AN/SRC-54
NAVY SHIPBOARD SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS)

TECHNICAL EVALUATION (DT-IIB) FINAL REPORT

SPACE AND NAVAL WARFARE SYSTEMS COMMAND
PMW 176

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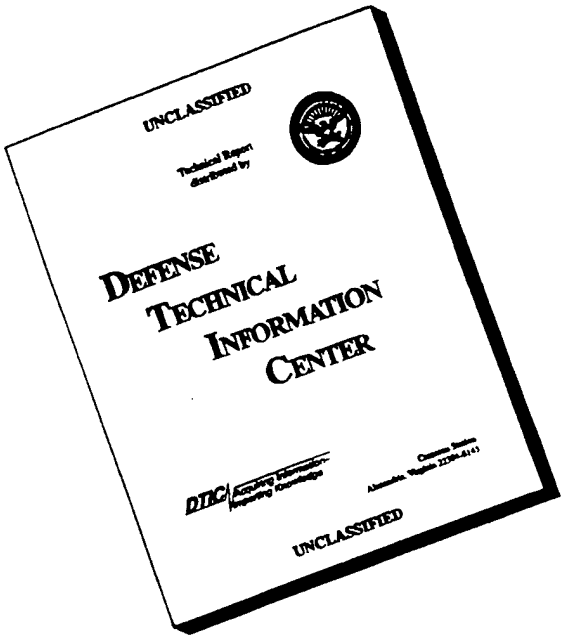

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1.0 PURPOSE. The purpose of DT-IIB was to conduct both technical and operational testing in order to verify that the AN/SRC-54 Navy Shipboard Single Channel Ground and Airborne Radio System (SINCGARS) is performing to the required equipment/system specifications and that it meets the critical technical and operational performance parameters and threshold requirements of the Test and Evaluation Master Plan (TEMP) No. 0706-01. Based on the results of testing, a decision will be made whether or not to certify the system ready to commence Operational Evaluation (OPEVAL) (OT-II).

2.0 EQUIPMENT/SYSTEM DESCRIPTION. The AN/SRC-54 Navy Shipboard SINCGARS provides secure, anti-jam (AJ), Very High Frequency - Frequency Modulated (VHF-FM) tactical ship-to-ship, ship-to-air-to-shore/ship, and ship-to-shore communications, used primarily for amphibious and surface fire support missions. All Navy SINCGARS Ship Segment installations use the basic AN/SRC-54 Radio Set. Other Government Off-the-Shelf (GOTS) and developmental equipment is used, dictated by the capability provided, i.e., single channel, non-AJ (AN/VRC-46 Replacement), and single-circuit AJ.

2.1 KEY FEATURES. The principle component of the Navy Shipboard SINCGARS Ship Segment is the RT-1730/SRC-54 Radio Receiver-Transmitter (RT). The RT is a slightly modified version of the U.S. Army's GOTS integrated communications (ICOM) security, single channel (SC) AJ radio (AN/VRC-90A SINCGARS radio set). It has a frequency range of 30.000 - 87.975 MHz, and a 2,320 discreet 25 kHz channel spacing which complies with the North Atlantic Treaty Organization Standardization Agreement (NATO STANAG) 4204. VINSON encryption is employed through a module embedded within the RT. AJ capability is also provided by an embedded module producing the JTC3A 9001C prescribed SINCGARS electronic protection (EP) waveform, hereinafter referred to as frequency hopping (FH). In addition, Revised Battlefield Electronic Communications System (RBECS), an EP fill information and transmission security key, is used for the creation, generation, and distribution of joint communication electronic operating instructions. Operating mode selection and control settings are performed from front panel controls. Modes include SC, FH, and remote. Although inherently capable of FH operation, RTs are intended for SC (fixed-frequency) operation only.

2.1.1 Remote Operation. SINCGARS FH configurations will use the Securable Remote Control Unit, C-11561/U (SRCU), which has its own embedded encryption and FH. For each FH configured RT, there will be one SRCU. The identical control functions performed at the RT front panel may be performed from the SRCU. Remote encryption bypass is also possible in all configurations, allowing RT operation with external cryptographic equipment (TSEC/KY-58) via the

SA-2112(V)/STQ Single Audio System (SAS).

2.1.2 **Antennas and Multicouplers**. SINCGARS FH configurations will use broadband antennas capable of coping with the rapid frequency changes in FH operation. The SC FH configurations antenna will be the AS-4366/U (modified GOTS AS-3900 SINCGARS Vehicular Antenna). Because the SC FH configuration is a single radio configuration, multicoupling is not required. Multicircuit FH configuration will use a suitable FH multicoupler and high power antenna. The antenna and multicoupler used with AN/VRC-46 Replacement radios will be dictated by the quantity of radios to be installed. Multiple replacement radios will use AS-3226A/VRC or AS-3226B/VRC antennas.

2.1.3 **Ancillaries**. One H-250(A)/U Handset will be provided with each FH RT. The handset may be used with both the RT and the SRCU.

2.1.4 **Interoperability**. By the use of GOTS, SINCGARS interoperability requirements are satisfied. Navy SINCGARS is interoperable with Marine Corps and Army SINCGARS, and the AN/PSC-2A Digital Communications Terminal (DCT), used with Marine Corps SINCGARS ashore for data exchange. It is also interoperable with allied VHF systems.

2.2 TECHNICAL CHARACTERISTICS

2.2.1 TECHNICAL PARAMETERS

a. **Frequency Coverage** - 30.000 - 87.975 MHz

b. **Channels** - 2,320 discreet 25 kHz channel capacity, with 25 kHz channel spacing

c. **Bit Error Rate** - 10^2 (Frequency Hopping - (FH) Mode)
10^3 (Single Channel Non-FH Mode)

d. **False Alarms** - 10% (Threshold)

2.2.2 **Survivability/Vulnerability**. The requirements for the design and construction, environmental service conditions, parts selection, and testing of the AN/SRC-54 are in accordance with the general requirements of MIL-STD-2036 (formally MIL-E-16400) as addressed in the system specification.

2.2.3 Electromagnetic Pulse (EMP) Protection. All hardware components of the AN/SRC-54 are designed to withstand an EMP resulting from an exoatmospheric nuclear explosion in accordance with MIL-STD-461 as addressed in the system specification.

2.2.4 Electromagnetic Compatibility (Platform/Force Level). All AN/SRC-54 system hardware components met the applicable requirements of MIL-STD-461 as addressed in the system specification.

2.2.5 Interoperability. The AN/SRC-54 system hardware is interoperable with Marine Corps and Army SINCGARS, and the AN/PSC-2A DCT, used with Marine Corps SINCGARS ashore for data exchange. It is also interoperable with allied VHF systems.

2.2.6 Compatibility (Physical and Environmental). The AN/SRC-54 systems physical dimensions and power requirements is compatible with LHA 2 and other surface ships. The equipment is built to withstand all environments to which it may be subjected (manufacture, shipping, installation, and operational).

2.2.7 Safety. The AN/SRC-54 system complies with the safety criteria of MIL-STD-2036 (formally MIL-E-16400), MIL-STD-1472, and Requirements 1, 8, 45, and 74 of MIL-STD-454.

2.2.8 Human Factors. The number, complexity, and frequency of tasks was evaluated to ensure optimum manpower requirements were realized. Human engineering criteria follows the guidelines of MIL-STD-1472B.

2.2.9 Reliability/Maintainability. The AN/SRC-54 system hardware was evaluated for compliance with the reliability and maintainability criteria specified in section 2.3.

2.3 OPERATIONAL CHARACTERISTICS

2.3.1 Operational Effectiveness Issues

Characteristics	Parameter	Threshold
Range (nmi = nautical miles)	Ship-to-Shore (w/o Relay)	$\geq$15 nmi
	Ship-to-Ship (w/o Relay)	$\geq$15 nmi
	Ship-to-Relay	$\geq$35 nmi
	Ship-to-Shore (w/Relay)	$\geq$50 nmi

2.3.2 Operational Suitability Issues

Characteristic	Parameter	Threshold
Reliability	Mean Time Between Operational Mission Failures (MTBOMF) (Note 1)	$\geq$1250 hrs
Maintainability	Mean Corrective Maintenance Time for Operational Mission Failures (MCMTOMF) (Note 2)	$\leq$2 hrs
Availability	Operational Availability (A_o) (Note 3)	$\geq$0.90

Notes

(1) The reliability of Navy Shipboard SINCGARS AN/SRC-54 will be expressed as MTBOMF. An operational mission failure is defined as any failure that prevents the system from performing its mission. MTBOMF will be computed using the following formula:

$$\text{MTBOMF} = \frac{\text{Total Operating Time}}{\text{Total Number of Operational Mission Failures}}$$

(2) MCMTOMF is the total number of clock-hours of corrective, on-system, active repair time, which was used to restore failed systems to mission-capability status after an operational mission failure (OMF) occurs, divided by the total number of OMFs. MCMTOMF will be computed using the following formula:

$$\text{MCMTOMF} = \frac{\text{Total Corrective Maintenance Time}}{\text{Total Number of Operational Mission Failures}}$$

(3) Operational availability (A_o) is calculated as:

$$A_o = \frac{\text{Uptime}}{\text{Uptime} + \text{Downtime}}$$

2.3.3 Failure Definitions

a. **Critical Failure**. One that prevents the system from performing its mission or results in the loss of some significant mission capability.

b. **Minor Failure**. One that affects system performance but does not impact the ability to perform the mission.

3.0 BACKGROUND. SINCGARS was developed by the U. S. Army in response to a need identified in Joint Operational Requirement (JOR) JCSM 110-76. For AJ capability, JCSM 110-76 directed all military departments to adopt a common EP waveform in radios developed for this system. This EP waveform is further defined in JTC3A 9001C as the SINCGARS EP waveform.

Development of the Navy Shipboard SINCGARS was initiated under Operational Requirement (OR) 136-094-85, which was derived from JCSM 110-76. An updated Operational Requirements Document (ORD) 411-06-95, was approved 15 August 1995. The new ORD superseded OR 136-094-85, and identified specific criteria for the Navy Shipboard SINCGARS VHF AJ system. While Navy Shipboard SINCGARS is being built around the basic Army-developed radio, additional distinct, yet related developments are necessary due to the uniqueness of the shipboard operating environment and specific Naval applications of this system. As stated in the ORD, among these developments is a SINCGARS relay to be carried by helicopter to support over-the-horizon (OTH) VHF communications, a shipboard interface unit to integrate available SINCGARS radios with shipboard communications systems, and a computer terminal to interface with the U.S. Marines AN/PSC-2A for digital data communications to support amphibious and Naval Surface Fire Support (NSFS) operations.

Testing in 1991, by the In-Service Engineering Agent (ISEA), and Naval Research Laboratory (NRL) demonstrated the potential of NDI/GOTS SINCGARS to provide the requisite capabilities to the fleet. System performance was evaluated in the shipboard operational environment onboard the USS PONCE (LPD 15) and USS SAIPAN (LHA 2).

Test results are documented in NRL Report 9334 of July 12, 1991. Testing was also conducted extensively at the ISEA to facilitate development of required components, ancillaries, and modifications. The basic capabilities and performance of NDI/GOTS SINCGARS is documented, having undergone formal DT/OT through the course of the Army SINCGARS Program. Subsequent Navy DT&E is primarily centering on verification and validation of the system's performance, with modifications and development equipment, when integrated with shipboard communications suites.

A coordinated NISE East and COMOPTEVFOR operational performance assessment was conducted on the SINCGARS AN/SRC-54 Systems during the 1st and 2nd Qtrs of FY96. The USS WASP, USS WHIDBEY ISLAND, USS SHREVEPORT, USS NASSAU, USS ASHLAND, and USS SAIPAN provided message reports pertaining to the operational performance of the installed systems during normal underway operations in the Atlantic Ocean and Caribbean Sea. A total of 46 radios were installed providing a total of 82,271 hours in an operational status. Annex B provides the consolidated results of the operational performance of the SINCGARS Radios during the assessment, as reported by the ships.

A Milestone Decision (MS-IIA) was conducted with a Program Decision Memorandum (PDM) being issued 28 February 1995. The PDM provided authorization that the Program Manager, upon successful completion of Operational Testing, proceed with Milestone III activities.

4.0 SCOPE

4.1 **OBJECTIVES**. The AN/SRC-54, onboard the USS SAIPAN (LHD 2), USS AUSTIN (LPD 4), and USS GUNSTON HALL (LSD 44), was tested in its operational environment. Representative communication circuits, ship-to-ship, ship-to-air/shore, and ship-to-shore were processed through the SINCGARS to ensure the system is meeting program objectives.

The AN/SRC-54 was exercised to verify that it is supporting the ship's operational requirements for information transfer. Logistic support identified in the Integrated Logistics Support Plan (ILSP) was exercised. Operational testing evaluated the production AN/SRC-54 system interfaced with equipment of its operating environment and involved complete end-to-end testing of telecommunications links.

All aspects of operational effectiveness and operational suitability were evaluated. The testing provided a thorough examination of operational real-world communication links, system documentation, Planned Maintenance System (PMS), Allowance Parts Lists (APLs), drawings, spare parts, accuracy of records, equipment operation, and human and safety factors.

4.1.1 End-to-End System Assessment

To assess the adequacy of communications equipment, interfaces, and interactions between the AN/SRC-54 onboard the USS SAIPAN, USS AUSTIN, USS GUNSTON HALL, amphibious units ashore, and Naval Surface Gunfire Support Advanced Field Artillery Tactical Data System (AFATDS), and communications facilities ashore, afloat, and airborne to support the ship's mission.

To verify the AN/SRC-54 SINCGARS system/equipment performance using system specifications and DT-IIB Test Plan requirements.

4.1.2 Operational Effectiveness Issues

a. Communications Capability. Will the AN/SRC-54 demonstrate the capability to effectively fulfill VHF voice/data requirements in a shipboard operational environment?

b. Operational Modes. Will the AN/SRC-54 operate effectively in all functions/modes of single channel (SC), frequency hopping (FH) and data communications?

c. Intelligibility. Will the AN/SRC-54 plain text (PT) and cipher text (CT) voice intelligibility be equal to or better than current VHF-FM radios (AN/VRC-46/49) in the single channel non-FH mode?

d. Electronic Protection (EP). Will the AN/SRC-54, with EP module employed, provide effective anti-jam protection for operational communications while meeting or exceeding required communication ranges?

e. Operational Range. Will the AN/SRC-54 provide effective voice and data communications, both secure and clear ,at sufficient ranges to meet operational mission requirements?

f. Joint Interoperability. Will the AN/SRC-54 effectively interface and operate with corresponding systems or units of other U.S. Forces in the execution of its intended operational mission?

g. Tactics. Will the tactics developed for the AN/SRC-54 support effective employment in the intended operating environment?

h. Survivability. Will the susceptibility and vulnerability characteristics of the AN/SRC-54 enhance the successful completion of the ship's mission?

4.1.3 Operational Suitability

a. Reliability. Will the reliability of the AN/SRC-54 support completion of the host ship's mission?

b. Maintainability. Will the AN/SRC-54 be maintainable by fleet personnel?

c. Availability. Will the availability of the AN/SRC-54 support completion of the host ship's mission?

d. Logistic Supportability. Will the AN/SRC-54 be logistically supportable?

e. Compatibility. Will the AN/SRC-54 be compatible with a shipboard operational environment?

f. Interoperability. Will the AN/SRC-54 be interoperable with the systems in which it must interface?

g. Training. Will the AN/SRC-54 training support operation and maintenance by fleet personnel?

h. Human Factors. Will the human factors aspect of the AN/SRC-54 support completion of its mission?

i. Safety. Will the AN/SRC-54 be safe to operate and maintain?

j. Documentation. Will the technical documentation support operation and maintenance of the AN/SRC-54?

5.0 TEST CONDUCT AND RESULTS

The DT-IIB evaluation was conducted on a Not-to-Interfere Basic (NIB) onboard the USS SAIPAN, USS AUSTIN, and USS GUNSTON HALL as the ships interfaced with various other ships, aircraft, and shore activities. The DT-IIB Test Plan (Appendix A) contains testing procedures, data sheets, forms, and a Human Factors Questionnaire provided to the operator and maintenance personnel. These

documents, along with communications logs, personnel interviews, Test Director observations, and operational performance of the system prior to and during DT-IIB, formed the basis of test conduct and results. The period of evaluation was 1 October 1995 to 30 May 1996, encompassing ship operations in-port and at-sea in various locations of the Atlantic Ocean. The AN/SRC-54 SINCGARS system functioned in its operational environment during DT-IIB.

