EXCELLENCE IN ACTION

Prepared by: U. S. ARMY

INFORMATION SYSTEMS ENGINEERING COMMAND

CONTINENTAL UNITED STATES (USAISEC-CONUS)

Fort Ritchie, Maryland 21719–6010

ENGINEERING INSTALLATION PACKAGE (EIP)
FOR THE
HIGH FREQUENCY RADIO STATION
AT
COPPELL, TX

PREPARED BY:
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SECTION 1 - GENERAL

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1.1 BACKGROUND. Executive Order (E.O.) 12472 mandated the establishment of a survivable telecommunications management structure to direct the reconstitution of the Nation's critical telecommunications services following disruption caused by a national security crisis. In response to E.O. 12472, the Office of Management, National Communications System (OMNCS) has implemented a program known as the National Telecommunications Management Structure (NTMS). The operational sites that comprise the NTMS are located CONUS-wide and are interconnected with communications provided by the National Telecommunications Coordinating Network (NTCN).

1.2 GENERAL SYSTEM DESCRIPTION. USAISEC-CONUS has been tasked with the responsibility to establish an HF capability at operational sites in CONUS in support of the NTCN. This task consists of performing site surveys, producing engineering/installation documentation, and installing HF radio equipment and antennas that are being purchased and distributed to sites participating in the NTCN. This EIP sets forth the requirements for the establishment of an HF station at the Coppell GTE Site, Coppell, TX.

1.2.1 The following major items of equipment will be installed by this project:

1.2.1.1 Harris Model RF-3200EHF Transceiver	1
1.2.1.2 Harris Model RF-3236 Power Supply	1
1.2.1.3 Harris Model RF-3560A Telephone Interface Unit	1
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1.2.1.7 Sabre Model MLP-1 Rotatable Log-Periodic (RLP) Antenna with 40-foot Tower and Erection Kit	1

1.3 SITE POINT OF CONTACT AND LOCATION.

1.3.1 Contact GTE Manager, Government Plans, Programs & Technology; Mr. James Beam, commercial (202) 466-2302, prior to arrival onsite. Mr. Beam will also give directions to GTE facility at Coppell, TX.

SECTION 2 - REVISED SITE CONCURRENCE MEMORANDUM

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1. **REFERENCE**. USAISEC-CONUS engineering site survey conducted by Mr. Ronald Johnson, 15 Oct 93.

2. **PURPOSE**. The purpose of this document is to coordinate the installation of a high frequency (HF) radio communications system at the GTE facility located at Coppell, TX. This HF radio system will function as an integral part of a nationwide HF network, the purpose of which is to support the mission of the National Telecommunications Management Structure (NTMS) in the event of a telecommunications system failure.

3. **REQUIREMENTS**.

a. **Communications**. The communications requirement is to establish a primary HF communications link between the GTE facility and the Federal Emergency Management Agency's (FEMA) Region VI Federal Regional Center (FRC) in Denton, TX, and secondary links with FRCs at Region VII (Kansas City, MO), Region VIII (Denver, CO), Region IX (San Francisco, CA), and Region IV (Thomasville, GA).

b. **Engineering**. The engineering approach, as discussed during the site survey, is to propose a radio equipment/antenna site for approval that will meet the above communication requirement and define the site preparation parameters required to support the proposal. In addition to meeting the above requirements, the station must have the capability for remote control of the radio link from the GTE Dallas/Fort Worth facility.

c. **Equipment**. The following major equipment items will be installed at the facility to support the NCS mission/engineering objectives:

Quantity	Manufacturer	Model #	Equipment Description
1	Harris	RF-3200E	HF Transceiver
1	Harris	RF-3236	Power Supply
1	Harris	RF-3560A	Telephone Interface Unit
1	Sabre	MLP-1	Rotatable Log-Periodic (RLP) Antenna with 40-foot Tower and Erection Kit
1	Sabre	800-T-T-1	HD NVIS Antenna
1	Sabre	RC-30-C-2	Remote Antenna Positioning System with Two Control Panels and One Transfer Switch
1	Harris	RF-3249	Desktop Microphone

4. PROJECT DESCRIPTION.

a. This project began with an engineering survey of the facility conducted by Mr. Ronald Johnson, this agency, 15 Oct 93. From the information collected and informal agreements made between Messrs. Johnson, James Beam, and William Martin of GTE, USAISEC-CONUS has developed the engineering data required to prepare the facility for acceptance of the aforementioned radio system. This data is contained in this SCM and is submitted for formal approval. Once project approval is made, USAISEC-CONUS will complete the engineering instructions required to install the radio system and compile them in what is known as an Engineering Installation Package (EIP). USAISEC-CONUS will also develop a Bill of Materials (BOM) specifying all materials required to perform the installation. This BOM will be funded and procured at the direction of NCS and delivered to the site approximately 60 days before installation of the radio system. It is requested that GTE accept delivery of this BOM when it arrives and provide a safe temporary storage area for it until the project has been completed. After SCM approval, it is requested that GTE perform the site preparation outlined in this SCM utilizing the services of either its facility personnel or outside contractors. Whichever method is selected, NCS will reimburse GTE for all site preparation costs incurred.

b. Once the site preparation work has been completed, USAISEC-CONUS will install the procured material per the specifications outlined in the EIP and local engineering practices.

c. After the installation has been completed, a USAISEC-CONUS Test and Field engineer will ensure that the installation was accomplished in accordance with the EIP.

5. **INSTALLATION DATA**. This section describes the technical aspects of the radio system.

a. **General**. The station will be designed with two antennas to allow long-distance communication (200 to 1,200 miles) and short-distance communication (0-200 miles) with various FEMA FRCs. The radio will be installed in the main building with a remote capability to allow control of the radio link from the GTE Dallas/Fort Worth facility via the PSTN network. The RLP antenna is designed for remote control of the antenna position from the local communication center (Coppell) and the GTE Dallas/Fort Worth facility via the PSTN or dedicated lines. An antenna transfer switch will allow for antenna selection and will be remotely controlled from Coppell and the Dallas/Fort Worth facility. The RLP antenna has a motor-driven rotator that will allow a 360-degree rotation of the antenna. The antenna will be installed on a 40-foot tower with a hinged base for easy lowering and erecting for maintenance. For short-distance communication, a Near Vertical Incidence Skywave (NVIS) antenna will be installed.

b. **Radio System**.

i. **Physical Placement**. The radio and antenna control equipment will be installed in room 129 of the GTE SSOC Building. Facility personnel will identify an exact location for the equipment in an existing console. The radio equipment package consists of a transceiver and power supply that is installed in a 19-inch height by 20.5-inch width by 26-inch depth cabinet that is suitable for desk-top mounting. Since the equipment is rack mounted in a standard 19-inch EIA rack, it can be removed and installed in a standard 19-inch cabinet or console without a problem. Twenty-one and a half inches of vertical rack space is required for the radio, antenna control, and telephone interface unit.

ii. **Power**. The transceiver receives power from a DC-power supply, which in turn receives its power from a breaker protected 115-volts, AC circuit. The input power required to support this equipment is a single-phase 115 VAC, 60-Hz circuit protected by a 15-20 ampere breaker. When keyed, the transceiver will require 8 amperes of current at 115 VAC to provide full power output of 125 watts. Power from an uninterrupted source (UPS) or emergency generator is required to ensure continuous operations during an emergency situation.

iii. **Grounding**. The transceiver and power supply will be grounded to the existing station ground system in the room. The antenna system and cables will be grounded to a new lightning ground system established at the antenna site. A grounded bulkhead entrance panel will be installed at the rear side of the building for all antenna cables entering the building. This panel will serve as a single ground point with connection to the existing perimeter ground system.

iv. **Transient/Coaxial Protectors**. Devices will be installed at the antennas, at the cable entrance panel, and at the transceiver to protect the equipment from transients originating from static discharge, lightning, and electromagnetic pulse (EMP).

c. **Antenna**.

i. **Orientation/Capability**. The RLP antenna, designed for 360-degree rotation, has a unidirectional radiation pattern that provides 9 Db of gain over a frequency range of 6.5-30 MHz. The NVIS antenna, with a frequency range of 2-30 MHz, will provide omnidirectional high-angle radiation for optimum communications to station within 200 miles.

ii. **Antenna Cable Support.** The antennas will require four cables that will be aerially supported by messenger wires installed between the existing power/telephone poles and one new pole at the antenna site. From the new pole (pole no. 4), the cables will be routed underground via PVC conduit to the antennas.

iii. **Antenna Remote-Control Capability.** The selection of either antenna and the control of the position of the RLP antenna will be controllable from the communication center at Coppell and GTE Dallas/ Fort Worth. Dedicated lines are required between the two sites for this service.

d. **Radio Remote-Control Capability.** An RF-3560A Telephone Interface Unit (TIU) will be installed to locally control the radio as well as allow control of the Coppell radio from GTE Dallas/Fort Worth using the PSTN network. The TIU is connected to the radio unit and subscriber PSTN lines to provide an automated means of communication with FEMA/NCS HF outstations. The TIU answers calls from the phone subscriber and allows access to the radio link, permitting communications with the HF outstations. Locally, the TIU controls the radio via its remote-control port, audio, and key line. It also controls access to the radio link and monitors the phone line for incoming calls. A secure, auto-answering feature prevents unauthorized use of the radio link.

6. **Site Preparation Work.** The site preparation effort is work that should be performed prior to installation of the radio equipment. In other words, it is work or material required to prepare the site for the equipment installation. Since USAISEC-CONUS will be installing the radio/antenna equipment, it is recommended that the work be performed in two steps with site preparation as step one and equipment installation as step two. The site preparation work or material required is described below.

a. **Antenna.** The contractor or GTE shall provide the following support for installation of the two antennas:

i. **Antenna Site.** The contractor shall install the concrete base and anchors for the RLP and NVIS antennas according to drawings 02978HF-AT00001 and 02978HF-IN00001, sheets 1-4. After construction work is completed, repairs shall be made to the asphalt parking area around the base/anchors/ trench with an asphalt substance to form a waterproof seal. The anchors shafts/rods, P/N 870124 are available from Sabre Communications. The anchor bolts (grade 5) should be locally procured. WARNING: IT IS VERY IMPORTANT TO ORIENTATE THE BASE AND TOWER CORRECTLY TO MAKE SURE THAT THE TOWER CAN BE LOWERED CORRECTLY!

ii. **Pole No. 4.** The contractor shall install a 30-foot, class 6, wooden pole in the location shown on drawings 02978HF-SP00001 and

02978HF-IN00001, sheet 3, for the antenna (class 6 pole is identified as pole diameter of 7-1/2 inches to 8-inches and milled from a southern pine tree). Approximately, 5 feet should be buried in the ground. Again, repairs shall be made to the pavement with asphalt to provide a waterproof seal around the base of the pole.

iii. **PVC Conduit.** The contractor shall install two each 2-inch O.D. PVC pipes (Schedule 40) below ground level (18 inches) between pole no. 4 and the 40-foot antenna tower base as shown on drawing 02978HF-IN00001, sheet 3. Place a 1/4-inch steel cable in each conduit to aid in installing cables. Repairs shall be made to the trench area with an asphalt substance to form a waterproof seal.

iv. **Power For RLP Antenna.** An AC-power circuit of 220 VAC, single-phase, 60 Hz protected by a 20-ampere breaker should be furnished near the cable entrance panel. An electrician shall install #8-AWG (3 conductor) wires, in conduit, from the nearest power panel and terminate in a utility box located within 18 inches of the entrance panel (inside the building). The power cable will be supported on the lower messenger wire with the relay control cable

v. **Coaxial Relay Switch Control.** The relay switch will be controlled by the relay #1 on the RC-30 C Remote Control located in the radio room. The power cable for the control will be run from the tower unit-control panel, it will be #18 AWG (3 conductor).

vi. **Antenna Lightning Ground System.** The contractor shall install a ground system at the base of the 40-foot tower as shown on drawing 02978HF-IN00001, sheet 3.

vii. **Messenger Wire.** The contractor shall install two 1/4-inch stranded steel wires (zinc coated) between poles 1-4 one at a height of at least 25 feet above ground level and the second, one foot below. See drawing 02978HF-SP00001 for location of the poles and messenger wires. A #1-AWG copper wire shall be run from the antenna ground system at the 40-foot tower base to the top messenger wire at pole no. 4, per drawing 02978HF-IN00001, sheet 3.

viii. **Dedicated Lines.** Two-pair lines are required between Coppell and Dallas/Fort Worth to support remote-control functions for the antenna system.

ix. **Bulkhead Entrance Panel/Ground Connection.** The contractor shall furnish or/and install the following at the cable entrance panel:

(1) Two Polyphaser, Model IS-NEMP-CO, Impulse Suppressor-Nuclear EMP N connector (female) on the inside of the panel.

