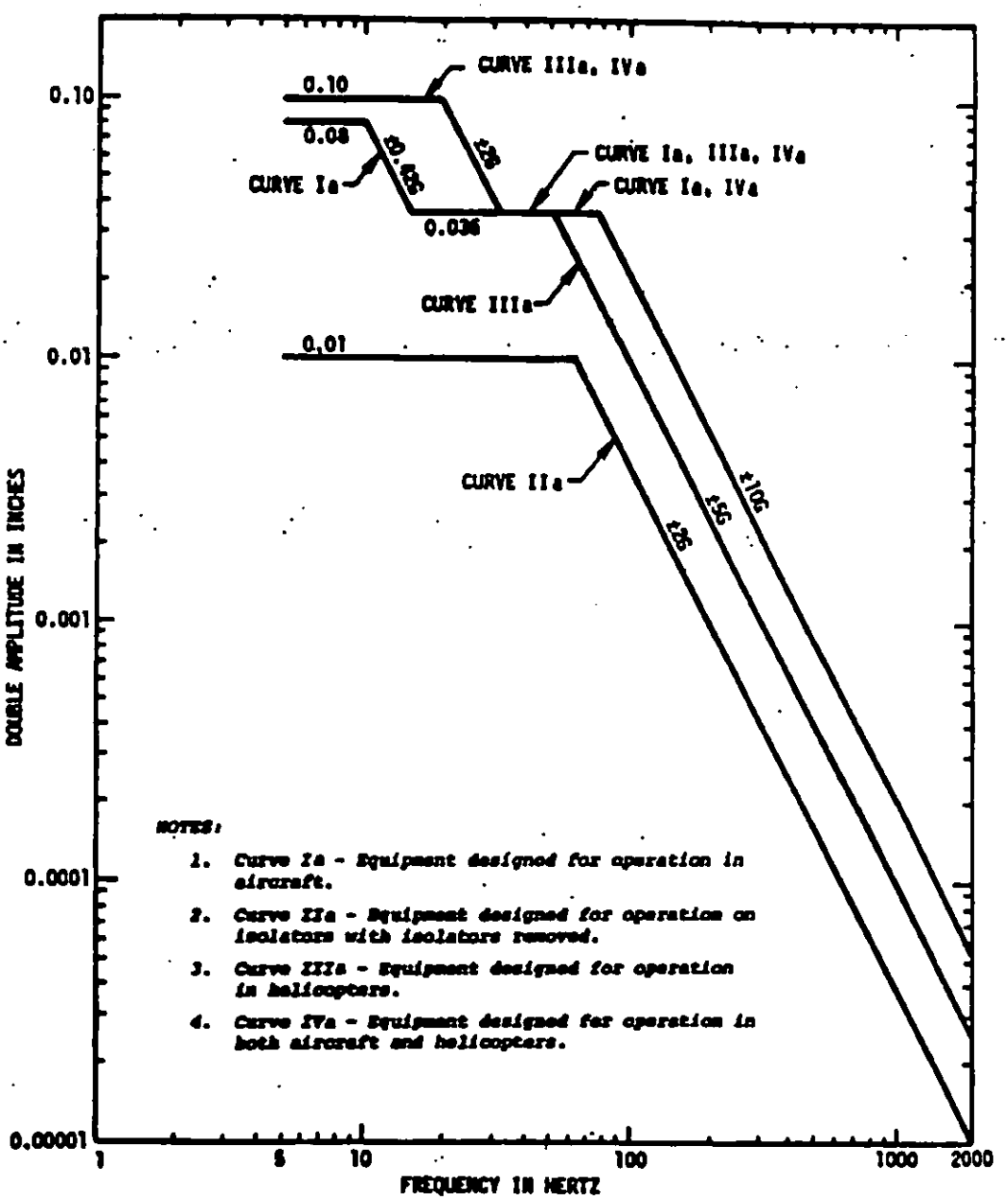


FIGURE 11. Sinusoidal Vibration Requirements.

the completion of this step, the equipment shall be closely inspected for any evidence of mechanical failure. If a change in the resonant frequency occurs during the test, its time of occurrence shall be recorded and the frequency shall be immediately adjusted to maintain the peak resonance condition. The final resonant frequency shall be recorded.

Note (a) - Step 1 may be completed for all three axes before proceeding with step 2.

TABLE XV. Vibration Test Schedule.
(Time shown refers to one axis of vibration)

No. of Resonances	0	1	2	3	4
Total Time at Resonance 1/	---	30 min.	1 hr.	1-1/2 hr.	2 hr.
Cycling Time 1/	3 hr.	2-1/2 hr.	2 hr.	1-1/2 hr.	1 hr.

1/ 30 minutes at each resonance, except that if more than four resonant modes are noted for any one axis, the time for each mode shall be 120/N minutes, where N is the number of modes. However, in no case shall the time for each mode be less than 20 minutes, nor shall the cycling time be less than one hour.

Step 3 - Cycling. The equipment shall be vibrated along the axis chosen for steps 1 and 2 with the frequency varying through the specified range, at the amplitudes indicated by the applicable curve of figure 13. The sweep rate shall be specified in 4.3.2.1.5.7. The test shall continue for the time specified in table XV. During the cycling test a performance check shall be made and the results recorded. At the completion of this step, the equipment shall be closely inspected for any evidence of mechanical failure.

Step 4 - Steps 1, 2, and 3 shall be repeated along one of the remaining major axes.

Step 5 - Steps 1, 2, and 3 shall be repeated along the third major axis. At the completion of this step, a performance check shall be made and the results recorded.

4.3.2.1.6 Explosive atmosphere. The equipment shall be tested in accordance with MIL-STD-810, method 511.2, procedure I.

4.3.2.1.7 Temperature shock. The equipment shall not suffer damage or subsequently fail to provide the performance specified while being subjected to temperature shock as specified in MIL-STD-810, Method 503.2, Procedure I. The low temperature is -54°C and the high temperature is +71°C.

4.3.2.1.8 Fungus. This requirement shall be fulfilled upon the contractors certification that the materials used do not support the growth of fungus.

4.3.2.1.9 Rain. The remote control and the indicator shall be tested in accordance with MIL-STD-810, method 506.2.

4.3.2.1.10 Sand and dust. The equipment shall be tested to demonstrate compliance with the requirements of MIL-STD-810, method 510.2.

4.3.2.2 Verification of required performance by similarity or analysis. With the approval of the acquisition activity, the requirements of 4.3.2.1.8 through 4.3.2.1.10 may be satisfied by analysis or similarity to units that have been previously subjected to the test. Documentation in support of all findings shall be made available to the acquisition activity (see 6.2.2).

4.3.3 Preproduction (first article) approval. Approval of the preproduction sample shall be by the acquisition activity upon satisfactory completion of all tests. No production equipments shall be delivered prior to this approval. Prefabrication of production equipment prior to the approval of the preproduction sample is at the contractor's own risk. The approved preproduction sample shall be retained by the contractor for his use in the fabrication and testing of equipment to be submitted for acceptance. The preproduction samples shall not be considered as among the equipments under the contract.

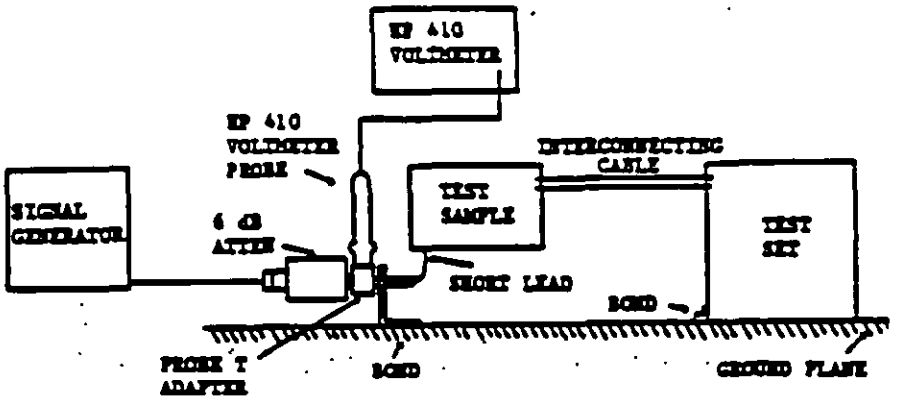
4.3.4 Electromagnetic interference (EMI) tests. Compliance with the requirements of 3.3.6 and its subparagraphs shall be demonstrated by tests. These tests shall be performed in accordance with MIL-STD-462 notice 2 as modified by this section.

4.3.4.1 EMI test plan. The supplier shall perform EMI tests in accordance with an EMI test plan. Said test plan shall describe all EMI tests required to demonstrate compliance with the requirements of 3.3.6 and shall address all anomalies, inconsistencies, and omissions (if any). Said test plan shall detail a combination of operating modes and frequencies to be tested. Said combination must represent all operating modes of the radio and at least three frequencies (as defined in MIL-STD-449, 3.20.1) in each major frequency band defined in 3.5.1.1. Said test plan must be approved by the acquisition activity prior to the commencement of EMI testing.

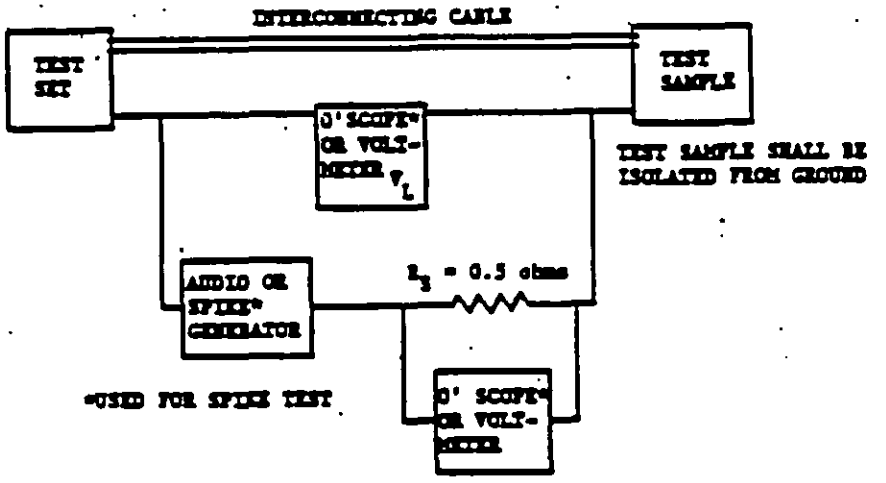
4.3.4.2 CE01 AND CE03 test procedure. The requirements of 3.3.6.2 shall be demonstrated using MIL-STD-462 notice 2 test methods CE01 and CE03 for all power leads and MIL-STD-462 notice 2 test methods CE02 and CE04 for all control and signal leads tested.

4.3.4.3 Ground plane interference. The requirements of 3.3.6.5 shall be demonstrated by test using the setup shown in figure 14. In addition to the susceptibility criteria of 3.3.6.4, the radio shall be tested with another radio set for voice communication intelligibility, i.e., "talked out". The second radio set transmitter output shall be attenuated to provide a low level signal (not to exceed 20 microvolts input to the receiver under test).

4.3.4.4 Emission control. The requirements of 3.3.6.9 shall be demonstrated by test. Said demonstration may use a combination of RE02 and CE06 key-up data with suitable analysis to show compliance.



GROUND PLANE INTERFERENCE TEST SETUP (0.05 to 100 MHz)



GROUND PLANE INTERFERENCE TEST SETUP SPIKE TEST AND 320 Hz TO 50 kHz TEST

FIGURE 14. Ground plane interference test set-up.

4.3.4.5 Spectrum signature. The supplier shall perform tests in accordance with a spectrum signature plan devised to provide that information required for support of the frequency allocation application of 3.3.6.10. This plan shall use MIL-STD-449 as a basic guideline, but shall include only those test procedures required to provide said support. The use of EMI data gathered during MIL-STD-461 and MIL-STD-462 testing is authorized so long as the data are directly applicable.

4.3.4.6 CE07 test procedures. The contractor shall devise a test to demonstrate compliance with the requirements of 3.3.6.2. This test shall be included as part of the EMI test plan.

4.3.4.7 CS11 test procedures. The CS11 requirements of 3.3.6.3 shall be demonstrated using MIL-STD-462, notice 5 test methods.

4.3.5 Random vibration test. A random vibration test shall be conducted as specified in 4.3.5.1 through 4.3.5.4.

4.3.5.1 Test item operation. The test item shall be operated during application of random vibration so that the functional effects caused by these tests may be evaluated. Both functional and endurance vibration tests shall be conducted. The test item shall meet performance requirements, as specified, while the functional vibration levels are being applied and immediately preceding and following the application of the endurance levels.

4.3.5.2 Mounting techniques. The test item shall be attached by its normal mounting means, either directly to the vibration exciter or transition table or by means of a rigid fixture capable of transmitting the vibration conditions specified herein. Precautions shall be taken in the establishment of mechanical interfaces to minimize the introduction of extraneous responses in the test setup. The test load shall be distributed as uniformly as possible on the vibration exciter table in order to minimize the effects of unbalanced loads. The input control sensing device(s) shall be rigidly attached to the vibration table, or fixture if used, as near as possible to the attachment point(s) of the test item. Additional vibration sensors shall be located in or on the test item to determine resonant frequencies and amplification factors. Locations to be selected should include main structure, printed circuit boards, large components, and modules, where practicable. The sensor sizes and weights shall be limited so that their effects on the dynamic responses being measured are minimal.

4.3.5.3 Performance of test. The individual equipment test item shall be subjected to broadband random vibration excitation with the power spectral density levels specified in 4.3.5.4 and power spectral density envelope shown on figure 15. The test item shall be attached to the vibration exciter according to 4.3.5.2. Vibration shall be applied sequentially along each of the three orthogonal axes of the test item. Two test levels are required, a functional level and an endurance level. For each axis, one half of the functional test shall be conducted first, then the endurance test, followed by the second half of the functional test. The equipment shall perform according to the equipment specification operating requirements specified in 4.3.5.1. The acceleration power spectral density (G^2/Hz) of applied vibration, as

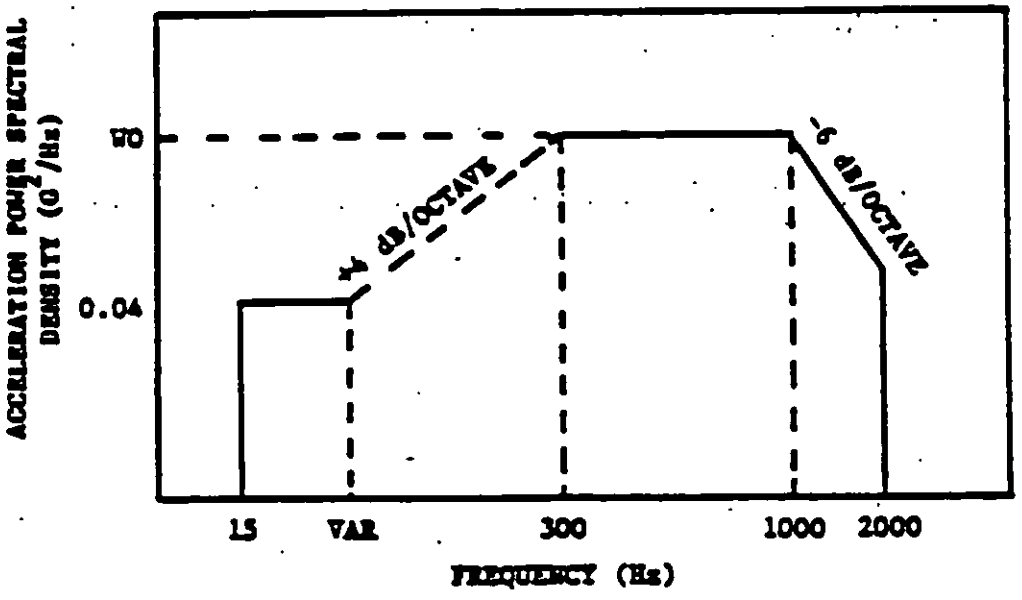


FIGURE 15. Random vibration envelope.

measured on the test fixture at mounting points of the test item, shall be as specified in 4.3.5.4.

Test times shall, for each axis, be one hour each for functional and endurance levels. The instantaneous random vibration acceleration peaks may be limited to three times the RMS acceleration level. The power spectral density of the test control signal shall not deviate from the specified requirements by more than +3.0 , -1.5 dB below 500 Hz and ± 3 dB between 500 and 2,000 Hz, except that deviations as large as ±6 dB shall be allowed over a cumulative bandwidth of 100 Hz maximum, between 500 and 2,000 Hz.

Tolerance levels in terms of dB are defined as follows:

$$dB = 10 \ LOG_{10} \ (W_1/W_0)$$

Where W_1 = measured acceleration power spectral density in G^2/Hz units. The term W_0 defines the specified level in G^2/Hz units. Confirmation of these tolerances shall be made by use of an analysis system providing statistical accuracies corresponding to a bandwidth-time (BT) constant product, BT = 50 minimum. Specific analyzer characteristics shall be as specified below or equivalent, subject to the minimum limitation of BT = 50.

(a) On-line, contiguous filter, equalization/analysis system having a bandwidth as follows:

B = 25 Hz, maximum between 20 and 200 Hz
B = 50 Hz, maximum between 200 and 1,000 Hz
B = 100 Hz, maximum between 1,000 and 2,000 Hz

(b) Swept frequency analysis system characterized as follows:

(1) Constant bandwidth analyzer

a. Filter bandwidth as follows:

B = 25 Hz, maximum between 20 and 200 Hz
B = 50 Hz, maximum between 200 and 1,000 Hz
B = 100 Hz, maximum between 1,000 and 2,000 Hz

b. Analyzer averaging time = T = 2 RC = 1 second, minimum, where T = true averaging time constant

c. Analysis sweep rate (linear)

$$= \frac{B}{4RC} \text{ or } \frac{B^2}{8} \text{ (Hz/second)}$$

(2) Constant percentage bandwidth analyzer

a. Filter bandwidth = PFC = one-tenth of center frequency maximum (0.1FC) where P = percentage and FC = analyzer center frequency

b. Analyzer averaging time = T = 50 milliseconds, minimum

c. Analysis sweep rate (logarithmic)

$$= T = \frac{PFC}{4RC} \text{ OR } \frac{(PFC)^2}{8} \cdot (Hz/second),$$

maximum, whichever is smaller.

d. Digital power spectral density analysis employing quantization techniques providing accuracies corresponding to the above approach.

4.3.5.3.1 Worst case axis. During the vibration testing, data shall be obtained to identify the worst case axis for vibration screening tests on production equipments.

4.3.5.4 Test levels. For the random vibration test, the following test levels shall be used:

Functional level - .05 G^2/Hz (8.5 G RMS minimum)
Endurance level - .12 G^2/Hz (12.7 G RMS minimum)

4.3.6 Reliability qualification test (RQT). When required by the acquisition activity, a reliability qualification test shall be performed as part of the preproduction tests. Four equipment systems shall be tested in accordance with MIL-STD-781 as modified herein. Each equipment shall have successfully completed the normal burn-in of 4.5.1.3 and the all equipment test (AET) of 4.5.3.1 prior to the start of RQT. The mission profile test cycle shall begin at the "12 hour" point of figure 9. Random vibration shall be applied with the units hard-mounted (using a MT-6567/ARC mount). Vibration shall be applied to the worst case axis as determined per 4.3.5.3.1. The power spectral density levels shall be in accordance with figure 10. Test plan IVC of MIL-STD-781 shall be used. MIL-STD-2074 failure criteria shall apply.

4.3.7 Production equipments. Equipment supplied under the contract shall in all respects, including design, construction, workmanship, performance, and quality, be equivalent to the approved preproduction sample. Each equipment shall be capable of successfully passing the same tests as imposed on the preproduction sample. Evidence of noncompliance with the above shall constitute cause for rejection.

4.4 Initial production tests. When required by the acquisition activity, one of the first ten production equipments shall be selected and sent at the contractor's expense to a designated Government laboratory for test. This equipment shall be selected by the acquisition activity after it has successfully passed all individual tests. No other tests shall be conducted on equipment prior to starting the initial production tests. The preproduction sample shall not be selected for this test.

4.4.1 Scope of tests. This equipment may be subjected to any and all tests the acquisition activity deems necessary to assure that the production equipment is equivalent to the previously approved preproduction sample in design, construction, workmanship, performance, and quality, and that it meets all applicable requirements.