5.1 EVALUATION CRITERIA. See paragraphs 2.2 and 2.3.

5.1.1 Test Chronology. DT-IIB project evaluation commenced on 1 October 1995. Included in the grooming portion of the evaluation was the System Operational Verification Tests (SOVT), and a Combat System Readiness Review (CSRR). Also, pre-deployment readiness checks, in addition to various system groom checks as outlined in the DT-IIB Technical Evaluation Test Plan, including all Planned Maintenance System (PMS) tests associated with the AN/SRC-54 were performed. The results of these tests were reviewed by the Test Director and ISEA to determine deficiencies. Corrective action was taken to resolve noted deficiencies. The AN/SRC-54 system/equipment demonstrated peak technical performance in accordance with equipment specifications (See SPAWAR-S-837 of 15 Aug 1990). DT-IIB Test Plan operational effectiveness and operational suitability data were collected and analyzed for at-sea and in-port periods from 1 October 1995 to 30 May 1996, while evaluating the installed systems demonstrated operational performance onboard USS SAIPAN, USS AUSTIN, USS GUNSTON HALL, and a UH-1N HMLA Helicopter. Appendix C provides at-sea Situation Reports (SITREPS). The ISEA and Test Team members provided additional/refresher training during the at-sea and in-port periods. The conduct and results of operational effectiveness tests (E-Tests) and operational suitability tests (S-Tests) are provided in the following paragraphs of this report.

5.1.2 General Approach. Testing exercised the AN/SRC-54 system in its intended operating environment. The system was operated and maintained by ship's company. The ISEA and Test Team personnel were instructed to provide assistance only in emergency situations.

5.1.3 End-to-End Assessment.

a. Adequacy. The adequacy of communications equipment, interfaces, and interactions between the AN/SRC-54 onboard the USS SAIPAN, USS AUSTIN, USS GUNSTON HALL, and communication facilities ashore, afloat, and airborne were assessed to be satisfactory in supporting the ship's mission. The assessment results were obtained through end-to-end circuit testing and Communications Plan

(COMMPLAN) requirements, providing communication circuits for ship-to-shore, ship-to-ship, and ship-to-air-to ship/shore, during in-port and underway operations.

b. Performance. The performance of the AN/SRC-54 during DT-IIB satisfied the requirements of system/equipment specifications and Test and Evaluation Master Plan (TEMP) No. 0706-01. Performance tests were conducted during in-port and at-sea real-world operational environments, including induced tests during the period 1 October 1995 - 30 May 1996.

5.2 OPERATIONAL EFFECTIVENESS TESTS

5.2.1 Test E-1, Range

a. Objective. To verify that the system will provide effective communications at sufficient ranges to meet operational requirements.

b. Procedure. Ship's force obtained and provided the Test Team members ship's position and distant-end communications circuit contact's position. These reports, coupled with supervisor/technical control logs, 8 o'clock reports, Data Sheet E-1 (Circuit Capacity Summary Data Sheet), and Test Director observations, were used to provide the basis for a determination of the range in distance and status of terminated circuits.

c. Data Analysis. Data Sheet E-1, supervisor/technical control logs, 8 o'clock reports, and Test Director observations/Notebook were quantitatively and qualitatively evaluated.

d. Results. The SINCGARS system demonstrated the capability to provide effective communications at sufficient ranges to meet mission operational requirements as stated in para. 2.3.1. The ship maintained various communications circuits during at-sea operations with a maximum range (w/o) relay ship-to-ship of 42 nmi (criterion $\geq$ 15 nmi), and (w) relay ship-to-shore of 42 nmi (criterion $\geq$ 50 nmi).

5.2.2 Test E-2, Survivability

a. Objective. To verify if the system operational performance or inherent characteristics do not increase the susceptibility or vulnerability of the ship in which it is installed.

b. Procedure. Ship's force completed Data Sheet E-2 (Survivability Data Sheet). On-scene physical examinations and personnel interviews were conducted by the Test Director using system/equipment installation drawings to verify that

the Terminal Protection Devices (TPDs) of the ship's transmit antennas were installed properly and in good working order. A physical examination of the ship's antennas was conducted to ensure proper installation. An investigation was conducted to ensure the AC power would be available to critical radio circuits in the event of AC power failure. The Test Director also considered:

(1) Primary and secondary effects of weaponry, including conventional, nuclear (including electromagnetic pulse (EMP)), biological, chemical and laser weapons. Effects included material damage and crew casualties.

(2) Subsystem vulnerability because of:

(a) Unnecessary number of components, large size or large (vulnerable) area.

(b) Basic structure not hardened, shielded or armored to resist penetration.

(c) Insufficient redundancy of critical components or cable pathways.

(d) Electronics or system components mounted external of the skin of the ship, susceptible to blast, shock or fragmentation.

(e) Electronics using solid-state electronics without coupling protection, etc., against EMP.

(f) Lack of manual inputs and/or manual overrides.

(3) On-board installation, to verify whether good survivability practices had been followed:

(a) Critical components and series components being installed too close together.

(b) Critical areas being shielded by noncritical components and/or armor.

(c) Parallel or redundant components being difused or installed with unacceptable separations.

c. Data Analysis. Data Sheet E-2, personnel interviews, communications logs, and Test Director physical examinations form the basis for a qualitative evaluation.

d. Results. No deficiencies were noted. The on-scene inspection of the AN/SRC-54 system on-board installation was completed using subsystem and installation check lists. There were no adverse conditions that would affect survivability or make the system vulnerable to threats or damage. The system was enclosed in armor shielded spaces. Interior wall covering in all spaces were of Kevlar which provides protection against shrapnel dispersement. All cable runs were protected and shielded against EMP. The subsystems were installed according to accepted standard Navy shipboard installation practices. All outside components were enclosed or protected from the elements. The system met Navy standards for survivability and vulnerability.

5.3 OPERATIONAL SUITABILITY TESTS

5.3.1 Test S-1, Reliability.

a. Objective. To verify the reliability of the system in its intended operational environment.

b. Procedure. This test was conducted continuously during test operations by logging all failures. Data Sheet S-1 (Maintenance Action Form (MAF)) was completed for each operational failure and for those instances during preventive maintenance which revealed a failed component/part, element of hardware, or firmware. Supervisor/technical control logs, Test Director notebook, personnel interviews, historical records, logs, and maintenance documentation were reviewed. For this testing, failures were defined as:

(1) Critical Failure. Any failure which prevented the system from performing its mission.

(2) Minor Failure. Any failure that affects the system performance but does not impact the ability to perform the mission.

c. Data Analysis. Reliability was determined by computing MTBOMF as follows:

$$\text{MTBOMF} = \frac{\text{Total Operating Time}}{\text{Number of Operational Mission Failures}}$$

d. Results.

(1) Total operating time was 37,675 hours MTBOMF (criterion: $\geq$ 1250 hours).

(2) Total operational mission downtime was 0 hours.

(3) There were 0 operational mission critical failures observed during 37,675 hours of operation. A Maintainability Demonstration was conducted.

5.3.2 Test S-2, Maintainability

a. **Objective**. To verify the maintainability of the system in its intended operational environment.

b. **Procedure**. This test was conducted continuously during test operations by logging all failures. Data Sheet S-1 was completed for each operational failure and for those instances during preventive maintenance which revealed a failed component/part, element of hardware, or firmware. Supervisor/technical control logs, Test Director notebook, personnel interviews, historical records, logs, and maintenance documentation were reviewed.

c. **Data Analysis**. System maintainability was evaluated by computing the Mean Corrective Maintenance Time for Operational Mission Failures (MCMTOMF) from Data Sheet S-1 using:

$$\text{MCMTOMF} = \frac{\text{Corrective Maintenance Time}}{\text{Total Number of Operational Mission Failures}}$$

d. **Results**. During DT-IIB, 0 operational mission failures occured (MCMTOMF criterion: $\leq$ 2 hours). The AN/SRC-54 demonstrated the capability to support mission accomplishment. A Maintainability Demonstration was performed onboard the USS GUNSTON HALL. The results are as follows:

FAULT 1: AM-7238 RF Amp

Equip Down	1128
Troubleshooting Began	1138
Isolation Complete	1146

Total Time = 18 Min

FAULT 2: MX-11586 SIU

Equip Down	1335
Troubleshooting Began	1344
Isolation Complete	1351

Total Time = 16 Min

FAULT 3: AM-7516 Amp Adptr

Equip Down	1420

Troubleshooting Began 1428
Isolation Complete 1433
Total Time = 13 Min

FAULT 4: RT-1730 R/T
Equip Down 1500
Troubleshooting Began 1506
Isolation Complete 1512
Total Time = 12 Min

5.3.3 Test S-3, Availability

a. **Objective**. To verify the probability that the system will be operationally ready, when needed, at any point in time.

b. **Procedure**. This test was conducted continuously during test operations by logging all failures. Data Sheet S-1 was completed for each operational failure and for those instances during preventive maintenance which revealed a failed component/part, element of hardware, or firmware. Supervisor/technical control logs, Test Director notebook, personnel interviews, historical records, logs, and maintenance documentation were reviewed.

c. **Data Analysis**. During test operations all pertanent operator logs and MAFs were reviewed. Availability was computed using the formula:

$$A_o = \frac{\text{Uptime}}{\text{Uptime} + \text{Downtime}}$$

(1) Uptime includes the time when the system is considered to be ready for use and is either operating, in standby, or off.

(2) Downtime is the time the system is inoperable because of repairs for mission critical failures and/or for restoration from mission critical faults, including off-board logistic delays. Downtime also includes planned maintenance time with a periodicity less than or equal to the test duration time that prevents the system from performing its assigned mission. Planned maintenance time is considered neutral time and is not included in the availability calculation.

d. **Results**. The demonstrated A_o was 100% (criterion: $\geq$ .90) based upon 37,675 hours of operation with 0 hours downtime.

5.3.4 Test S-4, Logistics Supportability

a. Objective. To assess AN/SRC-54 logistic supportability in a deployed operational environment.

b. Procedure. This test was conducted continuously during the test period.

(1) The adequacy of the ILSP/ULSS was evaluated.

(2) The following items relating to logistic support was evaluated:

(a) Clarity, completeness, accuracy, and availability of technical manuals and Planned Maintenance System (PMS) documentation.

(b) Availability and adequacy of equipment and special tools as provided in the ILSP/ULSS.

(c) Adequacy of support (including spare parts, operating and maintenance procedures, and training) provided in conjunction with test equipment and special tools.

(d) Adequacy of supply support.

1 The requirements for, and availability of, spare parts were evaluated. Any requirement that indicated unexpected high component failure rates were investigated.

2 Logistics delays in obtaining replacement components was investigated.

3 The COSAL was verified to ensure Allowance Parts List (APL) #00034423CL was included in onboard spare parts allowance.

(e) The adequacy of the following aspects of support was also evaluated: Calibration requirements.

a. Data Analysis. Data Sheet S-3 (Logistics Supportability Questionnaire) and Test Director notebook entries were assessed. The adequacy of each element of logistic support in supporting the AN/SRC-54 in an operational environment was assessed. The integration of all logistic elements into an overall concept of logistic support planning in meeting system operational and readiness objectives.

b. **Results**. No discrepancy was noted. The Test Director and ISEA reviewed the COSAL and APL with the on-board parts list.

ILSP, requirements on manning, adequacy of all technical manuals, PMS documentation, including MRCs, were assessed. (See Tables 5-1, 5-2, and 5-3). Maintenance personnel performance was observed. PMS was reviewed in connection with adequacy of maintenance planning, support equipment, and test equipment. The configuration, integration and efficiency of logistic support resources provided to support the AN/SRC-54 system are technically and operationally suitable in the following areas:

(1) The availability of APLs, allowance equipage lists and spare parts.

(2) The ILSP/ULSS.

(3) Maintenance and operator manning.

(4) Maintenance planning, support equipment, and test equipment.

TABLE 5-1 AN/SRC-54 Documentation Checklist

TECHNICAL MANUALS		
EQUIPMENT	**Manual Number**	**Onboard**
AN/SRC-54	EE-140-QB-OMI-010 DTD 3/96	YES
TD-1289(V)1/GRC	TM-11-5820-880-12 DTD 8/83	YES
MX-18290	TM-11-5821-333-12	YES
AN/CYZ-10	ON477340 Rev B	YES
LOGISTICS DOCUMENTATION		
Integrated Logistic Support Plan	SPAWAR P4110-680B of 13 FEB 96	YES
User's Logistic Support Summary	SPAWAR P4110-945 of 13 FEB 96	YES
Navy Training Plan	NTP-E-70-9301 (Approved JUN 93) (Update NTP-E-70-9301A out for review and comment)	YES
Allowance Parts List	March 28, 1996	YES

TABLE 5-2 AN/SRC-54 MIP and MRC Checklist

	Onboard
AN/SRC-45 MIP: SWAB No. 4415/040-B5	YES
MRC: Various Serial Numbers:	
FAE7	YES
FAE8	YES
FAE9	YES
FAE0	YES
FAF1	YES
FAF2	YES
FAF3	YES
ANTENNAS AS-3226 and AS-4366 SWAB MIP No. 4411/006-34 or 4400/061-73	YES
MRC:ARU1, ARU3	YES
TD-1289(V)1/GRC SWAB MIP 4412-003-photocopy onboard-FBR submitted	YES
MRC:	N/A
EEQ2-photocopy onboard-FBR submitted	YES

TABLE 5-3 AN/SRC-54 GPETE Checklist

SCAT CODE	DESCRIPTION	MODEL NUMBER	ONBOARD
4245	Multimeter; Digital 3 1/2 Digit	77/BN	YES
4370	Generator, Signal, RF, AM/FM	6080A	YES
4958	Test Set, Power Measuring	4410-025	YES

5.3.5 Test S-5, Compatibility

a. Objective. To assess the compatibility of the system with its operating environment.

b. Procedure. This test was conducted and evaluated continuously during the testing period. Special consideration was given to the adequacy of the ship's cooling system to support continued system operation and electromagnetic interference from other installed shipboard RF generating systems. The Test Director observed and noted any adverse effects from the operating environment, including:

(1) Temperature and humidity.

(2) Ship's motion, shock, and vibration.

(3) Electrical and electronic interference, including voltage fluctuation, frequency instabilities, power failures, EMI, RF transmissions from own ship, passing ships, and aircraft. Observations on system performance were recorded by supervisory personnel in the supervisor's log, and Test Director notebook.

c. Data Analysis. Compatibility data were analyzed qualitatively. The compatibility of the system with its operating environment was assessed. Temperature and humidity, ship's motion, shock, and vibration, electrical and electronic interference, including voltage fluctuation, frequency instabilities, power failures, EMI, RF transmissions from own ship, passing ships, and aircraft were observed, recorded, and analyzed.

d. Results. No deficiencies were noted.

5.3.6 Test S-6, Interoperability

a. Objective. To verify the AN/SRC-54 interoperability with other Department of Defense (DoD) and allied VHF equipment, as outlined in the Operational Requirements Document (ORD).

b. Procedure. This test was conducted continuously during project operations. Interoperability anomalies were noted by supervisory personnel in the supervisor's log, Data Sheet S-2 (Human Factors Questionnaire), and Test Director observations. The ship's Communication Plan was examined to ensure the following types of circuits (System Tests) were demonstrated:

- Single Channel, Frequency Modulation (SC-FM)

analog voice and data

- Frequency Hopping, Frequency Modulation (FH-FM) digital voice and data

- Single Channel analog data

- Single Channel digital data

- Frequency Hopping digital data

- SC-FM digital voice and data

c. Data Analysis. Interoperability data, including data rate testing using the AN/PSC-2 and/or AFATDS surface fire support equipment was qualitatively analyzed.

d. Results. All communications interoperability with the AN/PSC-2, AN/VRC-90A, AN/URC-46, AN/ARQ-182 and AN/ARQ-53 were evaluated satisfactorily.

5.3.7 Test S-7, Training

a. Objective. To verify the adequacy of the training planned for system operators and maintenance personnel.

b. Procedure. This test was conducted continuously during project operations. Personnel interviews were conducted by the Test Director and ISEA, and Data Sheet S-2 (Human Factors Questionnaire) was completed by system operators and maintainers. The Test Director also concentrated on the following areas:

(1) System manning levels between the Ship's Manning Document (SMD), Navy Training Plan (NTP), and ILSP/ULSS.

(2) Training for General Purpose Electronic Test Equipment (GPETE) and Special Purpose Electronic Test Equipment (SPETE).

(3) Training Facilities/Tools.

(4) Training adequacy.

c. Data Analysis. Training requirements data were qualitatively analyzed.

d. Results. Navy Training Plan provisions for manning requirements for 1 technician and 3 operators were adequate. Training was verified to be adequate.

(1) 15 technicians formally trained are onboard.