(2) One Polyphaser, Model 3PB, entrance panel at the building below the messenger-wire anchor bolt.

(3) Install two copper straps (P/O 3PB) from the entrance panel (outside the building) to the perimeter ground system around the building. See drawing 02978HF-IN00002, sheets 1-2, for construction details.

The contractor shall cadweld the 1-inch sandwich bar (bottom of copper strap) to the existing perimeter ground system. The messenger wire shall be grounded to the entrance panel.

b. Radio. The contractor or GTE should provide the following support for installation of the radio equipment:

i. **AC Power.** Two 115 VAC, 15-ampere power circuits in a standard duplex outlet (with ground connection) is required within 4 feet of the radio equipment location. One duplex will be used to furnish power to the radio. The second duplex will be used to furnish power to the telephone interface unit and the antenna control panel. The circuits should be protected by a circuit breaker and connect to the emergency power source, be it UPS or emergency generators.

ii. **RF Cable.** The contractor shall install two each Government furnished RF cables from the cable entrance panel (inside the building) to the communication center, (room 129). The contractor shall furnish all hangers, etc., necessary to support the cables from the ceiling. This work will be required after the installation hardware has arrived onsite and prior to arrival of the installation team. The RF cables will be supported on the top messenger wire to the fourth pole.

iii. **Ground Connection.** Station ground in the room should be extended to the equipment area for connection to the chassis of the radio equipment cabinet. A #6-AWG copper insulated wire is adequate for this purpose.

iv. **Radio Equipment Installation.** GTE personnel will remove the radio equipment from the cabinet and install in the console in room 129. Power and grounding connections will be checked by the test director.

v. **PSTN Service.** The remote control of the radio requires a telephone line (subscriber line) between Coppell and Dallas/Fort Worth.

7. **RESPONSIBILITIES**.

a. USAISEC-CONUS (ASQB-CSE-TR) is responsible for project engineering.

b. USAISEC-CONUS (ASQB-CIN-TR) is responsible for installation of the radio system.

c. USAISEC-CONUS (ASQB-CTF-NE) is responsible for project quality assurance and acceptance testing when the project is completed.

d. USAISEC-CONUS (ASQB-CMS-TS) is responsible for the preparation of project as-built drawings upon completion of the installation effort.

e. NCS will coordinate with GTE to ensure that areas proposed in this SCM for radio equipment and antenna installation are reserved for this project.

f. NCS will obtain operating frequencies and coordination with FEMA for operational test.

g. NCS has agreed to provide funds for BOM purchases and site preparation work required to complete this project.

h. GTE personnel have agreed to coordinate with potential contractors to have the site preparation work completed as specified in this SCM. Contractor bids should be submitted to NCS for approval prior to commencement of work.

i. GTE is responsible for obtaining local permits (if required) to install the antenna in the area selected.

8. **DRAWINGS SUPPLIED**. The following project drawings are enclosed to furnish detailed guidance for the site preparation work:

DRAWING NUMBER	DESCRIPTION
02978HF-SP00001 (sheet 1)	Site Plan
02978HF-BK00001 (sheet 1)	Block Diagram
02978HF-AT00001 (sheet 1)	Antenna Layout
02978HF-IN00001 (sheets 1-4)	Installation Details, Base and Anchors
02978HF-IN00002 (sheets 1-2)	Installation Details, 3-Port Entrance Panel

9. **POINTS OF CONTACT**.

a. NCS Program Manager, Mr. Donald Smith, commercial (703) 692-8509.

b. USAISEC-CONUS Program Manager, Mr. Bo Borzager, commercial (717) 878-4210.

c. USAISEC-CONUS Project Engineer, Mr. Ronald Johnson, commercial (717) 878-5692.

d. USAISEC-CONUS Test and Field Engineer, Mr. John Manning, commercial (717) 878-4672.

e. USAISEC-CONUS Chief of Technical Support Branch, Mr. Keith Snow, commercial (717) 878-5807.

f. USAISEC-CONUS Chief of Installation's Transmission Branch, Mr. Jim Walker, commercial (717) 878-5697.

g. GTE Manager, Government Plans, Programs, and Technology, Mr. James Beam, commercial (202) 466-2302.

SECTION 3 - INSTALLATION SPECIFICATIONS AND INSTRUCTIONS

SECTION 3 - INSTALLATION SPECIFICATIONS AND INSTRUCTIONS

3.1 GENERAL. The following documents are required for the installation of this project.

3.1.1 Site Concurrence Memorandum (SCM), Section 2 of this EIP.

3.1.2 Facility and Standard HF Drawings, Section 4 of this EIP.

3.1.3 Bill of Materials (BOM), Section 5 of this EIP.

3.1.4 Quality Assurance (QA) Procedures, Section 6 of this EIP.

3.1.5 Test and Acceptance, Section 7 of this EIP.

3.1.6 Completion Certification, Section 8 of this EIP.

3.2 REFERENCES.

3.2.1 **Technical Orders (T.O.) and Technical Manuals (TM).**

3.2.1.1 T.O. 31-10-2: Fanning and Forming Conductors for Ground C-E Equipment.

3.2.1.2 T.O. 31-10-7: Termination and Soldering Electrical Connections.

3.1.1.3 T.O. 31-10-13: Cabling for Fixed C-E Equipment.

3.1.1.4 T.O. 31-10-16: Strapping of Fixed Ground C-E Equipment.

3.2.2 **Military Regulations.**

3.2.2.1 ASR 702-1-2: USACC Quality Assurance Program for Engineering, Installation and Acceptance of Communications Equipment and Systems.

3.2.2.2 ASR 385-1: Mission Safety.

3.2.2.3 CCCR 34-2: Preparation of Engineering Installation Packages and Standard Engineering Installation Packages.

3.2.2.4 CCCR 34-3: Standardization Engineering Drawings.

3.2.2.5 CCCR 702-1: USACC Quality Assurance and Testing Program.

3.2.2.6 MIL HDBK 419, Vol 2: Grounding, Bonding, and Shielding for Electronic Equipments and Facilities.

3.2.3 **Commercial Publications.**

3.2.3.1 National Electrical Code, 1990.

3.2.3.2 Publication No. 10212-0300: Harris Corporation Service Manual for the RF-3200 Transceiver.

3.2.3.3 Publication for Model 600 MLP-1 Log-Periodic Antenna, 6.2-30 MHZ; Sabre Communications Corporation; Sioux City, IA, Installation Instructions.

3.2.3.4 Publication for Model 800-T-T-1-G-HD, 2-30 MHZ; Coaxial Transportable Antenna System; Sabre Communications Corporation; Sioux City, IA, Installation Instructions.

3.2.3.5 Publication for Model RC-30-C-2, Remote-Control Antenna Positioning System; Sabre Communications Corporation; Sioux City, IA, Installation Instructions.

3.3 GENERAL INSTRUCTIONS.

3.3.1 **Adherence to Policies and Documents.**

3.3.1.1 The equipment shall be installed in accordance with established policies, engineering drawings, and instructions. Minor deviations from the EIP may be made by the installation supervisor without prior approval by the project engineer. A minor change is one that does not:

3.3.1.1.1 Alter the specified major item of equipment.

3.3.1.1.2 Violate a mandatory standard.

3.3.1.1.3 Alter the intended operational capability or procedures.

3.3.1.1.4 Alter the intent or end result of the required testing.

3.3.1.1.5 A major change is one which alters or violates the specifications listed in 3.2.1.1.1 through 3.2.1.1.4 above. The installation team shall not make major changes to the requirements and instructions contained in this specification without the prior approval of the project engineer. Request for an approval of major changes may be made by telephone, be documented (red lined) by the team chief and the document which authorized the change shall be included in the documentation. Two sets of red-lined documents are required. One set shall be left onsite for use by maintenance personnel until the project as-built drawings are received.

3.3.1.1.6 Installation personnel must be familiar with applicable Technical Order AFTO 31-10 series, and the National Electrical Code, to ensure that the facility is installed in accordance with standard practices.

3.3.1.1.7 Prior to the start of installation, all team members should review the safety instructions in ASR 385-1 and in the installation and operating manuals furnished by the equipment manufacturers.

3.3.2 **Change in Scope.** The installation team shall not accomplish work requested by local regional personnel unless such work is covered by the EIP or other agreements.

3.3.3 **General Installation Precautions.** The installation team chief will ensure that all safety regulations and proper accident prevention regulations are observed by all members of his team during all phases of installation. He must contact the responsible accident clinic prior to start of work to ensure quick medical treatment in case of emergency. To help prevent injuries to personnel and damage to equipment, the following safety regulations should be observed:

3.3.3.1 Installation personnel should be trained in safety practices pertinent to their duties and in the application of emergency first aid, rescue, resuscitation, and closed-heart massage.

3.3.3.2 Approved installation tools, in good condition, should be used for electrical work. Tools with friction or rubber tape-covered handles should be avoided.

3.3.3.3 With exception of test equipment, metallic measuring rules or metal-cased objects should not be used near energized electrical circuits. Personnel should not wear metallic objects such as rings, identification tags, medals, wrist watches, or bracelets while working on or near electrical equipment.

3.4 INSTALLATION INSTRUCTIONS.

3.4.1 **Preinstallation Steps.** Prior to starting installation, the following must be accomplished:

3.4.1.1 Coordinate installation task with the operating agencies and/or other cognizant organizations. This will include logistics, review of support requirements, and request of any support necessary for the completion of the project.

3.4.1.2 Verify that all support requirements are complete or will be completed when needed in time to prevent installation delays.

3.4.1.3 Brief team members on particular hazards that may be encountered. Emphasize safety by reviewing safety procedures and practices.

3.4.1.4 Inventory the BOM items to ensure that all items are on hand. Missing items or shortages must be noted. The BOM for this project is attached as Section 5 and lists major items as well as installation hardware items required to install this project.

3.4.1.5 Arrange for the transportation of personnel and equipment; determine the methods for control and storage of BOM items, tools, and other required equipment.

3.4.1.6 Review all specifications and drawings to ensure that no additional engineering assistance is required prior to the start of installation. Onsite engineering is available from USAISEC-CONUS only by request of the installation team chief.

3.5 INSTALLATION REQUIREMENTS.

3.5.1 **General.** All cables are to be tagged showing the termination points of each end of the cable. Tag cables to be removed from old equipment so that the same system functions can be easily rewired to the new replacement equipment.

3.5.2 When terminating signal/power/RF cables to the transceiver, leave sufficient cable slack to permit the equipment to be removed for maintenance without disassembling the various cables.

3.5.3 Power and signal (RF and audio) cable installation separation will be maintained in accordance with the following standards:

3.5.3.1 Inside Plant - a minimum of 4-inch separation between power and signal cables.

3.5.3.2 Outside Plant - a minimum of 48-inch separation between coaxial and high-voltage distribution and a minimum of 18-inch separation between coaxial and telephone distribution cables.