4.4.2 Accessory material. In addition to the complete equipment submitted for initial production tests, the contractor shall also submit such accessory material and data necessary to test the equipment.

4.4.3 Initial production sample approval. Approval of the initial production sample shall be by the acquisition activity upon satisfactory completion of all tests. Any design, material, or performance defect made evident during the test shall be corrected by the contractor to the satisfaction of the acquisition activity. Failure of the initial production sample to pass any of the tests shall be cause for deliveries of equipment under the contract to cease until proper corrective action is approved and accomplished. Corrective action shall also be accomplished on equipment previously accepted when requested by the acquisition activity.

4.4.4 Reconditioning of initial production test sample. On completion of the initial production test, the equipment shall be reworked by the contractor by replacing all limited life or damaged items. After reworking, the contractor shall resubmit the equipment for acceptance.

4.5 Acceptance tests and environmental stress screening (ESS). The contractor shall furnish all samples and shall be responsible for accomplishing the acceptance tests. All inspection and testing shall be under the supervision of the Government representative. Contractors not having adequate facilities for conducting all required tests shall engage the services of a commercial testing laboratory acceptable to the Government. The contractor shall furnish test reports showing quantitative results for all acceptance tests. Such reports shall be signed by an authorized representative of the contractor or laboratory, as applicable. Acceptance or approval of material during the course of manufacture shall not be construed as a guarantee of the acceptance of the finished product. Acceptance tests shall consist of the following:

(a) Individual tests (see 4.5.1)

(b) Sampling tests (see 4.5.2)

(c) Reliability assurance tests (see 4.5.3)

(d) Special tests (see 4.5.4)

(e) Computer program testing (see 4.5.5)

4.5.1 Individual tests. Each equipment submitted for acceptance shall be subjected to the individual tests. The tests shall be adequate to determine compliance with the requirements of materials, workmanship, operational adequacy, and reliability. Prior to the tests, each equipment

shall have been preconditioned in accordance with paragraph 4.5.1.3. As a minimum, each equipment accepted shall have passed the following tests:

(a) Examination of product (see 4.5.1.1)

(b) Operational test (see 4.5.1.2)

(c) Environmental stress (see 4.5.1.3)

4.5.1.1 Examination of product . Each equipment shall be carefully examined to determine that the material and workmanship requirements have been met.

4.5.1.2 Operational test. Each equipment shall be operated long enough to permit its temperature to stabilize and to check sufficient characteristics and record adequate data to assure satisfactory equipment operation. Software and bit functions shall be tested in accordance with MIL-STD-471 addendum A and MIL-STD-1679.

4.5.1.3 Environmental stress screening. In addition to any other burn-in, the equipment shall be subjected to environmental stress screening (ESS)/burn-in in accordance with task 301 of MIL-STD-785 prior to undergoing sample tests or reliability assurance tests. ESS screening/burn-in shall consist of WRA random vibration and temperature cycling. SRAs sold as spares shall also have undergone the ESS of equivalent severity to the ESS specified herein.

4.5.1.3.1 WRA random vibration. Prior to conducting WRA temperature cycling, each WRA shall have completed 10 minutes failure-free vibration screen at 6.3 G in accordance with figure 16. Power spectral density shall cover 20-2000 Hz. Pseudo-random vibration methods are acceptable. WRA's in which commercial parts are used shall also be subjected to a 1.5-hour period of random vibration. This vibration period shall be performed at the mid-point of the WRA burn-in in accordance with figure 17.

4.5.1.3.2 RT temperature cycling. Each WRA shall undergo 25 temperature cycles between -54°C and +71°C. The rate of temperature change between extremes shall be at least 5°C per minute. When the WRA temperature has stabilized within 5°C of either temperature extreme, the WRA shall be soaked. Hot soak at +71°C shall be two hours; cold soak at -54°C duration shall be one hour. At the conclusion of each soak, the next temperature ramp shall begin. The WRA shall be energized throughout temperature cycling except during the cool down period from +71°C to -54°C and during the 60 minute soak at -54°C. In addition, the WRA shall be turned off for one minute at points 30, 60 and 90 minutes into each hot soak period. Equipment performance shall be checked periodically during each cycle and repairs shall be made to correct failures. The last five consecutive temperature cycles shall be failure-free. One temperature cycle is defined as: operation at +71°C for the 120 minute hot soak (including three minutes "off"), non-operational cool down to -54°C, 60 minutes non-operational cold soak at -54°C, operational temperature increase to +71°C.

4.5.1.3.3 Control/indicator temperature cycling. Each WRA shall undergo the same temperature cycling specified in 4.5.1.3.2 except that the upper temperature extreme shall be not less than +55°C.

4.5.1.3.4 Board and SRA temperature cycling. Each populated printed circuit board on which one or more commercial components is mounted shall undergo 44 temperature cycles between -65°C and +100°C with at least 15°C per minute rate of change. The last nine cycles shall be failure free. Each SRA in which one or more commercial parts is used shall be subjected to 16 temperature cycles between -54°C and +95°C with at least 15°C per minute rate of change. The last 3 cycles shall be failure-free.

4.5.2 Sampling tests. Equipments shall be subjected to sampling tests; these equipments shall first, however, have passed the individual tests. Equipments shall be selected for sampling tests by the customer or customer representative in accordance with the following:

Quantity of Equipments Offered for Acceptance	Quantity to be Selected for Sampling Test
First 10	1*
Next 50	1
Next 75	1
Next 100	1
Each additional 200	1
	1 for each additional 200 or fraction thereof

* One out of first ten need not be selected and tested if initial production tests are conducted. Sampling tests are not required when reliability assurance tests are conducted.

4.5.2.1 Scope of tests. As a minimum, each equipment selected shall be subjected to the following sampling tests:

(a) Complete operational test at ambient room conditions, making all necessary measurements to assure that all applicable specification requirements have been met.

(b) Complete operational test at certain environmental conditions. The conditions may vary for each equipment tested and should be based on results of the preproduction, initial production, individual, and special test.

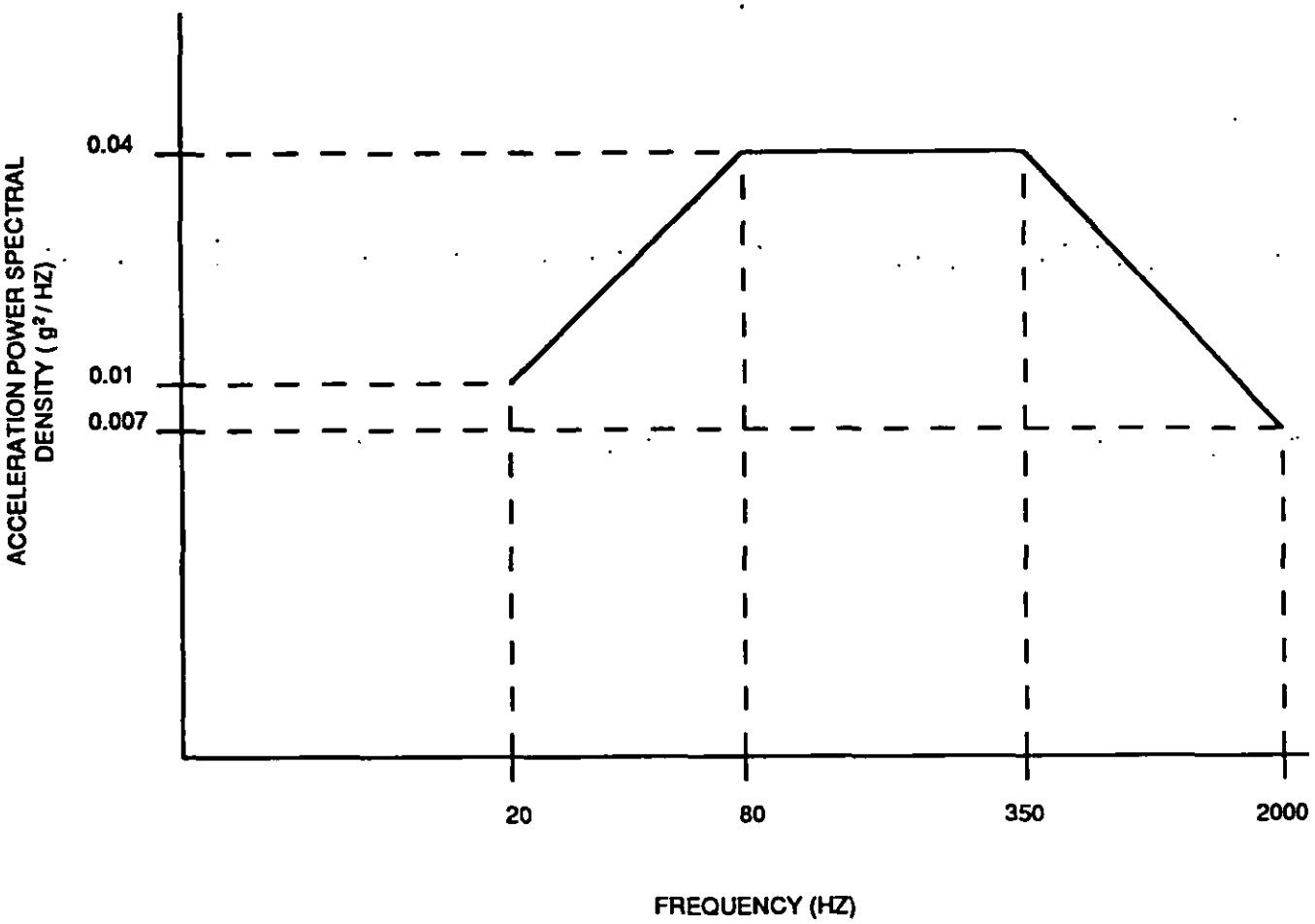
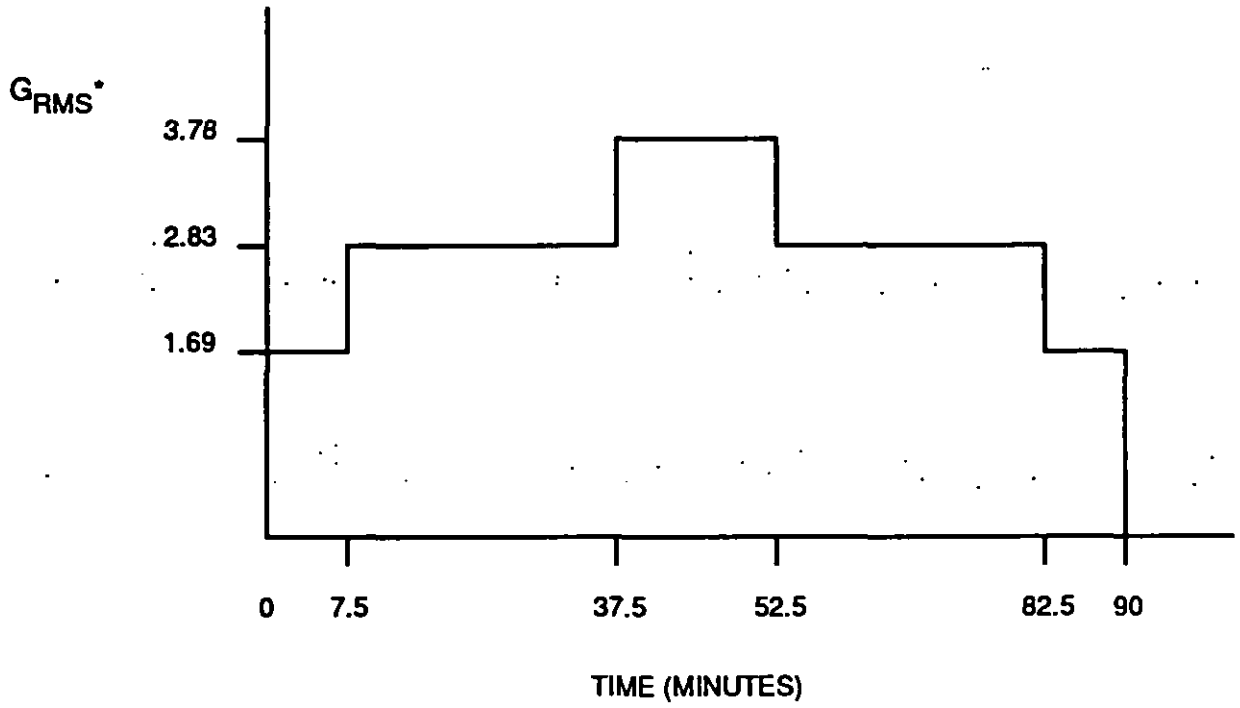


FIGURE 16. ESS 10 minute random vibration envelope - (see 4.5.1.3.1).



* VIBRATION LEVELS ROUDED TO ONE DECIMAL PLACE ARE ACCEPTABLE. VIBRATION LEVELS SHALL BE MONITORED AND MAINTAINED WITHIN ±1.5dB OF THE NOMINAL VALUES.

FIGURE 17. Three-step random vibration profile - (see 4.5.1.3.1).

(c) Complete all equipment test specified in 4.5.3.1. Each failure shall be analyzed as to cause and remedial action taken to reduce the possibility of its recurring in future equipment.

4.5.3 Reliability assurance tests. Reliability assurance tests shall be conducted using MIL-STD-781. Classification of failures shall be in accordance with MIL-STD-2074.

4.5.3.1 All equipment test. Each equipment, throughout production, shall be tested as specified in MIL-STD-781 (as modified herein). Each equipment (WRA) produced (inclusive of each SRA contained therein) shall be tested for at least 125 operating hours with the last two cycles failure-free. The MTBF for the specified group of designated equipment shall be listed in 3.3.2.3. To determine whether the MTBF is being met at any time during the contract, the operating test hours and the failures therein (not counting burn-in failures or burn-in operating time) shall be totaled and the results compared with the reject line of test plan XVIIIC of MIL-STD-781. (Extend the line as necessary to accommodate the data.) These totals shall accumulate so that at any one time the experience from the beginning of the contract is included. In addition, a 3 month moving average MTBF shall be maintained to be compared to the reject line of test plan XVIIIC of MIL-STD-781. At any time that the current totals of all operating test hours and test failures since the beginning of AET testing on WRAs along with the 3 month accumulated operating test hours and test failures plotted on the test plan XVIIIC curves show a reject situation, the acquisition activity shall be notified.

4.5.3.2 Test details. Test details such as the length of the test cycle, environmental conditions, performance characteristics to be measured, special failure criteria, preventive maintenance to be allowed during the test etc., shall be part of the test procedures to be submitted and approved by the acquisition activity prior to the beginning of the qualification test phase of the reliability assurance tests.

4.5.3.3 Reliability assurance for spares and repair parts. Portions of the equipment, components, or parts that are supplied as spares or repair parts shall receive a reliability screening test. This test shall not be less in duration nor in severity of stress than the same item received when tested as an integral portion of the system in which it was installed. Details of the reliability screening test to be performed shall be included in the reliability program plan and the contractor's test procedures.

4.5.4 Special tests. Special tests shall be conducted to check the effect of any design or material change on the performance of the equipment and to assure adequate quality control. The equipment selected for special tests may be selected from equipments previously subjected to the sampling or reliability assurance tests.

4.5.4.1 Special test schedule. Selection of equipments for special tests shall be made as follows:

(a) On an early equipment after an engineering or material change

(b) Whenever failure reports or other information indicate that additional tests are required. (This will be determined by the acquisition activity.)

4.5.4.2 Scope of tests. Special tests shall consist of those approved by the acquisition activity. Test procedures previously approved for the preproduction tests shall be used when applicable; when not applicable, the contractor shall prepare a test procedure and submit it to the acquisition activity for approval prior to conducting the tests.

4.5.5 Computer program tests. When required by the acquisition activity, all computer programs (including firmware) developed for or in support of the equipment covered by this specification shall be subjected to the following tests in accordance with MIL-STD-1679:

(a) Requirements from section 3 of this specification that are partially or completely implemented in software.

(b) Quality assurance tests in compliance with MIL-STD-1679, 5.10.

Details of the required testing shall be as provided in the corresponding computer program test plan and computer program test procedures documents, which shall be subject to approval by the acquisition activity.

4.5.6 Equipment failure. Should a failure occur during either the individual sampling, reliability assurance, special tests, or computer program test the following actions shall be taken:

(a) Determine the cause of failure and the equipment BIT performance in detecting and isolating the failure.

(b) Determine if the failure is an isolated case or design defect.

(c) Submit to the acquisition activity for approval proposed corrective action intended to reduce the possibility of the same component or BIT failure(s) occurring in future tests or documented justification when no corrective action is proposed.

(d) Where practical, include in the individual test an all equipment check for those requirements until reasonable assurance is obtained that the defect has been satisfactorily corrected.

(e) Failures determined to be caused by software shall also be categorized in accordance with MIL-STD-1679.

4.5.7 Failure classification. All incidents occurring during reliability assurance tests shall be classified and reported as either relevant or non-relevant in accordance with MIL-STD-2074 and MIL-STD-781. Failure classification is subject to Government approval. Only those incidents classified as relevant failures shall be accountable for making an accept/reject decision.

4.5.7.1 Relevant failures. All test incidents shall be considered as relevant failures unless determined to be non-relevant in accordance with the criteria of MIL-STD-2074.

4.5.7.2 Non-relevant failures. Although non-relevant failures are not used for reliability assurance test accept/reject decisions, all test article incidents and equipment failures shall be recorded and reported.

4.6 Test procedures. The procedures used for conducting all tests required by section 4.0 shall be prepared by the contractor and submitted to the acquisition activity for review and approval. The right is reserved by the acquisition activity or the Government representative to modify the tests or require any additional tests deemed necessary to determine compliance with the requirements of this specification or the contract. MIL-T-18303 shall be used as a guide for preparation of test procedures. When approved test procedures are available from previous contracts, such procedures will be provided and may be used when approved by the acquisition activity; however, the acquisition activity reserves the right to require modification of such procedures, including additional tests, when deemed necessary.

4.7 Reconditioning of tested equipment. Equipment that has been subjected to initial production and acceptance tests shall be reconditioned by the contractor by replacing all worn or damaged items. After reworking, the contractor shall resubmit the equipment for acceptance.

4.8 Presubmission testing. No item, part, or complete equipment shall be submitted by the contractor until it has been previously tested and inspected by the contractor and found to comply, to the best of his knowledge and belief, with all applicable requirements.

4.9 Rejection and retest. Equipment that has been rejected may be reworked or have parts replaced to correct the defects and may be resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished to the Government inspector.

4.10 Testing of spare and repair parts. Portions of the equipment delivered as spare or repair parts shall undergo acceptance tests to ensure that the items meet performance and reliability requirements that are not less than those imposed in the original production.

4.10.1 Weapons replaceable assemblies (WRAs). All items to be delivered as spares at the WRA or higher level shall receive performance, ESS, and all equipment tests commensurate with those afforded the original production equipment.

4.10.2 Shop replaceable assemblies (SRAs). All items to be delivered as spares at the SRA or sub-SRA level shall receive functional checks, ESS, and failure-free test cycles under conditions and for a duration commensurate with those imposed on these assemblies in the original production.

4.10.3 Repair parts. All electronic component parts to be delivered as repair parts shall receive functional and screening tests equivalent to those imposed on the parts when they were delivered as components of the system. However, when less than 50 pieces of a particular component are supplied, standard functional tests and screening may be used, provided they are at least as severe as the original screening tests.

4.10.4 Test details. The details of acceptance tests to be performed on items supplied as spare or repair parts shall be incorporated into item specifications and drawings.

5. PACKAGING

5.1 General. All major units and parts of the equipment shall be preserved, packaged, packed, and marked for the level of shipment specified in the contract or order in accordance with specifications MIL-E-17555 and MIL-STD-2073. In the event the equipment is not covered in specification MIL-E-17555, the method of preservation for level a shall be determined in accordance with the selection chart in MIL-STD-2073, appendix D.

6. *NOTES*

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The AN/ARC-210(V) radio set shall be of a variable configuration using common modules that can be used to meet the prime and back-up UHF AM voice plus prime UHF/VHF/AM/FM/ECCM voice and data communication requirements in any tactical aircraft. The variable configurations are intended to provide functional replacement of one AN/ARC-182(V), AN/ARC-159, AN/ARC-159(V)1, or AN/ARC-159(V)2 radio in aircraft equipped with one or more of these radios. They are intended for production incorporation in all new aircraft plus retrofit in selected "out-of-production" aircraft.