(2) 29 operators onboard have been formally trained. Other operators have received training through OJT. DT-IIB Test Team personnel provided additional 24 hours of OJT during DT-IIB.

5.3.8 Test S-8, Human Factors

a. Objective. To verify the adequacy of human factors features of the system.

b. Procedure. This test was conducted continuously during project operations. Data Sheet S-2 was completed by system operators and maintainers. The Test Director also conducted personnel interviews.

c. Data Analysis. Human factors data were qualitatively analyzed.

d. Results. No deficiencies were noted.

5.3.9 Test S-9, Safety

a. Objective. To verify the adequacy of system safety features and, where appropriate, observe the adequacy of Navy occupational health and safety standards of the system.

b. Procedure. This test was conducted continuously during project operations. Data Sheet S-2 was completed by system supervisors, operators, and maintainers. Data concerning any safety deficiency identified was recorded in the supervisor's log, Test Director notebook, and on MAFs.

c. Data Analysis. Data was qualitatively analyzed.

d. Results. No deficiencies were noted. The equipment design and installation conformed to good safety practices. The AN/SRC-54 system safety features were reviewed by the Test Director, and operation of the system was observed and found to meet Navy occupational health and safety standards. Hazard areas were well marked, the warning documentation included notations on hazards that could be encountered.

5.3.10 Test S-10, Documentation

a. Objective. To assess the adequacy and accuracy of the documentation provided for the system.

b. Procedure. This test was conducted continuously during project operations. The Test Director and ISEA also conducted personnel interviews and reviewed applicable documentation. Checklists provided in Tables 5-1, 5-2, and 5-3 were completed.

c. Data Analysis. Documentation was qualitatively analyzed.

d. Results. No deficiencies were noted. All documentation was readily available to operators and technicians. Checklists provided in Tables 5-1, 5-2, and 5-3 were completed.

6.0 CONCLUSION

a. The AN/SRC-54 Single Channel Ground and Airborne Radio System demonstrated during DT-IIB that it meets or exceeds technical requirements as outlined in TEMP 0706-01.

b. The AN/SRC-54 Single Channel Ground and Airborne Radio System demonstrated during DT-IIB that it meets or exceeds the operational effectiveness and operational suitability requirements as outlined in TEMP 0706-01.

APPENDIX A

DT-IIB Technical Evaluation Test Plan

Recvd 4/10/96

AN/SRC-54
NAVY SHIPBOARD SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS)

TECHNICAL EVALUATION (DT-IIB) TEST PLAN

SPACE AND NAVAL WARFARE SYSTEMS COMMAND
SPAWAR, PMW 176

April 1996

AN/SRC-54
NAVY SHIPBOARD SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS)

TECHNICAL EVALUATION (DT-IIB)
TEST PLAN

Prepared by:_____
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Mr. Tim McManus, PMW 176-3B Date

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DEVELOPMENTAL TESTING

1.0 INTRODUCTION

In accordance with the Test and Evaluation Master Plan (TEMP) No.0706-01, AN/SRC-54 system Developmental Testing (DT-IIB) must be conducted. COMSPAWARSYSCOM shall certify the AN/SRC-54 system ready for operational testing prior to commencement of the Operational Test and Evaluation (OPEVAL (OT-II)). During the TECHEVAL (DT-IIB), the AN/SRC-54 will be subjected to both technical and operational performance testing to ensure compliance with the system specifications and Critical Operational Issues (COIs) of the TEMP. This portion of the TECHEVAL (DT-IIB) Test Plan outlines the critical technical and operational performance aspects of the testing and provides a description of the issues requiring verification. The verification of the critical technical and operational performance factors in this DT-IIB Test Plan will be supplemented by selected tests from the System Operation and Verification Tests (SOVT), included as Attachment (1) to this document.

For an approximate 24-hour time frame of the Navy SINCGARS DT-IIB test period, the TD-1456 will be tested; however, this testing will not be considered as part of the actual AN/SRC-54 TECHEVAL. The purpose of the TD-1456 testing is to determine its ability to serve as a shipboard multicoupler for the AN/SRC-54 installations in VRC-46 replacement and Type-1 configurations. The TD-1456 will be de-installed upon completion of DT-IIB. The test plan for the TD-1456 are included as Attachment (2) to this document.

2.0 OBJECTIVE

During the Navy SINCGARS TECHEVAL, the AN/SRC-54 Navy Shipboard SINCGARS aboard the USS SAIPAN, USS GUNSTON HALL, and USS AUSTIN will be tested in its operational environment. Representative communications circuits, ship-to-ship, ship-to-shore, and ship-to-air-to-shore, will be processed through the AN/SRC-54 equipment to ensure the system is meeting the program objectives. The AN/SRC-54 system will be exercised to ensure that it will support the ship's operational requirements for information transfer. Logistic support identified in the Integrated Logistics Support Plan (ILSP) will be exercised. Developmental testing will evaluate the production representative system that interfaces with its operating environment equipment. These interfaces will involve complete end-to-end testing of the very high frequency (VHF) telecommunications link. The AN/SRC-54 system operational effectiveness and operational suitability will also be verified.

3.0 DOCUMENTATION SUPPORT

The status of documentation and technical manuals to support the AN/SRC-54 system will be verified to ensure that current and up-to-date documentation is available. Table 3-1, AN/SRC-54 Documentation Checklist, will identify the required technical documents to support the AN/SRC-54 system. Table 3-2, AN/SRC-54 MIP and MRC Checklist, identifies the Maintenance Index Pages (MIPs) and Maintenance Requirement Cards (MRCs) required to support the Planned Maintenance Subsystem (PMS). Table 3-3, AN/SRC-54 GPETE

Checklist, identifies the General Purpose Electronic Test Equipment (GPETE) required to maintain the AN/SRC-54 system.

Table 3-1. AN/SRC-54 Documentation Checklist

TECHNICAL MANUALS		
Equipment	**Manual Number**	**Onboard**
AN/SRC-54	EE-140-QB-OMI-010	_____
TD-1289(V)1/GRC	TM 11-5820-880-12	_____
MX-18290	TM-11-5821-333-12	_____
AN/CYZ-10	ON477340 Rev B	_____
LOGISTICS DOCUMENTATION		
Integrated Logistic Support Plan	SPAWAR P4110-680B of FEB 96	_____
User's Logistic Support Summary	SPAWAR P4110-945 of FEB 96	_____
Navy Training Plan	NTP-E-70-9301 (Approved JUN 93) (Update NTP-E-70-9301A out for review and comment)	_____
Allowance Parts List	March 28, 1996	_____

Table 3-2. AN/SRC-54 MIP and MRC Checklist

	Onboard
AN/SRC-54 MIP: SWAB No. 4415/040-B5	_____
MRC: Various Serial Numbers:	
FAE7	_____
FAE8	_____
FAE9	_____
FAE0	_____
FAF1	_____
FAF2	_____
FAF3	_____
Antennas AS-3226 and AS-4366 SWAB MIP No. 4411/006-34 or 4400/061-73	_____
MRC: ARU1, ARU3	_____
TD-1289(V)1/GRC SWAB MIP 4412-003	_____
MRC: DNV4	_____
ECZ3	_____
EEP9	_____
EEQ1	_____
EEQ2	_____
EEQ3	_____
EEQ4	_____
EEQ5	_____

Table 3-3. AN/SRC-54 GPETE Checklist

SCAT Code	Description	Model Number	Onboard
4245	Multimeter; Digital 3½ Digit	77/BN	
4370	Generator, Signal, RF, AM/FM	6080A	
4958	Test Set, Power Measuring	4410-025	

4.0 CRITICAL TESTING ISSUES

Critical Testing Issues for verification during DT-IIB are:

a. Effectiveness Issues

(1) Range. Will the AN/SRC-54 provide effective communications at sufficient ranges to meet operational requirements?

(2) Survivability. Will the operational performance or inherent characteristics of the AN/SRC-54 system increase the susceptibility or vulnerability of the ship in which it is installed?

(3) Electromagnetic Compatibility. Will the AN/SRC-54 system be degraded due to platform or force level electromagnetic emission?

b. Suitability Issues

(1) Reliability. Will the reliability of the AN/SRC-54 system support the completion of the host ship's mission?

(2) Maintainability. Will the AN/SRC-54 system be maintainable by fleet personnel?

(3) Availability. Will the availability of the AN/SRC-54 system support the completion of the host ship's mission?

(4) Logistic Supportability. Will the AN/SRC-54 system be logistically supportable?

(5) Compatibility. Will the AN/SRC-54 system be compatible with the shipboard operational environment?

(6) Interoperability. Will the AN/SRC-54 system be interoperable with the systems with which it must interface?

(7) Training. Will the AN/SRC-54 system training support the system operation and maintenance by fleet personnel?

(8) Human Factors. Will the human factors aspects of the AN/SRC-54 system support completion of its mission?

(9) Safety. Will the AN/SRC-54 system be safe to operate and maintain?

(10) Documentation. Will the AN/SRC-54 system technical documentation support the operation and maintenance of the AN/SRC-54 system?

5.0 TEST OBJECTIVES

The specific test objectives, critical testing issues to which they apply, and the tests designed to verify the issues are provided in Table 5-1. The organizations which will be responsible for performing each test or providing data, as well as for analyzing/verifying the tests, are contained in Appendix C, AN/SRC-54 DT-IIB Testing Schedule.

Table 5-1. Test Objectives, Critical Testing Issues, and Verification Tests

Specific Objectives	Critical Testing Issues	Verification Test
Verify the system's capability to provide communication at ranges, that meet operational mission requirements	Range	E-1
Verify survivability	Survivability	E-2
Verify no degradation of the AN/SRC-54 system due to platform or force level electromagnetic emissions	Electromagnetic Compatibility	E-3
Verify reliability, maintainability, and availability	Reliability Maintainability Availability	S-1 S-2 S-3
Verify logistic supportability and technical documentation	Logistic Supportability Documentation	S-4 S-10
Verify compatibility	Compatibility	S-5
Verify AN/SRC-54 interoperability	Interoperability	S-6
Verify training, human factors, and safety	Training Human Factors Safety	S-7 S-8 S-9

6.0 EVALUATION CRITERIA

CNO provided the following evaluation criteria in TEMP No. 0706-01:

CHARACTERISTIC	PARAMETER	THRESHOLD
Operational Effectiveness:		
Range (nmi = nautical miles)	Ship-to-Shore (w/o Relay)	$\geq$ 15 nmi
	Ship-to-Ship (w/o Relay)	$\geq$ 15 nmi
	Ship-to-Relay	$\geq$ 35 nmi
	Ship-to-Shore (w/Relay)	$\geq$ 50 nmi
Reliability	Mean Time Between Operational Mission Failures (MTBOMF) (Note (1))	$\geq$ 1250 hrs
Maintainability	Mean Corrective Maintenance Time for Operational Mission Failures (MCMTOMF) (Note (2))	$\leq$ 2 hrs
Availability	Operational Availability (A_0) (Note (3))	$\geq$ 0.90

Notes: (1) The reliability of Navy Shipboard SINCGARS AN/SRC-54 will be expressed as "MTBOMF." An operational mission failure is defined as any failure that prevents the system from performing its mission. MTBOMF will be computed using the following formula:

$$\text{MTBOMB} = \frac{\text{Total Operating Time}}{\text{Total Number of Operational Mission Failures}}$$

(2) MCMTOMF is the total number of clock-hours of corrective, on-system, active repair time, which is used to restore failed systems to mission-capable status after an Operational Mission Failure (OMF) occurs, divided by the total number of OMFs. MCMTOMF will be computed using the following formula:

$$\text{MCMTOMF} = \frac{\text{Total Corrective Maintenance Time}}{\text{Total Number of Operational Mission Failures}}$$

(3) Operational availability (A_0) is calculated as:

$$A_0 = \frac{\text{Uptime}}{\text{Uptime + Downtime}}$$

Where "uptime" is time when the system is considered to be ready for use and is either operating, in standby, or off. "Downtime" is the time the system is down for repair of operational mission failures, including off-board logistic delays. It also includes planned maintenance time of a periodicity less than or equal to the test duration time that prevents the system from performing its assigned mission. Planned maintenance time that is of periodicity greater than the test duration time is considered neutral time and is not included in the availability calculation.

7.0 TESTS

The AN/SRC-54 system will be exercised in its intended operational environment. This test will provide the test data for evaluation in individual tests of effectiveness (E-tests) and suitability (S-tests) discussed in paragraphs 7.2 and 7.3.

a. Safety. In the conduct of all operations associated with this project, SAFETY IS PARAMOUNT. No operations will be conducted that, in the opinion of the Commanding Officer, the Test Director or his designated representative will endanger personnel or equipment. If an unsafe situation should develop, report immediately to the Test Director, his designated representative or the Commanding Officer. Also, notify Commander, Space and Warfare System Command (COMSPAWARSYSCOM) or NCCOSC In-Service Engineering (NISE) East the In-Service Engineering Activity (ISEA) of the circumstances as soon as possible. Include any rectifying safety procedures and any further action required or recommended.

b. Data Collection.

(1) Data Sheets. Special data sheets for use during this test period are contained in Appendix B. Blank copies of the data sheets and forms will be distributed to test participants by the Test Director. Standard Navy forms, logs, 8 o'clock reports, etc., are identified and described in paragraphs 7.2 and 7.3.

(2) Data Recording. Operators' verbal comments, completed data sheets, and personnel interviews conducted by the Test Director will complete the data collection process.

7.1 Prerequisite Tests

AN/SRC-54 system will be installed on the designated DT-IIB ships. DT-IIB will start upon completion of equipment installation and verification checkout. During the TECHEVAL, all Planned Maintenance System (PMS) tests associated with the AN/SRC-54 system shall be performed. The selected tests below from the System Operation and Verification Tests (SOVT), Attachment (1), will be performed prior to the commencement of DT-IIB. The results of the PMS and SOVT will be reviewed by the DT-IIB Test Director to identify deficiencies. Deficiencies not corrected by ship's force will be corrected by ISEA technicians. The following equipment and system tests of the AN/SRC-54 System Operation and Verification Test (SOVT) shall be performed by the ISEA as the prerequisite system groom in Table C-1, AN/SRC-54 DT-IIB Testing Schedule and Data Responsibility.

Equipment-Level Test Procedures	SOVT, Appendix A
System-Level Test Procedures	SOVT, Appendix B
Antenna/Feed Line/VSWR Test Procedures	SOVT, Appendix C
Multiplexer Test	SOVT, Appendix D

7.2 Effectiveness Tests (E-Tests)

Effectiveness testing will exercise the AN/SRC-54 system in the intended operational environment. The system shall be operated during this test by ship's company.

- A description of each test including test objective, procedures, data requirements, and data analysis is included in this section. Test procedures and data collection for one test may meet the requirements of several tests simultaneously.

- Interviews with operators and maintainers will be conducted by the Test Director throughout the evaluation period.

- The system will be used to process real-world first-run message traffic throughout the evaluation period. Test messages may be required if real-world traffic volume is too low.

- Copies of test reports, Technical Control Logs and Supervisor Logs will be appropriately classified and retained by test participants. The Test Director will obtain copies of these logs for analysis following the testing period.

7.2.1 Test E-1: Range

a. Objective. To verify that the system will provide effective communications at sufficient ranges to meet operational requirements.

b. Procedure. Ship's force shall provide Data Sheet E-1 (Communication (Circuit) Capacity Summary). These reports, supervisor/technical control logs, and 8 o'clock reports will be provided to the Test Director. Using this information, the Test Director will make a determination as to whether or not the range was adequately tested. If this data proves insufficient or inconclusive, logs of past fleet exercises will be examined to determine if this requirement was demonstrated.

c. Data Requirements. Using status reports, logs, etc. the test team shall complete for each day of the test period, Data Sheet E-1 (Communication (Circuit) Capacity Summary). Data Sheet E-1 will be used to summarize the maximum range of radio circuits.

d. Data Analysis. Data Sheet E-1 will be quantitatively/qualitatively evaluated.

7.2.2 Test E-2: Survivability

a. Objective. To verify that the system operational performance or inherent characteristics do not increase the susceptibility or vulnerability of the platform in which it is installed.

b. Procedure

(1) Electromagnetic Pulse (EMP). Conduct a physical examination of ship's VHF antenna and multicoupler systems to ensure proper installation — particularly the grounding and bonding.

(2) Vibration. Conduct a physical examination of platform antennas.

(3) Power. Ensure critical radio circuits can be maintained in the event of a partial AC power outage (as appropriate).

c. Data Requirements. Data Sheet E-2 will be completed to determine the survivability of the system.

d. Data Analysis. Data Sheet E-2 (Survivability Data Sheet) and communications logs will be quantitatively/qualitatively evaluated.