3.5.3.2.1 All cables shall be neatly formed, laced together, and secured to supporting structures such as equipment racks, tower railings, and cable support ladders. Ty-raps, lacing twine, wraplock, and cable clamps have been included on the BOM for this purpose. The team chief is to select the correct item depending upon the situation encountered.

3.5.3.2.2 When securing RF cables to supporting structures such as conduits, messenger wire, and tower railings, wrap the connection point with tape and tighten the securing hose clamp, wraplock, etc., to prevent cutting of the RF

cables outer covering, which leads to water leaking into the cable and eventual cable failure; ensure the securing clamp is not over-tightened.

3.5.4 **Major Item Description.**

3.5.4.1 The following is an overview of the major items of equipment:

3.5.4.1.1 Radio Equipment. The radio equipment required for this project will be supplied by NCS and will consist of one each radio transceiver. Harris Corporation will program frequencies/channels into the transceiver before it leaves the plant. Equipment operating instructions will be furnished with the equipment.

3.5.4.1.2 Antennas. The antenna will be installed in the field east of the building complex as outlined in the manufacturer's manual and on drawings AT00001 (1 sheet) and IN00001 (4 sheets). The antenna and associated coaxial cables will be installed by the installation team. A 1/2-inch cable will be used as the RF feeder cable as well as the control cable for the rotator/ switch control circuit.

3.5.4.1.3 Antenna Grounding System. The antenna ground system will be installed as part of the site preparation work. A #1/0 AWG copper wire will be installed/connected from the antenna ground system to the cable entrance panel via the top messenger wire. At pole no. 1, as shown on drawing IN00001 (sheet 4) make sure the messenger wire is grounded to the entrance panel.

3.6 DRAWING IDENTIFICATION. Facility drawings associated with this project will be referred to by the last seven digits of the drawing numbers. As an example, 02978HF-IN00001 will be referenced as IN00001.

3.7 DETAIL EQUIPMENT INSTALLATION.

3.7.1 **Transceiver Installation.**

3.7.1.1 The transceiver and the power supply will be mounted by the GTE personnel in the an existing console in room 129 of the GTE SSOC building. The installation team will install the Model 415 EMP device (item #37) on the panel (item #56) and place in the box (item #11) as shown on drawing IN00003. Install the neon lamp on the top of the box to indicate that power is present and do not forget to ground the case of the box to the ground lead (green lead) of the AC-power input and the ground buss bar using a #6-AWG yellow insulated copper wire.

3.7.1.2 Install 3 conductor/#14-AWG power cords (item #33) to the input side (bottom) of the EMP device. Cut the AC plug off of the power cord for the RF-3236 power supply. Strip the end of the cord and connect to the output side (top) of the EMP device. Attach the box to the wall or inside the

console within 4 feet of the AC outlet installed by the contractor for the radio. The spare outlet will be used for NCS equipment that will be installed in the future. Ensure that the 3-prong outlet installed by the contractor is properly wired for 115 VAC, with the third wire grounded, and ensure that the service is connected to a single pole, 15- or 20-ampere breaker. See drawing IN00003 for details. Install the same EMP device for the RC-30C antenna-control unit and RF-3660A telephone interface unit. These two units are powered for the same EMP/surge protector unit. The ground wire (#6 AWG) from each protector unit (2 each) shall be connected to the rear connection of the NCS radio cabinet.

3.7.1.3 The NCS radio cabinet ground point (rear connector) shall be grounded to the existing ground system in the room using a #6-AWG wire. A second #6-AWG wire shall be ran from the rear connector on the NCS radio to the 3-port cable entrance panel shown on drawing IN00002 (sheet 1). WARNING: IT IS VERY IMPORTANT TO ENSURE THAT ALL RADIO EQUIPMENT IS CONNECTED TO THE EXISTING PERIMETER GROUND SYSTEM VIA THE 3-PORT CABLE ENTRANCE PANEL OR THROUGH A DIRECT CONNECTION.

3.7.1.4 Connect the microphone to the radio.

3.7.1.5 Install the RC-30C antenna-control unit and RF-3560A per the manufacturer's instructions.

3.7.1.6 Connect the Coaxial Switch Control cable (440) through the AC Surge protector to Relay # 1 terminals on the back of the RC-30C Antenna Control Unit. The cable will be connected to the designated terminals on the Antenna Position Control Unit at the tower base. Install the cable with the power cable on the messenger wire. The two cables should be attached to the lower messenger wire with wraplocks.

3.7.2 **Coaxial Cable Installation.** Install two coaxial cables as shown on drawing BK00001. One cable is for the radio equipment and the second cable is for the rotator/RF switch control signal produced by the RC-30C unit. The RG-214/U will be installed from the cable entrance panel to the radio/control equipment in room 129. The RF cables will be supported on individual messenger wire installed under site preparation work. Install both of the 1/2-inch coaxial cables on the top messenger wire from the entry plate to the antenna. The lower wire is reserved for the power cable. Support the cables every 3 feet with wraplock. Use electrical tape around the cable before installing the wraplock straps. Use SCOTCHKOTE at each strap to weatherproof. Make sure at the entrance panel that you remove part of the cable jacket that is grounded to the panel under the rubber boot. The connectors shall be taped and coated with SCOTCHKOTE to weatherproof the connectors. At pole no. 4, run the cables in the underground conduit to the antenna/control equipment.

3.7.3 **Ground System Installation.** Verify that the ground system has been installed as specified in drawing IN00001 (sheet 3). Test the ground system per the method outlined in the test plan. If the resistance is greater than 10 ohms, the GTE project engineer should be contacted for corrective action.

3.7.4 **Antenna Installation.** The antenna will be installed as specified in manufacturer's manual and drawings AT00001 (1 sheet) and IN00001 (4 sheets) by the installation team.

3.7.5 **AC Power for Rotator Motor.** Install 3 conductor #18 power cable from the rotator motor of the antenna to the entrance via the lower messenger wire. Support the cable every 3 feet with wraplock. Use electrical tape around the cable before installing the wraplock straps. Use SCOTCHKOTE at each strap to weatherproof. Once inside the building, protect the conductors as shown on drawing IN00004. Install the protector (Note: Rated for 220 VAC) and box above the entrance panel similar to method outlined in paragraph 3.6.1 above. Make sure the box and protector is grounded to the entrance panel.

3.7.6 **Installation of EMP Devices.** The EMP devices will be installed as specified on drawings BK00001, IN00003, and IN00004.

3.7.6.1 Transceiver. Install the Model No. FCC-250B-350-UHF device on the antenna connection of the transceiver. Place a PL-259A connector on the RF cable and connect it to the UHF EMP device. See drawing BK00001.

3.8 TRANSCEIVER FREQUENCIES.

3.8.1 **Frequencies.** Operate the radio with FEMA Federal Regional Center, Battlecreek, MI, per the test plan in Section 7 of this EIP.

SECTION 4 - ENGINEERING INSTALLATION DRAWINGS

SECTION 4 - ENGINEERING INSTALLATION DRAWINGS

4.1 GENERAL. Facility and standard diagram drawings that are required for this project will be reproduced in D-size blue-line copies (two each) and forwarded to the installation team chief. The installation team chief will mark-up drawings for project as-built records. One copy of the marked-up drawings will be retained by the site and one copy will be forwarded to USAISEC-CONUS (ASQB-COP) so as to bring the project drawings up to as-built status.

4.2 DRAWINGS. Drawings required for the installation of this project are as follows:

DRAWING NUMBER	TITLE
02978HF-AT00001	Antenna Layout-NCS HF Radio System
02978HF-BK00001	Block Diagram - NCS HF Radio System
02978HF-IN00001 (4 sheets)	Installation Details - 40-Foot Tower Base and anchors
02978HF-INOOOO2 (2 sheets)	Installation Details - 3-Port Cable Entrance Panel
02978HF-IN00003	Installation Details - AC-Power EMP, 120 VAC, 60 HZ Device Model MCG 415
02978HF-IN00004	Installation Details - AC-Power EMP, 230 VAC, 60 HZ Device Model MCG 417
02978HF-LM00001 (3 sheets)	List of Materials
02978HF-SP00001	Site Plan, NCS HF Radio Antenna System

SECTION 5 - BILL OF MATERIALS

PIC NUMBER 06A-025-93 CHG-
TITLE HIGH FREQ RADIO SYS
LOCATION COPPELL,TX
UIC / DODAAC /

POC OFFICE ASQB-CSE-TR
NAME MR ROBERT GIVIDEN
DSN 277 - 25692
COMMERCIAL 301 878 - 25692

***** S U P P L Y N O T E S *****

01 THIS PROJECT WAS ENGINEERED BY MR. RONALD JOHNSON_____,
DSN 277-5692. QUESTIONS/PROBLEMS RELATED TO TECHNICAL REQUIREMENTS
AND ANY SUBSTITUTIONS SHOULD BE REFERRED TO THE PROJECT ENGINEER.
02 UNLESS OTHERWISE SPECIFIED ALL CABLE LENGTHS LISTED ARE THE MINIMUM
CUTTING LENGTH (MSL)
03 SML 44558H IS SOLE SOURCE TO BE PROCURED FROM SABRE COMMUNICATIONS CO
RPORATION.
04 * ITEM TO BE LOCALLY PROCURED BY INST TEAM CHIEF.

PIC NUMBER 06A-025-93 CHG-
TITLE HIGH FREQ RADIO SYS
LOCATION COPPELL,TX
UIC / DODAAC /

POC OFFICE ASQB-CSE-TR
NAME MR ROBERT GIVIDEN
DSN 277 - 25692
COMMERCIAL 301 878 - 25692

SML	NSN / REFERENCE NUMBER	NICP	FSCM	UNIT PRICE / QNTIV EXP	UI / UM	LIN	TOTAL REQD	AVAIL CMD	REQD ACQ	REMARKS
00558H	5310-00-285-1650 43A1767 NUT,HEX;1/4-20,STEEL>CAD SURF; PLAIN; 0.52IN W ACROSS FLATS, 0.25IN H FLAT BEARING SURF RH, 2B, UNC THD SER.	S9IT2	94033	19.97	HD	A00	1	0	1	
03624E	6145-00-542-6115 MWC24-1J2 WIRE,ELEC-24AWG,RED,SOL>0.073IN OD; SOLID TIN PLATED SOFT COPPER COND, PVC INSUL; POLYAMIDE NYLON JACKET, 1000V MAX RATING, 80 DEG-C; 28.3 OHMS RESIS PER 1000FT, COLOR RED.	S9IQ2	81349	.01	FT	A00	10	0	10	
07626C	5935-00-500-5183 RE49F169 CONNECTOR,PLUG;COAX,UHF>STRAIGHT PLUG; THREADED COUPLING; UG STANDARD TERM; NON CONSTANT IMPEDANCE; NON-WEATHER PROOF; FUW RG-8/U, RG-9/U, RG-11/U, RG-13/U, RG-63/U, RG-87/U, RG-149/U, RG-213/U, RG-216/U OR RG-225/U CABLE OR EQUIVALENT.	S9EQ2	99993	2.87	EA	A00	2	0	2	
09091P	5305-00-015-0970 MS35493-264 SCREW,WOOD,10X1.000IN LG>ROUND HD, CROSS RECESS DRIVE; HEAD DIA 0.334IN; 0.123IN MIN AND 0.137IN MAX HEAD HEIGHT; COPPER ALLOY MATL.	S9IT2	96906	8.85	HD	A00	1	0	1	
10012B	5340-00-640-3996 190750 KIT,STRAPPING AND SEALING>COMPONENT QTY 101; NONSUPPLY ITEMS P/N SSB12 BUCKLE 100, SGW10 WRENCH, REVERSIBLE 1, END ITEM NONBAJFKDX.	S9IT2	02563	30.11	EA	A00	2	0	2	
10130J	5305-00-988-1727 MS35206-283 SCREW,MACH;1/4-20X1.000IN LG>PAN HEAD; CROSS-RESCESSED; CADMIUM PLATED STEEL MATERIAL; MAX HEAD DIA 0.492IN; RIGHT HAND THREAD.	S9IT2	96906	8.32	HD	A00	1	0	1	