6.2. Acquisition requirements. Acquisition documents must specify the following:

(a) Title, number, and date of this specification
(b) Equipment title and type designations
(c) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of the individual documents referenced (see 2.1.1 and 2.2)
(c) Panel light color (red, white, or night vision)
(d) Selection of applicable levels of packaging and packing (see paragraph 5.1).

6.3 Consideration of data requriements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data

are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD FORM 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD FORM 1423.

Reference Paragraph	DID Number	DID Title
3.2.1	DI-MISC-80071A	Part approval request
4.6	DI-T-4903	Production/acceptance inspection procedures
4.3.1 4.3.2	DI-NDTI-80809A	Test/inspection reports
3.3.8	DI-CMAN-80194	Request for confirmation of nomenclature
3.3.8.1	DI-CMAN-80195	Request for assignment of serial number and serial number prefix letters
3.3.8	DI-CMAN-80196	Request for approval of identification plate drawings
3.3.8	DI-E-7194	Request for nomenclature (DD Form 61)
4.3.4.1	DI-EMCS-80201	Electromagnetic interference test plan
4.3.1	DI-EMCS-80200	Electromagnetic interfernce test report
4.6	DI-RELI-80251	Reliability test procedures
4.1	DI-RELI-80252	Reliability test reports
4.5.7	DI-RELI-80253	Failed item analysis report
4.10.4	DI-DRPR-81000	Product drawings, engineering and associated lists
4.6	DI-NDTI-800603	Test procedures
3.3.6.10	DI-MISC-81174	Frequency allocation data

The above DID's were those cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.3.1 Options. The following options are available:

(a) Inclusion of frequency chart (see 3.5.1.7)

(b) Design approval tests (see 4.2)

(c) Reliability development growth test (see 4.2.4)

(d) Initial bit assessment tests (see 4.2.5.1)

(e) Maintainability demonstration (see 4.2.5.2)

(f) Reliability qualification test (see 4.3.6)

(g) Computer program tests (see 4.5.5)

6.4 Precedence of documents. When the requirements of the contract, this specification, or applicable subsidiary specifications are in conflict, the following precedence shall apply:

(a) Contract. The contract shall have precedence over any specification.

(b) This specification. This specification shall have precedence over all applicable subsidiary specifications. Any deviation from this specification, or from subsidiary specifications where applicable, shall be approved in writing by the acquisition activity.

(c) Referenced specifications. Any referenced specification shall have precedence over all applicable subsidiary specifications referenced therein, and shall apply to the extent specified.

6.5 Performance objectives. Minimal size and weight, simplicity of operation, ease of maintenance, and an improvement in the performance and reliability of the specific functions beyond the requirements of this specification are objectives that shall be considered in the production of this equipment. Where it appears a substantial reduction in size and weight or improvement in simplicity of design, performance, ease of maintenance, or resultant reliability would result from the use of materials, parts, and processes other than those specified in MIL-E-5400, their use should be investigated. When investigation shows advantages can be realized, a request for approval shall be submitted to the acquisition activity for consideration. Each request shall be accompanied by complete supporting information.

6.6 Type designations. The type designation may be modified by the acquisition activity upon application by the contractor for assignment of nomenclature in accordance with 3.3.8. The correct type number shall be used on nameplates, shipping records, and instruction books, as applicable, except that, irrespective of the contractor's purchase order requirements, no radio shall be shipped with an AN/ARC-210(V) nomenclature until such time as initially cleared by AIR-5464. Preproduction radios shall be shipped to customers other than NAVAIR with a commercial type number. This will include radios destined for airframes eventually to be purchased by NAVAIR.

radios destined for airframes eventually to be purchased by NAVAIR.

6.7 Revisions. In specification revisions and superseding amendments, an asterisk "*" preceding a paragraph number denotes paragraphs in which changes have been made from the previous issue. This has been done as a convenience only, and the Government assumes no liability whatsoever for any inaccuracies in these notations.

6.8 Associated equipment. This equipment shall operate with the associated equipment, not supplied with it, listed in table XVI.

6.9 Engineering cognizance. This specification is under the cognizance of Naval Air Systems Commander, Code AIR-546M.

6.10 Warranty display. A sticker displaying the warranty requirements shall be attached prominently on each piece of equipment.

6.11 Subject term (key word) listing.

Amplitude modulation
Automatic relay
Electronic counter-countermeasures
Frequency hopping
Frequency modulation
Guard channels
HAVEQUICK
Line-of-sight
Maritime channels
Multiplex data bus
Receiver-transmitter
Remote control
Scanning function
Secure data
Secure voice
Single channel ground and airborne radio system (SINCGARS)
Spread spectrum
Tactical data
Tactical voice
Ultra high frequency
Very high frequency

Preparing activity:
Navy - AS

(Project 5821-N244)

TABLE XVI. List of associated equipment.

Item	Equipment Designation	Specification
Amplifiers, audio frequency	AS-3597C/A	MIL-A-23595
Antenna	AS-3191/ARC-182(V)	AS-4580(AV)
	AS-3238/ARC-182(V)	
	AT-256A/ARC	MIL-A-5815
Antenna, blade, passive	AS-3968/A, AS-3969/A	
Antenna, tunable	AS-3970/A, AS-3972/A	
Beacon, rescue	S.A.R.B.E. 5	Not applicable
Control unit	C-10320/ARC	MIL-C-85697
Direction finder group	AN/ARA-48	MIL-D-38402
	AN/ARA-50	
	OA-8697A	
	DF-301	
Intercommunication sets	AN/AIC-10	MIL-I-22352
	AN/AIC-14	MIL-C-22352
	AN/AIC-18	MIL-C-563
	AN/AIC-25	
	C-6533/ARC	MIL-C-55653
	LS-460/AIC	MIL-I-22767
Data transfer device	AN/CYZ-10	ON477311
Logic converter unit	CV-4092/A	
Microphones, boom mounted	M-96A/A	MIL-M-22179
Night vision goggles	AN/PVS-6	MIL-85762
	AN/PVS-5A	MIL-N-49065
Radio set	AN/ARC-159(V)	MIL-R-81877
	AN/ARC-182(V)	MIL-R-85664
Radio set, survival	AN/PRC-90	MIL-R-81493
Relay switching unit	SA-2498/A	MIL-S-85673(AS)
Relay switching unit control	C-11628/ARC	MIL-C-85674(AS)
Speech security equipment	TSEC/KY-58	CSEEB-32
		SCESC-14
Switch	SA-521A/A	MIL-S-25879

Glossary

AC	Alternating current
ADF	Automatic direction finding
AET	All equipment test
AGC	Automatic gain control
ALC	Automatic level control
AM	Amplitude modulation
ANVIS	Aviators night vision imaging system
ARINC	Aeronautical Radio Incorporated
ATE	Automatic test equipment
BIT	Built-in test
BITE	Built-in test equipment
BT	Bandwidth-time
CASS	Command activated sonobuoy system
CD	Candela
CDRL	Contract data requirements list
COMSEC	Communication security
CW	Continuous wave
DARCOM	U.S. Army Material Development and Readiness Command
DB	Decibel
DBM	Decibel relative to a milliwatt
DC	Direct current
DICASS	Directional command activated sonobuoy system
ECCM	Electronic counter-countermeasure
EIA	Electronics Industries Association
EMCON	Emission control
EMI	Electromagnetic interference
EMP	Electromagnetic pulse
ERF	ECCM remote fill
ESD	Electronic Systems Division
ESS	Environmental stress screening
FM	Frequency modulation
FSK	Frequency shift keying
GHZ	Gigahertz
HPA	High power amplifier
HZ	Hertz
IF	Intermediate frequency
KHZ	Kilohertz
LSI	Large-scale integration
MHZ	Megahertz
MIL-STD	Military standard

Glossary

MSEC	Millisecond
MSI	Medium-scale integration
MSK	Minimum shift keying
MTBF	Mean time between failures
MTTR	Mean time to repair
MUX	Multiplexer
MWOD	Multiple word of day
NAVAIR	Naval Air Systems Command
NLT	No less than
NSA	National Security Agency
NVG	Night vision goggles
ORT	Operational readiness test
PA	Power amplifier
PAM	Pulse amplitude modulated
PM	Program memorandum
PPM	Parts per million
PPS	Pulses per second
P-P	Peak-to-peak
PW	Pulse width
QPL	Qualified products list
QRA	Quick replaceable assembly
RDT	Reliability development test
RF	Radio frequency
RMS	Root-mean-square
RQT	Reliability qualification test
SIMOP	Simultaneous operation
SINAD	Ratio of signal to noise and distortion
SINCGARS	Single channel ground and airborne radio system
(S+N)/N	Signal-plus-noise to noise ratio
SRA	Shop replaceable assembly
TCXO	Temperature compensated crystal oscillator
TDM	Time division multiplex
TOD	Time of day
T/R	Transmit/receive
TRANSEC	Transmission security
UHF	Ultra high frequency
VAC	Volts alternating current
VDC	Volts direct current
VHF	Very high frequency
VHSIC	Very high speed integrated circuits
VLSI	Very large-scale integration

Glossary

VSWR	Voltage standing wave ratio
WOD	Word of day
WRA	Weapons replaceable assembly
µs	Microsecond

APPENDIX A

RECEIVER-TRANSMITTER/REMOTE CONTROL DATA BUSES

10. SCOPE

10.1 Scope. This appendix details the requirements for the receiver-transmitter remote control data buses. This appendix is a mandatory part of the specification.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. REQUIREMENTS

30.1 General Description. There shall be two data busses between the Receiver-Transmitter and the Radio Set Control Unit. One bus shall carry information from the Control to the Receiver-Transmitter while the other bus shall convey data from the Receiver-Transmitter to the Control. The busses shall provide full-duplex, asynchronous operation with a data transfer rate around 60 K band.

The Receiver-Transmitter shall always return an acknowledgment message whenever a command is sent from the Control Unit. If the Control does not receive an acknowledgment message, the Control shall resend the message. If there is still no acknowledgment, a third try shall be made. If there is no reply after the third try, the Control shall light the FAULT legend on the panel of the Control

When the MIL-STD-1553 bus is in control of the Receiver-Transmitter, the Receiver-Transmitter shall send frequency or AJ net and waveform information to the Control for display. In this case, the Control shall act only as a display unit.

When the Radio Set Control is in control of the Receiver-Transmitter, the Receiver-Transmitter shall make available to the MIL-STD-1553 bus the current operational status of the Receiver-Transmitter, but shall not allow the MIL-STD-1553 bus to update Receiver-Transmitter operation. The information between the Control and Receiver-Transmitter shall be sent via an asynchronous data stream with a data transfer rate around 60 K band. The data bus shall be differential with nominal voltage levels of 0 and 5 volts. A 0-volt level shall indicate a logic 0 on the true line while a 5-volt level shall indicate a logic 1. The complement line shall be the reverse. The serial data shall be grouped in words with the word format being as follows:

1. Start bit
2. Eight data bits (called a byte)
3. Parity bit
4. Stop bit

30.2 Radio Set Control to Receiver-Transmitter Transfer. The protocol for the data transfer from the Remote Control Unit to the Receiver-Transmitter shall be as follows:

1. Command byte
2. Data Byte Count
3. The data bytes for the information defined by the Command byte.
4. Check sum byte which shall be the binary sum of all the data bytes, not including the Command byte or the Data Byte Count.

The eight-bit data format shall be as follows:

BIT NUMBER							
7	6	5	4	3	2	1	0
MSB							LSB

30.2.1 Command Byte. The command byte format shall be:

BIT NUMBER							
7	6	5	4	3	2	1	0
			COMMAND CODE				
DF	DF	UA	A	B	C	D	E

where the bits shall be defined as:

DF: Both DF bits set to logic 1 shall indicate that data follows the Command and Data Count bytes. If there are no data words to follow, the DF bits shall be set to 0 and there shall not be a Data Count byte, Data, or a Check Sum.

UA: Unit address shall indicate to which Receiver-Transmitter the message is addressed. This bit shall be used when there are two Receiver-Transmitters being controlled by one Radio Set Control. The code shall be a 0 for Receiver-Transmitter 1 and a 1 for Receiver-Transmitter 2. If there is only one Receiver-Transmitter, this bit shall be a 0.

MESSAGE CODE: Five-bit code for type of data being sent by the Radio Set Control or requested from the Receiver-Transmitter.

The command messages shall be defined as follows:

	COMMAND BYTE								NO.
	7	6	5	4	3	2	1	0	DATA
MESSAGE TYPE	DF	DF	UA	A	B	C	D	E	BYTES
Frequency Update	1	1	-	0	0	0	0	0	5
Cold Start Update	1	1	-	0	0	0	1	0	2
Mode Update	1	1	-	0	0	0	1	1	2
MWOD Erase	0	0	-	0	0	1	0	0	0

MESSAGE TYPE	COMMAND BYTE 7 DF	6 DF	5 UA	4 A	3 B	2 C	1 D	0 E	NO. DATA BYTES
RT Status Request	0	0	-	0	0	1	0	1	0
Channel Update	1	1	-	0	0	1	1	0	2
Beep Request	0	0	-	0	1	0	0	1	0
Time Request	0	0	-	0	1	0	1	0	0
Time Update	1	1	-	0	1	1	0	0	3
MWOD Date Verify	1	1	-	0	1	1	1	1	1
WOD Load	1	1	-	1	0	0	0	1	13
Training Net Load (HQII)	1	1	-	1	0	0	1	0	32
Electronic Remote Fill (ERF)	1	1	-	1	0	1	0	0	2
BIT Results Request	0	0	-	1	1	0	0	0	0
Operational Date Load	1	1	-	1	1	0	1	1	1
Net Update	1	1	-	1	1	1	1	0	4

30.2.2 Command Message Definitions. The definitions of the messages and their associated data bytes are provided in the following paragraphs.

30.2.2.1 Frequency Update Message. The fixed frequency update message shall be sent if one of the following conditions occur:

1. The frequency is changed while in the Manual mode.
2. The 243 MHz guard is enabled.
3. The 121.5 MHz guard is enabled.
4. A fixed frequency preset is loaded.

There shall be five data bytes which contain the channel type, channel number, and the frequency. The Receiver-Transmitter shall reply with the Acknowledge Frequency Update described in 30.3.2.1.

30.2.2.1.1 First Data Byte. The format for the first data byte shall be as follows:

BIT NUMBER 7	6	5	4	3	2	1	0
CHANNEL TYPE A	B	C	-	-	-	-	-

where the bits A, B, and C shall define the following:

CHANNEL TYPE	A	B	C
Single Channel (Channels 0, 1-25, 31)	0	0	1
Dual Frequency, Transmit (Channels 26-30)	0	1	0
Dual Frequency, Receive (Channels 26-30)	1	0	0

The fixed frequency preset channels, channels 1 through 25 and channel 31 shall store a single transmit/receive frequency. Channels 26 through 30 shall store separate transmit and receive frequencies. Two frequencies shall be stored in these dual-frequency channels even if both frequencies are the same.

30.2.2.1.2 Second Data Byte. The second data byte shall provide the channel number. Channel 30 shall be used to store the SINCGARS Cold Start Frequency while channel 31 shall be used to store the SINCGARS CUE frequency. The Radio Set Control shall display the letters CU rather than channel 31, and CS rather than channel 30. Channel 0 shall indicate that the Control is in the Manual mode. The format shall be as follows:

BIT NUMBER							
7	6	5	4	3	2	1	0
CHANNEL NUMBER							
MSB							LSB
(BINARY)							
128	64	32	16	8	4	2	1

30.2.2.1.3 Third Data Byte. The third data byte shall provide the tens and units of megahertz of the selected frequency. If in the manual mode (denoted by Channel 0), the frequency shall be the frequency to which the Receiver-Transmitter will tune. If in the preset mode, the frequency shall be the frequency (either simplex, transmit, or receive as applicable) which will be stored under the channel provided in the first data byte. The format for the byte shall be as follows:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENS MHZ				UNITS MHZ			
MSB			LSB	MSB			LSB
(BCD)				(BCD)			
80	40	20	10	8	4	2	1

30.2.2.1.4 Fourth Data Byte. The fourth data byte shall contain the tenths of megahertz, the 25 KHz increments, and the hundreds of megahertz portion of the frequency in the following format:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENTHS MHZ				25 KHZ		100s MHZ	
MSB			LSB	MSB	LSB	MSB	LSB
(BCD)				(BINARY)		(BINARY)	
0.8	0.4	0.2	0.1	50	25	200	100

30.2.2.1.5 Fifth Data Byte. The fifth data byte shall contain the 5-kHz offset increments to be added to the 25-kHz base frequency and the AM/FM selection. The offset shall be in the form of a sign and magnitude with the byte format being:

BIT NUMBER							
7	6	5	4	3	2	1	0
OFFSET			SPARES				AM
SGN	MAGNITUDE						
	MSB	LSB					
	-(BINARY)-						
+	10	5					

The sign bit shall be a 0 for negative and a 1 for positive. The AM bit shall be set to a 1 for AM selection and to a 0 for FM selection. This bit shall indicate the type of modulation that shall be stored for the selected channel or for manual operation. (Note: The modulation shall be able to be changed, but not stored through the Mode Update in 30.2.2.3).

30.2.2.2 Cold Start Update Message. The Cold Start Update message shall be sent by the Control to change the SINCGARS Cold Start frequency. The updated frequency shall be stored in preset channel 30. The Receiver-Transmitter shall reply with the Acknowledge Cold Start message given in 30.3.2.3.

30.2.2.2.1 First Data Byte. The first data byte shall contain the tens and units of megahertz portion of the frequency update per the following format:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENS MHZ				UNITS MHZ			
MSB			LSB	MSB			LSB
---------(BCD)----------				---------(BCD)----------			
80	40	20	10	8	4	2	1

30.2.2.2.2 Second Data Byte. The second data byte shall contain the tenths of megahertz, the 25 KHz increments, and the hundreds of megahertz portion of the frequency in the following format:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENTHS MHZ				25 KHZ		100s MHZ	
MSB			LSB	MSB	LSB	MSB	LSB
---------(BCD)----------				-(BINARY)-		-(BINARY)-	
0.8	0.4	0.2	0.1	50	25	200	100

30.2.2.3 Mode Update Message. The Mode Update Message shall be sent whenever there is a mode change initiated from the Radio Set Control. The message shall contain two data words. The first word shall contain the mode information for the Receiver-Transmitter The second word shall provide the zeroize command. The Receiver-Transmitter shall reply with the Acknowledge Mode Update message described in 30.3.2.4.

30.2.2.3.1 First Data Byte. The format of the data byte shall be as follows:

BIT NUMBER							
7	6	5	4	3	2	1	0
MODE			TST	-	STP	AM	SQ
A	B	C					

where the bits shall be defined as:

MODE: The mode shall be indicated by the codes:

FUNCTION	A	B	C
T/R	0	0	0
T/R+G	0	0	1
ADF	0	1	0
GPS Time	0	1	1
Send TOD	1	0	0
Receive TOD	1	0	1
HAVEQUICK Restart	1	1	0
Late Entry	1	1	1

The first three modes shall be the prime operating modes and the system shall always be in one of these modes whenever one of the other five subsidiary modes is selected. The Receiver-Transmitter shall remember which prime mode it was in when a subsidiary mode is selected.

The modes shall be:

T/R: Normal transmit/receive with the guard receiver off.

T/R+G: Normal transmit/receive with the guard receiver on and tuned to 243 or 121.5 MHz as applicable for the selected operating frequency.

ADF: Automatic direction finding where the receiver is switched to the ADF antenna.

GPS Time: Receive time over the hard-wire input from the Global Positioning Satellite receiver.

Send TOD: Send the stored HAVEQUICK Time-of-Day over the air on the operating frequency or channel.

Receive TOD: Receive TOD over the air on the operating frequency or channel.

HAVEQUICK Restart: Tell the Applique to zero the time stored for HAVEQUICK operation.

Late Entry: Tell the Applique to open the search window when in a SINCGARS AJ net.

The other bits shall be defined as:

TST: Place the Receiver-Transmitter in the Test mode (logic 1 for Test).