7.2.3 Test E-3: Electromagnetic Compatibility

a. Objective. To verify if the system operational requirements will be degraded due to platform or force level electromagnetic emission.

b. Procedure.

- Ship's force shall complete Data Sheets E-1 (Communication Circuit Log) and E-3 (Electromagnetic Compatibility). Using these logs and supervisory/user comments, the Test Director will make a determination if electromagnetic interference prevented or disrupted radio communications. Interference is defined as "loss of information."

- The Test Team will conduct an examination of ships records to determine if the Electromagnetic Interference (EMI) survey is current and indicates any previous problems.

c. Data Requirements. Data Sheet E-1 and E-3 will be completed to determine if any electromagnetic interference observed affected system communications.

d. Data Analysis. Data Sheet E-1, E-3, and communication logs will be quantitatively/qualitatively evaluated.

7.3 Suitability Tests (S-Tests)

The suitability testing will, in most instances, use data generated by continuous operations of the system throughout test operation, including the E-test runs described in paragraph 7.2. Tests specifically designed to generate suitability data are described below following the tests to which they apply.

7.3.1 Test S-1: Reliability

a. Objective. To verify the reliability of the system in its intended operational environment.

b. Procedure. This test will be conducted continuously during test operations by logging all failures. Data Sheet S-1 (Maintenance Action Form (MAF)) will be completed for each operational failure and for those instances during planned maintenance which reveal a failed component/part or element of hardware or firmware.

c. Data Requirements. Data Sheet S-1 will be completed for:

- Each failure or discrepancy noted during operations.
- Each corrective maintenance action.

d. Data Analysis. The reliability of Navy Shipboard SINCGARS AN/SRC-54 will be expressed as "MTBOMF." An operational mission failure is defined as any failure that prevents the AN/SRC-54 from performing its mission. The formula for computing MTBOMF is:

$$\text{MTBOMF} = \frac{\text{Total Operating Time}}{\text{Number of Operational Mission Failures}}$$

7.3.2 Test S-2: Maintainability

a. Objective. To verify the maintainability of the system in their intended operational environment.

b. Procedure. This test will be conducted continuously during test operations by logging all failures. Data Sheet S-1 (MAF) will be completed for each operational failure and for those instances during preventive maintenance which reveal a failed component/part or element of hardware or firmware. If insufficient system failures occur during testing (hardware, firmware, or component failures), records, logs and maintenance forms will be reviewed to obtain additional data.

c. Data Requirements. During test operations, all pertinent operator logs, MAFs (Data Sheet S-1), and activity records will be reviewed.

d. Data Analysis. The maintainability of SINCGARS AN/SRC-54 will be expressed as "MCMTOMF." MCMTOMF is the average elapsed corrective maintenance time needed to repair all operational mission failures/faults, including time for maintenance preparation, fault location and isolation, on-board parts procurement, fault correction, and adjustment and calibration, as well as follow-up checkout time.

MCMTOMF does not include off-board logistics delay time. The following formula will be used to determine MCMTOMF:

$$\text{MCMTOMF} = \frac{\text{Corrective Maintenance Time}}{\text{Total Number of Operational Mission Failures}}$$

7.3.3 Test S-3: Availability

a. Objective. To verify the probability that the system will be operationally ready, when needed, at any point in time.

b. Procedure. This test will be conducted continuously during test operations by logging all failures. Data Sheet S-1 will be completed for each operational failure and for those instances during preventive maintenance which reveal a failed component/part or element of hardware or firmware.

c. Data Requirements. During test operations, all pertinent operator logs, MAFs (Data Sheet S-1), and activity records will be reviewed.

d. Data Analysis. A_0 will be computed using the formula:

$$A_0 = \frac{\text{Uptime (in hours)}}{\text{Uptime + Downtime (in hours)}}$$

Where "uptime" is time when the system is considered to be ready for use and is either operating, in standby, or off. "Downtime" is the time the system is down for repair of operational mission failure, including off-board logistic delays. It also includes planned maintenance time of a periodicity less than or equal to the test duration time that prevents the system from performing its assigned mission. Planned maintenance time that is of periodicity greater than the test duration time is considered neutral time and is not included in the availability calculation.

7.3.4 Test S-4: Logistic Supportability

a. Objective. To verify the logistic supportability of the system in an operational environment.

b. Procedure. This test will be conducted continuously during the testing period:

(1) The adequacy of the Integrated Logistic Support Plan (ILSP) SPAWAR P4110-680B of 22 February 1996 (update of NTP-E-70-9301 approved JUN 93) will be evaluated.

(2) The following items related to logistic support will be evaluated:

(a) Clarity, completeness, accuracy, and availability of technical manuals and Planned Maintenance System (PMS) documentation.

(b) Availability and adequacy of test equipment and special tools as provided in the ILSP.

(c) Adequacy of support (including spare parts, operating and maintenance procedures, and training) provided in conjunction with test equipment and special tools.

(d) Adequacy of supply support.

1 The requirements for, and availability of, spare parts will be evaluated. Any requirements that indicate unexpectedly high component failure rates will be investigated.

2 Logistics delays in obtaining replacement components will be investigated.

(e) The adequacy of the following aspects of support will also be evaluated:

1 Calibration requirements for all GPETE.

2 Stowage space used for modules stored in the COMM Tech Control Room and Radio Transceiver Room.

3 All support resources used during testing that are not to be available to operational units will be noted.

c. Data Requirements

(1) The data required to conduct this test are as follows:

(a) Integrated Logistic Support Plan (ILSP).

(b) All technical manuals and PMS documentation.

(c) Completion of checklists contained in Tables 3-1, 3-2, and 3-3.

(d) Data Sheet S-3 will be completed by system maintainers. The Test Director will also conduct personnel interviews.

d. Data Analysis. Logistic support data will be qualitatively evaluated.

7.3.5 Test S-5: Compatibility

a. Objective. To verify the compatibility of the system to other systems and subsystems within its operating environment.

b. Procedure. This test will be conducted continuously during the testing period. Special consideration will be given to adequacy of ship's cooling system to support continued system operation and electromagnetic interference on/from other installed radio frequency (RF) generating systems.

c. Data Requirements. Observations on system performance will be recorded by supervisory personnel in the supervisor's log, Data Sheet E-3, and Data Sheet S-2.

d. Data Analysis. Compatibility data will be qualitatively evaluated.

7.3.6 Test S-6: Interoperability

a. Objective. To verify the AN/SRC-54 interoperability with other Department of Defense (DoD) and allied very high frequency (VHF) equipment, as outlined in the Operational Requirements Document (ORD).

b. Procedure. The ship's COMM Plan will be examined to ensure the following types of circuits (system tests) are demonstrated: Single Channel, Frequency Modulation (SC-FM) analog voice and data, Frequency Hopping, Frequency Modulation (FH-FM) digital voice and data, SC analog data, SC digital data, FH digital data, SC-FM digital voice and data. These tests will be conducted continuously during the testing period. In addition to data derived from the ship's COMM Plan, data rate testing will be conducted by the ISEA using the AN/PSC-2 and/or Advanced Field Artillery Tactical Data System (AFATDS) gunfire support equipment.

c. Data Requirements. Data requirements contained in the system tests listed above, as well as from interoperability anomalies noted by supervisory personnel in the supervisor's log and on Data Sheets E-1 and S-2 (Human Factors Questionnaire).

d. Data Analysis. Interoperability data will be qualitatively evaluated.

7.3.7 Test S-7: Training

a. Objective. To verify the adequacy of training for system operators and maintenance personnel.

b. Procedure. This test will be conducted continuously during the testing period.

c. Data Requirements. Personnel interviews will be conducted by the Test Director, and Data Sheet S-2 (Human Factors Questionnaire) will be completed by supervisors, system operators, and maintainers. The Test Director will also concentrate on the following areas:

(1) Determine if any inconsistencies exist in system manning levels between the Ship's Manning Document (SMD), Navy Training Plan (NTP), and ILSP.

(2) Training for General Purpose Electronic Test Equipment (GPETE), Special Purpose Electronic Test Equipment (SPETE), and Peculiar Support Equipment(PSE).

(3) Training facilities.

(4) Training adequacy.

d. Data Analysis. Training requirements data will be qualitatively evaluated.

7.3.8 Test S-8: Human Factors

a. Objective. To verify the adequacy of human factors features of the system.

b. Procedures. This test will be conducted continuously during the testing period.

c. Data Requirements. Data Sheet S-2 will be completed by system supervisors/ operators/maintainers. The Test Director will also conduct personnel interviews.

d. Data Analysis. Human factors data will be qualitatively evaluated.

7.3.9 Test S-9: Safety

a. Objective. To verify the adequacy of system safety features and, where appropriate, observe the adequacy of Navy occupational health and safety standards of the system.

b. Procedures. This test will be conducted continuously during the testing period.

c. Data Requirements. Data Sheet S-2 will be completed by system supervisors/operators/maintainers. Data concerning any identified safety deficiency will be recorded in the supervisor's log, the Test Director's notebook, and on the MAFs.

d. Data Analysis. Data will be qualitatively evaluated.

7.3.10 Test S-10: Documentation

a. Objective. To verify the adequacy and accuracy of the documentation provided for the system.

b. Procedure. This test will be conducted continuously during the testing period.

c. Data Requirements. Checklists provided in Tables 3-1, 3-2, and 3-3 will be completed.

d. Data Analysis. Documentation data will be qualitatively evaluated.

7.4 Test and Test Data Sheet Reference

A quick reference matrix is provided in Table 7-1 for test and test data sheet reference.

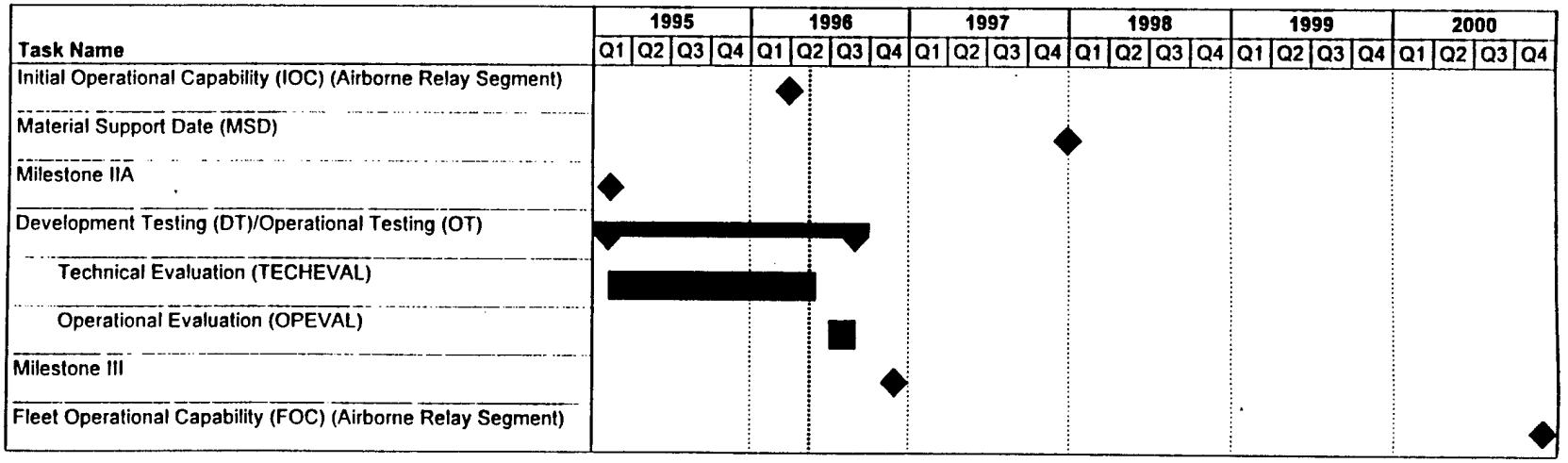
Table 7-1. AN/SRC-54 TECHEVAL Test and Test Data Sheet Matrix

Test	Test Description	Data Sheets	Page No.
E-1	Range	Data Sheet E-1	B-2, B-3
E-2	Survivability	Data Sheet E-2	B-4, B-5
E-3	Electromagnetic Compatibility	Data Sheet E-3	B-6, B-7
S-1	Reliability	Data Sheet S-1	B-8, B-9
S-2	Maintainability	Data Sheet S-2	B-10 - B-16
S-3	Availability	Data Sheet S-3	B-17
S-4	Logistics Supportability	Tables 3-1, 3-2 and 3-3 Data Sheet S-3	2, 3 and 4 B-17
S-5	Compatibility	Supervisor's Log	
S-6	Interoperability	Supervisor's Log Data Sheet E-1 Data Sheet S-1 Data Sheet S-2	 B-2, B-3 B-8, B-9 B-10 - B-16
S-7	Training	Data Sheet S-2	B-15
S-8	Human Factors	Data Sheet S-2	B-10
S-9	Safety	Data Sheet S-2	B-14 - B-15
S-10	Documentation	Tables 3-1 and 3-2	2, 3

8.0 SCHEDULE

An overall schedule/milestones for the AN/SRC-54 SINCGARS TECHEVAL and OPEVAL (DT-IIB/OT-II) is provided in Table 8-1, DT/OT Schedule of Events. The DT-IIB testing schedule of individual tests to be conducted and the organization who will be responsible for each test are contained in Appendix C, AN/SRC-54 DT-IIB Testing Schedule.

Table 8-1. DT/OT Schedule of Events



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APPENDIX A

POINTS OF CONTACT

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Table A-1. Points of Contact

Name	Organization	Telephone	Area of Responsibility
CAPT K. Slaght	SPAWAR PMW 176	(703) 602-8331	Program Manager
Bob Benson	SPAWAR PMW 176-3	(703) 602-8368	Division Head
Tim McManus	SPAWAR PMW 176-3B	(703) 602-8336	Branch Head
Willy Leger	SPAWAR PMW 176-3G	(703) 602-8334	Project Engineer
Angela Anderson	SPAWAR PD70L21B	(703) 602-4901	ILS
Vince Kopek	NISE EAST Charleston, ISEA	(804) 485-6422	DT-IIB Test Director
Leonard Halstead	NISE EAST Charleston, ISEA	(804) 485-6422	ILS

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APPENDIX B

FORMS AND DATA SHEETS

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FORMS AND DATA SHEETS

1. Introduction. Appendix B is provided to enable program data collection. Guidance contained in the basic test plan is expanded herein to aid designated data collection.

2. General.

   a. Greenwich Mean Time (GMT) ZULU shall be used when it is required for data recording. When data sheets are passed down between watch cycles, the responsibility for delivering each completed data sheet lies with the individual completing the final entry. Even incomplete data sheets are of value for system evaluation. Include any incomplete or partially filled data sheets in the data sheets package.

   b. Logs and records shall be appropriately classified and duplicated. Deliver the duplicated copies to the Test Director. Logs and records, or excerpts of logs and records, obtained during the test cycle are official documents.

3. Special Instructions. (for Data Sheet E-1, page 2 of 2)

   a. Columns 1 through 4 will be used in the same manner as standard traffic circuit logs except that Column 1 will be left blank on sheets used to document transmission/receipt of record traffic on voice circuits.

   b. Column 5 will be used to enter the number of transmissions required to accomplish delivery/receipt of each message. Example: If more than a single transmission is required to send/receive a message, enter "2" in Column 5. Enter "3" in Column 5 if three transmissions are required to send/receive a message. A MAXIMUM OF THREE TRANSMISSIONS SHOULD BE ATTEMPTED TO ACCOMPLISH DELIVERY/RECEIPT OF AN INDIVIDUAL MESSAGE. If unsuccessful after three transmissions, the circuit should be logged out and referred to tech control/circuit control. When the circuit is restored to service, the reason for outage supplied by tech control will be listed in Column 6 for the appropriate message.

   c. Enter in Column 6 reasons for any retransmissions. Reasons for retransmissions should be as concise as possible. Reasons for garbled messages should be determined if possible. Some examples could be "garbled, crypto dropped sync," "garbled, faulty TTY," "paper jammed," "operator voice clarity." The entry "garbled" in Column 6 will suffice if a message garbled for no apparent or identified cause. As indicated above, coordination with tech control/circuit control will be required, in some cases, to determine the reason for retransmission. When distant end operators request retransmissions, query them for reasons after the message is receipted.