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DSN 277 - 25692
COMMERCIAL 301 878 - 25692

SML	NSN / REFERENCE NUMBER	NICP	FSCM	UNIT PRICE / QNTIV EXP	UI / UM	LIN	TOTAL REQD	AVAIL CMD	REQD ACQ	REMARKS
11723H	5970-00-419-4291 BULLDOG BRAND 466 3-4INBLACK	S9GQ2	83905	1.55 80000000.0	RO FT	A00	3	0	3	
	TAPE,INSUL;PLSTC-0.75IN>108FT L X 0.09IN THK; BLAC K COLOR; 6000V DIELECTRIC RATING.									
13135A	6145-00-J04-1682 6Q-0803	B16G2	57672	3.50	FT	A00	450	0	450	
	CABLE,COND-03,08AWG;PWR>0.328X0.750IN OD; 40A PER COND; COPPER CONDUCTORS W/PVC INSUL AND JACKET; F/ USE FEEDER OR BRCH CKT CABLE; CAN BE USED IN MOIST , DAMP OR CORROSIVE AREAS; CAN BE INSTALLED INSIDE WALLS, UNDER GROUND OR DIRECT BURIAL IN EARTH; CO ND ARE CLR CODED.									
16067M	6145-00-660-8054 M17/75-RG214	S9IQ2	81349	1.82	FT	A00	300	0	300	
	CABLE,RF;COAX,50-OHM,RG214/U>0.425IN OD; STRANDED SILVER PLATED COPPER COND, 13AWG; 7-STRANDS PER CO ND; TWO BRAIDED SILVER PLATED COPPER SHIELDS; POLY ETHYLENE COND INSUL, PVC OUTER JACKET; 5000V MAX R ATING.									
19155P	5935-01-249-1987 L44P	S9EQ2	84147	27.73	EA	A00	2	0	2	
	CONNECTOR,PLUG;COAX,UHF>STRAIGHT MALE PLUG; MATES WITH SO-239A; THREADED COUPLING; FOR USE WITH 1/2I N 50-OHM, LDF4-50A CABLE OR EQUIVALENT.									
20789Z	5975-00-284-6976 066734	S9GQ2	31974	3.08	EA	A00	8	0	8	
	BOX CONNECTOR;0.500IN>STRAIGHT; FLEXIBLE CORD/POWE R CABLE; HUB SZ 0.500IN; IRON/STEEL MALLEABLE MATL ; LIQUIDTIGHT STRAIN RELIEF CONNECTOR; NEOPRENE BU SHING; ADD REF CAGE (59730), P/N 2523.									

PIC NUMBER 06A-025-93 CHG-
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SML	NSN / REFERENCE NUMBER	NICP	FSCM	UNIT PRICE / QNTIV EXP	UI / UM	LIN	TOTAL REQD	AVAIL CMD	REQD ACQ	REMARKS
22316H	6145-01-069-0584 LDF4-50A	S9IQ2	84147	1.55	FT	A00	900	0	900	
	CABLE,RF;HELIAX,50-OHM>0.640IN OD; SOLID COPPER IN NER COND, POLY-FOAM INSUL; CORRUGATED COPPER OUTER COND, BLACK POLYETHYLENE OUTER JACKET; LOW-LOSS F OAM DIELECTRIC CABLE, LOW PWR APPLICATION.									
23858Z	5935-01-105-8511 L44W	S9EQ2	84147	22.90	EA	A00	4	0	4	
	CONNECTOR,PLUG;COAX,N-TYPE>STRAIGHT PLUG (MALE); T HREADED COUPLING; MATES WITH UG-23; FUW 1/2IN 50-O HM, LDF4-50A COAXIAL CABLE OR EQUIVALENT.									
25252M	5310-00-889-2528 MS45904-68	S9IT2	96906	1.45	HD	A00	16	0	16	
	WASHER,LOCK;EXT/INTL T,0.267IN>STEEL MATL, CAD SUR F; FLAT; 0.725-0.76IN OD; 0.032-0.04IN THK.									
25777D	5935-01-049-2238 UG21U	N35P2	81349	14.50	EA	A00	4	0	4	SPECIAL HANDLING ITEM
	CONNECTOR,PLUG;COAX,N-TYPE>STRAIGHT STANDARD CLAMP PLUG; 50-OHMS IMPEDANCE; WEATHERPROOF; FUW WITH R G-8, 9, 213, 214 CABLE.									
30735B	6145-00-466-2587 JC30	S9IQ2	81348	.09	FT	A00	10	0	10	
	WIRE,ELEC-10AWG,GRN,SOL>0.200IN OD; SOLID SGL COPP ER COND, THERMOPLASTIC INSUL; 600V MAX RATING, GRE EN.									
33955W	5975-00-J04-9257 95091	S9EQ2	74545	11.20	EA	A00	2	0	2	
	PLATE,WALL;ELEC,ONE-GANG>FUW ONE SINGLE RECEPTACLE ; FITS BOSS DIA FROM 1.375-1.390IN; ANODIZED ALUM MATL.									

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DSN 277 - 25692
COMMERCIAL 301 878 - 25692

SML	NSN / REFERENCE NUMBER	NICP	FSCM	UNIT PRICE / QNTIV EXP	UI / UM	LIN	TOTAL REQD	AVAIL CMD	REQD ACQ	REMARKS
34083Y	5340-00-J04-9348 97031A029	S9IT2	3A054	57.87	HD	A00	1	0	1	
	SHIELD,EXP;0.250-20>ZINC ALLOY MATL; 1.375IN LG, D RILL SIZE 0.500IN; HEAVY DUTY DBL EXPANSION.									
36123J	5940-01-114-6993 A150	S9GG2	81790	.95	EA	A00	12	0	12	
	LUG,TERMINAL>NE-BOLT HOLE; 14-2/0 CABLE SIZE; 1/4I N STUD HOLE SIZE; MECHANICAL COMPRESSION; ALUMINUM BODY WITH TIN PLATED BRASS.									
38156L	6145-00-J03-2468 9365	S9IQ2	16428	.81	FT	A00	450	0	450	
	CABLE,COND-03,18AWG;SP>OD 0.248IN; 16 STRANDS OF 3 0AWG PER CONDUCTOR; TINNED COPPER; PVC INSULATED; CONDUCTORS CABLED; OVERALL BELDFOIL TAPE AND STRAN DED TINNED COPPER DRAIN WIRE; CHROME SUNLIGHT-RESI STANT PVC JACKET.									
39020Q	6150-00-071-1180 17419	S9GJ2	16428	3.21	EA	A00	2	0	2	
	CORD ASSY;03-COND,PWR,9FT>16AWG, STRANDED; 0.340IN OD; RUBBER JACKET; 1625 WATTS, 13A, 125V RATING; MOULDED PVC GROUNDING PLUG NEMA 5-15P ONE END; OTH ER END - OUTER JACKET STRIPPED 2IN, AND EA CONDUCT OR STRIPPED AND TWISTED 5/8IN; SJ TYPE; BLACK COLO R.									
39687J	5935-00-254-3437 3331C	S9EQ2	74545	9.61	EA	A00	2	0	2	
	CONNECTOR,PLUG;PWR 3 POLE>NON-NEMA; DIM 2.5IN X 1. 937IN; 3-WIRE, 125/250VAC OR DC; 30A; 3-CONTACT TW IST LOCK TYPE; INSULATED GRIP; NYLON MATERIAL, BLA CK AND WHITE COLOR; ADD REF (41326) P/N CLOD 3331, (21873) P/N 3331P.									

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DSN 277 - 25692
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SML	NSN / REFERENCE NUMBER	NICP	FSCM	UNIT PRICE / QNTIV EXP	UI / UM	LIN	TOTAL REQD	AVAIL CMD	REQD ACQ	REMARKS
41465F	5935-00-J03-5543 48000 CONNECTOR,JACK;COAX,N-TYPE>N-STRAGHT JACKS; FEMALE CONTACTS; FUW RG-/U 8, 9, 213, AND 214; MIL-23; MIL CLAMP I; OA LG 1-9/16IN; OA DIA 3/4IN; ACCOMODATES DIA .444IN; WEATHER PROOF; 50 OHMS; TFE INSULATION.	S9EQ2	74868	22.00	EA	A00	0	0	0	
41748D	5920-00-J03-5796 415 PROTECTOR,SURGE;OEM>EQUIPMENT LEVEL PROTECTOR INSTALLED WITHIN A PIECE OF EQUIPMENT; PREVENTS EQUIPMENT DAMAGE OR MALFUNCTION OF SENSITIVE EQUIPMENT; LED INDICATORS; 120VAC RATED VOLTAGE, 50/60/400HZ; 15A RATED CURRENT; PLASTIC ENCLOSURE; SCREW CLAMP TERMINALS; DIMS 5IN X 3IN X 2IN.	S9EQ2	ADL01	87.00	EA	A00	2	0	2	
41750E	5920-00-J03-5798 FCC-250B-350-N PROTECTOR,SURGE;XMTR/RCVR>PROVIDES PROTECTION FROM TRANSIENTS ORIGINATING FROM SWITCHING, LIGHTNING AND EMP; INSERTION LOSS IS .2 DB TO 450MHZ; N-TYPE MALE CONNECTOR ONE END, FEMALE N-TYPE CONNECTOR THE OTHER END.	S9EQ2	53779	70.00	EA	A00	1	0	1	
41751F	5920-00-J03-5799 FCC-250B-350-UHF PROTECTOR,SURGE;XMTR/RCVR>PROVIDES PROTECTION FROM TRANSIENTS ORIGINATING FROM SWITCHING, LIGHTNING AND EMP; INSERTION LOSS IS .2 DB TO 450MHZ; UHF MALE CONNECTOR ONE END, FEMALE UHF CONNECTOR THE OTHER END.	S9EQ2	53779	90.00	EA	A00	1	0	1	
41752G	6240-00-054-6540 CN01RCSN114 0 LAMP,CARTRIDGE;NEON,105-125V AC/DC>A1B LAMP RED COLOR; 3000 HRS APPROX LIFE; ALUM HOUSING, NICKEL SILVER PIN TERMINALS, PLASTIC LENS.	S9GJ2	07294	1.23	EA	A00	4	0	4	

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DSN 277 - 25692
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SML	NSN / REFERENCE NUMBER	NICP	FSCM	UNIT PRICE / QNTIV EXP	UI / UM	LIN	TOTAL REQD	AVAIL CMD	REQD ACQ	REMARKS
41753H	6210-00-764-2190 DNO-30BD14B	S9GJ2	07294	2.77	EA	A00	4	0	4	
	LAMPHOLDER,INDICATOR LIGHT>PANEL MOUNTED LAMPHOLDE R W/SCREW-ON COLLAR; SOLDER CUP TERMINALS; MTG BUS HING ALUM BLACK ANODIZED MATL, COLLAR ALUM MATL, T ERMINALS PHOSPHOR BRONZE, GOLD PLTD; FUW LAMP P/N 507-4537-0931-640 OR EQUIVALENT.									
41755Z	5975-00-J03-5801 7605K32	S9GQ2	3A054	2.75	EA	A00	4	0	4	
	PANEL,ENCLOSURE;6-3/4X4-7/8IN>14 GAUGE STEEL MATL; FUW 6IN X 8IN X 3-1/2IN HINGED JIC STEEL ELECTRIC AL BOX.									
41790A	5820-00-J03-5845 RF-3200	B16G2	14304	3,980.00	EA	A00	1	1	0	
	TRANSCEIVER,HF,SSB;1.6-30MHZ>125 WATTS PEP; SIMPLE X OR HALF DUPLEX MODES OF OPERATION INCLUDE SSB, U SB, LSB, AM/AME, ARQ AND CW; 12-VOLT DC INPUT, 1.2 5 AMPS RECEIVE, 18 AMPS TRANSMIT; 320 CHANNELS; 4. 35IN H X 12.25IN W X 12.63IN D, WEIGHT 15.5 LBS.									
41802C	6130-00-J03-5846 RF-3236	B16G2	14304	860.00	EA	A00	1	1	0	
	POWER SUPPLY,DC;12VDC>ALLOWS OPERATION OF THE 12VD C RF-3200 SERIES TRANSCEIVERS ON 115/230VAC, 50/60 HZ; AC VOLTAGE IS SELECTABLE BY A FRONT PANEL SWIT CH.									
41804E	5965-00-J03-5848 RF-3249	B16G2	14304	152.00	EA	A00	1	1	0	
	MICROPHONE,DESK;RF-3200>INCLUDES HEAVY BASE WITH P USH-TO-TALK BAR AND 7 FOOT CORD WITH CONNECTOR; FU W RF-3200 SERIES TRANSCEIVERS.									