STP: Tell the Receiver-Transmitter to single-step through the test sequence stopping after every test step and provide the results to the Control. The Control shall send another message for the Receiver-Transmitter to proceed to the next step in the sequence, with each press of the LOAD/OFST switch.

AM: Temporarily select the AM (logic 1) or FM (logic 0) mode. This mode shall not be stored in the Receiver-Transmitter. If any mode change is made the Receiver-Transmitter shall return to the modulation selected by the Frequency Update defined in 30.2.2.

SQ: Enable (logic 1) or disable (logic 0) the audio squelch in the Receiver-Transmitter.

30.2.2.3.2 Second Data Byte. The second data byte shall be used to command the Receiver-Transmitter to zero the ECCM parameters. All bits of the word are normally zero. The format for the zeroize command shall be as follows:

	BIT NUMBER						
7	6	5	4	3	2	1	0
1	1	0	1	0	0	0	1

30.2.2.4 MWOD Erase Message. The MWOD erase message shall consist of only the command message with no data bytes. This message shall request the radio to erase all HAVEQUICK Words of the Day. The Receiver-Transmitter shall respond with the Acknowledge MWOD Erase message given in Paragraph 30.3.2.5.

30.2.2.5 Receiver-Transmitter Status Request Message. The Receiver-Transmitter Status Request message shall be sent by the Control under the following three conditions:

1. When power is applied to the Control.

2. Whenever the Receiver-Transmitter is changed in a two receiver-transmitter system.

3. Approximately every three seconds if no activity has taken place on the Control.

The function of this message shall update the Control to the operating status of the Receiver-Transmitter. The Control shall periodically request a Receiver-Transmitter update to insure the display does not present erroneous information due to an anomaly during periods of no bus activity. The Status Request message shall consist only of the command byte with no data bytes. The Receiver-Transmitter shall respond with Acknowledge Status Request defined in 30.3.2.6.

30.2.2.6 Channel Update Message. The Channel Update message shall be sent whenever a preset channel is selected in either the non-AJ, Maritime, AJ, or AJ/M mode. The message shall contain two data words providing the channel type and channel number. The Receiver-Transmitter shall respond with the Acknowledge Frequency Update (see 30.3.2.1) if in the non-AJ or Maritime mode and the Acknowledge Net Update (see 30.3.2.16) if in the AJ or AJ/M mode.

30.2.2.6.1 First Data Byte. The first data byte shall provide the Channel Type according to the following format:

BIT NUMBER							
7	6	5	4	3	2	1	0
CHANNEL TYPE							

where the channel types shall be defined as:

CHANNEL TYPE	BIT NUMBER 7	6	5	4	3	2	1	0
AJ	0	0	0	0	0	0	0	1
AJ/M	0	0	0	0	0	0	1	0
Fixed Frequency (non-AJ)	0	0	0	0	0	1	0	0
Maritime-Ship	0	0	0	0	1	0	0	0
Maritime-Coast	0	0	0	1	0	0	0	0
Channel 26-30 Send	0	0	1	0	0	0	0	0
Channel 26-30 Receive	0	1	0	0	0	0	0	0

30.2.2.6.2 Second Data Byte. The second data byte shall contain the channel number according to the format:

BIT NUMBER							
7	6	5	4	3	2	1	0
CHANNEL NUMBER							
MSB							LSB
(BINARY)							
128	64	32	16	8	4	2	1

The SINCGARS COLDSTART frequency shall be stored in Channel 30. The SINCGARS CUE frequency shall be stored in Channel 31. Channel 32 shall select SCAN operation. Channels 33-40 reserved for future operation.

30.2.2.7 BEEP Request Message. The BEEP Request message shall be sent to tell the Receiver-Transmitter to create a BEEP-tone in the audio to the intercommunications. The BEEP tone is used to indicate to the operator that some function has occurred. The BEEP Request message shall consist only of the command byte with no data bytes. The Receiver-Transmitter shall return the Acknowledge BEEP Request defined in 30.3.2.7. An acknowledgment indication on the Control display is not required.

30.2.2.8 Time Request Message. The Time Request message shall ask for the SINCGARS time stored in the Applique. The Time Request message shall consist only of the command byte with no data bytes. This message shall be initiated only when the system is in a SINCGARS AJ channel and the time function is selected on the Control. This time is known as "wrist watch time". The

Receiver-Transmitter shall return the time via the Acknowledge Time Request message defined in 30.3.2.8. When the Control receives time from the Receiver-Transmitter, the Control shall show the day in the Channel portion of the display, the hours in the tens and units of megahertz portion of the display followed by the colon, and the minutes in the tenths and hundredths of MHz portion:

CHAN	FREQ/NET/TIME
DD	HH:MM

30.2.2.9 Time Update Message. The Time Update message shall be sent when the operator enters wrist watch time through the Control panel for the SINCGARS AJ nets. There shall be three data bytes in the message: the first byte for hours (24 hour time), the next byte for minutes, and the third byte for day. The acknowledgment message from the Receiver-Transmitter shall depend upon the mode during which the time update occurred according to the following table:

MODE	ACKNOWLEDGMENT MESSAGE	PARAGRAPH
Manual	Frequency Update	30.3.2.1
SINCGARS Cold Start	Cold Start	30.3.2.3
AJ	Net Update	30.3.2.15

The format for the data bytes shall be as follows:

	BIT NUMBER						
7	6	5	4	3	2	1	0
TENS DIGIT				UNITS DIGIT			
MSB			LSB	MSB			LSB
(BCD)				(BCD)			
80	40	20	10	8	4	2	1

First Byte:	TENS HOURS	UNITS HOURS
Second Byte:	TENS MINUTES	UNITS MINUTES
Third Byte:	TENS DAY	UNITS DAY

Note: Day Range is 00 to 99.

30.2.2.10 MWOD Date Verify Message. The MWOD (Multiple Word-of-the-Day) Date Verify message shall request the Applique to verify that a WOD exists within the Applique for the day entered by the operator through the Control panel. The message shall consist of one data word with the day of the month entered by the operator in the following format:

	BIT NUMBER						
7	6	5	4	3	2	1	0
TENS MONTHS				UNITS MONTHS			
MSB			LSB	MSB			LSB
(BCD)				(BCD)			
80	40	20	10	8	4	2	1

NOTE: Bits 6 and 7 are always 0. Day Range is 1 to 31.

The Receiver-Transmitter shall respond with the Acknowledge MWOD Date Verify message defined in 30.3.2.9 and shall add an audio tone to produce a BEEP in the intercommunications audio system, if MWOD verified.

30.2.2.11 WOD Load Message. The WOD Load message shall transfer each WOD entered by the operator through the Control panel. The Receiver-Transmitter shall return the Acknowledge WOD (30.3.2.10) and provide a double BEEP to the intercommunications system. The WOD Load message shall have thirteen data bytes. Twelve data bytes shall contain the six WOD segments while the thirteenth data byte shall provide the day of the month for the WOD. A WOD shall appear in the form of six six-digit frequencies. Each frequency shall occupy two data bytes. Thus, data bytes one and two shall be the first frequency segment of the WOD. Data bytes three and four shall be the second frequency segment and so forth with data bytes eleven and twelve being the sixth segment.

30.2.2.11.1 First Byte of a WOD Frequency. The first byte of a WOD segment shall contain the tens and units of megahertz portion of the frequency according to the format:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENS MHZ				UNITS MHZ			
MSB			LSB	MSB			LSB
(BCD)				(BCD)			
80	40	20	10	8	4	2	1

30.2.2.11.2 Second Byte of a WOD Frequency. The second byte of a WOD segment shall contain the tenths of megahertz, 25-KHz increments, and the hundreds of megahertz portion of the frequency according to the format:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENTHS MHZ				25 KHZ		100s MHZ	
MSB			LSB	MSB	LSB	MSB	LSB
(BCD)				(BINARY)		(BINARY)	
0.8	0.4	0.2	0.1	50	25	200	100

30.2.2.11.3 Day of the Month Byte. The format of the thirteenth data byte containing the day of the month for the WOD shall be:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENS MONTHS				UNITS MONTHS			
MSB			LSB	MSB			LSB
(BCD)				(BCD)			
80	40	20	10	8	4	2	1

NOTE: Bits 6 and 7 are always 0. Day Range is 0 to 31.

30.2.2.12 Training Net Load Message. The Training Net Load message shall provide net frequencies for HAVEQUICK II training nets that are loaded through the Control panel. A HAVEQUICK II training net contains 16 frequencies. The Data Byte Count byte shall indicate 32 data bytes to follow. The general format shall be the same as previously given for frequency entries. Two data bytes shall be allotted for each frequency. The format of the first data byte of the frequency shall be the same as that shown in 30.2.2.11.1. The format of the second byte of a frequency shall be the same as that given in 30.2.2.11.2. The Receiver-Transmitter shall return the Acknowledge Training Net message given in 30.3.2.11.

30.2.2.13 Electronic Remote Fill Message. The Electronic Remote Fill (ERF) message shall command the Receiver-Transmitter to exchange SINCGARS fill data with another radio via an over-the- air link. Fill data shall be either sent or received depending upon the coding in the second data byte of the message from the Control. The Receiver-Transmitter shall return the Acknowledge ERF Transfer message defined in 30.3.2.12. The message from the Control shall contain two data bytes as defined in the following paragraphs.

30.2.2.13.1 First Data Byte - The first data byte of the ERF message shall have the format:

	BIT NUMBER						
7	6	5	4	3	2	1	0
H/L	OPERATIONAL PRESET CHANNEL						
	MSB						LSB
	(BINARY)						
	64	32	16	8	4	2	1

where the terms shall be defined as:

H/L: Shall indicate whether a Hopset or a Lockout Set is to be transferred. If set to a 1, a Hopset shall be transferred while a 0 shall indicate a Lockout Set.

OPERATIONAL PRESET CHANNEL: The AJ channel number over which the transfer is to occur. The channel shall be either an AJ Coldstart or a SINCGARS AJ net.

30.2.2.13.2 Second Data Byte - The format for the second data byte shall be:

	BIT NUMBER						
7	6	5	4	3	2	1	0
SND	SOURCE/DESTINATION PRESET CHANNEL						
	MSB						LSB
	(BINARY)						
	64	32	16	8	4	2	1

where:

SND: Shall indicate whether the SINCGARS fill data is to be transmitted to (bit set to a 1) or received from (bit set to a 0) another radio..

SOURCE/DESTINATION CHANNEL: The channel from which the fill data shall be taken if the radio is to transmit the data or the channel in which the fill data shall be loaded if the data is to be received from another radio.

30.2.2.14 Built-In-Test Results Request Message. The Built-In-Test (BIT) request message shall ask the Receiver-Transmitter to supply the results of the BIT initiated by the setting of the Test bit in the Mode Update message described in 30.2.2.3. This message shall consist of a command word only. The Receiver-Transmitter shall reply with the Acknowledge BIT Results message defined in 30.3.2.13.

30.2.2.15 Operational Date Load Message. The Operational Date Load Message shall transfer the present operating day of the month entered by the operator to the Applique through the Receiver-Transmitter. This message shall have one data byte of the format:

	BIT NUMBER						
7	6	5	4	3	2	1	0
	TENS MONTHS				UNITS MONTHS		
MSB			LSB	MSB			LSB
		(BCD)				(BCD)	
80	40	20	10	8	4	2	1

NOTE: Bits 6 and 7 are always 0. Day Range is 1 to 31.

The Receiver-Transmitter shall reply with the Acknowledge Operational Date Load message defined in 30.3.2.13.

30.2.2.16 Net Update Message. The Net Update message shall be sent by the Control whenever the AJ Net information has been changed when the Control is in the AJ and Change Preset modes. The Receiver-Transmitter shall respond with the Acknowledge Net Update message defined in 30.3.2.15. The Net Update message from the Control shall have the four data bytes defined in the following paragraphs.

30.2.2.16.1 First Data Byte. The first data byte shall contain the hundreds and tens digit of the net number according to the format:

	BIT NUMBER						
7	6	5	4	3	2	1	0
	HUNDREDS DIGIT				TENS DIGIT		
MSB			LSB	MSB			LSB
		(BCD)				(BCD)	
800	400	200	100	80	40	20	10

30.2.2.16.2 Second Data Byte. The second data byte shall contain the units digit of the net number per the format:

BIT NUMBER							
7	6	5	4	3	2	1	0
UNITS DIGIT				SPARES			
MSB			LSB				
(BCD)							
8	4	2	1				

30.2.2.16.3 Third Data Byte. The third data byte shall contain the type of AJ waveform to be defined for the net. The format of this byte is:

BIT NUMBER							
7	6	5	4	3	2	1	0
WAVEFORM							

where the waveforms shall be defined as:

WAVEFORM	BIT NUMBER 7	6	5	4	3	2	1	0
Spare	0	0	0	0	0	0	0	0
Spare	0	0	0	0	0	0	0	1
Spare	0	0	0	0	0	0	1	0
Reserved for SINCGARS	0	0	0	0	0	0	1	1
HAVEQUICK I	0	0	0	0	0	1	0	0
HAVEQUICK II (NATO)	0	0	0	0	0	1	0	1
HAVEQUICK II (non-NATO)	0	0	0	0	0	1	1	0
Reserved for HAVEQUICK 11a	0	0	0	0	0	1	1	1
None Defined	1	1	1	1	1	1	1	1

30.2.2.16.4 Fourth Data Byte. The fourth data byte shall contain the preset channel number per the format:

BIT NUMBER							
7	6	5	4	3	2	1	0
CHANNEL NUMBER							
MSB							LSB
(BINARY)							
128	64	32	16	8	4	2	1

30.3 Receiver-Transmitter to Radio Set Control Transfer. The Receiver-Transmitter shall acknowledge every message received from the Radio Set Control. The Receiver-Transmitter shall inform the Control of frequency or net changes and BIT results when initiated by the MIL-STD-1553 bus. The format of the messages from the Receiver-Transmitter shall be similar to the messages originated by the Control. The protocol for the data transfer from the Receiver-Transmitter to the Radio Set Control Unit shall be as follows:

1. Status byte

2. Data Byte Count

3. The data bytes for the information defined by the Status byte.

4. Check sum byte which shall be the binary sum of all the data bytes, not including the Status byte or the Data Byte Count.

The eight-bit byte format shall be as follows:

BIT NUMBER							
7	6	5	4	3	2	1	0
MSB							LSB

30.3.1 Status Byte - The Status byte format shall be:

BIT NUMBER							
7	6	5	4	3	2	1	0
				ACKNOWLEDGMENT TYPE			
DF	FLT	UA	A	B	C	D	E

where the bits shall be defined as:

DF: The DF bit set to logic 1 shall indicate that data follows the Status and Data Count bytes. If there are no data words to follow, the DF bit shall be set to 0 and there shall not be a Data Count byte.

FLT: Fault indicator which shall be set to a 1 if there is an error in the last message received from the Radio Set Control. If there is no error on the last received message, this bit shall be a 0.

UA: Unit address shall indicate which Receiver-Transmitter is responding to the message. The address shall be the same one addressed in the Control Command byte. This bit shall used when there are two Receiver-Transmitters being controlled by one Radio Set Control. The code shall be a 0 for Receiver-Transmitter 1 and a 1 for Receiver-Transmitter 2. If there is only one Receiver-Transmitter, this bit shall be a 0.

ACKNOWLEDGMENT TYPE: Five-bit code for type of data.

The Acknowledgment type messages shall be defined as follows:

	COMMAND BYTE								NO.
	7	6	5	4	3	2	1	0	DATA
MESSAGE TYPE	DF	FLT	UA	A	B	C	D	E	BYTES
Acknowledge frequency update	1	-	-	0	0	0	0	0	4
Receiver-Transmitter status	1	-	-	0	0	0	0	1	2
Acknowledge cold start	1	-	-	0	0	0	1	0	2
Acknowledge mode update	0	-	-	0	0	0	1	1	0
Acknowledge MWOD erase	0	-	-	0	0	1	0	0	0
Acknowledge status request	1	-	-	0	0	1	0	1	7
Acknowledge BEEP request	0	-	-	0	1	0	0	1	0

	COMMAND BYTE								NO.
	7	6	5	4	3	2	1	0	DATA
MESSAGE TYPE	DF	FLT	UA	A	B	C	D	E	BYTES
Acknowledge time request	1	-	-	0	1	0	1	0	3
Acknowledge MWOD date verify	0	-	-	0	1	1	1	1	0
Acknowledge WOD	0	-	-	1	0	0	0	1	0
Acknowledge training net	0	-	-	1	0	0	1	0	0
Acknowledge ERF transfer	0	-	-	1	0	1	0	0	0
Acknowledge BIT results	1	-	-	1	1	0	0	0	6
Acknowledge operational date load	0	-	-	1	1	0	1	1	0
Acknowledge net update	1	-	-	1	1	1	1	0	4
Acknowledge scan	0	-	-	0	0	1	1	1	0

30.3.2 Acknowledgment Message Definitions - The definitions of the acknowledgment messages and their associated data bytes shall be as given in the following paragraphs.

30.3.2.1 Acknowledge Frequency Update Message - The Acknowledge Frequency Update message shall be sent to the Radio Set Control in response to a Frequency Update (see 30.2.2.1), a non-AJ Channel Update (see 30.2.2.6), or a Time Update (see 30.2.9) command message from the Control or equivalent change directed by the MIL-STD-1553 bus. The message shall have four data bytes.

30.3.2.1.1 First Data Byte. The first data byte shall contain the channel number per the format:

BIT NUMBER							
7	6	5	4	3	2	1	0
CHANNEL NUMBER							
MSB							LSB
(BINARY)							
128	64	32	16	8	4	2	1

Channel 0 shall indicate that the Receiver-Transmitter is in the manual mode. Channel 31 shall contain the SINCGARS CUE frequency.

30.3.2.1.2 Second Data Byte. The second data byte shall provide the tens and units of megahertz of the frequency stored under the channel given by the first data byte. If in the manual mode (denoted by Channel 0), the frequency shall be the frequency to which the Receiver-Transmitter is tuned. If in the preset mode, the frequency shall be the tuned frequency for simplex channels (1 through 25 and 31) or the transmit frequency for half-duplex channels (26 through 30). The format for the byte shall be is as follows:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENS MHZ				UNITS MHZ			
MSB			LSB	MSB			LSB
(BCD)				(BCD)			
80	40	20	10	8	4	2	1

30.3.2.1.3 Third Data Byte. The third data byte shall contain the tenths of megahertz, the 25 KHz increments, and the hundreds of megahertz portion of the frequency in the following format:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENTHS MHZ				25 KHZ		100s MHZ	
MSB			LSB	MSB	LSB	MSB	LSB
(BCD)				(BINARY)		(BINARY)	
0.8	0.4	0.2	0.1	50	25	200	100

30.3.2.1.4 Fourth Data Byte. The fourth data byte shall contain the 5-KHz offset increments that are added to the 25-KHz base frequency and the AM/FM selection. The offset shall be in the form of a sign and magnitude. The format shall be:

BIT NUMBER							
7	6	5	4	3	2	1	0
OFFSET			SPARES				AM
SGN	MAGNITUDE						
	MSB	LSB					
	(BINARY)						
+	10	5					

The sign bit shall be a 0 for negative and a 1 for positive. The AM bit shall be set to a 1 for AM operation and to a 0 for FM.

30.3.2.2 Receiver-Transmitter Status Message. The Receiver-Transmitter Status message shall be sent by the Receiver-Transmitter when a change that affects the operation or display of the Radio Set Control occurs, after hardware resets or periodically to update the Radio Set Control and Indicator. The message shall have two data bytes, but the second byte is a spare byte. The format for the first byte shall be as follows:

BIT NUMBER							
7	6	5	4	3	2	1	0
	NO						
GP	APP	PTT	CMF	FS	CUE	SPARE	

where the functions shall be defined:

GP: Guard Precedence: Bit set to a 1 when the external 243 MHz guard enable line to the Receiver-Transmitter has been grounded to enable the guard function. Set to 0 when the line is open-circuited.

NO APP: No Applique: Set to a 1 when an Applique is not connected to the Receiver-Transmitter.

PTT: Push-to-Talk: Bit is set to a 1 when the PTT KEY line to the Receiver-Transmitter goes to the keyed state. Set to a 0 when the line goes to the unkeyed state.