COMMUNICATION (CIRCUIT) CAPACITY SUMMARY DATA SHEET

(To be completed by Circuit Operators)

NAME _____ RANK/RATE _____ DATE _____

RADAY _____ AT-SEA _____ INPORT _____

(1)	(2)	(3)	(4)		(5)		(6)
					EST. RANGE (NM)		
CKT TYPE	TERMINATION	HOURS IN USE	SEND	RCV			REMARKS

CKT TYPE: VOICE	DATA	TELETYPE
SC FM analog SC FM digital FH FM digital	SC FM analog SC FM digital FH FM digital	SC FSK analog SC FSK digital FH FSK digital

COMMUNICATION (CIRCUIT) CAPACITY SUMMARY DATA SHEET (Cont'd)

WATCH SECTION: _____ PAGE _____ OF _____

RADAY _____ AT-SEA _____ INPORT _____ CIRCUIT _____ SEND _____ RECV _____

(1)	(2)	(3)	(4)	(5)	(6)
MSG NO.	DTG	TOR/TOD	CHOP	XMSNS REQD	REASON FOR RETRANSMISSION

ADDITIONAL REMARKS (KEYED TO CHANNEL NO., IF APPROPRIATE)

_____

_____

_____

_____
Signature

Date: _____

SURVIVABILITY DATA SHEET

EMP:

Do they appear to have any physical damage? Yes _____ No _____

If Yes, describe _____

_____

_____

_____

_____

_____

_____

_____

VIBRATION: Are antennas securely fastened (i.e., not hand tight) ?

Antenna ___ (Frame _____) Yes _____ No _____
Antenna ___ (Frame _____) Yes _____ No _____
Antenna ___ (Frame _____) Yes _____ No _____
Antenna ___ (Frame _____) Yes _____ No _____

_____
Signature

SURVIVABILITY DATA SHEET (Cont'd)

POWER: Is AN/SRC-54 provided AC power from two independent banks/sources? Yes _____ No ____

In the event of partial loss of AC power, are there any critical components that would be inoperable? Yes _____ No ___

If Yes, describe _____

_____

_____

_____

_____

Can AN/SRC-54 be provided power from platform's emergency power ? Yes _____ No ___

Have you ever experienced any problems (i.e., unbalanced phases, low voltage conditions, etc.) with either power source? Yes _____ No ___

If Yes, describe _____

_____

_____

_____

_____
Signature

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

(To be completed by Circuit Operators)

EMI SURVEY: Date of last EMI survey. Date:_____

Any topside changes since last survey? Yes _____ No _____

If Yes, describe _____

_____

_____

_____

_____

_____

_____

_____

_____
Signature

ELECTROMAGNETIC COMPATIBILITY DATA SHEET (Cont'd)

EMI SOURCES: Did you detect any electromagnetic interference which disrupted radio communications, resulting in lost information? Yes ____ No ____

If Yes, describe _____

_____

_____

_____

_____

_____

_____

What do you believe was the source of the interference?

Possible sources of EMI:

HF Transmitters _____
UHF Transmitters _____
Radars _____
Deck Machinery _____
AC Power _____
Flight Deck _____
Other (_____) _____

_____
Signature

Date: _____

MAINTENANCE ACTION FORM (MAF)

(To be completed by Maintenance Technicians)

1. Job Control Number Information:

   _____ Unit Identification Code

   _____ Work Center

   _____ Job Sequence Number

2. Fill in the date/time (ZULU) that each of the following events/actions occurred, as applicable:

   _____Z Equipment down/failed

   _____Z Trouble isolation commenced

   _____Z Trouble isolation completed

   _____Z Part(s) ordered _____

   _____Z Part(s) received

   _____Z Part(s) installation commenced

   _____Z Part(s) installation completed

   _____Z Equipment up/returned to normal operation

3. Equipment Identification _____

   Part Ordered _____

   _____

   _____

4. Source of replacement part(s): (check one)

   _____ Shop Spares

   _____ Navy Supply Center

   _____ Other ..... (Explain) _____

MAINTENANCE ACTION FORM (MAF) (Cont'd)

5. Maintenance technician's analysis of the cause of the failure:

_____

_____

_____

6. Additional comments pertinent to this maintenance action:

_____

_____

_____

7. Name, rank/rate of technician performing this maintenance action:

_____

_____

_____

_____
Signature

HUMAN FACTORS QUESTIONNAIRE

(To be completed by Supervisors, Operators and Maintenance Personnel)

NAME _____ RANK/RATE _____ DATE _____

PNEC _____ SNEC _____ YEARS IN SERVICE _____

MONTHS OF EXPERIENCE ON THE SPECIFIC EQUIPMENT _____

SUPERVISOR _____

Purpose and Instructions. The purpose of this questionnaire is to assist in evaluating the specified equipment from a human factors aspect. Your opinion concerning the adequacy of the system's design, operation, maintainability, safety, number of required personnel, their ratings, NECs, and experience will assist in this evaluation and help ensure a better product for the fleet. If a question is not applicable to your man/machine relationship, mark "N/A" by the question. Use the reverse of this questionnaire or additional sheets, as necessary, to provide short but complete answers.

1. List schools/training which you have attended that are directly related to the specified equipment.

SCHOOLS/TRAINING	LENGTH	START DATE

2. List other related schools/training you have attended.

SCHOOLS/TRAINING	LENGTH	START DATE

HUMAN FACTORS QUESTIONNAIRE (Cont'd)

CONTROLS

0001 How would you assess the ability of a trained operator to manipulate the equipment of the system as designed?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT __

COMMENTS: _____

_____

0002 Are all of the critical controls easy to reach?

NO ___ YES ___ if NO, name and describe _____

_____

0003 What is your assessment of the location of guarded and/or critical controls, preventing them from being moved accidentally?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT __

COMMENTS: _____

_____

0004 Do your fingers ever slip off any of the pushbuttons?

NO ___ YES ___ if YES, name and describe_____

_____

0005 How would you assess the ease of properly completing the system setup procedures?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT __

COMMENTS: _____

_____

FASTENERS AND CONNECTORS

0006 Do equipment thumbscrews secure satisfactorily?

NO ___ YES ___ if NO, name and describe_____

_____

FASTENERS AND CONNECTORS (Cont'd)

0007 Is the equipment designed for easy access to perform maintenance?

NO ___ YES ___ if NO, name and describe_____

_____

COMMUNICATIONS

0008 Is the amount of incoming information at your position too much for one person to handle?

NO ___ YES ___ if YES, name and describe_____

_____

0009 What is your assessment of the ease of understanding information generated by front pane indicators and displays?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: _____

_____

0010 What is your assessment of the ease of exchanging necessary information with the personnel at other commands on the circuit?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: _____

_____

OPERATING PROCEDURES AND TASKS

0011 What is your assessment of the ability to operate the equipment satisfactorily using the prescribed procedures?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: _____

_____

0012 Are there any computations required for operating the equipment which are difficult to use?

NO ___ YES ___ if YES, name and describe_____

_____

OPERATING PROCEDURES AND TASKS (Cont'd)

0013 What is your assessment of the amount of time you are required to expend in monitoring the equipment?

CONTINUOUSLY ___ MOST OF THE TIME ___ HALF OF THE TIME ___

PART OF THE TIME ___ OCCASIONALLY ___

COMMENTS: _____

_____

0014 What is your assessment of the ease of operating the equipment while performing the required interactions with other personnel?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: _____

_____

0015 What is your assessment of how fatiguing the equipment is to operate?

VERY FATIGUING ___ FATIGUING ___ SOMEWHAT FATIGUING ___

NO IMPACT ___

COMMENTS: _____

_____

0016 How many operators per watch do you consider necessary to satisfactorily operate and maintain this system?

List the number of operators required and any comments: _____

_____

0017 How much practice time do operators get a week? ___ HOURS

Do you consider this enough? YES ___ NO ___

If NO, how many hours do you recommend? ___ HOURS

_____

0018 What is your confidence in the performance of this equipment?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: _____

_____

OPERATING PROCEDURES AND TASKS (Cont'd)

0019 Do you consider your rating appropriate for operating this equipment?

NO ___ YES ___

COMMENTS: _____

_____

0020 What is your assessment of log keeping required of you as an operator?

EASY TO DO ___ INTERFERING ___ TOO DIFFICULT ___ NOT APPLICABLE ___

COMMENTS: _____

_____

SAFETY AND DISTRACTIONS

0021 What is your assessment of any equipment created reflection or glare that will cause problems with safety or distractions?

NO EFFECT ___ SOME EFFECT ___ UNSAT EFFECT ___

COMMENTS: _____

_____

0022 Are the actual techniques used in operating the equipment the same as those provided in the operating manual?

NO ___ YES ___ if NO, name and describe_____

_____

0023 How would you assess the safety of exposed equipment edges and corners?

ROUGH AND UNSAFE ___ CLEAN AND SAFE ___

COMMENTS: _____

_____

0024 Are the units in the system mounted so that you can gain access to them without danger from electrical charge, heat, moving parts, radiation, or other hazards?

NO ___ YES ___ if NO, name and describe_____

_____

0025 Have all the tools and test leads to be used near high voltages been adequately insulated?

NO ___ YES ___ if NO, name and describe_____

_____

SAFETY AND DISTRACTIONS (Cont'd)

0026 Have guards, grounds, interlocks, and warning placards been provided to minimize the possibility of exposing personnel to dangerous voltages or radiation where necessary?

NO ___ YES ___ if NO, name and describe_____

_____

0027 Does technical documentation provide adequate explanations of the hazards of radiation, and procedures to be followed to avoid exposure?

NO ___ YES ___ if NO, name and describe_____

_____

0028 Do you think that established operating and maintenance procedures provide adequate protection against electrical shock, radiation, exposure, or equipment damage?

NO ___ YES ___ if NO, name and describe_____

_____

0029 What is your overall impression of the safety aspects provided by this equipment?

VERY SAFE ___ SAFE ___ UNSAFE ___, if UNSAFE, describe_____

_____

0030 List ways in which equipment safety could be improved.

_____

_____

_____

TRAINING AND EXPERIENCE

0031 Prior operation/maintenance experience with similar equipment would be ____ to the operator.

EXTREMELY HELPFUL ___ SOMEWHAT HELPFUL ___ HELPFUL ___ NO HELP __

COMMENTS: _____

_____

0032 Does the information generated by the system require a particular skill, not received in training, in order to operate this system?

NO ___ YES ___ if YES, name and describe_____

_____

TRAINING AND EXPERIENCE (Cont'd)

0033 What is your assessment of the training you have received?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: _____

_____

0034 What is your assessment of required on-the-job training after completion of formal training?

MANDATORY ___ NICE TO HAVE ___ NOT REQUIRED ___

COMMENTS: _____

_____

0035 Was your training for interpreting information generated by the system adequate for your operator tasks?

NO ___ YES ___ if NO, name and describe_____

_____

0036 How would you assess the adequacy of formal training received on the manipulation of equipment controls?

OUTSTANDING ___ EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT _

COMMENTS: _____

_____

0037 Do you have any suggestions for additions/changes to the operator/maintenance training that would be of help to the operator/maintainer?

COMMENTS: _____

_____

0038 Provide any comments you feel would aid in making the system more valuable to the fleet.

_____

_____

_____

Signature

Date: _____

LOGISTICS SUPPORTABILITY QUESTIONNAIRE

(To be completed by Maintenance Personnel)

0001 Rate the adequacy of the SINCGARS ILSP and ULSS.

ILSP: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

ULSS: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

How would you improve on either? _____

_____

_____

0002 Rate the adequacy of the all technical manuals and PMS documentation.

TM: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

PMS: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

How would you improve on either? _____

_____

0003 Were all General Purpose Electronic Test Equipment (GPETE), APL, and spare parts onboard as required by the SINCGARS ILSP/ULSS and Technical Manuals?

Yes ___ No ___

If No, explain _____

_____

0004 Rate the adequacy of calibration requirements and stowage space for spare parts.

Calibration: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

Stowage: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

_____

0005 Rate the availability and adequacy of the AN/SRC-54, GPETE, and special tools.

AN/SRC-54: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

GPETE: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

Special Tools: EXCELLENT ___ GOOD ___ FAIR ___ POOR ___ UNSAT ___

_____

_____

Signature

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APPENDIX C

AN/SRC-54 DT-IIB TESTING SCHEDULE

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Table C-1. AN/SRC-54 DT-IIB Testing Schedule and Data Responsibility

Test	Event	Days	Dates	Responsibility	
				Providing Data	Analyzing/ Verifying
	Prerequisite Test: Groom System	10	Before Starting Tests	TD	TD
E-1	Range	10	March - May	Ship's Force	TD
E-2	Survivability	90	March - May	Ship's Force	TD
E-3	Electromagnetic Compatibility	90	March - May	TD & Ship's Force	TD
S-1	Reliability	90	March - May	Ship's Force	TD
S-2	Maintainability	90	March - May	Ship's Force	TD
S-3	Availability	90	March - May	Ship's Force	TD
S-4	Logistics Supportability	90	March - May	TD	TD
S-5	Compatibility	90	March - May	Ship's Force	TD
S-6	Interoperability	90	March - May	Ship's Force	TD
S-7	Training Requirements	90	March - May	Ship's Force	TD
S-8	Human Factors	90	March - May	Ship's Force	TD
S-9	Safety	90	March - May	Ship's Force	TD
S-10	Documentation	90	March - May	TD	TD

Legend: TD - Test Director

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NAVY SHIPBOARD SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS)

TECHNICAL EVALUATION (DT-IIB) TEST PLAN

ATTACHMENT 1

AN/SRC-54
SYSTEM OPERATION AND VERIFICATION TESTS (SOVT)

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SYSTEM OPERATIONAL AND VERIFICATION TEST (SOVT)

AN/SRC-54

Ship Single Channel Ground and Airborne Radio System (SINCGARS) Ship Segment TRANSCEIVER

ALTERATION INSTALLATION TEAM

EFA: Naval Command Control and Ocean Surveillance Center, ISE East Coast Detachment, Norfolk Norfolk, VA

Prepared For: _____

Date: _____

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APPROVAL CERTIFICATION

Preparation

NISE EAST, Norfolk Code 532VK	_____	_____
Organization and Code	Vince Kopek	Date

Review

NISE EAST, Norfolk Code 532VK	_____	_____
Organization and Code	Vince Kopek	Date

Approval

NISE EAST, Norfolk Code 532CK	_____	_____
Organization and Code	C.F. Krause	Date

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LIST OF EFFECTIVE PAGES

NOTE: The portion of text affected by changes is indicated by a vertical line in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands.

Dates of issue for original and changed pages are:
Original .....0.... February 1995

Total Number of Pages in this Publication is 51 Consisting of the following:

[1] Zero in this column indicates an original page.

RECORD OF CHANGES

Change No.	Date	Title or Brief Description	Entered By

TABLE OF CONTENTS

LIST OF TABLES

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Ship's Acceptance Agreement

AN/SRC-54
Shipboard SINCGARS (Ship segment)

Ship Name/Hull Number: _____ **Date:** _____

Documentation and material turnover has been accomplished. Proper operation of the system has been demonstrated as shown in Tables 1 through 7, except as described in the attached incomplete work item summary. The incomplete work item summary identifies each item requiring completion and/or correction. This system is released to the ship's force for operation and maintenance. This agreement does not release the EFA from providing future technical assistance and support as required.

It is the responsibility of the ship's force to submit OPNAV 4790/CK forms in accordance with OPNAVINST 4790.4 signifying completed, new equipment configuration changes. This will ensure proper parts and test equipment support.

SHIP	Engineering Field Activity
_____	_____
Name (Printed)	Name (Printed)
_____	_____
Signature	Signature
_____	_____
Department	Activity
_____	_____
Date	Date

Comments: _____

_____

_____

_____

_____

Incomplete Work Item Summary

Incomplete Item	Responsible Activity
The responsible activity for each incomplete work item shall notify the Engineering Field Activity (EFA) upon completion of the work.	

Attach additional pages if necessary

INTRODUCTION

The Navy Single Channel Ground and Airborne Radio System (SINCGARS) is a secure, Anti-Jam (AJ) Very High Frequency (VHF) communications system consisting of a ship segment, a relay segment, and a shore segment. Together, these segments provide an Over-The Horizon (OTH) communications link from ships at sea to the forces ashore. The system provides the Navy with VHF-FM Electronic Counter-Countermeasures (ECCM) equipment for enhanced communications performance. The system will also interoperate with the current inventory of conventional VHF-FM radio equipment in the Single Channel (SC) mode. The shore segment consists of Army and Marine vehicular or manpack SINCGARS equipment. The airborne relay segment contains the AN/ARQ-53 two channel relay device. The ship segment consists of the AN/SRC-54 and its associated peripherals.

SAFETY

The following warnings and cautions appear in the text of this document and are repeated here for emphasis.