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SML	NSN / REFERENCE NUMBER	NICP	FSCM	UNIT PRICE / QNTIV EXP	UI / UM	LIN	TOTAL REQD	AVAIL CMD	REQD ACQ	REMARKS
42166C	5920-00-J03-6164 417 PROTECTOR,SURGE;OEM>EQUIPMENT LEVEL PROTECTOR INSTALLED WITHIN A PIECE OF EQUIPMENT; PREVENTS EQUIPMENT DAMAGE OR MALFUNCTION OF SENSITIVE EQUIPMENT; LED INDICATORS; 240VAC RATED VOLTAGE, 50/60/400HZ; 25A RATED CURRENT; PLASTIC ENCLOSURE; SCREW CLAMP TERMINALS; DIMS 5IN X 3IN X 2IN.	S9EQ2	29779	97.00	EA	A00	2	0	2	
42972F	6145-00-J03-6892 W40-0014-004 CABLE,COND-04,24AWG;SP>USED FOR MAKING CABLES ASSEMBLIES; FUW CABLE ASSEMBLY KIT 10212-7222 (SML 42971E).	S9IQ2	14304	.50	FT	A00	25	0	25	
43339Z	6145-00-188-3651 19105 CABLE,COND-3,10AWG;PWR>0.705IN OD; STRANDED BARE COPPER CONDUCTORS, CONDUCTORS COLOR CODED BLACK, WHITE, GREEN; BLACK RUBBER OUTER JACKET; 600V; 60-DEG C TEMP; PAPER TAPE SEPARATOR.	S9IQ2	16428	.59	FT	A00	2	0	2	
44533E	5820-00-J03-8386 RF-3560 INTERFACE,TELEPHONE;T1>THE TELEPHONE INTERFACE IS USED FOR UNATTENDED OPERATION; INCOMING CALLS ARE AUTOMATICALLY PATCHED THROUGH A TWO-WIRE SUBSCRIBER INTO A PABX OR OTHER SWITCH W/O AN OPERATOR; SIZE 2IN(H), 7.5IN(W), 12.75IN(D), WT 3.9LBS; POWER SOURCE 115/230VAC, SINGLE PHASE.	B16G2	91417	4,992.00	EA	A00	1	0	1	
44558H	5985-00-J03-8309 ST-40 KD8MR 800-T ANTENNA,HF;MULTI TAKE-OFF ANGLE>ANT SYS; FREQ 2.0 TO 30.0MHZ; INPUT PWR 1KW AVG; PROVIDES NVIS/HORZ LOW ANG HIGH GAIN RADN CHAR CNTD IN A STURDY PKG THAT FITS AN AREA W/RAD OF 38FT; CMPNTS INCL MLP-1 HD LOG PERD ANT 6.2 TO 30.0MHZ/1KW, AFA-4 HD B MT ROTR, GUYED TWR/HNG B, RMT ANT POS SYS/2 CONT PNLS	B16GP	60348	32,725.00	EA	A00	1	0	1	

***** P R O J E C T S U M M A R Y *****

	TOTAL REQUIRED TOTAL	AVAILABLE IN COMMAND	REQUIRED ACQUISITION
ADPE	.00	.00	.00
TMDE	.00	.00	.00
COMSEC	.00	.00	.00
OMA	14,912.14	4,992.00	9,920.14
OPA	32,725.00	.00	32,725.00
TOTAL	47,637.14	4,992.00	42,645.14

	TOTAL ITEMS
REQUIRED	2233
AVAIL CMD	3
REQD ACQ	2230
LINES	37

SECTION 6 - QUALITY ASSURANCE PROCEDURES

SECTION 6. QUALITY ASSURANCE PROCEDURES

6.1 GENERAL OBJECTIVES.

6.1.1 This section is in accordance with USAESEIA Reg 702-1, USAISC REG 702-1, USAISC Reg 702-1-2, USAESEIA Reg 702-4 and USAESEIA-CONUS Memorandum 702-2.

6.1.2 This section establishes a Quality Control (QC)/Quality Assurance (QA) Plan for this project in order to achieve and maintain high standards of quality in terms of engineering, installation, operations, Quality Assurance and safety.

6.1.3 This section defines procedures and responsibilities for QC and QA during the project implementation phase, including engineering, installation and acceptance testing.

6.2 INSPECTION RESPONSIBILITIES.

6.2.1 USAISEC-CONUS has been assigned the engineering and installation responsibility for this project and is responsible for the overall QC and QA.

6.2.2 USAISEC-CONUS, Test and Field Engineering Division, is responsible for the implementation of the overall QA Standards and the evaluation of the project QA.

6.2.3 USAISEC-CONUS, Test and Field Engineering Division, is responsible for the project QA, including the preparation of Sections 6, 7 and 8 of this Engineering Installation Plan (EIP), QA Plans, on-site QA inspections, and test procedures. The Test and Field Engineering Division will assign the USAISEC-CONUS Test Director who will be responsible for insuring that the acceptance tests for this project are performed IAW approved test procedures.

6.2.4 USAISEC-CONUS, Installation Division, is responsible for equipment installation IAW Section 3 of this EIP, QC inspection, equipment alignment and pretest.

6.2.4.1 Equipment installation for this project, or portions thereof, may be performed (when properly tasked) by personnel from other agencies such as the USAISEC Installation Battalion, the local USAISC Detachment, etc. In this event they shall be responsible for all QC inspections in lieu of the USAISEC-CONUS Installation Division. QA inspections are to be performed in addition to these efforts.

6.2.5 USAISC Detachments, users and other activities which have been assigned responsibilities in support of the installation, operation, test and maintenance support are identified in the

Project Coordination Letter (PCL) contained in Section 2 of this EIP. All activities shall be responsible for the QC inspections for their respective tasking and shall adhere to the project QA plans defined herein.

6.3 DOCUMENTATION.

6.3.1 The following quality assurance documentation will be provided to the cognizant engineering, installation, test and evaluation and using activities:

6.3.1.1 Technical Acceptance Recommendation (TAR) - HQ ESEIA, ASC-QA, Form 98-R.

6.3.1.2 Quality Checklist - HQ ESEIA, ASC-QA, Form 112-R.

6.3.1.3 Quality Control Checklist - HQ ESEIA, ASC-QA, Form 111-R.

6.3.1.4 Quality Assurance Summary Checklist.

6.3.1.5 Cognizant Agency, Command and Facility QA Points of Contact (POC) - HQ ESEIA, ASC-QA, Form 113-R. (Only the QA and operating agency sections need be completed.)

6.3.2 The TAR is documented IAW Section 8 of this EIP. When the test and acceptance and Test and Field Engineering Representative functions are not performed concurrently, one copy of each completed form should be provided to the appropriate agencies. The completed EIP comments/checklist should be provided directly to the applicable engineering activity. If the QA inspection is not concurrent with the installation effort, the completed Quality Checklist (HQ ESEIA, ASC-QA, Form 112-R) should remain on-site with the using activity commander or his representative. The Test and Field Engineering Representative will then be responsible for the distribution of this information upon completion of the QA inspection.

6.4 QA PLANS AND REPORTS.

6.4.1 Quality Control Implementation.

6.4.1.1 The Installation Team Chief shall conduct periodic QC inspections IAW USAESEIA-CONUS Memorandum 702-2 during the installation phase. The results are to be recorded on HQ ESEIA, ASC-QA, Form 112-R which is contained as an enclosure to this EIP. Installations shall be in compliance with standard installation practices, technical orders as applicable, and all specifications and instructions contained in Section 3 of this EIP. USAESEIA Reg 702-1-2, Appendix F, and USAESEIA Reg 702, Appendices D, E and F, should be reviewed for additional information.

6.4.1.2 Work must cease on that portion of an installation where a QC deficiency is noted until satisfactory corrective action is taken. The Installation Team Chief is responsible for coordination with the project engineer as required IAW USAISEC Reg 702-4, Paragraph 8b(2) (a).

6.4.1.3 The installation team shall list the amount of excess BOM (both types and quantities) for disposition by the USAISC detachment. A copy of this list is to be provided to the USAISC detachment, another attached to the BOM contained in the EIP. The QAR/Test Director will insure that the excess BOM identification/ disposition is identified in the remarks section of the TAR.

6.4.2 Quality Assurance Implementation.

6.4.2.1 The Test and Field Engineering Representative (TFER) function is the responsibility of the Test and Field Engineering Division, USAISEC-CONUS, and is normally the responsibility of the Test Director. The Director, Test and Field Engineering Division, can designate an alternate TFER when the situation requires it. QA is performed by an individual other than the QC representative, IAW USAISC Reg 702-1-2, Appendix F. This procedure insures an independent QA evaluation of the project.

6.4.2.2 The Installation Coordinator shall notify the QAR of the estimated installation completion date 10 days prior to completion date. This is to allow the QAR sufficient time to schedule his arrival on-site prior to the completion date. An installation team representative should be available to the TFER for correction of any possible installation deficiencies.

6.4.2.3 The TFER and installation team representative will review the PCL (Section 2) and check for safety violations, workmanship discrepancies, and equipment locations against the floor plan drawings. All discrepancies will be brought to the attention of local personnel. Each unresolved discrepancy will be noted on the exception sheet of the TAR.

6.4.2.4 The TFER shall provide an inspection and overall evaluation upon project completion. In support of this overall evaluation, the documentation IAW Paragraph 6.3 of this EIP will be completed and attached as part of the TAR. All forms will be signed or initialed as required.

6.4.2.5 The TFER will validate the QC checklist (HQ ESEIA, ASC-QA, Form 112-R) provided by the Installation Team Chief. Only a representative sampling need be checked under each lettered section. TFER concurrence in the findings will be indicated adjacent to those items checked. For those situations where concurrence cannot be negotiated the actual situation and circumstances will be identified in the Quality Assurance Summary

Checklist. There should be sufficient detail in the summary to adequately present all aspects of the issue.

6.4.2.6 All changes to the EIP will be listed on the Quality Assurance Summary Checklist. Each change to the EIP will be identified as to source authority and nature of the approval. All aspects of the installation should be checked for compliance with the EIP.

6.4.2.7 Engineering Package Review - As part of the overall QA effort, the Installation Team Chief shall provide a field evaluation of the EIP through entries on the EIP comments/checklist. All "No" responses should be explained in detail in the comments section. Constructive comments are encouraged in the interest of providing a more effective EIP product. This checklist should be provided to:

Commander
USAISEC-CONUS
ATTN: ASQB-CTF
Fort Ritchie, MD 217196010

SECTION 7 - TEST AND ACCEPTANCE

SECTION 7. TEST AND ACCEPTANCE

7.1 GENERAL: This section contains procedures for on-site test and acceptance of installed equipment for the National Communications System (NCS). The purpose of these tests is to verify that the equipment is installed within manufacturer's guidelines; and the resultant system performance meets the specifications contained in the referenced documents. Test plan documentation in this section has been developed according to USAESEIA Reg 702-2.