CMF: Constant Monitor Fault: Set to a 1 if the Receiver-Transmitter detects a fault indication on the continuous fault monitor line within the Receiver-Transmitter. Bit set to a 0 if there is no fault.

FS: Fill Start: Bit set to a 1 when the Data Loader has started to Fill the radio. Set to 0 when fill has been completed.

CUE: Set to a 1 when activity has been detected on the SINCGARS CUE frequency. Set to a 0 when activity on the frequency ceases.

30.3.2.3 Acknowledge Cold Start. The Acknowledge Cold Start message shall be sent by the Receiver-Transmitter in response to the Radio Set Control Cold Start Update message given in 30.2.2.2 or the Time Update message under the conditions given in 30.2.2.9. The Acknowledge Cold Start message shall contain two data words having the format defined in the following paragraphs.

30.3.2.3.1 First Data Byte. The first data byte shall provide the tens and units of megahertz portion of the Cold Start frequency in accordance with the following format:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENS MHZ				UNITS MHZ			
MSB			LSB	MSB			LSB
(BCD)				(BCD)			
80	40	20	10	8	4	2	1

30.3.2.3.2 Second Data Byte. The second data byte shall contain the tenths of megahertz, the 25 KHz increments, and the hundreds of megahertz portion of the frequency in the following format:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENTHS MHZ				25 KHZ		100s MHZ	
MSB			LSB	MSB	LSB	MSB	LSB
(BCD)				(BINARY)		(BINARY)	
0.8	0.4	0.2	0.1	50	25	200	100

30.3.2.4 Acknowledge Mode Update Message. The Acknowledge Mode Update message shall be sent by the Receiver-Transmitter in response to Radio Set Control Mode Update message defined in 30.2.2.3. The acknowledgment message shall consist of only the Status Byte given in 30.3.1.

30.3.2.5 Acknowledge MWOD Erase. The Acknowledge MWOD Erase message shall be sent by the Receiver-Transmitter in response to the Radio Set Control MWOD Erase command given in 30.2.2.4. The acknowledgment message shall consist only of the Status byte given in 30.3.1.

30.3.2.6 Acknowledge Status Request Message. The Acknowledge Status Request message shall be returned in response to the Control's Receiver-Transmitter Status Request message given in 30.2.2.5. The acknowledge message shall have seven data bytes providing the over-all operating state of the Receiver-Transmitter. The first data byte shall be the same as the Receiver-Transmitter Status byte given in 30.3.2.2. The second data byte shall be a spare.

The third, fourth, and fifth bytes shall contain the last operating manual frequency and modulation type. The format shall be the same as the second, third, and fourth bytes respectively of the Acknowledge Frequency Update message defined in 30.3.2.1.

The sixth data byte shall be the last operating preset channel and shall have the same format as the first data byte of the Acknowledge Frequency Update message given in 30.3.2.1.1. The seventh data byte shall provide the last operating Maritime channel in the following format:

	BIT NUMBER						
7	6	5	4	3	2	1	0
CO	CHANNEL NUMBER						
	MSB						LSB
	(BINARY)						
	64	32	16	8	4	2	1

where:

CO: Shall indicate whether the radio is acting as a Ship station (bit set to a 0) or a Coast station (bit set to a 1). The Ship/Coast feature determines the transmitting frequency of the Receiver-Transmitter for the Maritime channels that are half-duplex.

CHANNEL NUMBER: The operating Maritime channel (1 through 28 and 60 through 88).

30.3.2.7 Acknowledge BEEP Request Message. This acknowledgment message consisting only of the Status byte given in 30.3.1 shall be returned in reply to the Control BEEP request of 30.2.2.7.

30.3.2.8 Acknowledge Time Request Message. The Acknowledge Time Request message shall return the SINCGARS time stored in the Applique in response to the Control Time Request message of 30.2.2.8. The acknowledgment message shall have three data bytes. The first data byte shall provide the tens and units of hours, the second byte has the tens and units of minutes, and the third byte gives the tens and units of day per the format:

BIT NUMBER							
7	6	5	4	3	2	1	0
TENS DIGIT				UNITS DIGIT			
MSB			LSB	MSB			LSB
(BCD)				(BCD)			
80	40	20	10	8	4	2	1

First Byte:	TENS HOURS	UNITS HOURS
Second Byte:	TENS MINUTES	UNITS MINUTES
Third Byte:	TENS DAY	UNITS DAY

NOTE: Hours Range is 00 to 29.
Minutes Range is 00 to 59.
Day Range is 01 to 99.

30.3.2.9 Acknowledge MWOD Date Verify Message. This message shall be returned to acknowledge the receipt by the Receiver-Transmitter of the MWOD Date Verify Control message given in 30.2.2.10. The acknowledgment message shall consist only of the Status byte of 30.3.1. If the Applique has a WOD for the requested day, an instruction shall be passed to the Receiver-Transmitter to produce a BEEP tone in the audio output to the intercommunications set and to set FLT, bit 6, in the status byte to a 0. If no WOD has been loaded for the requested date, the FLT bit shall be set to a 1 and the BEEP shall not be created.

30.3.2.10 Acknowledge WOD Message. This message shall be returned to acknowledge the receipt by the Receiver-Transmitter of the Control WOD Load message given in 30.2.2.11. The acknowledgment message shall consist only of the Status byte of 30.3.1. The Receiver-Transmitter shall insert a double BEEP tone on the audio output.

30.3.2.11 Acknowledge Training Net Message. This message shall be returned to acknowledge the receipt of the Training Net data message (see 30.3.2.12). The acknowledgment message shall consist only of the Status byte of 30.3.1.

30.3.2.12 Acknowledge ERF Transfer Message. This message shall be returned to acknowledge the receipt by the Receiver-Transmitter of the Control ERF Transfer message given in 30.2.2.13. The acknowledgment message shall consist only of the Status byte of 30.3.1.

30.3.2.13 Acknowledge BIT Results Message. The Receiver-Transmitter shall provide the test results in response to a request from the Radio Set Control (as defined in 30.2.2.14). The acknowledgment message shall contain six data words of which the fourth word is spare. The other words shall be as specified in the following paragraphs.

30.3.2.13.1 First Data Byte. The format of the first data byte shall be:

BIT NUMBER							
7	6	5	4	3	2	1	0
							SRA 1
TIP	ENG	TC	RNG	ANG	CONFIG ID		1.2
					A	B	

where the terms are defined as:

TIP: Test In Progress: When a 1, the initiated BIT is in progress. A 0 shall indicate that the initiated BIT was not in progress when the BIT results request was made. The test may not be in progress either because BIT was never initiated or the testing is complete. When TIP is a 0, the TC (Testing Complete) bit needs to be examined.

ENG: System equipment GO/NO-GO status: Set to a 0 for GO; 1 for NO-GO.

TC: Test Complete: Shall indicate that initiated BIT has been run and completed when a 1. Reset to 0 when the Radio Set Control leaves the TEST position, when directed by the MIL-STD-1553 message 30 command, upon initiation of a new test step in the single-step test mode.

RNG: Receiver-Transmitter GO/NO-GO status: Set to 0 for GO.

ANG Antenna GO/NO-GO status: Set to a 0 for GO.

CONFIG ID: System Configuration Identification: Shall indicate the Receiver-Transmitter in the system per the code:

RECEIVER-TRANSMITTER CONFIGURATION	A	B
RT-1250 (ARC-182)	0	0
RT-1250A (ARC-182)	0	1
RT-1556 without Applique (ARC-210)	1	0
RT-1556 with Applique (ARC-210)	1	1

SRA 1, 1.2: See definition in Second Data Byte in next paragraph.

30.3.2.13.2 Second Data Byte. The Second Data Byte (along with the last bit of the First Data Byte) shall provide the three most likely Receiver-Transmitter modules to have failed when a Receiver-Transmitter failure has been detected during initiated BIT. SRA 1 shall be the most likely failed module; SRA 2 shall be the second most likely; and SRA 3 shall be the third most likely. The format of the data byte shall be (Note: the last bit of the first byte is also shown for clarification):

FIRST DATA BYTE	SECOND DATA BYTE								
	BIT NUMBER								
0	7	6	5	4	3	2	1	0
	SRA 1			SRA 2			SRA 3		
1.2	1.1	1.0	2.2	2.1	2.0	3.2	3.1	3.0
MSB		LSB	MSB		LSB	MSB		LSB
----(BINARY)-----			----(BINARY)-----			----(BINARY)-----		
4	2	1	4	2	1	4	2	1

30.3.2.13.3 Third Data Byte. The third data byte shall provide an indication of which equipments in the system have reported a fault to the Receiver-Transmitter. When the equipments respective bit is set to a 0, the equipment shall not have reported a fault; a 1 indicates a reported fault. The byte format shall be:

BIT NUMBER							
7	6	5	4	3	2	1	0
APF	RTF	-	AMF	FF	MTF	ASF	CUF

where:

APF: CD-17 Applique fault.

RTF: RT-1556 Receiver-Transmitter fault.

AMF: AM-7370 External high-power RF amplifier fault.

FF: F-1616 External tunable RF filter fault.

MTF: MT-6565 Failure in the mount for the external amplifier and filter.

ASF: Antenna fault.

CUF: CV-4092 Antenna Converter Unit fault.

30.3.2.13.4 Fifth Data Byte. The fifth data byte shall provide the module and function being tested. The byte format shall be:

BIT NUMBER							
7	6	5	4	3	2	1	0
MODULE				FUNCTION			
MSB			LSB	MSB			LSB
(BINARY)				(BINARY)			
8	4	2	1	8	4	2	1

30.3.2.13.5 Sixth Data Byte. The sixth data byte shall be the test number of the test sequence being tested. The byte format shall be as follows:

BIT NUMBER							
7	6	5	4	3	2	1	0
TEST NUMBER							
MSB							LSB
(BCD)							
80	40	20	10	8	4	2	1

NOTE: Range for RT tests 09 to 99.

30.3.2.14 Acknowledge Operational Date Load Message. This message shall be returned to acknowledge the receipt by the Receiver-Transmitter of the Operational Date Load message given in 30.2.2.15. The acknowledgment message shall consist only of the Status byte of 30.3.1 with no data bytes.

30.3.2.15 Acknowledge Net Update Message. The Acknowledge Net Update message shall be sent to the Radio Set Control under any of the following conditions:

1. In response to the Channel Update message (see 30.2.2.6) from the Control if in an AJ mode.

2. In response the Net Update message (see 30.2.2.16) from the Control.

3. In response to the Time Update Message (see 30.2.2.9) from the Control if in an AJ mode.

4. If the MIL-STD-1553 bus has provided a net update.

The message shall contain four data bytes.

30.3.2.15.1 First Data Byte. The first data byte shall return the hundreds and tens digits of the net number per the format:

BIT NUMBER							
7	6	5	4	3	2	1	0
HUNDREDS DIGIT				TENS DIGIT			
MSB			LSB	MSB			LSB
(BCD)				(BCD)			
800	400	200	100	80	40	20	10

30.3.2.15.2 Second Data Byte. The second data byte shall contain the units digit of the net number and the fill status for the requested net number per the format:

BIT NUMBER							
7	6	5	4	3	2	1	0
UNITS DIGIT				FILL STATUS			
MSB			LSB	A	B	C	D
(BCD)							
8	4	2	1				

where the fill status shall be provided by the code:

FILL STATUS	A	B	C	D
All net AJ elements loaded, NB enabled	0	0	0	0
WOD for HAVEQUICK I not loaded	0	0	0	1
MWOD for HAVEQUICK II not loaded	0	0	1	0
Transec variable for SINCGARS not loaded	0	0	1	1
HAVEQUICK time not loaded	0	1	0	0
SINCGARS time not loaded	0	1	0	1

FILL STATUS	A	B	C	D
Operational day not loaded	0	1	1	0
Invalid net ID loaded	0	1	1	1
No HQI training net loaded	1	0	0	0
No HQII training net loaded	1	0	0	1
No valid fill for SINCGARS preset	1	0	1	0
All net AJ elements loaded, WB enabled	1	0	1	1
Spare	1	1	0	0
Spare	1	1	0	1
Spare	1	1	1	0
No fill data	1	1	1	1

30.3.2.15.3 Third Data Byte. The third data byte shall contain the type of AJ waveform to be defined for the net. The format of this byte shall be:

BIT NUMBER							
7	6	5	4	3	2	1	0
WAVEFORM							

where the waveforms shall be defined as:

WAVEFORM	BIT NUMBER 7	6	5	4	3	2	1	0
Spare	0	0	0	0	0	0	0	0
Spare	0	0	0	0	0	0	0	1
HAVEQUICK IIa	0	0	0	0	0	0	1	0
SINCGARS	0	0	0	0	0	0	1	1
HAVEQUICK I	0	0	0	0	0	1	0	0
HAVEQUICK II (NATO)	0	0	0	0	0	1	0	1
HAVEQUICK II (non-NATO)	0	0	0	0	0	1	1	0
No Fill	1	1	1	1	1	1	1	1

30.3.2.15.4 Fourth Data Byte. The fourth data byte shall contain the preset channel number per the format:

BIT NUMBER							
7	6	5	4	3	2	1	0
CHANNEL NUMBER							
MSB							LSB
(BINARY)							
128	64	32	16	8	4	2	1

APPENDIX B

RECEIVER-TRANSMITTER/ANTENNA AND FILTER BUS

10. SCOPE

10.1 Scope. This appendix details the requirements for the receiver-transmitter antenna and filter bus. This appendix is a mandatory part of the specification.

20. APPLICABLE DOCUMENTS
This section is not applicable to this appendix.

30. REQUIREMENTS

30.1 General Description. The Receiver-Transmitter shall provide frequency information to the tunable antenna and tunable filter or any other device requiring the operating frequency. The frequency word shall be Manchester encoded and shall be transferred at a one megahertz rate.

30.2 Word Format. The frequency word shall consist of three synchronization bits, sixteen data bits, and one parity bit. The weighing in megahertz of the data bits shall be as follows:

327.680	(MSB)
163.840	
81.920	
40.960	
20.480	
10.240	
5.120	
2.560	
1.280	
0.640	
0.320	
0.160	
0.080	
0.040	
0.020	
0.010	(LSB)

30.3 Test Format. The Receiver-Transmitter shall cause the antenna to go into a test mode to test the logic and tuning drivers by sending a frequency code outside the operating range. A code of 1101x...x shall cause an all 1's test of the driver circuitry. A code of 1110x...x shall be an all 0's test.

30.4 Bus Levels. The bus shall be differential. A logic 1 on the True line shall be 3.4 volts minimum, 5 volts maximum. A logic 0 shall be 1.3 volts maximum, 0 volts minimum. The levels for the False line shall be the inverse of the True line. The input impedance of the antenna or filter shall be greater than 400 ohms.

30.5 Antenna Fault Format. The Receiver-Transmitter shall monitor the Antenna Fault line, during normal operation, and through test to determine the functional status of the antenna and converter unit. Fault line interface is specified in appendix D, J5 pin 29.

APPENDIX C

RECEIVER-TRANSMITTER/MIL-STD-1553 BUS

10. SCOPE

10.1 Scope. This appendix details the requirements for the receiver-transmitter MIL-STD-1553 bus. This appendix is a mandatory part of the specification.

20. APPLICABLE DOCUMENTS
This section is not applicable to this appendix.

30. REQUIREMENTS

30.1 General Description. The ARC-210(V) Receiver-Transmitter shall be able to be controlled via a MIL-STD-1553 multiplex bus system. The Receiver-Transmitter shall be a commanded unit in that it shall not send any data on the bus unless specifically commanded by a message from the bus system. The bus message structure shall be fixed by the software within the Receiver-Transmitter. The following paragraphs describe the message structure unique to the Receiver-Transmitter. Standard broadcast commands and mode messages are not described since they are available in the MIL-STD-1553 document, but the Receiver-Transmitter shall comply with the standard messages and commands.

30.2 Receive Messages. The messages that the Receiver-Transmitter may receive from the MIL-STD-1553 bus contain either command data or requests for status data. The following messages shall be defined in the software within the Receiver-Transmitter:

1. Message number 1 which provides frequency in the non-AJ mode, net number in an AJ mode, mode information, preset channel, Maritime information, Transec commands, date, and time to the Receiver-Transmitter. The message shall be defined for a Command Word followed by up to seven data words. The Command Word is defined in 30.2.1. The data words are defined in 30.2.2 and the associated subparagraphs. The Receiver-Transmitter shall accept any number of data words as long as the word count in the Command word agrees with the numbers of data words sent. The Receiver-Transmitter shall accept up to the first seven words and shall discard any others. The first seven data words will be in the order given in the following paragraphs. The Receiver-Transmitter shall respond with the Status Word defined in 30.3.1.

2. Message number 2 requests frequency in the non-AJ mode, net number in an AJ mode, mode information, preset channel, Maritime information, Transec commands, date, and time from the Receiver-Transmitter. The message contains only the command word.

   The Receiver-Transmitter shall reply with Response Message 2 formatted with the Status Word defined in 30.3.1 followed by the data words defined in 30.3.2. The Command word will designate the number of data words to be returned by the Receiver-Transmitter. Any number of words may be requested, but only seven response words are defined. If less than seven words are requested, the Receiver-Transmitter shall return that number in the order given in 30.3.2. If more than seven status words are requested, the Receiver-Transmitter shall return with the status word, the seven defined data words, and then may fill the remaining words with meaningless information.

3. Message number 3 provides fill data for the Receiver-Transmitter non-AJ channels and the AJ data for the net fill in the ECCM Applique. The first data word is always the Fill Command data word followed by up to sixteen data words providing the fill data. The Receiver-Transmitter shall respond with the Status Word defined in 30.3.1.

4. Message Number 15 requests the test result status words defined in 30.3.3. The data words shall contain the random bit pattern provided by the MIL-STD-1553 bus as a part of message 30, a summary of the operational readiness status of the system, and module test status and test numbers.

   The Receiver-Transmitter shall reply with Response Message 15 formatted with the Status Word defined in 30.3.1 followed by the data words defined in 30.3.3. The Command word designates the number of status words to be returned by the Receiver-Transmitter. Any number of words may be requested, but only eight data response words are defined. If less than eight words are requested, the Receiver-Transmitter shall return that number in the order given in 30.3.3. If more than eight data words are requested, the Receiver-Transmitter shall return with the status word, the eight defined data words, and then may fill the remaining words with meaningless information.

5. Message Number 30 initiates test modes and provides a random bit pattern for test purposes. The message format is the command word followed by the two Data Words defined in 30.2.4. The Receiver-Transmitter shall respond with the Status Word defined in 30.3.1.

Each word is made up of 16 bits where bit 0 is the first bit to be received. The command word and the receive command data words are defined in the following paragraphs.

30.2.1 Command Word Definition. The command word is defined by:

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TERMINAL ADDRESS					T/R	MESSAGE SUBADDRESS					WORD COUNT				
MSB				LSB		MSB				LSB	MSB				LSB
-----(BINARY)------						-----(BINARY)------					-----(BINARY)------				
4	3	2	1	0		4	3	2	1	0	4	3	2	1	0

where the parameters within the word are defined:

TERMINAL ADDRESS: Address of the Receiver-Transmitter as strapped on the interface connector J2 on the Receiver-Transmitter:

BIT 4: J2-14
BIT 3: J2-12
BIT 2: J2-10
BIT 1: J2-7
BIT 0: J2-1

NOTE: The Receiver-Transmitter also requires a parity bit for the address to be strapped on J5-36 for odd parity. This is not a requirement of MIL-STD-1553, but is due to the integrated circuit bus interface device.

T/R: Tells the Receiver-Transmitter whether to send or receive a message. If this bit is a 0, the message is a receive command to the Receiver-Transmitter and the WORD COUNT portion of the word gives the number of data words that will be following the command word. If this bit is a 1, the Receiver-Transmitter shall return status and the WORD COUNT gives the number of data words to be sent by the Receiver-Transmitter. The T/R bit will be a 0 for message numbers 1, 3, and 30. The T/R bit will be a 1 for messages 2 and 15.

MESSAGE SUBADDRESS: The number designating a specific message format which is defined within the Receiver-Transmitter software. Message numbers 1, 2, 3, 15, and 30 have been defined. (See 30.2 Received Messages.)

WORD COUNT: Number of data words that follows the command word if the Receiver-Transmitter is to receive data (bit 5, T/R, a 0) or the number of words the Receiver-Transmitter is to send if the Receiver-Transmitter is to return data (bit 5, T/R a 1).