> Dangerous voltages exist on the equipment rack terminal boards and the rear of the equipment case. Exercise caution when working near these areas.
>
> Do not work alone when working on open energized equipment.
>
> Dangerous potentials exist when the power switch is in the OFF position due to retained charges on capacitors. To avoid casualties, always discharge to ground all exposed components prior to touching them.
>
> Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 series.
>
> Adhere to all safety precautions contained in the Shipyard Safety Program.
>
> Ensure all personnel are clear of radiating antennas prior to transmitting.

There are no specific additional safety hazards that are caused by the installation of the SINCGARS system.

EQUIPMENT AUDIT

An inventory of all the installed equipment must be taken. Table 1 provides blocks for entering equipment audit data. Attach additional copies of sheets as required.

DOCUMENTATION INVENTORY

A listing of required documentation which is left onboard after the installation is completed is provided in Table 2. Spaces have been provided within the table to check off each individual document. If any publication has not been provided, it is the responsibility of the AIT to ensure that an appropriate request message has been transmitted to ensure receipt of the document(s).

Copies of the 4790/CK forms required for removal of the old system components will be included in Appendix D.

Copies of the 4790/CK forms required for installation of the new system will be included in Appendix E.

PHYSICAL INSTALLATION INSPECTION

An inspection of the physical aspects of the installation will be performed and the results will be included in Table 3.

RELOCATED, MODIFIED OR DISTURBED EQUIPMENT

If it becomes necessary to modify, relocate or disturb any existing equipment during the course of the installation; all the affected equipment will be tested and certified operational. Space has been provided to accomplish this in Table 4.

TEMPEST INSPECTION

The ship's force must arrange for the inspection of the installation by a certified TEMPEST inspector, if required. The installation of the AN/SRC-54 SINCGARS transceivers should not effect any TEMPEST-related equipment.

PERSONNEL TRAINING

Personnel with prior communications equipment knowledge (CT,ET, and/or RM) must be provided from ship's force to assist in operational testing. The assigned personnel shall operate any existing equipment required during testing and coordinate with any facilities needed.

On-the-job training will be provided after all equipment has passed the operational performance certification procedures. Both operator and maintenance personnel will be made available from ship's force. Table 5 provides space for entering information on personnel trained, points of contact, and SOVT team members.

EQUIPMENT AND SYSTEM OPERATIONAL TEST PROCEDURES

Prior to any operational testing, the Exterior Communications System Installation/Resistance and Conductivity Test (44011-02-001) must be performed on all new transceivers and their interconnections.

Upon completion of the resistance and conductivity tests both the equipment and system operational tests must be performed on all new equipment. The equipment and system tests are provided in Appendix A and Appendix B, respectively. The antenna and feedline VSWR/impedance tests are provided in Appendix C. A summary of all the test results will be provided in Tables 6 and 7. Attach additional copies of Appendix A, B, & C as necessary.

SHIP'S ACCEPTANCE AGREEMENT

Once documentation and material turnover has been accomplished and proper operation of the system has been demonstrated as shown in Tables 1 through 7, the ship's acceptance agreement should be completed. Any exceptions should be described in the incomplete work item summary. The incomplete work item summary identifies each item requiring completion and/or correction. This releases the system to the ship's force for operation and maintenance. The agreement does not free the EFA from responsibilities in providing future technical assistance and support as required.

SHIPALT COMPLETION REPORT

Immediately after the installation and SOVT are completed, a SHIPALT completion report and general report will be submitted to the EFA representative. The complete SOVT document will be included with this report.

Table 1. Equipment Audit

AN/SRC-54 SYSTEM #: ________

Equipment	Serial Number	Location
RT-1730B/SRC-54		
AM-7238/VRC		
AM-7516/SRC-54		
MT-6352/VRC		
MX-111586/SRC-54		

AN/SRC-54 SYSTEM #: ________

Equipment	Serial Number	Location
RT-1730B/SRC-54		
AM-7238/VRC		
AM-7516/SRC-54		
MT-6352/VRC		
MX-111586/SRC-54		

AN/SRC-54 SYSTEM #: ________

Equipment	Serial Number	Location
RT-1730B/SRC-54		
AM-7238/VRC		
AM-7516/SRC-54		
MT-6352/VRC		
MX-111586/SRC-54		

Attach additional copies of page as required

Table 1 Equipment Audit (Continued)

OK-637/SRC

Equipment	Serial Number	Location
C-11561/U		
MX-10862/VRC		
MT-6576/VRC		
PP-8421/SRC		

POWER SUPPLY

Equipment	Serial Number	Location
PP-8422/SRC		
PP-8422/SRC		
PP-8422/SRC		
PP-8422/SRC		
PP-8422/SRC		
PP-8422/SRC		

ANTENNA

Equipment	Serial Number	Location
AS-4366/U		

AS-3226A/VRC		
AS-3226A/VRC		
AS-3226A/VRC		

ECCM FILL DEVICE

Equipment	Serial Number	Location
MX-18290/VRC		

Attach additional copies of page as required

Table 1 Equipment Audit (Continued)

MULTIPLEXER TD-1289()(V)/GRC

Equipment	Serial Number	Location
CU-2267/GRC		
F-1482/GRC #1		
F-1482/GRC #1		
F-1482/GRC #1		
F-1482/GRC #1		
F-1482/GRC #1		

MULTIPLEXER TD-1289()(V)/GRC

Equipment	Serial Number	Location
CU-2267/GRC		
F-1482/GRC #1		
F-1482/GRC #1		
F-1482/GRC #1		
F-1482/GRC #1		
F-1482/GRC #1		

MULTIPLEXER TD-1289()(V)/GRC

Equipment	Serial Number	Location
CU-2267/GRC		
F-1482/GRC #1		
F-1482/GRC #1		
F-1482/GRC #1		
F-1482/GRC #1		
F-1482/GRC #1		

Interference Mitigation Unit (I.M.U.)

Equipment	Serial Number	Location
T.B.D.		

Attach additional copies of page as required

Table 2.

Documentation Inventory

Document		Avail From	Qty	Onboard	
Title	Number			Yes	No
AN/SRC-54 Technical Manual	EE140-QB-OMI-010	EFA			
AN/SRC-54 Operator Instruction Chart	EEXXX-XX-XXX-XXX	EFA			
Operators Manual	TM11-5820-890-10-1	EFA			
SINCGARS Familiarization and Orientation		EFA			
SHIPALT Proposal		EFA			
List of SINCGARS Installations		EFA			
Completed 4790/CK Forms for Removal		EFA	*		
Completed 4790/CK Forms for Installation		EFA	*		
Completed Drawing Package		EFA			
Preliminary Maintenance Requirement Card (MRC) Package	Document #s vary with ship's configuration.	EFA	*		
Preliminary Maintenance Index Page (MIP)	Same as MRCs	EFA			

* Quantity will vary with each configuration.

Comments:

Table 3.

Physical Installation Inspection

Conditions	SAT	UNSAT	Inspector
New Equipment			
Modified Equipment			
Wiring and Connectors			
Grounding			
Bonding			
Area Clean and Clear of Installation Debris			
Operator Access			
Maintenance Access			
Equipment, Cables, and Conduit Labeled in Accordance with Installation Drawings			
Cables and Connectors installed with adequate clearances			
Painting and Touch-up			

Comments:

Table 4.

Modified/Disturbed/Relocated Equipment

Equipment	SAT	UNSAT	Inspector

Statement of Certification

All modified, disturbed, or relocated equipment has been tested and certified to be operational.

_____ _____

Signature Activity

Comments:

Table 5

Personnel Assignments

SOVT Team

Name	Activity

Points of Contact

Name	Department

Training

Oper	Maint	Name (Printed)	Rate	Signature

Attach additional copies of sheet as required

Table 6

System Test Results

Equipment	SYSTEM NUMBER	Resistance/ Conductivity		Equipment Level		System Level	
		S	U	S	U	S	U
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							
AN/SRC-54							

S - Satisfactory U - Unsatisfactory

Comments:

Table 7

Equipment Test Results

Equipment	SYSTEM NUMBER	VSWR IMPEDENCE		INSERTION LOSS	
		S	U	S	U
ANTENNA #:				XX	XX
				XX	XX
				XX	XX
				XX	XX
				XX	XX
				XX	XX
				XX	XX
				XX	XX
VHF MULTIPLEXER #:		XX	XX		
		XX	XX		
		XX	XX		
		XX	XX		
		XX	XX		
		XX	XX		
		XX	XX		
		XX	XX		

S - Satisfactory U - Unsatisfactory

Comments:

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APPENDIX A

EQUIPMENT LEVEL

TEST

PROCEDURES

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TEST OUTLINE

OBJECTIVE

To determine the performance characteristics of the AN/SRC-54 transceiver by testing the following:

a. Power On Sequence
b. Perform Self test
c. Audio Output
d. Audio In
e. FM Receive Sensitivity
f. Transmit Power Out and Frequency Accuracy
g. FM Deviation

ESTIMATED TIME

4.0 Hours

REFERENCES

a. EE140-QB-OMI-010 Technical Manual for SINCGARS, Ship Segment

TEST OR SUPPORT EQUIPMENT AND MATERIAL

GENERIC NAME	QUANTITY	IDENTIFYING INFORMATION
Generator AM/FM	1	Hewlett-Packard 8640B, SCAT 4370
Voltmeter, AC	1	Hewlett-Packard 400E, SCAT 4206
Function Generator	1	Hewlett-Packard 3312A, SCAT 4405
Frequency Counter	1	Hewlett-Packard 5328A, SCAT 4296
Oscilloscope	1	Tektronix 2246, SCAT ____
Time Domain Reflectometer (TDR) Cable Tester	1	Tektronix 1503C, SCAT 4298
Power Meter, Thruline	1	Bird 4410-025, SCAT 4958
Dummy Load	1	Bird 8890, SCAT 4658
Modulation Meter, AM/FM	1	Racal 9009N, SCAT 4262
Cable, test	8	RG-58/U with male BNC connectors on each end
Directional Coupler, 20dB	1	Narda 3040, SCAT 4881
Oscillator, Audio	1	Hewlett-Packard 200CD, SCAT 4358
Resistor, 600 ohms	1	Fixed film, 1 watt
Connector, "T"	2	BNC

TEST OR SUPPORT EQUIPMENT AND MATERIAL (Continued)

GENERIC NAME	QUANTITY	IDENTIFYING INFORMATION
Cable, test	2	Male N to Female BNC
ECCM Fill Device	1	MX-18290 (TRANSEC & HOPSET)
COMSEC Fill Device	1	KYK-13 and/or KOI-18
Adapter, Test	2	Banana to BNC Adapter, PN: (POMONA) 1269
Handset	2	H-250/U

PREREQUISITE TESTS
44011-02-001 Exterior Communications System Insulation/Resistance and Conductivity Test.

EQUIPMENT INVOLVED
AN/SRC-54 Communication Set

CONFIGURATION
AN/SRC-54 APL XXXXXXXXXX

METHOD
All basic functions of the transceivers are verified via their associated BIT tests.

RF power output and frequency accuracy are verified via a directional coupler and power meter in series with the transceiver output and a dummy load.

A FM signal source is connected to the receive RF input with a voltmeter connected to the receive audio output to measure FM receiver sensitivity and signal to noise ratio.

A function generator is connected to the data inputs with an ac voltmeter across the output to measure data levels.

STATION ASSIGNMENTS

STATION	NO. PERSONNEL	COMMENTS
AN/SRC-54	2	

SAFETY INSTRUCTIONS

1. Dangerous voltages exist on the equipment terminal boards and the rear of the equipment case. Exercise caution when working near these areas.
2. Do not work alone when working on open energized equipment.
3. Dangerous potentials exist when the power switch is in the OFF position due to retained charges on capacitors. To avoid casualties, always discharge to ground all exposed components prior to touching them.
4. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 series.
5. Adhere to all safety precautions contained in the Shipyard Safety Program.

STEP	STATION	INSTRUCTION
1.		**Initialization and Turn-On**
		A. Ensure radio set is connected to appropriate antenna or coupler
	MX-11586	B. Disconnect cables and remove SINCGARS Interface Unit (SIU) or put into TST/LD position.
		C. Power on Sequence:
	Power Panel	(1) Set equipment power panel switch to ON.
	PP-8422	(2) Set 28 Vdc Power Supply AC and DC switches to ON. Observe lights are on and record results on data sheets.
	RT-1730	(3) Set FCTN switch to STBY.
	AM-7516	(4) Set AM-7516 power switch (CB1) to ON. Observe that light is on and record results on data sheets.
		(5) Turn on test equipment. Allow 15 minute warm-up.
	RT-1730	D. Connect handset to AUD/DATA connector on R/T.
	RT-1730	E. Set R/T unit switches and controls:
		(1) CHAN to MAN
		(2) COMSEC to CT
		(3) VOL/WHSP to midrange
		(4) MODE to SC
		(5) RF PWR LVL to PA
		(6) FCTN to SQ ON
2.		**Perform Self-Test**
STEP	**STATION**	**INSTRUCTION**
		A. Ensure COMSEC variables are loaded. If not, load IAW OIC.
		B. Clear COMSEC alarm, that is heard in handset, by keying handset twice. Record results on data sheets.
	RT-1730	C. Set R/T unit FCTN switch to TST and verify the following sequence is displayed:
		NOTE: The HUB LOW indicator will be lighted throughout this test.
		(1) Observe "E C" is displayed and signal strength indicator goes from LOW to HI. Record results on data sheets.
		(2) Observe all dots in display light and signal strength indicator goes from LOW to HI. Record results on data sheets.
		(3) Listen in handset for short burst and tone. Record results on data sheets.
		(4) Observe "GOOD" displayed and signal strength indicator goes from LOW to HI. Record results on data sheets.
	RT-1730	D. Set R/T unit switches and controls:
		(1) COMSEC to PT
		(2) FCTN to Z-FH
	RT-1730	E. Observe "GOOD" is shown on display. Record results on data sheets.
	RT-1730	F. Set R/T unit FCTN switch to STBY
	AM-7516	G. Set AM-7516/SRC unit CB1 to OFF
	MX-11586	H. Replace SIU and reconnect cables
	AM-7516	I. Set AM-7516 unit CB1 to ON
	MX-11586	J. Ensure that +12V, -12V, and +28V LEDs on the SIU light. Record results on data sheets.
	RT-1730	K. Set R/T unit FCTN switch to SQ ON
		L. Key handset. Observe signal strength indicator goes high and the transmit status LED on the SIU lights. Record results on data sheets.
		M. Unkey handset.

3. **Measure Receive Sensitivity**

AM-7238	A.	Disconnect antenna cable from Power Amplifier (PA) ANT jack.
AM-7238	B.	Connect signal generator to PA ANT jack.
MX-11586	C.	Connect voltmeter to SAS PT/CT RCV audio jack on SIU across a 600Ω load.

CAUTION: DO NOT KEY TRANSMITTER. SERIOUS DAMAGE TO SIGNAL GENERATOR WILL RESULT.

RT-1730	D.	Set R/T unit switches and controls: (1) FCTN to SQ OFF (2) VOL to midrange

NOTE: Ensure RT unit is not patched through any associated patch panel(s) or switchboard(s). If ship is configured with the SA-2112() Automatic Switch, all remote audio lines should be removed prior to testing to prevent loading by removing P1 from J5 on the back of the SIU.

HP-8640	E.	Set signal generator switches and control: (1) Frequency to 30.0 MHz (2) Deviation to 6.5 kHz (3) Audio to 1 kHz (4) RF level to -116 dBm (.35 μV)
	F.	Fine tune signal generator frequency for peak indication on AC voltmeter
HP-400E	G.	Note voltmeter indication
HP-8640	H.	Set signal generator deviation OFF
HP-400E	I.	Observe voltmeter indication has decreased by 10 dBm or more. Record results on data sheets.
RT-1730	J.	Load frequency in RT-1730 (1) Set FCTN switch to LD

NOTE: Wherever a "Depress" appears, this action is to be taken on the keyboard

		(2) Depress FREQ: Display indicates loaded frequency (3) Depress CLR: Display shows five lines (4) Enter the next test frequency from Step K. (5) Depress STO: Display blinks and shows frequency. Observe display and record results on data sheets.
	K.	Repeat steps 3.D. through 3.J. substituting signal generator and R/T unit frequencies with 50.225 MHz, 56.875 MHz, and 87.975 MHz. Record results on data sheets.

4. **Measure Squelch Sensitivity**

STEP	STATION		INSTRUCTION
	RT-1730	A.	Set RT FCTN to SQ ON
	HP-8640	B.	Set signal generator controls: (1) Audio 150 Hz (2) RF output to minimum
STEP	STATION		INSTRUCTION
	HP-8640/ HP-400E		(3) Slowly increase RF output until an audio indication is on AC voltmeter (squelch disables) (4) Observe RF output level indicates < -116 dBm (.35μV) and record results on data sheets.