7.2 REFERENCES:

7.2.1 Tasking letter from National Communications System, dated 15 February 1991.

7.2.2 US Army Communications Electronics Engineering Installation Agency (USACEEIA) Regulation No. 702-1.

7.2.3 US Army Communications Electronics Engineering Installation Agency Regulation No.702-2.

7.3 BACKGROUND: This project will provide a communications link between the specific NCS site and the appropriate Federal Emergency Management Agency (FEMA) Federal Regional Center (FRC). This link provides an orderwire circuit to manage the initiation, coordination, restoration, and reconstruction of telecommunication services and facilities required in support of national security leadership requirements.

7.4 RESPONSIBILITIES:

7.4.1 Operating Agency. NCS will designate a site QA representative no later than the start of the installation effort. The agency will also assign a technical representative to assist the test director with such information as workable test frequencies for system operational testing. Both functions may be accomplished by the same person.

7.4.2 Installation Agency. USAISEC-CONUS, Fort Ritchie, MD, will install the equipment, establish and maintain a quality control (QC) system, and perform initial alignments. The QC and test records are to be available for review by the test director. The quality control checklist (EIP Section 6) is to be successfully completed before offering the installed system for acceptance testing. The installation agency will designate a Quality Control Representative (QCR) for the project.

7.4.3 Quality Assurance Agency. USAISEC-CONUS, Fort Ritchie, MD, will perform Quality Assurance (QA) evaluation and the technical acceptance tests for the referenced NCS HF radio system.

7.5 TEST REQUIREMENTS. This test plan provides test and acceptance procedures for the newly installed NCS HF radio system. Site testing is grouped into three phases; installation quality, system operational capability, and acceptance verification.

7.5.1 Installation, Checkout and Alignment. The installation team will: install, adjust, and align all equipment according to the engineering instructions. The team will test each newly installed cable for proper termination and connectivity. Results of all tests conducted by the installation team will be provided to the test director.

7.5.2 Acceptance Testing. The test agency, with personnel support from the operating agency (NCS) and the installation agency, will conduct acceptance testing using the enclosed Appendices.

7.5.3 Acceptance testing will start after the Installation Team Chief has provided a statement of readiness to USAISEC-CONUS, ATTN: ASQB-CTF-NE, Ft. Ritchie, MD 21719-6010, DSN 277-5212. The statement of readiness will be provided at least 10 days in advance of the anticipated installation completion date.

7.5.3.1 Power Up Test. The objective of this appendix is to provide a systematic procedure for turn on and initial check of the newly installed equipment. Refer to Appendix A.

7.5.3.2 Radio Transceiver RF-3200E. The objective of this appendix is to verify the transceiver's capability of meeting the performance standards as specified by Harris Corp. Refer to Appendix B.

7.5.3.3 Coaxial Cable Test. The objective of this appendix is to evaluate the integrity and performance of the newly installed antenna cable system. Refer to Appendix C.

7.5.3.4 Antenna System Test. The objective of this appendix is to evaluate the integrity and performance of the newly installed antennae. Refer to Appendix D.

7.5.3.5 System Operational Acceptance Test. The objective of this appendix is to verify that the system is operational and ready for site acceptance. Tests will include communication with the regional FRC. Coordination of time and frequencies are to be set up by the NCS supplied representative. Refer to Appendix E.

7.5.4 Test Results Documentation. Test data sheets are included in each appendix of the test plan. The test director will be responsible to insure that an adequate number of copies is available. The test director will complete all test results documentation for inclusion in the test report if necessary.

7.5.5 Operational Testing. The Quality Assurance Test Team, supported by the NCS appointed witness, will conduct operational testing of the system according to the command's operational requirements and procedures. Documented results of diagnostic tests, and corrective action in case of test failures, will be made available to the test director.

7.6 TEST PERSONNEL: USAISEC-CONUS Test and Field Engineering Division, will provide a test director for tests specified by this plan.

7.7 TEST EQUIPMENT. Test equipment used to perform final acceptance tests shall have a current calibration decal attached showing date of last calibration and date of next calibration. The operating agency will provide test measuring diagnostic equipment (TMDE) support to complete acceptance testing. The following equipment is required:

TEST EQUIPMENT

a. IFR 1200S Communications Test Set or equal
b. Megohmmeter Biddle MDL 218638, ZM-21 or equal
c. Multimeter Fluke MDL 77 or equal
d. RF Millivoltmeter, Boonton 92C or equal
e. Time Domain Reflectometer, Tektronix 1503 or equal
f. Bird Thru-line Wattmeter MDL 43 or equal
g. 50-Ohm Dummy Load (Rated for 150 Watts)

APPENDIX A STATION POWER UP TEST

1. Objective: The objective of this appendix is to provide a systematic procedure for turn on and initial check of the newly installed equipment.

2. Requirement: All installed equipment will be turned on in sequence, with no non-clearable alarms or faults.

3. Procedures:

a. On all newly installed equipment, verify the base unit power supply is set for the proper AC line voltage.

b. With all equipment power switches and controls in the "off" or "normal" position, place the main circuit breakers on.

c. Power up each newly installed unit.

d. Burn in all equipment for a minimum of 24 hours.

4. Success Criteria: There are no unclearable faults after completion of the power up sequence.

5. Data Requirements: Note all failures as remarks at the end of this sheet.

REMARKS:

APPENDIX B RECEIVER-TRANSMITTER RF-3200E

1. Equipment Description. The RF-3200E is a solid state, multi-mode, 125 Watt, HF transceiver, tunable in 10 Hz steps within the frequency range of 1.6 to 30 Mhz.

2. Objectives. The receiver-transmitter will meet performance standards as specified by Harris Corp and is fully compatible with the supplied ancillary equipment.

3. Requirements.

a. All Transceiver functions and features are available to the user.

b. Receiver sensitivity will be verified by connecting an RF signal source to the RF input. The audio output of the receiver will be connected to a 600 ohm terminated audio voltmeter. The signal plus noise to noise ratio (S+N/N) is then measured at a minimum of three frequencies for each mode.
(NOTE: Audio Out can be monitored between pins three and six on the Accessory connector at the rear of the RF-3200E.

c. The RF output power, sideband suppression and dial frequency accuracy of the transmitter will be measured with the IFR-1200S Communications Test Set to verify the equipment is within vendor specifications.

d. ALE operations including LQA, Autocall, AMD message receive and transmit and proper programming will be verified during operational testing.

e. Test Instrument: IFR 1200S Communications Test Set or equal

4. Procedures:

a. Select all available functions and features of the unit under test using the instructions in section three of the RF-3200E technical manual.

b. Signal plus Noise to Noise Ratio (s+n/n).

NOTE: Refer to the IFR Operator's Guide to set up the 1200S for this test.

LSB MODE

(1) Connect the audio line output of the transceiver (pin three of the rear panel accessory connector) to the appropriate SINAD port of the IFR 1200S.

(2) Connect the RF input port of the transceiver to the appropriate output port of the IFR 1200S.

(3) Adjust the signal source (1200S) for a 0.5 Uv, 6.100 Mhz unmodulated carrier.

(4) Set the RF-3200E frequency to 6.101 Mhz, and the mode to LSB.

(5) Measure the receiver audio output level in Db. This is the signal plus noise (s+n) reference level. Remove the rf signal and measure the receiver

noise (n) level. With a 0.5 Uv input signal the measured s+n/n ratio will be Not Less Than (NLT) 10 dB.

(6) Repeat the above for the frequencies listed on the data sheet.

USB MODE

(1) Repeat the same procedures as in the LSB mode, except adjust the signal source (1200S) for a 0.5 uV, 6.101 MHz unmodulated carrier, and set the RF-3200 frequency to 6.100 MHz, and the mode to USB.

(2) The S+n/n ratio requirement is the same as that for the LSB mode.

(3) Repeat the above for the frequencies listed on the data sheet.

CW MODE

(1) Repeat the procedures as stated above for USB, except set the mode to CW. The S+n/n requirement is the same as above.

(2) Repeat the CW procedures for the frequencies listed on the data sheet.

AM MODE

(1) Repeat procedures as above for connecting the audio and RF signals to the transceiver and the test equipment.

(2) Set the RF-3200E frequency to 6.100 MHz, and the mode to AM.

(3) Change the mode of the 1200S to AM. The signal source will be set for 30 % modulation with an output level of 3 uV at 6.100 MHz.

(4) With modulation applied measure the receiver audio output level (signal plus noise) in dB. On the signal generator portion of the 1200S select unmodulated carrier. Measure the receiver audio noise. With a 3.0 uV rf input level the measured s+n/n will be NLT 10 dB.

(5) Repeat the AM procedures for the frequencies listed on the data sheet.

c. Transmitter Tests

(1) Connect the audio line input of the transceiver (pin four of the rear panel accessory connector) to the appropriate input/output port of the 1200S.

(2) Connect the rf input/output port of the transceiver to the appropriate input/output port of the 1200S.

(3) Adjust the audio source for a 1 kHz 0 dBV (1Vrms) signal.

(4) Set the RF-3200E frequency to 15 MHz and the mode to USB.

(5) Key the transmitter by grounding the key line (pin 5 of the rear panel accessary connector). The measured rf output power will be not less than +16 dBm. Using the spectrum analyzer feature of the 1200S measure the carrier,

opposite sideband and 2nd harmonic suppression. The residual carrier will be down at least 46 dB. The residual opposite sideband tone will be down at least 55 dB. Harmonic suppression will be down at least 65 dB. Unkey the transmitter. These measurements use the selected sideband PEP tone as the spectrum analyzer reference point.

(6) Repeat these procedures in the LSB and CW modes.

(7) Change the mode of the RF-3200E to AM. Key the transmitter and measure the rf output. The rf output power should be NLT 35 Watts. Change the frequency of the RF-3200E to 30.000 MHz and key the transmitter in the AM mode. Using the frequency error feature of the 1200S, measure the frequency of the AM signal and record. The transmitted carrier frequency will be 30.000 MHz $\pm$15 Hz.

d. The test director will conduct any additional tests necessary to insure all requirements are satisfied.

5. Data Requirements. The test director will record all test results on the enclosed data sheets.

APPENDIX B DATA SHEET RF-3200E TEST RESULTS Receiver Sensitivity

Receiver Frequency	Receiver LSB S/N	Receiver USB S/N	Signal Level (uVolts)	Comments
2.0 (MHz)				
3.0				
4.0				
5.0				
6.0				
7.0				
8.0				
9.0				
10.0				
11.0				
12.0				
13.0				
14.0				
15.0				
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				
23.0				
24.0.				
25.0.				
26.0				
27.0				
28.0				
29.0				
29.9				

APPENDIX B DATA SHEET (CONTINUED)

SIGNAL SOURCE FREQUENCY	RF-3200E FREQUENCY	MODE	LEVEL	PASS
6.100 MHz	6.101 MHz	LSB	0.5uV	_____
15.100 MHz	15.101 MHz	LSB	0.5uV	_____
29.900 MHz	29.901 MHz	LSB	0.5uV	_____
6.101 MHz	6.100 MHz	USB	0.5uV	_____
15.101 MHz	15.100 MHz	USB	0.5uV	_____
29.901 MHz	29.900 MHz	USB	0.5uV	_____
6.101 MHz	6.100 MHz	CW	0.5uV	_____
15.101 MHz	15.100 MHz	CW	0.5uV	_____
29.901 MHz	29.900 MHz	CW	0.5uV	_____
6.100 MHz	6.100 MHz	AM	3.0uV	_____
15.100 MHz	15.100 MHz	AM	3.0uV	_____
29.900 MHz	29.900 MHz	AM	3.0uV	_____

TRANSMITTER TESTS

Mode	Power NLT +16dBm	Undesired Signal Suppression		
		Residual Carrier 46dB down	Opposite Sideband 55dB down	Second Harmonic 65dB down
USB				
LSB				
CW				
AM		XXXXXXXXX	XXXXXXXXX	

Frequency Accuracy

AM Mode, _____ MHz 30.000 MHz ±15 Hz

SITE:_____ DATE:_____ PROJECT NO:_____

Performed By:_____

Test Director:_____

APPENDIX C ANTENNA CABLE SYSTEM TEST

1. Objective. The objective of this appendix is to evaluate the integrity and performance of the newly installed antenna cable system. This series of tests will include measurements of the insulation resistance, leakage resistance and attenuation of the coaxial cable.