30.2.2 Data Words for Command Message 1. The following describe the command words to the Receiver-Transmitter.

30.2.2.1 Receive Command Data Word 1. This data word contains the command frequency in single channel or preset load mode or the net information if in an AJ load mode. The format for frequency in single channel or preset load mode is:

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TENS MHZ				UNITS MHZ				TENTHS MHZ				25 KHZ		100s MHZ	
MSB			LSB	MSB			LSB	MSB			LSB	MSB	LSB	MSB	LSB
-----(BCD)-----				-----(BCD)-----				-----(BCD)-----				(BINARY)		(BINARY)	
80	40	20	10	8	4	2	1	.8	.4	.2	.1	50	25	200	100

The format for Data Word 1 when in an AJ load mode (bit 3 in Receive Command Data Word 4 set to a 1 & bit 1 of Word 3 set to a 1) is:

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HUNDREDS DIGIT				TENS DIGIT				UNITS DIGIT				NOT USED			
MSB			LSB	MSB			LSB	MSB			LSB				
-----(BCD)-----				-----(BCD)-----				-----(BCD)-----							
800	400	200	100	80	40	20	10	8	4	2	1				

30.2.2.2 Receive Command Data Word 2. This word provides the mode commands for the Receiver-Transmitter having the following format:

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MODE		SQL	AM	RES	RES	MO	GM	2.5 SPARE			OFFSET(KHZ)			SPARE	
A	B							KHZ			SGN	MAG		B	S
												MSB	LSB	D	A
												10	5		T

where:

The MODE is determined by the coding:

MODE	A	B
Transmit/receive	0	0
Transmit/receive plus guard receiver	0	1
Undefined	1	0
Automatic Direction Find	1	1

SQL is the squelch command: 0 to disable squelch and 1 for squelch enabled.

AM denotes AM (a logic 0) or FM (logic 1).

RES are reserved bits that are not used. (These bits are used in the ARC-182.)
MO signifies the that the Receiver-Transmitter is to operate at a Maritime offset from the transmit frequency if the selected transmit frequency (either manual or preset channel) is a valid transmit Maritime frequency. If the transmitter is not set at a valid transmit frequency, there is no offset. A logic 1 enables the Maritime offset. NOTE: This condition should not be confused with the Maritime Mode selected by bit 7 of Receive Data Word 3. This function is disabled when Maritime Mode is selected.

GM being a logic 1 indicates that the main communications receiver is to tune to the guard frequency applicable for the band selected by the manual or preset channel frequency. The applicable guard frequencies are 243 MHz for the bands 30-88, 156-174, or 225-400 MHz and 121.5 MHz for the 108-156 MHz band. When GM is a logic 0, the main receiver tunes to the normal commanded frequency. When the manual or preset frequency is invalid, the 243 MHz is selected.

2.5 KHZ offsets the base frequency an additional 2.5 KHZ from the offset frequency.

OFFSET is the number of 5 KHz increments that the frequency is to be offset from the manually entered or preset base frequency which is in 25 KHz increments. The SGN bit is a 1 to add the offset to the base frequency and is a 0 to subtract the offset from the base. The two bits labeled MAG provides the magnitude of offset (binary coded) to add or subtract from the base frequency.

B-D is the BEEP disable command. There are several functions for which a BEEP tone in the intercommunications output is produced. This command allows the user to disable this tone. The bit set to a 1 disables the tone.

SAT is the command used in loading the non-AJ half-duplex channels 26 through 30. In these channels, separate transmit and receive frequencies may be stored. SAT set to a 1 indicates that the frequency to be stored in the designated channel is the transmit frequency while a 0 indicates the receive frequency.

30.2.2.3 Receive Command Data Word 3. Data Word 3 provides Preset and Maritime information. The word format is:

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PRE	LD	CHANNEL NUMBER						MR	CO	MARITIME CHANNEL NUMBER					
		MSB				LSB				MSB					LSB
		-----(BINARY)------								---------(BINARY)----------					
		16	8	4	2	1				64	32	16	8	4	2	1

where:

PRE indicates the Preset Mode (logic 1) or Manual Mode (logic 0). If the Receiver-Transmitter is in the Preset Mode, the operating frequency shall be that frequency stored for the given Channel Number in the word, not the frequency in Word 1.

If LD is a 1, PRE is a 1, and the radio is in the non-AJ mode, the frequency given in Receive Command Data Word 1 is to be stored in the Preset Channel. If the selected channel is 26 through 30, the SAT bit in the second data word designates whether the frequency is a transmit or receive frequency. If LD is a 0, the frequency is not stored in a preset channel. If in the AJ preset store mode, the net number is

stored in the CD-17. Only HQ and HQII nets are able to be loaded. CHANNEL NUMBER indicates the channel to use if in the Preset or AJ modes. If in Preset and Load mode, this indicates the channel that is to be loaded with the frequency or net number. If in an AJ mode and an ERF (ECCM Remote Fill) is directed, this indicates the communications channel for the transfer. Channel 31, AJ or non-AJ, is SINCGARS CUE channel. Channel 30, AJ, is SINCGARS Coldstart channel.

MR selects the Maritime Mode (logic 1) and the Receiver-Transmitter is to use the frequencies stored according to the International Maritime Channel Number assignments. There are two frequencies stored, one for the coast transmitter and one for the ship's transmitting frequency. The Receiver-Transmitter is to select the coast frequency as the transmitting frequency and the ship frequency for the receiving frequency if the CO bit is a logic 1. If CO is a zero, the Receiver-Transmitter becomes a ship station and reverses the frequency sense.

The MARITIME CHANNEL NUMBER indicates the channel number to select if in the Maritime mode. If the system is in an AJ mode and an ERF is directed, the Maritime Channel number bit positions indicate the destination channel for the ERF if the Receiver-Transmitter is receiving and the source channel if transmitting.

30.2.2.4 Receive Command Data Word 4. This data word provides commands related to the ECCM functions. The format is:

					BIT NUMBER										
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
WAVE FORM			AJ	MASTR	TIME CMD			ERF			LE	-	DTV	DTL	TD
A	B	B			A	B	C	A	B	C					

where:

WAVEFORM indicates the particular ECCM waveform that is to be stored in an AJ preset if bit 1 Word 3 is set per the coding:

ECCM WAVEFORM	A	B	C
No change	0	0	0
Spare	0	0	1
Have Quick IIa	0	1	0
SINCGARS	0	1	1
Have Quick I	1	0	0
Have Quick II (NATO)	1	0	1
Have Quick II (non-NATO)	1	1	0
No Fill	1	1	1

* NOTE: SINCGARS waveform cannot be loaded.

AJ enables ECCM modes (logic 1) or places the Receiver-Transmitter in single channel (logic 0).

MASTR indicates that the system is to be a SINCGARS master station when this bit is a 1.

The function performed by the TIME CMD is determined by the code:

FUNCTION	A	B	C	EVENT
No time message	0	0	0	
Receive time over the air	0	0	1	Search for 1 minute for receipt of time over the air.
Receive time from the GPS input	0	1	0	Search for 1 minute for time at the GPS input.
Receive time from the bus	0	1	1	Update wrist watch time to time given in Message 1, Word 5.
Send time over the air	1	0	0	
Reset master time to zero	1	0	1	
Time request	1	1	0	Update time in Message 2, Word 5 to the time stored in the Applique
Spare	1	1	1	

The ERF functions are defined:

FUNCTION*	A	B	C	EVENT
No ERF message	0	0	0	
Receive Hopset	0	0	1	Receive Hopset on channel given in the channel number field in word 3 and store in the channel given by the Maritime channel in Word 3.
Receive Lockout set	0	1	0	Receive Lockout set on channel given in the channel number field in word 3 and store in the channel given by the Maritime channel in Word 3.
Send Hopset	0	1	1	Send Hopset stored in the channel given by the Maritime channel in Word 3 over the channel given by the channel number field.
Send Lockout set	1	0	0	Send Lockout set stored in the channel given by the Maritime channel in Word 3 over the channel given by the channel number field.

FUNCTION*	A B C	EVENT
Coldstart frequency change	1 0 1	Tune to the frequency given by the receive Command Data Word 1.
Spare	1 1 0	Valid in AJ channel 30.
Spare	1 1 1	

* NOTE: This field only valid if operating in a SINCGARS net.

LE, when a 1, selects the Late Entry mode to open the clock boundary for a SINCGARS net.

DTV, when a one, verifies the HAVEQUICK mwod date for the day in the time field of receive command data word 6. Verification indicated by tone in headset.

DTL, when a one, indicates the day byte in the time field of the receive command data word 6 is to be loaded as a HAVEQUICK MWOD date.

TD, when a one, selects the rt transmitter turn-down values defined in command message 3. A zero selects normal (default) turn-down values defined within the RT.

30.2.2.5 Receive Command Data Word 5. This word provides wristwatch time-of-day in hours and minutes where hours is 24-hour time:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TENS HOURS				UNITS HOURS				TENS MINUTES				UNITS MINUTES			
MSB			LSB	MSB			LSB	MSB			LSB	MSB			LSB
-----(BCD)-----				-----(BCD)-----				-----(BCD)-----				-----(BCD)-----			
80	40	20	10	8	4	2	1	80	40	20	10	8	4	2	1

30.2.2.6 Receive Command Data Word 6. This data word transfers the day and zeroize with the format being:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TENS DAYS				UNITS DAYS				ZEROIZE							
MSB			LSB	MSB			LSB	1	1	0	1	0	0	0	1
-----(BCD)-----				-----(BCD)-----											
80	40	20	10	8	4	2	1								

Day Range is 00 to 99.

Zeroize byte set to (11010001) shall erase all AJ presets if the Receiver-Transmitter is on. All other bit patterns are ignored.

30.2.2.7 Receive Command Data Word 7. This data word selects the scan operation with the format being:

BIT NUMBER																
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	C B A selects
													SCAN			0 0 1 scan of
													C	B	A	presets
																22-25.

30.2.3 Data Words for Command Message 3. Command Message 3 allows the Receiver-Transmitter and Applique to be filled with fixed frequency preset and AJ parameters over the MIL-STD-1553 bus. The message consists of a Fill Command Word followed by either eight or sixteen Fill Data Words.

30.2.3.1 Receive Fill Command Word. This data word provides the command information for the fill data and has the format:

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	0	0	0	0	0	0	0	0	0	A	B	C	D	E

where the coding for the designated bits are:

FUNCTION	A	B	C	D	E
No fill	0	0	0	0	0
Start fill	0	0	0	0	1
Receiver-Transmitter fill	0	0	0	1	0
Applique fill	0	0	1	0	0
End fill	0	1	0	0	0
Word-of-the-Day load	1	0	0	0	0
HAVEQUICK II training net	1	0	0	1	0
RF power turndown	1	0	0	1	1
SINCGARS Transec variable	1	0	1	0	0

All fill command words are followed by eight data words except the HAVEQUICK II training net, which is followed by sixteen data words.

30.2.3.1.1 Procedure to Fill the Fixed Frequency Presets. The procedure to fill the fixed frequency presets in the Receiver-Transmitter is as follows:

1. Send the Start Fill *command*. The eight data words that follow the Start Fill command are the number of RT fill packets, the CUE frequency, the Manual frequency and the Coldstart frequency. These are defined in 30.2.3.2.1.

2. Send the Receiver-Transmitter Fill Command followed by eight Preset Fill Words as defined in 30.2.3.2.2 providing the preset channel data.

3. Continue to send the Receiver-Transmitter Fill Command followed by eight Preset Fill Words until all desired presets are filled.

4. Send the End Fill command. In the first data word following this command the second byte contains the Check sum of the fill data received since the Start Fill command. The seven data words following do not have any significance and are to be discarded. These words are not included in the Check sum.

30.2.3.1.2 Procedure to Fill the AJ Parameters. The procedure to fill the Applique with the AJ parameters is as follows:

1. Send the Start Fill command. If no RT fill is to be sent the first data word after start fill contains zero. This message is defined in 30.2.3.2.1.

2. Send the Applique Fill Command followed by eight AJ Fill Words as defined in 30.2.3.3 providing the fill data.

3. Continue to send the Applique Fill Command followed by eight AJ Fill Words until all desired information is filled.

4. Send the End Fill Command. In the first data word following this command the second byte contains the Check sum of the fill data received since the Start Fill command. The seven data words following do not have any significance and are discarded. These words are not included in the Check sum.

30.2.3.1.3 Procedure to Fill Single Function Parameters. The procedure to fill the single functions (Word-of-the-Day, HAVEQUICK II training net, RF power turndown, and SINCGARS Transec variable) is to send the appropriate Fill Command word followed the corresponding Fill Data words given in 30.2.3.4. No End Fill command or Check sum are required.

30.2.3.2 Fixed Frequency Preset Fill Data Words. The eight fixed frequency fill data words are grouped in eight-bit bytes per the following format:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
BYTE N								BYTE N+1							

where the bytes N and N+1 are defined as:

DATA WORD	N	N+1
1	0	1
2	2	3
3	4	5
4	6	7
5	8	9
6	10	11
7	12	13
8	14	15

Byte 0 provides the number of total eight-word packets in the Receiver-Transmitter fill or the Block Number for the preset fill as described in the following paragraphs. The remaining 15 bytes are divided into five groups of three bytes each. Each of the five groups provide preset data for a channel. The preset channel groupings are bytes 1, 2, and 3; bytes 4, 5, and 6; bytes 7, 8, and 9; bytes 10, 11, and 12; and bytes 13, 14, and 15. In turn, the bytes within a group are defined as the Most Significant Byte (MSB), the Middle Byte (MDB), and the Least Significant Byte (LSB) as follows:

BYTE NUMBER		
MSB	MDB	LSB
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15

The format of each three-byte group is as follows:

MOST SIGNIFICANT BYTE (MSB)							
BIT NUMBER WITHIN THE BYTE							
7	6	5	4	3	2	1	0
TENS MHZ				UNITS MHZ			
MSB			LSB	MSB			LSB
(BCD)				(BCD)			
80	40	20	10	8	4	2	1

MIDDLE BYTE (MDB)							
BIT NUMBER WITHIN THE BYTE							
7	6	5	4	3	2	1	0
TENTHS MHZ				25 KHZ		100s MHZ	
MSB			LSB	MSB	LSB	MSB	LSB
(BCD)				(BINARY)		(BINARY)	
.8	.4	.2	.1	50	25	200	100

LEAST SIGNIFICANT BYTE (LSB)							
BIT NUMBER WITHIN THE BYTE							
7	6	5	4	3	2	1	0
OFFSET(KHZ)				SPARE			AM
SGN	MAG						
	MSB	LSB					
	10	5					

where the AM bit is set to a 1 for AM operation and to 0 for FM.

30.2.3.2.1 Packet Number. The first eight data words sent for a Receiver-Transmitter fill give the total number of eight-word messages that will be sent over the MIL-STD-1553 bus for the Receiver-Transmitter fill. Word 1 provides the number of packets in binary format. The byte group 1, 2, and 3 provide the fill for the SINCGARS CUE frequency; byte group 4, 5 and 6

provide the fill for the manual frequency; and, byte group 7 and 8 provide the fill for the SINCGARS COLDSTART frequency. All other bytes are spare.

30.2.3.2.2 Fixed Frequency Preset Data Words. The fill message for the fixed frequency presets consists of a block number and the data (see 30.2.3.2) for five preset channels for the specific block number. The Receiver-Transmitter shall only change the presets assigned to the block received over the MIL-STD-1553 bus. However, all preset within the received block shall be changed. Therefore, even if only some of the presets are changed, the data for all preset channels must be sent. The message is formatted in bytes as described in 30.2.3.2 where the bytes in the message have the following format:

BYTE 0 BLOCK NUMBER CODE	BYTES 1-3 PRESET CHANNEL	BYTES 4-6 PRESET CHANNEL	BYTES 7-9 PRESET CHANNEL	BYTES 10-12 PRESET CHANNEL	BYTES 13-15 PRESET CHANNEL
00010001	1	2	3	4	5
00100010	6	7	8	9	10
00110011	11	12	13	14	15
01000100	16	17	18	19	20
01010101	21	22	23	24	25
01100110	26 TX	26 RX	27 TX	27 RX	28 TX
01110111	28 RX	29 TX	29 RX	30 TX	30 RX

NOTE: Preset channels 26 through 30 are half-duplex channels that can store separate transmit and receive frequencies. Even if both the transmit and receive frequencies are the same, they shall be stored separately.

30.2.3.3 AJ fill Data Words. The message for the fill of the Applique with the AJ parameters is divided into eight-bit bytes as given in 30.2.3.2. However, the format of the message structure is different than that of the fixed frequency non-AJ presets. The format for the AJ information is:

1. First field byte is the code (10010110) for the Start of Transmission of a data group type.

2. The next field byte is a code for the Group Type of data as given in 30.2.3.3.1.

3. The next field byte is the number in binary format of data bytes for the group type that will follow.

4. The next set of bytes contain the data for the Group Type. The number of these bytes must agree with the count given in the previous step. The data may span several messages. If the data extends into another message, the data is continued with the first byte of the next message, after the fill command. There is no Group Type information.

5. The next byte following the group data contains another Start of Transmission code to indicate the start of the next group of data. The previous steps will be repeated with the Start of Transmission code, the code for the Group Type, the number of data bytes, and the data.

6. The preceding sequence will be continued until all data groups have been transferred.

7. At the message byte following the last data group, the End of Transmission code (011001001) is given. The rest of the bytes of the message after the End of Transmission code are ignored by the Applique, but the remaining bytes are included in the Check sum.

30.2.3.3.1 Applique AJ Group Type Codes. The codes for the various types of data are :

GROUP CODE	AJ DATA TYPE
00000000	SINCGARS Transec Variable
00000001	Presets for AJ Channel 1
00000010	Presets for AJ Channel 2
00000011	Presets for AJ Channel 3
00000100	Presets for AJ Channel 4
00000101	Presets for AJ Channel 5
00000110	Presets for AJ Channel 6
00000111	Presets for AJ Channel 7
00001000	Presets for AJ Channel 8
00001001	Presets for AJ Channel 9
00001010	Presets for AJ Channel 10
00001011	Presets for AJ Channel 11
00001100	Presets for AJ Channel 12
00001101	Presets for AJ Channel 13
00001110	Presets for AJ Channel 14
00001111	Presets for AJ Channel 15
00010000	Presets for AJ Channel 16
00010001	Presets for AJ Channel 17
00010010	Presets for AJ Channel 18
00010011	Presets for AJ Channel 19
00010100	Presets for AJ Channel 20
00010101	Presets for AJ Channel 21
00010110	Presets for AJ Channel 22
00010111	Presets for AJ Channel 23
00011000	Presets for AJ Channel 24
00011001	Presets for AJ Channel 25
00011010	SINCGARS CUE Frequency
00011011	HAVEQUICK I Word-of-the-Day
00011100	HAVEQUICK II Words-of-the-Day (see Note)
00011110	HAVEQUICK II Training Net
00011111	SINCGARS Lockout Set 1
00100000	SINCGARS Lockout Set 2
00100001	SINCGARS Lockout Set 3
00100010	SINCGARS Lockout Set 4
00100011	SINCGARS Lockout Set 5
00100100	SINCGARS Lockout Set 6

GROUP CODE	AJ DATA TYPE
00100101	SINCGARS Lockout Set 7
00100110	SINCGARS Lockout Set 8
00100111	SINCGARS waveshape and module data
00101000	HAVEQUICK waveshape and module data

NOTE: If all six words of the Words-of-the-Day are used, the header byte included in the data fill of the first Word-of-the-Day will be set to 0. If all six are not used, the data fields and header bytes for the unused Words-of-the-Day positions will be set to 0.