5. Measure PT Receive Audio Out

STEP	STATION	INSTRUCTION
	RT-1730	A. Set R/T FCTN to SQ OFF.
	HP-8640	B. Set signal generator controls:
		(1) Audio to 1 kHz
		(2) Deviation to 8 kHz
		(3) RF output to 141μV (-64 dBm).
	MX-11586/ HP-400E	C. Connect the voltmeter across a 600 ohm resistor to the sas PT/CT RCV jack on the SIU.
	HP-400E	D. Observe voltmeter indicates 0 dB (± 1dB). Record results on data sheets.

6. Measure PT Transmit Audio In.

STEP	STATION	INSTRUCTION
	MX-11586/ HP-3312A	A. Connect function generator between SAS PT/CT XMT test jacks. Adjust for 1 kHz @ 0dBm.
	HP-400E	B. Connect AC Voltmeter across RT PT/CT XMT test jacks.
		C. AC Voltmeter should read a nominal 0dBm. If not, adjust PT XMT adjustment to reflect 0dBm and record results on data sheet.

7. Measure CT Transmit Audio In.

STEP	STATION	INSTRUCTION
	MX-11586	A. Disconnect Audio cables (W4) from J3 & J4.
		B. Ground J3 pin F
	HP-3312A	C. Connect function generator between SAS PT/CT XMT test jacks. Adjust for 16 kHz square wave @ 0dBm.
		D. Ensure COMSEC switch is in the EXT position (E1/E2 strapped in units with Ser No. 001 through 020).
	2246	E. Connect O-Scope across RT PT/CT XMT test jacks.
		F. O-Scope should read a 10 Vp-p signal. If not, adjust CT XMT adjustment to reflect 10 Vp-p and record results on data sheet.
		G. Disconnect all test equipment and return system to normal condition.

8. Measure Power Output and Frequency Accuracy

STEP	STATION	INSTRUCTION
	Bird 4410	A. Connect test equipment:
		(1) Power meter between PA ANT jack and directional coupler input
		(2) Dummy load to directional coupler output jack
	HP-5328A	(3) Frequency counter to directional coupler sample port
	RT-1730	B. Set R/T unit switches and controls:
		(1) FREQ to 30.000 Mhz
		(2) FCTN to SQ ON
		(3) MODE to SC
		(4) COMSEC to PT
		(5) RF to PA
	Bird 4410	C. Set power meter to measure incident (forward) power
	MX-11586	D. Depress SIU TEST KEY (momentary) and hold long enough to record readings from power meter and frequency counter then release TEST KEY.
		E. Observe indications are within the specifications listed in Table 1. Record results on data sheets.
		G. Repeat steps 8.D. and 8.E. for remaining frequencies in Table 1.

Table A-1
Test Frequencies

Freq (Mhz)	Power	Frequency (Mhz) Limits
30.000 ,	32 to 69W	30.000 ±500 Hz
33.800	32 to 69W	33.800 ±500 Hz
36.875	32 to 69W	36.875 ±500 Hz
43.625	32 to 69W	43.625 ±500 Hz
50.225	32 to 69W	50.225 ±500 Hz
56.875	32 to 69W	56.875 ±500 Hz
68.425	32 to 69W	68.425 ±500 Hz
87.975	32 to 69W	87.975 ±500 Hz

9. **Measure Transmit Deviation**

STEP	STATION		INSTRUCTION
	HP-5328A	A.	Disconnect frequency counter from directional coupler sample port and replace with modulation meter
	HP-400E	B.	Connect voltmeter to audio oscillator via BNC "T" connector
	MX-11586	C.	Connect audio oscillator to SIU SAS PT/CT XMT audio jack
		D.	Adjust audio oscillator for a 1 Khz, 0 dBm output
	MX-11586	E.	Depress SIU TEST KEY, observe modulation meter for indication of 7.5 to 11.5 kHz and record results on data sheets.
	MX-11586	F.	Release SIU TEST KEY

10. **Measure CT Receive Audio Out**

STEP	STATION		INSTRUCTION
	AN/SRC-54	A.	Set-up two radios for over the air testing as follows:

NOTE: Ensure that the SIU and R/T under test is in a radio position that can be patched to external crypto. If not, remove from TYPE 1 position and place in the Single Channel position. If SIU is removed, ensure correct COMSEC strapping options are selected for test, then restrap for normal configuration at completion of test.

	B.	SIU and R/T under test (Single Channel)
		(1) Set-up IAW Appexdix B Step B.(1) thru (5).
		(2) Select CIPHER on TA-970
	C.	Supporting Radio
		(1) If a Single Channel radio is available, set-up the same as SIU and R/T under test.
		(2) If in TYPE 1 configuration, set-up IAW Appendix B Step A.(1) thru (8).
AN/SRC-54	D.	At unit under test, connect AC voltmeter to SAS PT/CT RCV, on the SIU, across a 600 ohm resistor.
AN/SRC-54	E.	Key the supporting radio and note that the AC voltmeter indicates 0 dBm (± 1 dBm). If not, Adjust CT RCV. Record results on data sheets.

TEST RECORDING

SYSTEM NO._____

PREREQUISITES

44011-02-001 Exterior Communications System Insulation/Resistance and Conductivity Test completed.

INSTRUCTIONS

The following sheets are to be used as a worksheet for figuring test elements and results. The "ACTUAL RESULTS" block should not be filled in on these sheets; they should be filled in on Table A-2 provided at the end of the data sheets. The cumulative results of these tests (SAT overall, UNSAT overall) should then be transferred to table 6 (page 10).

STEP	TEST ELEMENT	EXPECTED RESULTS	ACTUAL RESULTS
	Initialization and Turn On		
1.C.(2)	Observe Power Supply Lights on	Lit	_____
1.C.(4)	Observe Power Lights on	Lit	_____
	Self Test		
2.B	Listen in Handset	COMSEC Alarm clears when handset keyed twice	_____
2.C.(1)	Observe Display	"E C" displayed and signal strength indicator goes from LOW to HI	_____
(2)	Observe Display	All dots displayed and signal strength indicator goes from LOW to HI	_____
(3)	Listen in Handset	Short burst and tone is heard	_____
(4)	Observe Display	"GOOD" displayed and signal strength indicator goes from LOW to HI	_____
2.E.	Observe Display	"GOOD" displayed	_____
2.J.	Observe +12V, -12V, and +28V Lights on SIU are on	Lit	_____

TEST RECORDING (Continued)

SYSTEM NO._____

STEP	TEST ELEMENT	EXPECTED RESULTS	ACTUAL RESULTS
2.L.	Observe Display	Signal strength indicator goes high and xmit status LED on SIU lights	_____
	Receiver Sensitivity		
3.I/3.K	Observe Voltmeter	>10dB Decrease @ 30.000 MHz	_____dB
		>10dB Decrease @ 50.225 MHz	_____dB
		>10dB Decrease @ 56.875 MHz	_____dB
		>10dB Decrease @ 87.975 MHz	_____dB
	Squelch Sensitivity		
4.B.(4)	Observe RF output level	< -116dBm (.35μV)	_____dBm
	PT Receive Audio Out		
5.D.	Observe Voltmeter	0dB ±1dB	_____dB
	Measure PT Transmit Audio In		
6.C.	Observe VTVM	0dB ±1dB	_____dB
	Measure CT Transmit Audio In		
7.F.	Observe VTVM	10 Vp-p	_____Vp-p
	Power Out and Frequency Accuracy		
8.E/8.G	Observe Freq. Counter	30.000 MHz ±500 Hz	_____MHz
	Observe Power Meter	32 to 69W	_____W
	Observe Freq. Counter	33.800 MHz ±500 Hz	_____MHz
	Observe Power Meter	32 to 69W	_____W
	Observe Freq. Counter	36.875 MHz ±500 Hz	_____MHz
	Observe Power Meter	32 to 69W	_____W
	Observe Freq. Counter	43.625 MHz ±500 Hz	_____MHz
	Observe Power Meter	32 to 69W	_____W

SYSTEM NO._____

.EP	TEST ELEMENT	EXPECTED RESULTS	ACTUAL RESULTS
	Power Out and Frequency Accuracy (Continued)		
8.E./8.G	Observe Freq. Counter	50.225 MHz ±500 Hz	_____MHz
	Observe Power Meter	32 to 69W	_____W
	Observe Freq. Counter	56.875 MHz ±500 Hz	_____MHz
	Observe Power Meter	32 to 69W	_____W
	Observe Freq. Counter	68.425 MHz ±500 Hz	_____MHz
	Observe Power Meter	32 to 69W	_____W
	Observe Freq. Counter	87.975 MHz ±500 Hz	_____MHz
	Observe Power Meter	32 to 69W	_____W
	Transmit Deviation		
E.	Observe Modulation Meter	7.5 to 11.5 kHz	_____kHz
	Measure CT Receive Audio Out		
10.E.	AC Voltmeter	0 dB (± 1dB)	_____dB

TABLE A-2 Equipment Level Test Data

STEP	REFERENCE	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____
1.C.(2)	Power On								
1.C.(4)	Power On								
2.B	Alarms Clear								
2.C(1)	"E" &" C"								
2.C(2)	All Dots in Display Light								
2.C(3)	Short Burst in Handset								
2.C(4)	"Good" Display & Signal Indicator to HI								
2.E	"Good" Displayed								
2.J	SIU Lights Displayed								
2.L	Signal Indicator goes HI XMT Status on SIU Lit								
3.I/3.K	30.000 MHz >10dB Drop								
3.I/3.K	50.225 MHz >10dB Drop								
3.I/3.K	56.875 MHz >10dB Drop								

Use Additional Copies as Required

TABLE A-2 Equipment Level Test Data (Continued)

STEP	REFERENCE	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____
3.I/3.K	87.975MHz >10dB Drop								
4.B(4)	<-116 dB								
5.D	0dB ± 1dB								
6.C	0dB ± 1dB								
7.F	10 Vp-p								
8.E/8.G	32 to 69 W 30.000 MHz								
8.E/8.G	32 to 69 W 33.800 MHz								
8.E/8.G	32 to 69 W 36.875 MHz								
8.E/8.G	32 to 69 W 43.625 MHz								
8.E/8.G	32 to 69 W 50.225 MHz								
8.E/8.G	32 to 69 W 56.875 MHz								
8.E/8.G	32 to 69 W 68.425 MHz								
8.E/8.G	32 to 69 W 87.975 MHz								
9.E	7.5 to 11.5 kHz								
10.E	0dB ± 1dB								

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APPENDIX B

SYSTEM LEVEL

TEST

PROCEDURES

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TEST OUTLINE

OBJECTIVE

To demonstrate the performance characteristics of the AN/SRC-54 SINCGARS system by testing the following:

a. Transmit SC via Single Audio System
b. Transmit FH via Single Audio System

ESTIMATED TIME

2.0 Hours

REFERENCES

a. EE140-QB-OMI-010 AN/SRC-54 SINCGARS Technical Manual.
b. Operator Instruction Charts for AN/SRC-54.

TEST OR SUPPORT EQUIPMENT AND MATERIAL

GENERIC NAME	QUANTITY	IDENTIFYING INFORMATION
Fill Device	1	MX-18290/VRC
Fill Device	1	KYK-13
Handset	1	H-250/U

PREREQUISITE TESTS

a. 44011-02-001 Exterior Communications System Installation/Resistance and Conductivity Test
b. AN/SRC-54 Transceiver equipment test of Appendix A of SOVT.

SPECIAL CONDITIONS AND SERVICES

Must obtain appropriate SC and FH frequencies for back-to-back test.

EQUIPMENT INVOLVED

a. TA-970 Remote handset
b. C-11561 SRCU
c. AN/SRC-54 Transceivers

CONFIGURATION

AN/SRC-54 APL XXXXXXXXXX

METHOD

Two radio sets will transmit to each other and verify functional operation of FH and SC mode.
Remote operation will be verified using SRCU and remote handset.

SAFETY INSTRUCTIONS

1. Ensure all personnel are clear of radiating antennas prior to transmitting.

2. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 series.

3. Adhere to all safety precautions contained in the Shipyard Safety Program.

TESTING STEPS

STEP	STATION	INSTRUCTION

1. Overall System Test

NOTE: In laboratory, test each unit in all configurations. On shipboard installations, perform configurations tests as applicable for unit under test. Test units over the air with authorized test frequency from ship or lab test frequency coordinator. Test to be conducted using units at local site back-to-back or with remote sites.

A. TYPE 1 (Utilizing R/T internal COMSEC) - SC and FH

NOTE: Ensure all units under test are connected to appropriate antenna or coupler.

MX-11586	(1)	Ensure SIU "COMSEC" switch is in the "RT" position. (E3 and E4 strapped in prototype SIU)
	(2)	Ensure COMSEC and TRANSEC variables are loaded. If not, load in accordance with (IAW) SINCGARS OIC
RT-1730	(3)	Set R/T unit switches and controls: a. FCTN to SQ ON b. CHAN to MAN c. COMSEC to CT d. VOL to midrange e. MODE to SC f. RF to PA g. FREQ to assigned frequency
SAS	(4)	Connect a TA-970 (line) to radio set via appropriate SAS trunk for unit under test.
TA-970	(5)	Select PLAIN on TA-970
AN/SRC-54	(6)	Perform radio check with "distant" end with radio configured the same.
Handset	(7)	Listen for clear two-way communications in "Local" and "Distant" hand sets. Record results on data sheets.
TA-970	(8)	Select CIPHER on TA-970
Handset	(9)	Listen for clear two-way communications in "Local" and "Distant" handsets. Record results on data sheets.
RT-1730	(10)	R/T MODE switch to FH
AN/SRC-54	(11)	Repeat steps A.(5) through A.(9) in FH mode. Record results on data sheets.

B. Single Channel System Utilizing External COMSEC - SC only.

MX-11586	(1)	Ensure SIU "COMSEC" switch is in "EXT" position (E1 and E2 strapped in prototype SIU).
RT-1730	(2)	Set R/T unit switches and controls: a. FCTN to RXMT b. CH to MAN c. COMSEC to PT d. VOL to Midrange e. MODE to SC f. RF to PA g. Frequency to assigned frequency.
KY-58	(3)	Ensure COMSEC variable is loaded in external COMSEC device. If not, load IAW KY-58 loading procedures.
Black SAS or Switch-board	(4)	Connect an external COMSEC device (i.e. TSEC/KY-58) to radio set via Black SAS trunk or transmit and receive switchboards.
SAS	(5)	Connect a TA-970 (line) to appropriate COMSEC device via appropriate SAS trunk.
TA-970	(6)	Select PLAIN on TA-970

STEP	STATION		INSTRUCTION
	AN/SRC-54	(7)	Perform radio check with "distant" end with radio configured the same.
	Handset	(8)	Listen for clear two-way communications in the "Local" and "Distant" handsets. Record results on data sheets.
	TA-970	(9)	Select CIPHER on TA-970
	Handset	(10)	Listen for clear two-way communications in both hand sets. Record results on data sheets.

C. TYPE 1 (Utilizing R/T internal COMSEC) back-to-back with Single Channel Radio (Utilizing external COMSEC) - SC only.

AN/SRC-54	(1)	Set-up one radio set as TYPE 1 configuration as in step A.(1). through A.(5).
AN/SRC-54	(2)	Set-up the other radio set as Single Channel configuration as in step B.(1). through B.(5).
TA-970	(3)	Select PLAIN on TA-970
AN/SRC-54	(4)	Perform radio check between the two radio configurations.
Handset	(5)	Listen for clear two-way communications in "Local" and "Distant" hand sets. Record results on data sheets.
TA-970	(6)	Select CIPHER on TA-970
Handset	(7)	Listen for clear two-way communications in both hand sets. Record results on data sheets.
AN/SRC-54	(8)	If feasible, reconfigure radio sets to the opposite configuration of that previously tested. Test repeating steps C.(1) through C.(7). Record results on data sheets.

2. Perform SRCU self-test.

STEP	STATION		INSTRUCTION
	SRCU	A.	Set SRCU switches and controls:
		(1)	Power to ON (mounting base/adapter)
		(2)	COMSEC to CT
		(3)	MODE to SC
		(4)	VOL to Midrange
		(5)	FCTN to SQ ON
		(6)	RF PWR to PA
	SRCU	B.	Set FCTN switch to TST
		(1)	Observe all display segments light for 3 seconds. Record results on data sheets.
		(2)	Observe "GOOD" is displayed for 2 seconds. Record results on data sheets.

3. Shutdown and Securing

STEP	STATION		INSTRUCTION
	RT-1730	A.	Secure RT-1730
		(1)	Set FCTN switch to OFF.
	C-11561	B.	Secure C-11561
		(1)	Set FCTN switch to OFF.