2. Requirements.

a. The measured loop resistance between coaxial transmission line conductors at the equipment will not exceed five (5) ohms when a short circuit condition exists at the cable's opposite end.

b. With the antenna end of the coaxial cable open circuited, the measured insulation resistance will not be less than those values listed on the attached information sheet.

c. The test director will use a TDR (Time Domain Reflectometer) to test the installed cables for circuit discontinuities and run length. Each cable run with connectors installed will not exhibit any faults due to installation damage, poor workmanship, water in the cable, shorts or defective connecting devices. Cable should be open or short circuited at the distant end.

d. The coaxial cable insertion loss will not exceed vendor attenuation specifications.

e. Required test equipment (dependant on test method):

a. IFR 1200S Communications Test Set or equal
b. Megger Biddle MDL 218638, ZM-21 or equal
c. Multimeter Fluke MDL 77 or equal
d. RF Millivoltmeter, Boonton 92C or equal
e. Time Domain Reflectometer, Tektronix 1503 or equal

3. Procedures:

a. LOOP RESISTANCE. Disconnect the antenna end of the cable under test (CUT) and short the center conductor to the shield. At the transceiver end of the cable, connect an ohmmeter between the center conductor and the shield. Using the lowest resistance scale of the ohmmeter measure the loop resistance. Record the measured data.

b. LEAKAGE RESISTANCE. Remove the short circuit between the center conductor and the shield of the CUT installed during the loop resistance test. Leave the antenna end of the cable unterminated. At the transceiver end of the cable connect a megohmmeter between the center conductor and the shield. Measure the leakage resistance and record the data.

c. TIME DOMAIN REFLECTOMETRY. Connect the TDR between the center conductor and the shield of the CUT. Use the procedures provided with the TDR to measure the electrical length of the cable. Record the data. Adjust the TDR controls to view the entire length of the cable on one screen. Use the

TDR strip chart recorder to record the cable response. Refer to the TDR manual for interpretation of the response waveform. Repeat test for each cable installed. Include a strip chart for each cable tested with the data sheet.

d. COAXIAL CABLE INSERTION LOSS. There are four methods of testing the installed cable for insertion loss. The test director will determine the methodology used on a site by site basis. Refer to Figure 1.

Method 1. Connect a signal generator to the cable and terminate the distant end of the cable with a fifty ohm load. Adjust the signal generator for maximum CW signal at 30 MHz. Use the rf voltmeter to measure the input and output signal levels. The signal difference in dB will be the cable attenuation at the test frequency.

$$\text{Insertion loss (dB)} = 20 \log (V1/V2).$$

Method 2. Disconnect the coaxial cable at the antenna. Terminate the cable with a wattmeter and a 50 ohm dummy load. Insert a thru-line wattmeter in series with the transmitter and the coaxial cable. Energize the transmitter and measure the power at the transmitter end (P1) and at the terminated end (P2). Use the formula below to calculate the coaxial cable insertion loss.

$$\text{Insertion loss (dB)} = 10 \log (P1/P2).$$

Method 3. Terminate the antenna end of the coaxial cable with a short circuit. Insert a thru-line wattmeter in series with the transmitter and the cable under test. Energize the transmitter and adjust the output level for low forward power (about 100 watts or less). Measure the forward power (P1) and the reflected power (P2). The coaxial cable insertion loss may be determined by the formula:

$$\text{Insertion loss (dB)} = \frac{10 \log (P1/P2)}{2}$$

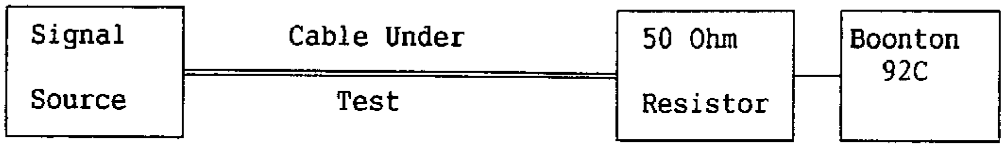
Method 4. The IFR 1200S may be used as the power meter and 50 ohm load. Place the meter function of the IFR in Meter Mode. Connect the transceiver to the IFR's 150 WATT MAX input with a short piece of coax. Key the transmitter in CW mode and wait for ten seconds for the power to stabilize. This should be done and recorded for 29 MHz and 12.5 MHz. Next, normalize the antenna cable to the 3200 and move the IFR to the distant end of the cable. Connect the IFR to the cable at the feed point of the antenna or fast tune coupler (if installed). Repeat procedures done at the radio and record powers. (They will be lower.)

$$\text{Insertion loss (dB)} = 10 \log (P1/P2).$$

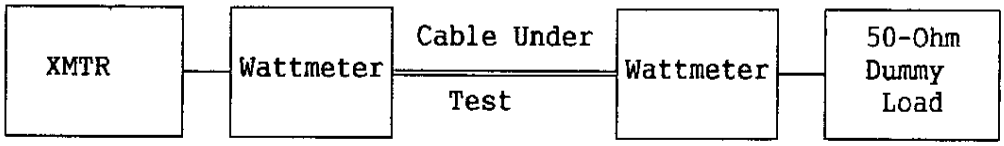
4. Data Requirements: Record the data from these tests on the enclosed data sheets.

FIGURE 1 COAXIAL CABLE ATTENUATION, INSERTION LOSS

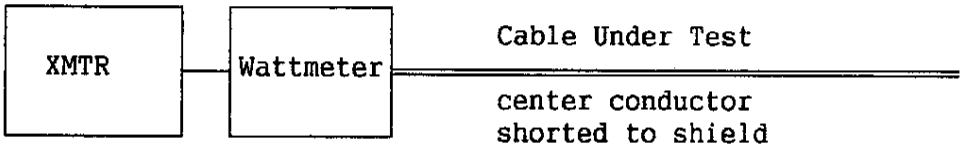
METHOD 1



METHOD 2 (Note: Limit XMTR power to 100 Watts)



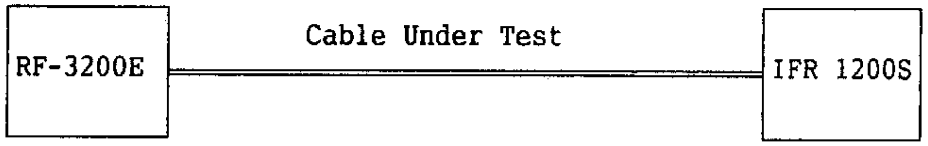
METHOD 3 (Note: Limit XMTR power to 100 Watts)



METHOD 4 (Note: Limit XMTR power to 150 Watts)

Step 1.

Step 2.



COAXIAL CABLE INFORMATION SHEET

INSULATION RESISTANCE

Dielectric Type	Cable Length (Feet)	Insulation Resistance
Polyethylene or Teflon	100	40,000 Megohms
	200	20,000 Megohms
	500	8,000 Megohms
	1000	4,000 Megohms
Synthetic Rubber @ 20 C	10	35,000 Megohms
	100	3,500 Megohms
	1000	500 Megohms

COAXIAL CABLE ATTENUATION

CABLE LOSS IN DB AT 100 MHZ PER 100 FEET OF LENGTH

Cable Type	Impedance (Ohms)	VF	Loss (Db)
RG 8/U	52	.66	2.2
RG 58/U	53.5	.66	4.5
RG 122/U	50	.66	7.0
RG 174/U	50	.66	8.9
RG 213/U	50	.66	2.2
RG 214/U	50	.66	2.2
RG 218/U	50	.66	0.8
LDF4-50A FOAMFLEX	50	.88	0.685
LDF5-50A FOAMFLEX	50	.89	0.369
LDF6-50A FOAMFLEX	50	.89	0.275
LDF7-50A FOAMFLEX	50	.88	0.225

Formula for determining attenuations at frequencies not listed in Table 2:

$$Au = (Ak) \sqrt{Ft / Fk}$$

Where,

Au = unknown attenuation
Ak = known attenuation at Fk
Ft = test frequency
Fk = frequency at which attenuation is known.

DATA SHEET ANTENNA SYSTEM TESTS

1. Antenna type_____

Coaxial Cable Type _____length (TDR)_____feet

DC Loop resistance _____ohms Leakage Resistance_____Mohms

TDR _____ Pass/Fail Insertion Loss at 30 mHz_____dB

2. Antenna type_____

Coaxial Cable Type _____length (TDR)_____feet

DC Loop resistance _____ohms Leakage Resistance_____Mohms

TDR _____ Pass/Fail Insertion Loss at 30 mHz_____dB

3. Antenna type_____

Coaxial Cable Type _____length (TDR)_____feet

DC Loop resistance _____ohms Leakage Resistance_____Mohms

TDR _____ Pass/Fail Insertion Loss at 30 mHz_____dB

4. Antenna type_____

Coaxial Cable Type _____length (TDR)_____feet

DC Loop resistance _____ohms Leakage Resistance_____Mohms

TDR _____ Pass/Fail Insertion Loss at 30 mHz_____dB

SITE:_____ DATE:_____ PROJECT NO:_____

Performed By:_____

Test Director:_____

APPENDIX D Antenna System Test

1. Objective. The objective of this appendix is to evaluate the integrity and performance of the newly installed RLP and NVIS antenna system. This series of tests will include measurements of Return Loss of the installed antennae.

2. Requirements.

a. Using an in-line wattmeter at the transceiver end of the RF circuit the corrected VSWR of the installed RLP antenna and NVIS antenna shall not exceed vendor specifications.

b. The newly installed Rotatable Log Periodic (RLP) antenna will be rotated through 360 degrees verifying proper rotation of the array and return loss of the rotary joint.

g. Required test equipment

Bird in-line Wattmeter

3. Procedures:

e. Antenna Return Loss Test. Using the installed transceiver as the RF source, connect a thru-line wattmeter in series between the transceiver and the transceiver end of the coaxial cable. Key the transceiver in the CW mode. Measure and record the forward and reflected power every two MHz for the frequency range of the installed antenna. Compute the Return Loss and record the results on the data sheet provided. Subtract the two way loss of the transmission line in dB from the return loss. Check the vendor data sheets for the new antennae to determine the Return Loss requirements. As an example, a VSWR requirement of not more than 2.5:1 will require a corrected return loss not less than 7.360 dB.

$$\text{Return Loss (RL)} = 10 \text{ (log)} \frac{\text{reflected power}}{\text{forward power}}$$

Corrected RL (CRL) = RL - two way loss of transmission line (dB).

2.5:1 VSWR = CRT of not less than 7.360 dB.

The formula to determine Return Loss for VSWR other then 2.5:1 is below:

$$RL = 10 \text{ Log} \left[\frac{1}{\left[\frac{VSWR - 1}{VSWR + 1} \right]^2} \right]$$

f. Rotator Tests. Determine if a rotary joint was installed in the feedline of the array, if not installed, ensure the micro-switch on the rotator assembly is set to open when the array is looking north (000 degrees). Apply power to the Antenna Remote Control Panel. Using the ROTATION control, rotate the array clockwise 90 degrees. Verify the array is looking east. Rotate clockwise to the 180 degree azimuth and verify the array is looking south. Rotate clockwise to an azimuth of 270 degrees and verify the array is looking west. Return the array to an azimuth of 000 degrees and verify array rotation stopped and is looking north. Repeat this series with anti-clockwise rotation.

With the installation of the rotary joint in the array feedline, the micro-switch on the rotator assembly should not be engaged, therefore the array will not stop at 000 degrees. Repeat the above series to verify the calibration of the azimuth dial on the Remote Control Panel.