30.2.3.4 Single Function Data Words. For the single functions Word-of-the-Day and the training nets, each word of the message is in the form of a frequency with the following format:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TENS MHZ				UNITS MHZ				TENTHS MHZ				25 KHZ		100s MHZ	
MSB			LSB	MSB			LSB	MSB			LSB	MSB	LSB	MSB	LSB
-----(BCD)-----				-----(BCD)-----				-----(BCD)-----				(BINARY)		(BINARY)	
80	40	20	10	8	4	2	1	.8	.4	.2	.1	50	25	200	100

The RF power output under various conditions shall be able to be controlled from the MIL-STD-1553 bus. Each byte of the message as described in 30.2.3.2 shall be able to control the RF power turndown under the following conditions:

BYTE	OPERATING CONDITION
0	Normal operating conditions
1-4	Abnormal VSWR's (range dependent)
5	Abnormal VSWR or temperature range
6	Abnormal VSWR or temperature range
7	Abnormal VSWR or low input supply power

A byte code of all 1's provides full power output; a code of all 0's will reduce the power by approximately 20 dB. The internal Receiver-Transmitter software shall have default values of the abnormal conditions which will protect the radio. If a value higher than the default value for a given condition is provided over the bus, the radio shall select the default. If the bus supplied value is less than the default value, the radio shall use the bus supplied value.

30.2.4 Data Words for Command Message 30. The data words for message 30 initiate test modes and provide a random bit test pattern.

30.2.4.1 Receive Command Data Word 1. This word initiates tests within the system and will have the format:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
IBT	SP	MUX	SSB	SPARE											

where:

IBT transition from a 0 to a 1 initiates built-in-test.

SP is a spare bit.

MUX is a configuration bit which, when set to 1, inhibits use of the Terminal Fault and Busy flags.

SSB, when set to a 1 along with IBT being set to 1, shall initiate a single-step built-in-test. One test step shall be run with each command message. In operation, the single-step test mode shall be initiated and the response message 15 from the Receiver-Transmitter will be monitored for test complete before another single-step command will be given to proceed to the next step.

30.2.4.2 Receive Command Data Word 2. This data word is a random bit logic pattern. It is used to test the transfer of data between the command center and the Receiver-Transmitter.

30.3 Transmit Messages. The transmitted message from the Receiver-Transmitter shall be a direct response to the received command. The Receiver-Transmitter shall respond to MIL-STD-1553B messages and mode codes with a response gap of four to seven microseconds. The response shall be compatible with MIL-STD-1553A bus formats. The ARC-210 shall be capable of providing a valid response to any command up to a maximum rate of 20 times per second. This means the minimum intermessage gap to assure valid response data will be 50 milliseconds. The defined messages that the Receiver-Transmitter shall transmit over the bus consist of a status word and up to eight data words. The status response messages that shall be defined are:

1. Status response shall be always returned whenever the Receiver-Transmitter is addressed. The status word, which shall be the only message in response to receive command message numbers 1, 3, and 30 is defined in 30.2.2, 30.2.3, and 30.2.4 respectively.

2. Message number 2 shall provide the operating conditions (frequency, mode, AJ information, etc.) of the Receiver-Transmitter. This message shall be in response to transmit command message 2. The response shall contain the status word and up to seven data words. The command message can request any number of data words from the Receiver-Transmitter. However, only the first seven words are defined. If more than seven words are requested, the Receiver-Transmitter shall send the requested number, but all words beyond the seventh may be meaningless.

3. Message number 15 shall provide test result data and shall be in response to transmit command message number 15. Eight data words are defined for message 15. The command message may request any number and that number shall be returned by the Receiver-Transmitter. Any words beyond the eighth may be meaningless.

As with the command messages, each word shall contain 16 bits where bit 0 is the most significant bit and the first bit to be transmitted. The status word and the response data words are defined in the following paragraphs.

30.3.1 Status Word Definition. A status word shall be always sent to acknowledge the receipt of a message addressed to the Receiver-Transmitter except for broadcast commands. If there are format errors in the received command, the status word shall be suppressed. This message shall not contain the SUBMESSAGE ADDRESS or the WORD COUNT that is a part of the command received message given in 30.2.1. The format of the status word shall be:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TERMINAL ADDRESS					ME	INS	SR	ST2	ST1	ST0	BCR	BSY	S/F	DBA	T/F
MSB				LSB											
-----(BINARY)------															
4	3	2	1	0											

where the parameters within the word shall be defined:

TERMINAL ADDRESS: Same as that described for the command word in 30.2.1.

ME: Message error. Shall be set to a 1 if an an illegal command messages is received, if there was an error in the subaddress, or if the word count does not agree with the number of words received.

INS: Instrumentation bit which shall not be used and is always 0.

SR: Service request which shall not be used and is always 0.

ST2, ST1, ST0: Not used and are always 0.

BCR: Broadcast command received. When a broadcast command is received, the Receiver-Transmitter shall set this bit to 1, but shall not respond over the bus until a command is directly addressed to the Receiver-Transmitter requesting data.

BSY: Shall be set to a 1 if the Receiver-Transmitter terminal is busy and cannot accept commands.

S/F: System fault flag that shall be set to a 1 if there is a Radio System fault.

DBA: Dynamic bus acceptance which shall not be used and is set to 0.

T/F: Set to a 1 if there is a fault in the bus terminal.

30.3.2 Data Words for Response Message 2. The following describe the data words that shall be sent by the Receiver-Transmitter in response to a request for data:

30.3.2.1. Transmit Response Data Word 1. This data word shall provide the actual operating frequency in the non-AJ mode or AJ net number if in an AJ mode. The format for frequency in a non-AJ mode shall be:

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TENS MHZ				UNITS MHZ				TENTHS MHZ				25 KHZ		100s MHZ	
MSB			LSB	MSB			LSB	MSB			LSB	MSB	LSB	MSB	LSB
-----(BCD)-----				-----(BCD)-----				-----(BCD)-----				(BINARY)		(BINARY)	
80	40	20	10	8	4	2	1	.8	.4	.2	.1	50	25	200	100

The format for Data Word 1 when in an AJ mode shall be:

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HUNDREDS DIGIT				TENS DIGIT				UNITS DIGIT				FILL STATUS			
MSB			LSB	MSB			LSB	MSB			LSB				
-----(BCD)-----				-----(BCD)-----				-----(BCD)-----							
800	400	200	100	80	40	20	10	8	4	2	1				

where the FILL STATUS shall be defined as follows:

	BIT NUMBER			
FUNCTION	12	13	14	15
Everything loaded, Narrowband selected (HAVEQUICK non-conferencing selected)	0	0	0	0
Word-of-the-Day for HAVEQUICK I not loaded	0	0	0	1
Words-of-the-Day for HAVEQUICK II not loaded	0	0	1	0
TRANSEC for SINCGARS not loaded	0	0	1	1
HAVEQUICK Time not loaded	0	1	0	0
SINCGARS time not loaded	0	1	0	1
No Operational Day loaded	0	1	1	0
Invalid Net ID number loaded	0	1	1	1
No HAVEQUICK I training net loaded	1	0	0	0
No HAVEQUICK II training net loaded	1	0	0	1
No valid fill for SINCGARS preset	1	0	1	0
Everything loaded, Wideband selected (HAVEQUICK conferencing selected)	1	0	1	1
Spare	1	1	0	0
Spare	1	1	0	1
Spare	1	1	1	0
No Fill data	1	1	1	1

30.3.2.2 Transmit Response Data Word 2. This data word shall provide the operating mode information of the Receiver-Transmitter. The word format shall be as follows:

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MODE		SQL	AM	RX	IF	MO	GM	2.5	SQL	AM	OFFSET			CONFIG	
A	B							KHZ	IND	IND	SGN	MAG		ID	
												MSB	LSB		

where:

The MODE shall be indicated by the coding:

MODE	A	B
Transmit/receive	0	0
Transmit/receive plus guard receiver	0	1
Undefined	1	0
Automatic Direction Find	1	1

SQL shall be the state of Receive Command Message 1 Data Word 2, 30.2.2.2.

AM shall denote the state of Receive Command Message 1 Data Word 2, 30.2.2.2.

The RX bit shall indicate that the Receiver-Transmitter is in the receive mode if set to a 1 and in the transmit mode if reset to a 0.

IF, when a logic 1 indicates an invalid frequency which is any frequency out of band. This means any frequency below 30.000 MHZ, between 88.000 and 107.975 MHZ, 174.001 to 224.975 MHZ, and above 400.000 MHZ.
MO shall signify the that the Receiver-Transmitter is operating at a Maritime offset from the transmit frequency if the selected transmit frequency (either manual or preset channel) is a valid transmit Maritime frequency. If the transmitter is not set at a valid transmit frequency, there shall be no offset. A logic 1 shall indicate the Maritime offset.

NOTE: This condition should not be confused with the Maritime Mode where the Maritime channel is selected.

GM being a logic 1 shall indicate that the main communications receiver is tuned to the guard frequency applicable for the band selected by the manual or preset channel frequency. The applicable guard frequencies are 243 MHz for the bands 30-88, 156-174, or 225-400 MHz and 121.5 MHz for the 108-156 MHz band. When GM is a logic 0, the main receiver shall tuned to the normal commanded frequency.

2.5 KHZ shall be 2.5 KHZ offset of the operational frequency.

SQL IND shall be set to a 0 if squelch is enabled.

AM IND shall be set to a 0 if the Receiver-Transmitter is in the AM mode and to a 1 if in the FM mode.

OFFSET shall be the number of 5 KHz increments that the operating frequency is offset from the manually entered or preset base frequency which is in 25 KHz increments. The SGN bit shall be a 1 to indicated that the offset is added to the base frequency and a 0 to indicate that the offset is subtracted from the base. The two bits labeled MAG shall provide the magnitude of offset (binary coded) that is added or subtracted from the base frequency.

CONFIG ID shall provide the type of Receiver-Transmitter that is in the system:

RECEIVER-TRANSMITTER TYPE	BIT 14	BIT 15
RT-1250	0	0
RT-1250A	0	1
Configuration per Word 7	1	0
not used	1	1

30.3.2.3 Transmit Response Data Word 3. Data Word 3 shall provide Preset and Maritime information within the Receiver-Transmitter. The word format shall be:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PRE	LD	CHANNEL NUMBER					MR	CO	MARITIME CHANNEL NUMBER						
		MSB				LSB			MSB						LSB
		-----(BINARY)------							---------(BINARY)----------						
		16	8	4	2	1			64	32	16	8	4	2	1

where:

PRE shall indicate the Preset Mode (logic 1) or Manual Mode (logic 0). If the Receiver-Transmitter is in the Preset Mode, the operating frequency (or Net in an AJ mode) shall be that frequency (or Net) stored for the given Channel Number in the word, and shall be reported in Word 1.

If LD is a 1 the radio shall have stored the frequency (or net) given in Word 1 in the Channel given in Word 3.

CHANNEL NUMBER shall indicate the operating channel if in the Preset or AJ modes. Word 1 shall indicate the frequency or net of operation.

MR if a logic 1 shall indicate that the Receiver-Transmitter is in the Maritime Mode. The Receiver-Transmitter shall use the frequencies stored according to the International Maritime Channel Number assignments. There shall be two frequencies stored, one for the coast transmitter and one for the ship's transmitting frequency. The Receiver-Transmitter shall use the coast frequencies as the transmitting frequency and the ship frequency for the receiving frequency if the CO bit is a logic 1. If CO is a zero, the Receiver-Transmitter shall be acting as a ship station and the frequency sense is reversed.

The MARITIME CHANNEL NUMBER shall indicate the operating Maritime channel number if in the Maritime mode. If the system is in an AJ mode and an ERF is directed, the Maritime Channel number bit positions shall indicate the destination channel for the ERF if the Receiver-Transmitter is receiving and the source channel if transmitting.

30.3.2.4 Transmit Response Data Word 4. Data Word 4 shall provide the actual AJ operational function of the Receiver-Transmitter. The format shall be:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
WAVEFORM			TDS	TDR	LES	AJ	AJ	-	FILL PROCESS				CUE	TIM	ERF
A	B	C				SEL	MAS		A	B	C	D	ACT	RCV	RCV

where:

WAVEFORM shall be the actual ECCM waveform under which the Receiver-Transmitter is operating:

ECCM WAVEFORM	A	B	C
Spare	0	0	0
Spare	0	0	1
HAVEQUICK IIa	0	1	0
SINCGARS	0	1	1
HAVEQUICK I	1	0	0
HAVEQUICK II (NATO)	1	0	1
HAVEQUICK II (non-NATO)	1	1	0
No Fill	1	1	1

TDS set to a 1 shall indicate that the Receiver-Transmitter is using RF power output turn-down tables in accordance with those supplied over the MIL-STD-1553 bus. If TDS is set to 0, the Receiver-Transmitter shall be using the tables stored within the Receiver-Transmitter software.

TDR set to a 1 shall indicate that the Receiver-Transmitter has received RF power output turn-down tables over the MIL-STD-1553 bus.

LES set to a 1 shall signify that Late Entry into a SINCGARS net has been selected.

AJ SEL set to a 1 shall indicate that the Receiver-Transmitter is in an AJ mode.

AJ MAS set to a 1 shall indicate that the radio system is operating as a SINCGARS master station.

The FILL PROCESS shall indicate the status of the Fill operation per the following code:

FUNCTION	A	B	C	D	EVENT
No Fill Operation	0	0	0	0	Reset, power-on
Fill in process	0	0	0	1	Start Fill command has been received, but End Fill processing has not been completed.
Fill failed	0	0	1	0	Calculated check sum did not equal check sum received on bus.
Fill failed validity	0	0	1	1	Applique indicates Fill process failed.

FUNCTION	A	B	C	D	EVENT
Fill completed passed	0	1	0	0	Applique indicates Fill complete and passed.
Zeroize complete	0	1	0	1	Applique memory erase has been completed.

CUE ACT set to a 1 shall indicate there is activity on the CUE channel.

TIM RCV set to a 1 shall denote that time has been received.

ERF RCV shall be set to a 1 when the Receiver-Transmitter is in the ERF receive mode.

30.3.2.5 Transmit Response Data Word 5. This data word shall return the hours and minutes of the wristwatch time that is stored in the Applique for SINCGARS operation where hours is 24-hour time:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TENS HOURS				UNITS HOURS				TENS MINUTES				UNITS MINUTES			
MSB			LSB	MSB			LSB	MSB			LSB	MSB			LSB
-----(BCD)-----				-----(BCD)-----				-----(BCD)-----				-----(BCD)-----			
80	40	20	10	8	4	2	1	80	40	20	10	8	4	2	1

30.3.2.6 Transmit Response Data Word 6. This data word shall return the day of the month that is stored in the Applique for SINCGARS operation and the scan operation status with the format being:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TENS DAYS				UNITS DAYS				SPARE		DWELL		SCAN			
MSB			LSB	MSB			LSB							C	B A
-----(BCD)-----				-----(BCD)-----											
80	40	20	10	8	4	2	1								

SCAN CBA indicates scan mode selected. Dwell set to 1 indicates active receive on current frequency in Word 1.

30.3.2.7 Transmit Response Data Word 7. This word shall provide the system configuration or revision and the ARC-210 Receiver-Transmitter identification according to the format:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SYSTEM CONFIGURATION												SYSTEM ID			

where the first release of the system shall have a System Configuration of 0 and will be incremented with each successive revision. The System Identification shall be 0001 for an RT-1556 Receiver-Transmitter alone and 0010 for an RT-1556 with a CD-17 Applique.

30.3.3 Data Words for Response Message 15. The following describe the data words that shall be sent by the Receiver-Transmitter in response to a request for test and configuration data:

30.3.3.1 Transmit Response Data Word 1. This data word shall be the random bit pattern that was received as Receive Command Message 30 Data Word 2 defined in 30.2.4.2. The pattern shall be returned during the test mode to enable the MIL-STD-1553 bus controller to check the interface with the Receiver-Transmitter.

30.3.3.2 Transmit Response Data Word 2. This data word shall return test status and shall have the following format:

BIT NUMBER

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TIP	EGN	TCM	RGN	AGN	CONFIG ID		SRA NO 1 ID			SRA NO 2 ID			SRA NO 3 ID		
							A	B	C	A	B	C	A	B	C

where:

TIP shall be a 1 for Built-in-Test (BIT) in progress.

EGN shall be a 0 if the system is in a GO condition and a 1 for a NO-GO condition.

TCM shall be a 1 if BIT is complete.

RGN shall be a 0 if the Receiver-Transmitter is in a GO condition.

AGN shall be a 0 if the antenna subsystem is in a GO condition.

CONFIG ID shall be the system configuration as given by the code:

RECEIVER-TRANSMITTER TYPE	BIT 5	BIT 6
RT-1250	0	0
RT-1250A	0	1
Configuration per Word 5	1	0
Not used	1	1

SRA NO 1 ID shall be the code for the most likely failed SRA in the Receiver-Transmitter.

SRA NO 2 ID shall be the code for the second most likely failed SRA in the Receiver-Transmitter.

SRA NO 3 ID shall be the code for the third most likely failed SRA in the Receiver-Transmitter.

The codes for the SRAs within the Receiver-Transmitter shall be:

SRA	A	B	C
External to RT	0	0	0
Chassis	0	0	1
Power Amplifier	0	1	0
Control	0	1	1
Power Supply	1	0	0
Synthesizer	1	0	1
Receiver	1	1	0
Guard Receiver	1	1	1

30.3.3.3 Transmit Response Data Word 3. This word shall be used to report the fault status of each of the units in the system. If there is a fault in a unit, its respective bit in the following format shall be set to a 1. Otherwise, the bit shall be a 0 for a properly operating unit.

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
APP	RT	-	HPA	FIL	MT	ANT	ACU	SPARE							

where the units shall be defined as:

APP: Applique.

RT: Receiver-Transmitter only, not considering the Applique.

HPA: High Power Amplifier an the EMC system (future growth).

FIL: Filter in the EMC system (future growth).

MT: Mount in the EMC system (future growth).

ANT: Antenna.

ACU: Antenna Converter.

30.3.3.4 Transmit Response Data Word 4. This data word provides results of detailed tests of the Receiver-Transmitter. The format shall be:

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ITEM UNDER TEST				TEST ELEMENT				TEST NUMBER							
MSB			LSB	MSB			LSB	MSB							LSB
---(BINARY)----				---(BINARY)----				----------(BCD)----------							
								60	40	20	10	8	4	2	1

where:

ITEM UNDER TEST shall be a major element within the Receiver-Transmitter such as a Shop Replaceable Unit (SRA) or a card within an SRA.

TEST ELEMENT shall be a subgroup of the major element such as a card if the major element was an SRA or a gate array if the major element was an SRA or a card.

TEST NUMBER shall be the specific test number where a series of tests may be performed.

30.3.3.5 Transmit Response Data Word 5. This word shall provide the system configuration or revision and the ARC-210 Receiver-Transmitter identification. It shall provide the same information as Recieve Command Message 2 Data Word 7 given in 30.3.2.7.

30.3.3.6 Hardware and Software Configuration Data Words. Data Words 6, 7, and 8 shall provide the configuration revision. Word 6 shall relate to the Receiver-Transmitter; Word 7 to the PN portion of the Applique; and Word 8 to the SYNC portion of the Applique. The format for each word shall be as follows:

BIT NUMBER															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HARDWARE CONFIGURATION								SOFTWARE CONFIGURATION							
MSB							LSB	MSB							LSB
(BINARY)								(BINARY)							

The first release of the software will be coded 0101H.

APPENDIX D

INTERFACE DESCRIPTIONS

10. SCOPE

10.1 Scope. This appendix details the PIN assignment requirements for the AN/ARC-210(V) interface connnectors. This appendix is a mandatory part of the specification.