Using the installed transceiver as the RF source, connect a thru-line wattmeter in series between the transceiver and the transceiver end of the coaxial cable. Key the transceiver in the CW mode on an unused authorized frequency. Measure and record the forward and reflected power of the installed antenna. Unkey the Transceiver. Using the ROTATION control on the Remote Control Panel rotate the array 10 degrees clockwise. Measure and record the forward and reflected power of the array. Repeat this series for each 10 degrees of rotation of the array. Compute the Corrected Return Loss and record the results on the data sheet provided. The Return Loss for each 10 degree position of the array should be the same as that measured at 000 degrees.

4. Data Requirements: Record the data from these tests on the enclosed data sheets.

Return Loss for the RLP Antenna

Frequency MHz	Return Loss dB	Transmission Line Loss dB	Corrected Return Loss dB
6.2			
8			
10			
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			

Return Loss for the NVIS Antenna

Frequency MHz	Return Loss dB	Transmission Line Loss dB	Corrected Return Loss dB
2			
4			
6			
8			
10			
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			

Site:_____ Date:_____ Project No:_____

Performed By:_____

Test Director:_____

Antenna System Data Sheet

Rotation of installed Array

Indicated Azimuth Remote Panel	Actual Azimuth of Array Clockwise Rotation		Actual Azimuth of array Anti-clockwise Rotation	
000	North		North	
090	East		East	
180	South		South	
270	West		West	
000	North		North	

Return Loss of the Array with Rotary Joint (if installed).

Array Azimuth degrees	Return Loss dB	Array Azimuth degrees	Return Loss dB
000		190	
010		200	
020		210	
030		220	
040		230	
050		240	
060		250	
070		260	
080		270	
090		280	
100		290	
110		300	
120		310	
130		320	
140		330	
150		340	
160		350	
170		000	
180			

Site:_____ Date:_____ Project No:_____

Performed By:_____

Test Director:_____

APPENDIX E SYSTEM OPERATIONAL ACCEPTANCE TEST

1. Objective. The objective of this appendix is to verify the system is operational and ready for site acceptance and to establish the newly installed equipment's compatibility with existing systems.

2. Requirement. The completed system shall be capable of simplex voice operation between the project site and other stations in the network.

3. Procedure. Upon completion of the installation effort, and any required corrective actions, the installed equipment will be given a system operational acceptance test.

a. For the acceptance test of this HF radio equipment, the associated appendices of this test plan will be used as required or as thought necessary by the test director.

b. Station to Station Simplex: Radio contact will be established between the station tested and a designated station at a distant location. The operational agency will determine the frequencies for these tests.

c. Automatic Linking Equipment (ALE): Using the procedures in the RF3200E Technical Manual, verify the proper operation of the ALE functions of this equipment.

4. Data Requirements: Record the data from these tests on the following data sheet.

Simplex Voice Operational Test: Pass/Fail

ALE Functions:	LQA	Pass/Fail
	Autocall	Pass/Fail
	AMD Message	
	Transmit	Pass/Fail
	Receive	Pass/Fail
	Programming	Pass/Fail

Distant Station Location:_____

Frequency:_____ Time of Day:_____

SITE:_____ DATE:_____ PROJECT NO:_____

Performed By:_____

Test Director:_____

SECTION 8 - COMPLETION CERTIFICATION

SECTION 8. COMPLETION CERTIFICATION

8.1 CERTIFICATION DOCUMENTATION CONTENT. The format and content of the Technical Acceptance Recommendation (TAR), attached as Enclosure 1 to this Section, is IAW USAISEC Reg 702-2.

8.2 PURPOSES. The purposes of the TAR in Encl 1 of this Section are to:

8.2.1. Identify major items of equipment installed or relocated and documentation provided to the O&M Command(s) under this project.

8.2.2 Document exceptions to the requirements of the project which require follow-on corrective action.

8.2.3 Certify the following:

8.2.3.1 Completion of installation, quality assurance (QA) inspections and acceptance testing.

8.2.3.2 Concurrence by all signatories with the findings and recommendations contained in the TAR.

8.2.3.3 Acceptance of the installed system for O&M. This acceptance in no way implies acceptance required by contractual agreement or the authority to process classified data.

8.3 RESPONSIBILITIES.

8.3.1 USAISEC-CONUS Test Director (or Authorized Representative). Prepare the TAR in Encl 1 IAW the instructions.

8.3.2 Operations and Maintenance Command Representative(s). Sign the TAR signifying concurrence with the findings and acceptance of the installed system for O&M.

8.3.3 Installation Command Representative. Sign the TAR signifying concurrence with the findings and recommendations contained therein.

8.4 IMPLEMENTATION. The TAR will be prepared and executed by all signatories immediately upon completion of QA inspection and acceptance testing. This action will terminate USAISEC-CONUS responsibilities under this project, except for the correction of exceptions documented and the provision of as-built drawings to the appropriate O&M Command(s). Two copies of the completed TAR will be provided to each signatory.

SECTION 8 - COMPLETION CERTIFICATION

ENCLOSURES

1. Instructions for Preparing the Technical Acceptance Recommendation.

2. Technical Acceptance Recommendation (TAR)-USAISEC-QAD Form 98-R.

Instructions for Preparing
the
Technical Acceptance Recommendation

1.0 General.

1.1 The attached form will be used as prescribed in CCR-702-2 for documenting the Technical Acceptance Recommendation (TAR).

1.2 Entries on the data sheets are to be typed whenever possible to insure legibility and provide a quality, fully-legible product when reproduced. If a typewriter is not available, the forms may be completed by printing with black ink and in block letters to insure legibility of reproduced copies.

1.3 Pages are to be sequentially numbered to show both the individual page number as well as the total number of pages constituting the completed TAR. Additionally, as a minimum, each page will be identified by date and project/contract number in the appropriate block.

2.0 TAR Format and Contents.

2.1 Refer to the TAR, as applicable.

2.1.1 Project/Contract Number. Enter the appropriate project or contract number.

2.1.2 Title. Enter the project name or title.

2.1.3 Location. Enter the geographical location where the project was installed.

2.1.4 Facility. Enter the name of the facility and other pertinent identifying information.

2.1.5 Test Director. Enter the name, title and grade of assigned test director.

2.2 Technical Acceptance Recommendation (Summary).

2.2.1 Operating, Engineering, Installation and Testing Agencies. Identify the respective agencies including their complete mailing address.

2.2.2 Project Description. Enter a brief and concise description of the project to which the TAR applies.

2.2.3 Technical Acceptance Recommendation (Installed Equipment). List the major items of equipment installed or relocated in accordance with the project requirements. Enter the bill of material (BOM) line number, material description, assigned part

number or national stock number, and the quantity of each major item. Components, assemblies, and subassemblies configured into major item, as listed in SB-700-20 or CCP-700-20. In addition, excess BOM material should also be recorded in the same format.

2.4 Technical Acceptance Recommendation (Documentation). Enter the document identification such as drawing number, technical manual number, etc., the documentation title, and the quantity of each document provided as part of the project.

2.5 Technical Acceptance Recommendation (Exceptions).

2.5.1 Upon completion of installation and testing, any exceptions to the requirements of the project which require followup corrective action will be listed. All exceptions must be fully described and precisely identified to preclude requests for followup explanations. Exceptions must be based on the specified requirements of the project and supportable through the test results or other valid documentation.

2.5.2 The appropriate exception block of the form must be annotated and separate sheets should be used for each category of exception.

2.5.3 The test director will also enter the suggested action agency for each exception, recognizing that the test director may not always be in a position to determine the final action agency.

2.6 Technical Acceptance Recommendation (Remarks).

2.6.1 The remarks section may be used to provide any additional information on or in support of a recommendation in relation to the project installation, engineering or testing. Shortcomings, which do not require corrective action (not considered an exception), and recommendations for improving projects of a similar nature may be entered on this form.

2.6.2 The form may also be used to identify material that was excess to the project or a statement to indicate that a list of excess material was provided the operating command for final disposition.

2.7 The operating or maintaining agency shall be given the opportunity to provide additional exceptions or remarks to the appropriate TAR sheets. All such exceptions and remarks shall be coordinated with the testing and installing agencies. Differences of opinion should be documented succinctly and accurately.

2.8 Technical Acceptance Recommendation (Certification). This form is self-explanatory and provides for recording the signatures and certification that the project was installed, tested, and accepted for operation with or without exceptions as applicable.

2.9 All completed test summary sheets for tests performed shall be available for inspection by those signing the TAR. Completed copies will be available for distribution as required.

2.10 Distribution. The completed signed TAR, with attached QA and test forms, will be forwarded along with the final acceptance test report in accordance with project requirements.

TECHNICAL ACCEPTANCE RECOMMENDATION SUMMARY CCR-702-2	PAGE 1 of 6 PAGES DATE (DAY/MONTH/YEAR) / /

PROJECT/CONTRACT NO.	TITLE	LOCATION

FACILITY	TEST DIRECTOR
OPERATING UNIT	ENGINEERING ELEMENT
INSTALLATION ELEMENT	TESTING ELEMENT
SOFTWARE ELEMENT (WHEN APPLICABLE)	OTHER ELEMENT/PARTICIPANT/WITNESS/ OBSERVER (Identify)

PROJECT DESCRIPTION (MAY BE CONTINUED IN REMARKS)

This Technical Acceptance Recommendation is executed by on-site representatives of the installation, test and operating agencies. It does not constitute official acceptance of the project but does certify the MAJOR ITEMS INSTALLED AND DOCUMENTATION PROVIDED are as stated herein. This document further certifies the project has been installed and performs satisfactorily in accordance with the requirements listed under REFERENCES except as noted under EXCEPTIONS and REMARKS. upon execution of this TAR (Technical Acceptance Recommendation). USAISEC considers this project complete except for such follow-up action as may be necessary to clear the EXCEPTIONS noted herein.

TECHNICAL ACCEPTANCE RECOMMENDATION (INSTALLED EQUIPMENT)	PAGE 2 of 6 PAGES TITLE

MAJOR EQUIPMENT/SOFTWARE INSTALLED/LOCATED/LOADED

DESCRIPTION	NOMENCLATURE	SERIAL NUMBER

TECHNICAL ACCEPTANCE RECOMMENDATION (DOCUMENTATION)	PAGE 3 of 6 PAGES TITLE

PROJECT DOCUMENTATION PROVIDED

DOCUMENT #	TITLE OF DOCUMENT	# COPIES

TECHNICAL ACCEPTANCE RECOMMENDATION REMARKS	PAGE 4 of 6 PAGES TITLE

REMARKS:

TECHNICAL ACCEPTANCE RECOMMENDATION EXCEPTIONS	PAGE 5 of 6 PAGES TITLE
EXCEPTIONS:	SUGGESTED ACTION AGENCY:

TECHNICAL ACCEPTANCE RECOMMENDATION (COORDINATION)	PAGE of PAGES TITLE

Installation as been completed (without/with noted) exceptions and assistance provided as required for conduct of Acceptance Tests.

INSTALLATION ELEMENT	SIGNATURE PRINTED NAME AND TITLE

Acceptance Tests and Quality Assurance are complete for the equipment/software installed under this project. Technical acceptance (is) (is not) recommended.

TEST ELEMENT USAISEC-CONUS ASQB-CQA-TR Fort Ritchie, MD 21719	SIGNATURE PRINTED NAME AND TITLE

Installation and Acceptance Tests have been observed or monitored and this form as been coordinated as specified below.

SOFTWARE ELEMENT	SIGNATURE PRINTED NAME AND TITLE
OTHER APPLICABLE ELEMENT (IDENTIFY)	SIGNATURE PRINTED NAME AND TITLE
OPERATING UNIT (SITE)	SIGNATURE PRINTED NAME AND TITLE
OPERATING COMMAND	SIGNATURE PRINTED NAME AND TITLE