20. APPLICABLE DOCUMENTS
This section is not applicable to this appendix.

30. REQUIREMENTS

30.1 Receiver-Transmitter Interfaces. The Receiver-Transmitter shall have four multi-function interface connectors having the following functions:

1. Power.

2. Same functions (other than power) and same type as the non-ECCM ARC-182 (i.e. the RT-1250A).

3. The expanded functions of the ARC-182 ECCM radio.

4. Data/control transfer between the Receiver-Transmitter and the Applique.

30.1.1 Power Connector.

Designation: J6
Part Number: D38999/20WA35PN
Mating Connector: D38999/26WA35SN

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
1	I	+ 27.5 VDC Primary Power	Primary power (155W transmit average)
2	I	Primary Power Return	Power/signal ground return for primary
3	I	Primary Power Return	Power/signal ground return for primary
4	I	CHASSIS GROUND	Chassis ground
5		SPARE	
6	I	+ 27.5 VDC Primary Power	Primary power (155W transmit average)

30.1.2 Compatible Control Connector

Designation: J2
Part Number: RPN 371-9037-010
Mating Connector: RPN 359-0677-040

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
1	I	1553 Terminal ADDRESS A	Open or ground for address. Ground for RT1 and open for RT2 for two RTs and one control. Sets 1553 terminal address.
2		RESERVED	
3		RESERVED	
4	I	SYSTEM OFF	Open for RT off; ground to turn RT on.
5	I	SQUELCH DISABLE	Open for normal squelch; ground or 0 +/- 5 VDC sinking 5 ma to disable squelch.
6	I	TONE TRANSMIT	Open for no tone; ground or 0 +/- 5 vdc sinking 5 ma for 1000 Hz tone modulation.
7	I	1553 TERMINAL ADDRESS A1	Open or ground for address. Sets 1553 Terminal Address.
8	I	CHASSIS GROUND	
9	I	CHASSIS GROUND	
10	I	1553 TERMINAL ADDRESS A2	Open or ground for address. Sets 1553 Terminal Address
11	I	PUSH TO TALK (KEY)	Open for receive; ground or 0 +/- 5 vdc sinking 5 ma for transmit.
12	I	1553 TERMINAL ADDRESS A3	Open or ground for address. Sets 1553 Terminal Address.
13	I	GUARD PRECEDENCE	Open for normal; ground or 0 +/- 5 vdc sinking 5 ma for 243 MHz guard monitor.
14	I	1553 TERMINAL ADDRESS A4	Open or ground for address. Sets 1553 Terminal Address.

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
15	I	RECEIVER SENSITIVITY	Open for normal; ground or 0 +/- 1 vdc sinking 5 ma to reduce receiver sensitivity by 10 dB in the 108-174 MHz band.
16	O	UHF BAND INDICATOR	Open for VHF; ground or 0 ± 1.3V sinking 100 ma for UHF.
17	I	X-MODE AUDIO SELECT	Open for plain text; ground or 0 +/- 5 vdc sinking 5 ma for X-mode audio.
18	O	RT DATA HI	Differential Aperiodic pulse train; V-low: 0-1 v; V-high: 3.4-5 v.
19	I	CONTROL DATA HI	Differential Aperiodic pulse train; V-low: 0-1 v; V-high: 3.4-5 v.
20	O	ADF MODE INDICATOR	Open for normal; ground or 0 ± 1.3V sinking 100 ma for ADF.
21		RESERVED	
22	I	CASS/DICASS AUDIO	0.5 v rms, 1000-50000 Hz for 90% modulation.
23	O	LOW VHF FM INDICATOR	Open for normal; ground or 0 ± 1.3V sinking 100 ma for FM in 30-88 MHz band.
24		RESERVED	
25	I	TAKE CONTROL	Open for 1553 bus in control; ground or 0 +/- 1 VDC sinking 5 ma for the Remote Control.
26	I	RT DATA LO	See Pin 18.
27	I	CONTROL DATA LO	See Pin 19.
28	O	AM MODE INDICATOR	Open for FM mode; ground or 0 ± 1.3V sinking 100 ma for AM mode.
29	O	WIDEBAND RECEIVE AUDIO OUTPUT	0.25-8.3 v rms for 90% AM or +/- 8000 Hz FM deviation.
30		RESERVED	
31	O	ADF AUDIO OUTPUT	4 v pk-pk for 90%, 1000-Hz modulation.

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
32	O	ERD HI	Ready: pin 32 2-5 volts more positive than pin 33; not ready: pin 33 2-5 volts more positive than pin 32 or both open circuit.
33	0	ERD LO	See pin 32.
34	I	IF BANDWIDTH CONTROL	Open for narrowband; ground or 0 +/- 5 vdc sinking 5 ma for wideband mode.
35		SPARE	
36	O	VOICE OUTPUT 150 OHMS	200 mw for 30% AM or +/-2400 Hz FM deviation.
37	O	VOICE OUTPUT 600 OHMS	250 mw for 30% AM or +/-2400 Hz FM deviation.
38	O	GUARD X-MODE AUDIO OUTPUT	0.15-0.45 v rms into 600 ohms for 30% AM at 1000 Hz.
39	O	RETRANSMIT CONTROL	Open for no relay; ground or 0 ± 1.3V sinking 100 ma for keying of auto relay transmission.
40	I	RETRANSMIT AUDIO INPUT	6.5 +/- 1 volt to produce 90% AM or +/-5600 FM deviation.
41	O	SYNCHRONIZED PTT	Open for receive; ground or 0 ± 1.3V sinking 100 ma to key KY.
42	O	RETRANSMIT AUDIO OUTPUT	6.5 +/- 1 v rms for 30% AM or +/-2400 Hz FM deviation at 1000 Hz.
43	I	DELAYED PTT (KEY)	Open for receive; ground or 0 +/- 5 vdc sinking 5 ma for transmit mode.
44	O	VOICE OUTPUT COMMON	Return for pins 36 and 37.
45	O	MAIN RECEIVER AGC	Test point.
46	O	GUARD RECEIVER AGC	Test point.
47	I	MIC AUDIO INPUT LO	Return of microphone input.
48	I	WIDEBAND TRANSMIT AUDIO INPUT	12 +/- 1 v pk-pk to produce 90% AM or +/-5600 Hz deviation.
49	I	MARITIME OFFSET	Open for normal; ground or 0 +/- 5 vdc sinking 5 ma for 4.6 MHz offset on selected frequencies.

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
50		SPARE	
51	I	X-MODE RECEIVE AUDIO INPUT	6.5 +/- 1 v rms for 250 mw voice output at pin 37.
52	O	UNATTENUATED AUDIO (OUTPUT)	6.5 +/- 1 v rms for 30% AM or +/-2400 Hz FM deviation at 1000 Hz.
53	I	MIC AUDIO INPUT HI	0.25-1.5 v rms produces 90% AM or +/-5600 Hz FM deviation; provides 16 v minimum microphone bias.
54		SPARE	
55	I	CHASSIS GROUND	Chassis, shield ground.

30.1.3 ECCM and Functions Control Connector.

Designation: J5
Part Number: RPN 371-9037-020
Mating Connector: RPN 359-0677-070

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
1	-	SPARE	Reserved for future growth.
2	-	SPARE	Reserved for future growth.
3	I	SHIELD GROUND	Tied to chassis.
4	I	SPARE INPUT 1	Reserved for future growth.
5	I	DS-101 LOGIC REF	RT ground.
6	O	SPARE OUTPUT 1	Reserved for future growth.
7	-	SPARE	Reserved for future growth.
8	I	HPA SIDETONE	560 +/- 150 mv for 30% AM.
9	O	FM MODE INDICATOR	Open for AM; ground or 0 $\pm$ 1.3V sinking 100 ma for FM.
10	I	ANTENNA TYPE	Open for passive antenna; short or 0 +/- 1 vdc relative to ANTENNA REF for tunable.
11	I/O	DS-101 DATA (+)	Aperiodic data: V-high: +3 to +5 v relative to pin 5 REF; V-low: 0 to +2 v relative to pin 5.

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
12	I	GUARD ANTENNA SELECT	Open for comm antenna; ground or 0 +/- 5 VDC sinking 5 ma for Guard antenna.
13	-	SPARE	Reserved for future growth.
14	-	SPARE	Reserved for future growth.
15	-	SPARE	Reserved for future growth.
16	-	SPARE	Reserved for future growth.
17	I/O	DS-101 DATA (-)	See pin 11 for levels.
18	I	LOW LEVEL WB INPUT SELECT	Open for normal; ground or 0 +/-5 Vdc sinking 5 mA for Low Level select.
19	I	ANTENNA REFERENCE	Ground reference for Antenna Converter unit.
20	I	DS-101 WAKEUP	Same level as Pin 5 for not busy; +5 v relative to Pin 5 prior to DS-101 Data Link.
21	O	ECCM Blanking	0 $\pm$ 1.3 v for RT blanked; open for RT not blanked.
22	I	SPARE	Reserved for future growth.
23		SPARE	
24	I/O	1553 DIRECT Bus A LO	Balanced; transmit: 6-9 v pk-pk; receive: 1.3-20 v pk-pk.
25	O	ECCM MODE INDICATOR	Open for normal; ground or $\pm$ 1.3V sinking 100 ma for ECCM.
26	I	RECEIVER INJECTION BLANKING REFERENCE	Grounded at source.
27	O	SPARE OUTPUT 2	Reserved for future growth.
28	I	SQUELCH TONE DISABLE	Open for tone; ground or 0 +/- 5 vdc sinking 5 ma to disable tone.
29	I	ANTENNA FAULT	Open for fault; short or 0 +/- 1 vdc relative to ANTENNA REF for normal.
30	I	ZEROIZE	Open for normal; 0 $\pm$ 1 Vdc to Zeroize AJ data.

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
31	I/O	1553 DIRECT Bus A HI	See pin 24.
32	I	RECEIVER INJECTION BLANKING SIGNAL	Mark: -4 to -6 v; space: +4 to +6 v.
33	I	AUXILIARY CLOCK ENABLE	External 12 - 15 vdc battery enables Applique clock during RT off. Open time lost 7 sec after power off.
34	O	HALF-DUPLEX INDICATOR	Open for normal operation, 0 ± 1.3 Vdc for Half-Duplex operation; sink 100 mA.
35	I	KY SQUELCH CONDITION	Open for normal operation 0 ± 5 Vdc for KY detected signal.
36	I	1553 TERMINAL ADDRESS PARITY	Open or ground for odd parity. Enables 1553 Terminal Address.
37		SPARE	Reserved for future growth.
38		SPARE	
39	O	AGILE FILTER DATA LO	Differential aperiodic data; V-low: 0 - 1.3 v; V-high: 3.4 - 5 v.
40	I	SATCOM TURN-DOWN	Open for normal operation 0 ± 1 V for turn-down of PA RF output.
41	I	GPS TIME OF DAY	HAVE QUICK GPS PTTI in accordance with ICD-GPS-060 Manchester II serial format at 1667 BPS, TTL
42	O	TX MODE INDICATOR	Open for receive; 0 ± 1.3 Vdc sinking 100 ma for transmit.
43		SPARE	
44		SPARE	
45		SPARE	
46	O	AGILE FILTER DATA HI	See pin 39.
47	O	IFM HI/LO BAND INDICATOR	Ground or 0 +/- 1.3 vdc for 30 - 51.4 MHz; open for above 51.4 MHz.
48	I/O	1553 XFMR BUS A HI	Transmit: 18 - 27 v pk-pk; Receive: 0.86 - 14 v pk-pk.
49	I/O	1553 DIRECT BUS B HI	See pin 24.

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
50	I/O	1553 XFMR BUS B HI	See pin 48.
51	O	ANTENNA DATA HI	See pin 39.
52	O	ANTENNA DATA LO	See pin 39.
53	I/O	1553 XFMR BUS A LO	See pin 48.
54	I/O	1553 DIRECT BUS B LO	See pin 24.
55	I/O	1553 XFMR BUS B HI	See pin 48.

30.1.4 Applique Interface Connector.

RT Designation: J7
RT Connector Part Number: ITT DDMAMF51537-46
Applique Connector Part Number: ITT DDMAM51536-37

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
1		SPARE	Reserved for future growth.
2	O	CIPHER	Logic 0 for secure mode; logic 1 for plain text; see Note 1 for levels.
3	I	APP FREQUENCY	Next frequency; level per Note 1.
4	I	AUDIO GND	Audio return to Baseband circuits.
5	I	+7.5 V DC APP	Regulated voltage from the RT.
6	I	APP RETRANSMIT	Logic 0 for no signal present; logic 1 for signal; see Note 1 for levels.
7	I	HEADSET DATA	Same signal as Pin 10 in non-ECCM or HAVE QUICK I or II; logic 0, level per Note 1, in SINCGARS non secure mode; digital data stream, levels per Note 1, in SINCGARS secure mode.
8	I	HEADSET AUDIO	Same as Pin 10 in non-ECCM mode; levels per Note 3 in ECCM modes.
9	I	MONITOR FAULT	Logic 0 for Applique fault; logic 1 for normal; levels per Note 3.

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
10	O	RCV AUDIO/DATA	Gated detector outputs depending upon mode (see Pins 35 and 40). Audio levels for AM or FM per Note 3 in non-ECCM; AM audio or audio plus 8 KHz tone in Have Quick I or II; FM audio in SINCGARS.
11	O	FREQ CLOCK	1 MHz, 25 pulse signal to clock the next frequency from the Applique to the RT; levels per Note 1.
12	I	RECEIVE ENABLE	Logic 0 for transmit mode; logic 1 for receive mode; levels per Note 1.
13	O	UTC	Universal Coordinated Time as obtained from over-the-air (level per Note 1) or GPS (level per Note 2).
14	O	MAIN SQ CONDITION	Logic 0 indicates received signal signal below hardware-set level; logic 1 if signal above level; logic levels per Note 1.
15	I	FREQ TRANSFER	Momentary pulse during blanked state to initiate frequency word transfer; levels per Note 1.
16	O	GUARD SQUELCH CONDITION	Logic 0 indicates received signal below hardware-set level; logic 1 if signal above level; logic levels per Note 1.
17	I	SATCOM MODEM MODE	Logic 0 indicates normal operation. Logic 1 indicates SATCOM modem selected.
18	O	RECEIVE MODE	Logic 1 in the receive mode; logic 0 in the transmit mode; logic levels per Note 1.
19		SPARE	Reserved for future growth.
20	I	+16 V DC APP	Regulated voltage from the RT.
21		SPARE	Reserved for future growth.
22	O	BUFFERED DELYD PTT	Logic 0 keys the transmitter; logic 1 in the receive mode; levels per Note 1.

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
23	O	PTT APP	Logic 0 for ICS PTT unkeyed; logic 1 for ICS PTT keyed; levels per Note 1.
24	O	COMMAND APP	Data bus from the RT to the Applique; levels per Note 1.
25	O	-12 V DC APP	Regulated voltage from the RT.
26	O	CLOCK ENBL OUT	External battery hold-up for clock.
27	I	APP DISCONNECT	Ground for Applique connected; open for Applique disconnected.
28	I	TRANSMIT AUDIO	Audio same as Pin 41 in an AM ECCM waveform (Have Quick I or II); 8 KHz tone may be superimposed; Manchester data for time-of-week transmission; ground otherwise.
29	O	MIC DATA	Digital data stream, 16 KBPS maximum; level per Note 2.
30	O	SYSTEM RESET	Logic 0 for normal; logic 1 for reset command; levels per Note 1.
31	I	TRANSMIT DATA	Same as Pin 29 for non-ECCM or Have Quick I or II; gate array signal in SINCGARS; levels per Note 2.
32		SPARE	Reserved for future growth.
33	I	APP SYNC PTT	Logic 0 to unkey the KY-58; logic 1 to key the KY; levels per Note 1.
34	O	+5 V DC APP	Regulated voltage from the RT.
35	O	RCV AUDIO AM	AM detector audio output; level per Note 3.
36	I	UNBLANK	Logic 0 for transmit or receive audio blanked; logic 1 for transmit or receive audio enabled (UNBLANKED); see Note 1 for levels.
37	O	DIGITAL GND APP	Signal ground, return to power supply.
38	O	SIGNAL GND APP	Signal ground, return to power supply.

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
39	I	COMMAND RT	Data bus from the Applique to the RT; levels per Note 1.
40	O	RCV AUDIO FM	FM detector audio output; level per Note 3.
41	O	MIC AUDIO	Audio from microphone; 0.5 v rms to produce 30% AM or 5600 FM deviation.
42	O	+12 V DC APP	Regulated voltage from the RT.
43	I	CONSTANT AGC	Logic 0 for receiver to operate in a constant gain mode; logic 1 for normal receiver operation; levels per Note 1.
44	I	APP RESET	Logic 1 to reset applique; Logic 0 for normal operation; levels per Note 1.
A1	I or O	110 MHz II	110.56 MHz IF output from receiver or input to receiver in transmit mode.
A2	O	10 MHz REF	10 MHz reference from synthesizer.

NOTES:

1. Signal source levels:
   Logic 0: 0 to 0.1 v at 1 microampere,
   0.4 v maximum at 6 ma.

   Logic 1: 4.85 to 5.1 v at -1 microampere,
   4.1 v minimum at -6 ma.

2. TTL levels:
   Logic 0: 0.8 v maximum,

   Logic 1: 2 v minimum.

3. Analog signal levels:
   AM: 165 mv at 30% modulation,

   FM: 165 mv at 2400 Hz deviation.

30.2 Remote Control Interface. There is one multi-pin connector on the Remote Control unit defined as follows:

Designation: J1
Part Number: RPN 359-0678-020
Mating Connector: RPN 359-0677-030

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
1	I	+ 27.5 VDC Primary Power	Primary power
2	I	PANEL LAMP POWER-5V	AC or DC (use pin 2, 9, or 14, but only one).
3	I	PRIMARY POWER RETURN	Ground
4	I	UNATTENUATED AUDIO RETURN	Ground
5	I	UNATTENUATED AUDIO HI	6.5 +/- 1 v rms for 30% AM or +/-2400 Hz FM deviation at 1000 Hz.
6	O	ATTENUATED AUDIO 150 OHMS	200 mw FOR 30% am OR +/-2400 Hz FM deviation.
7	O	ATTENUATED AUDIO RETURN	Return for pins 6 and 16.
8		OPEN	
9	I	+110 VDC	AC panel lamp voltage.
10	O	CONTROL DATA HI	Differential aperiodic data; V-low:0-1 v; V-high:3.4-5 v.
11		SPARE	
12	O	MIC AUDIO OUTPUT	Jumpered to pin 34.
13	I	CHASSIS GROUND	Ground.
14	I	PANEL LAMP POWER - 28 V	AC or DC; See pin 2.
15	O	WB/NB SELECT	Jumper to pin 28.
16	O	ATTENUATED AUDIO 600 OHMS	250 mw FOR 30% am OR +/-2400 Hz FM deviation.
17	I	TAKE CONTROL	Open for the Remote Control in control; ground or 0 +/- 1 vdc sinking 5 ma for 1553 bus in control.
18	O	CONTROL DATA LO	See pin 10.

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
19	I	RT DATA HI	Differential aperiodic data; V-low:0-1 v; V-high:3.4-5 v.
20	I	RT DATA LO	See pin 19.
21	I	PANEL LAMP COMMON	Return for pins 2 and 14.
22	I	SMC 2	Open for 1 RT and 1 Control; Ground sinking 5 ma for 2 RTs and 1 Control.
23	I	SMC 3	Ground to open pulse; 30 ms for RT 1 commands; 80 ms for RT 2.
24	O	CONTROL OFF	Open for mode switch in "off" position, ground ± 1 V for any other position.
25		SMC 1	Open.
26	I	SYSTEM OFF	Open for Control off; ground ± 7 V to turn Control on.
27	O	ICS PTT (OUT)	Jumper to pin 31.
28	I	BASEBAND/DIPHASE SELECT	Jumper to pin 15.
29		OPEN	
30		OPEN	
31	I	ICS PTT (IN)	Jumper to pin 27.
32	O	SYNCHRONIZED PTT (OUT)	Jumper to pin 35.
33		OPEN	
34	I	MIC AUDIO IN	Jumper to pin 12.
35	I	SYNCHRONIZED PTT (IN)	Jumper to pin 32.
36	I	GUARD PRECEDENCE	Open for normal; ground or 0 +/- 5 vdc sinking 5 ma for 243 MHz guard monitor.
37		RESERVED	

30.3 Indicator Interface. The Indicator unit has one multi-pin connector defined as follows:

Designation: J1
Part Number: RPN 359-0676-010
Mating Connector: RPN 359-0677-010

PIN NO.	I/O	FUNCTION	CHARACTERISTICS
1	I	5-VOLT DISPLAY ILLUMINATION	AC or DC (use pin 1 or 2, but not both).
2	I	28-VOLT DISPLAY ILLUMINATION	AC or DC; See pin 1.
3	I	PANEL LAMP COMMON	Return for pins 1 and 2.
4	I	POWER RETURN	Ground
5	I	ON/OFF CONTROL	Open for Indicator off; ground to turn Indicator on.
6	I	+ 28 VDC	Primary power
7		RESERVED	
8		RESERVED	
9	I	RT DATA (H)	Differential aperiodic data; V-low:0-1 v; V-high:3.4-5 v.
10	I	RT DATA (L)	See pin 9.
11		RESERVED	
12		SPARE	
13		SPARE	

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