TEST DATA RECORDING

SYSTEM NO._____

PREREQUISITES

44011-02-001 Exterior Communications System Insulation/Resistance and Conductivity Test completed.

INSTRUCTIONS

The following sheets are to be used as a worksheet for figuring test elements and results. The "ACTUAL RESULTS" block should not be filled in on these sheets; they should be filled in on table B-1 provided at the end of the data sheets. The cumulative results of these tests (SAT overall, UNSAT overall) should then be transferred to table 6 (page 10).

STEP	TEST ELEMENT	EXPECTED RESULTS	ACTUAL RESULTS
SINCGARS Overall Performance Test			
1.A.(7)	Listen in Hand Set	Clear Communications: SC PLAIN Radio #1	_____
		SC PLAIN Radio #2	_____
1.A.(9)	Listen in Hand Set	Clear Communications: SC CIPHER Radio #1	_____
		SC CIPHER Radio #2	_____
1.A.(11)	Listen in Hand Set	Clear Communications: FH PLAIN Radio #1	_____
		FH PLAIN Radio #2	_____
		FH CIPHER Radio #1	_____
		FH CIPHER Radio #2	_____
Single Channel Back-to-Back			
1.B.(8)	Listen in Hand Set	Clear Communications: SC PLAIN Radio #1	_____
		SC PLAIN Radio #2	_____
1.B.(10)	Listen in Hand Set	Clear Communications: SC CIPHER Radio #1	_____
		SC CIPHER Radio #2	_____

SYSTEM NO._____

STEP	TEST ELEMENT	EXPECTED RESULTS	ACTUAL RESULTS
TYPE 1 to Single Channel Back-to-Back			
1.C.(5)	Listen in Hand Set	Clear Communications: Radio #1 TYPE 1, SC PLAIN	_____
		Radio #2 Single Channel, SC PLAIN	_____
1.C.(7)	Listen in Hand Set	Clear Communications: Radio #1 TYPE 1, SC CIPHER	_____
		Radio #2 Single Channel, SC CIPHER	_____
1.C.(8)	Listen in Hand Set	Clear Communications: Radio #1 Single Channel, SC PLAIN	_____
		Radio #2 TYPE 1, SC PLAIN	_____
		Radio #1 Single Channel, SC CIPHER	_____
		Radio #2 TYPE 1, SC CIPHER	_____
SRCU Self Test			
2.B.(1)	Observe Display	Display lights for for 3 seconds	_____
2.B.(2)	Observe Display	Display indicates "GOOD" for 2 seconds	_____

TABLE B-1 Syst Level Test Data

STEP	REFERENCE	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____	AN/SRC-54 SYSTEM # ____
1.A (7)	Plain Indication								
1.A (9)	Cipher Indication								
1.A (11)	FH Plain Indication								
1.A (11)	FH Cipher Indication								
1.B (8)	SC Plain Indication								
1.B (10)	SC Cipher Indication								
1.C (5)	Type 1 SC Plain								
1.C (5)	SC, SC Plain								
1.C (7)	Type 1 SC Cipher								
1.C (7)	SC, SC Cipher								
1.C (8)	SC, SC Plain								
1.C (8)	Type 1 SC Plain								
1.C (8)	SC, SC Cipher								
1.C (8)	Type 1, SC Cipher								
2.B (1)	Display Lights 3 Sec.								
2.B (2)	Display Indicates "GOOD" 2 Sec								

APPENDIX C

ANTENNA/FEEDLINE/VSWR

TEST PROCEDURES

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TEST OUTLINE

OBJECTIVE

demonstrate the performance of the AN/SRC-54 SINCGARS system antennas and feedlines by testing the ollowing:

a. VSWR levels
b. Line impedance

ESTIMATED TIME

2.0 Hours

REFERENCES

a. EE140-QB-OMI-010 Technical Manual for AN/SRC-54
b. Operator Instruction Charts for AN/SRC-54

TEST OR SUPPORT EQUIPMENT AND MATERIAL

GENERIC NAME	QUANTITY	IDENTIFYING INFORMATION
TDR Oscilloscope	1	Tektronix 1502, SCAT 4298
Power Meter, Thruline	2	Bird 4410-025, SCAT 4958
Adaptor	1	UG-201A/U

PREREQUISITE TESTS

a. 44011-02-001 Exterior Communications System Installation/Resistance and Conductivity Test

SPECIAL CONDITIONS AND SERVICES

None

EQUIPMENT INVOLVED

a. Two AN/SRC-54 Transceivers
b. AS-4366/U

CONFIGURATION

AN/SRC-54 APL XXXXXXXXXX

METHOD

a. A TDR will be connected to the feedlines to test the line impedance.
b. Radios will transmit with power meters set up at one end of the feedlines to measure VSWR and line loss.

STATION ASSIGNMENTS

STATION	NO. PERSONNEL	COMMENTS
AN/SRC-54	1	Due to testing sequence, only 2 personnel are required for this test.
Antenna	1	

SAFETY INSTRUCTIONS

1. Ensure all personnel are clear of radiating antennas prior to transmitting.

2. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 series.

3. Adhere to all safety precautions contained in the Shipyard Safety Program.

TESTING STEPS

STEP	EQUIPMENT	INSTRUCTION
1. **Antenna VSWR and TDR**		
A.	TDR	Ensure TDR is set for appropriate transmission line type and good display. Refer to TDR instructions as necessary.
B.	TDR	TDR antenna transmission line for any indication of shorts or opens. Attach print-outs to data sheets.
C.	ANTENNA	Test antenna for VSWR - verify readings are within specification.
D.	Connecting test equipment:	
	RT-1730	(1) Power meter between amplifier ANT jack and antenna under test
	RT-1730	Set R/T unit switches and controls as follows: (1) FCTN to SQ ON (2) CHAN to MAN (3) COMSEC to PT (4) RF to PA (5) FREQ to 30.000 Mhz
E.	RT-1730	Key transmitter and note forward and reflected power readings

NOTE: VSWR should not exceed 3:1 on any frequency tested. The formula for calculating VSWR is:

$$VSWR = \frac{1 + \sqrt{\frac{\text{REFLECTED PWR}}{\text{FORWARD PWR}}}}{1 - \sqrt{\frac{\text{REFLECTED PWR}}{\text{FORWARD PWR}}}}$$

F. Repeat step E. for the frequencies listed below and record results in 1F.

Freq. (MHz)	Freq. (MHz)
30.000	33.800
36.875	43.625
50.225	56.875
68.425	87.975

TEST DATA RECORDING

NOMEN:_____

ANT SER #:_____

DESIG:_____

PREREQUISITES

AN/SRC-54 Transceiver Set Equipment Test completed.

INSTRUCTIONS

The following sheets are to be used as a worksheet for figuring test elements and results. The "ACTUAL RESULTS" block should not be filled in on these sheets; they should be filled in on table C-1 provided at the end of data sheets. The cumulative results of these tests (SAT overall, UNSAT overall) should then be transferred to table 6 (located on page 10).

STEP	TEST ELEMENT	EXPECTED RESULTS	ACTUAL RESULTS

Antenna TDR

1.B. Attach TDR Print-Outs here.....

1.F **Antenna VSWR** ≤ 3:1

Observe Power Meter:

$$VSWR = \frac{1+\sqrt{\frac{\text{REFLECTED PWR}}{\text{FORWARD PWR}}}}{1-\sqrt{\frac{\text{REFLECTED PWR}}{\text{FORWARD PWR}}}}$$

Freq. (MHz)	Fwd. Power	Refl. Power	VSWR
30.000	_____	_____	_____
33.800	_____	_____	_____
36.875	_____	_____	_____
43.625	_____	_____	_____
50.225	_____	_____	_____
56.875	_____	_____	_____
68.425	_____	_____	_____
87.975	_____	_____	_____

TABLE C-1 Anter 'Feedline Test Data

STEP	REFERENCE	NOMEN: _____ ANT SER# _____ DESIG: _____	NOMEN: _____ ANT SER# _____ DESIG: _____	NOMEN: _____ ANT SER# _____ DESIG: _____	NOMEN: _____ ANT SER# _____ DESIG: _____	NOMEN: _____ ANT SER# _____ DESIG: _____	NOMEN: _____ ANT SER# _____ DESIG: _____	NOMEN: _____ ANT SER# _____ DESIG: _____	NOMEN: _____ ANT SER# _____ DESIG: _____
1.F/1.G	VSWR-FREQ: 30.000 MHz								
1.F/1.G	VSWR-FREQ: 33.800 MHz								
1.F/1.G	VSWR-FREQ: 36.875 MHz								
1.F/1.G	VSWR-FREQ: 43.625 MHz								
1.F/1.G	VSWR-FREQ: 50.225 MHz								
1.F/1.G	VSWR-FREQ: 56.875 MHz								
1.F/1.G	VSWR-FREQ: 68.425 MHz								
1.F/1.G	VSWR-FREQ: 87.975 MHz								

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APPENDIX D

MULTIPLEXER

TEST OUTLINE

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TEST OUTLINE

OBJECTIVE

To demonstrate the performance of the TD-1289(V)/GRC Multiplexer by testing the following:

a. Insertion loss

ESTIMATED TIME

1.0 Hours

REFERENCES

a. TM 11-5820-880-12 Technical Manual for TD-1289(V) /GRC
b. Operator Instruction Charts for TD-1289(V) /GRC

TEST OR SUPPORT EQUIPMENT AND MATERIAL

GENERIC NAME	QUANTITY	IDENTIFYING INFORMATION
Generator AM/FM	1	Hewlett-Packard 8640B,SCAT 4370
Microwattmeter RF	1	Boonton model 4200
Power sensor	1	Boonton model 4200-4A
Cable, test	2	Male N to Male BNC
Adapter, connector	1	N Female to N Female

PREREQUISITE TESTS

44011-02-001 Exterior Communications System Installation/Resistance and Conductivity Test

SPECIAL CONDITIONS AND SERVICES

None

EQUIPMENT INVOLVED

TD-1289()(V)/GRC MULTIPLEXER

CONFIGURATION

TD-1289()(V)/GRC APL

METHOD

RF Generator will be used to inject a known signal into each filter. The Multiplexers output will be connected to the Microwattmeter and the loss will be measured in dB's.

STATION ASSIGNMENTS

STATION	NO. PERSONNEL	COMMENTS
TD-1289(V)()/GRC	1	Due to testing sequence, only 2 personnel are required for this test.

SAFETY INSTRUCTIONS

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 series.

2. Adhere to all safety precaution contained in the Shipyard Safety Program.

TESTING STEPS

STEP	STATION	INSTRUCTION

1. Initialization and Turn-On

		A. Turn on test equipment and allow to warm up.
	TD-1289	B. Course tune the filter to be tested and ensure all unused filters are tuned off center frequency of the filter to be tested by 5% min.
	Generator	C. Set Generator controls: (1) Frequency to test frequency (see table 1 below). (2) MODULATION to OFF (3) Output level to 0dBm.
	Meter,4200	D. Set Meter controls: (1) MODE set to dB (2) RANGE set to AUTO (3) SELECT Set to CHNL 1
		E. Connect Power Sensor to front of Microwattmeter (CHNL 1).
		F. Using test cable connect RF generator output to Power Sensor input and turn on Signal Generator RF OUT.
		G. Set RF Generator output to reflect a 0dBm indication on Microwattmeter.
		H. Disconnect RF generator from Microwattmeter.

2. MULTIPLEXER INSERTION LOSS

STEP	STATION	INSTRUCTION
	TD-1289	A. Connect RF Generator to input of filter under test, then connect Power Sensor to the Multiplexer output.
		B. Using correct tuning procedures adjust filter tune knobs until the highest reading is obtained on the Microwattmeter.

NOTE: INSERTION LOSS should not exceed 2.0dB on any frequency tested. The formula for calculating INSERTION LOSS is:

INSERTION LOSS = INPUT POWER in dB's - OUTPUT POWER IN dB's.

C. Repeat steps 1.F through 2.C for the frequencies listed below and for all filters. Record results on data sheets.

TABLE 1

Freq. (MHz)
30.000
44.500
59.000
73.500
87.975

TEST DATA RECORDING

COUPLER NOMENCLATURE _____
COUPLER NO. _____

PREREQUISITES

AN/SRC-54 Transceiver Set Equipment Test completed.

INSTRUCTIONS

The following sheets are to be used as a worksheet for figuring test elements and results. The "ACTUAL RESULTS" block should not be filled in on these sheets; they should be filled in on table D-1 provided at the end of data sheets. The cumulative results of these tests (SAT overall, UNSAT overall) should them be transferred to table 7 (located on page 11).

STEP	TEST ELEMENT	EXPECTED RESULTS	ACTUAL RESULTS
2.C.	Test Coupler for Insertion Loss	≤ 2 Db	_____
2.D.	Test Results:		

FILTER NO. _____ **FILTER NO.** _____

Freq.(MHz)	Power IN	Power OUT	Insertion LOSS	Power IN	Power OUT	Insertion LOSS
30.000						
44.500						
59.000						
73.500						
87.975						

FILTER NO. _____ **FILTER NO.** _____

Freq.(MHz)	Power IN	Power OUT	Insertion LOSS	Power IN	Power OUT	Insertion LOSS
30.000						
44.500						
59.000						
73.500						
87.975						

FILTER NO. _____

Freq.(MHz)	Power IN	Power OUT	Insertion LOSS
30.000			
44.500			
59.000			
73.500			
87.975			

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TABLE D-1

Coupler Insertion Loss Test Data

COUPLER # _____

STEP	REFERENCE	FILTER NO: _____ NOMEN: _____ SER NO: _____	FILTER NO: _____ NOMEN: _____ SER NO: _____	FILTER NO: _____ NOMEN: _____ SER NO: _____	FILTER NO: _____ NOMEN: _____ SER NO: _____	FILTER NO: _____ NOMEN: _____ SER NO: _____
2.C	INSERTION LOSS 30.000 MHz					
2.C	INSERTION LOSS 44.500 MHz					
2.C	INSERTION LOSS 59.000 MHz					
2.C	INSERTION LOSS 73.500 MHz					
2.C	INSERTION LOSS 87.975 MHz					

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APPENDIX E

COMPLETED 4790/CK FORMS

REMOVAL

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APPENDIX F

COMPLETED 4790/CK FORMS

INSTALLATION

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NAVY SHIPBOARD SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS)

TECHNICAL EVALUATION (DT-IIB) TEST PLAN

ATTACHMENT 2

TD-1456
SHIPBOARD MULTIPLEXER
TEST PLAN

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TEST PLAN FOR SHIPBOARD EVALUATION OF FREQUENCY HOPPING MULTIPLEXER TD-1456/VRC

1. INTRODUCTION

1.1 Purpose

The purpose of the testing described herein is to determine the ability of the TD-1456 Frequency Hopping Multicoupler (FHMUX) to perform as a shipboard multicoupler for SRC-54 installations in VRC-46 replacement and Type-1 configurations. Particular interest is in the application of one frequency-hopping channel with two or three fixed-frequency channels which will cover the requirements of a large number of smaller ships.

1.2 Description of UUT

The TD-1456 is a four-port frequency-hopping multiplexer which can connect four SINCGARS RTs to a single antenna. SINCGARS operates in the 30-88MHz frequency band with a nominal power output of 50W per channel. The TD-1456 was developed by Xetron Corporation for the Army to be used in wheeled and tracked ground vehicles. All connections and operator controls are on the front of the unit. Along the lower left of the unit are the four radio RF interface ports. Across the middle of the unit are the channel priority switch, the input power connector, the power switch, the power indicator, and the four SINCGARS Shipboard Non-Tactical ADP Program (SNAP) ports with their associated fault indicators. On the upper right of the unit is the antenna port.

1.3 Scope

The test descriptions herein provide guidance for the collection of the data required to evaluate the ability of the TD-1456 to provide adequate functionality in the shipboard environment. Emphasis is on the coupling of one frequency-hopping SINCGARS circuit and three single-channel SINCGARS circuits to a single antenna for use in the Type I Navy SINCGARS. Some guidance for optional tests and data is given which could further help evaluate the TD-1456 for other shipboard configurations. The tests are described in terms of objectives and data collection methodology.

1.4 Objectives

The objectives of this testing are to:

1) characterize the bit-error-rate performance of the TD-1456 in the shipboard environment.
2) compare the TD-1456 performance with that of a Type I system using a dedicated frequency-hopping antenna.
3) provide data for subsequent analyses, modeling, and laboratory testing.

2. RESPONSIBILITIES

2.1 Naval Air Warfare Center - Aircraft Division Indianapolis (NAWC-AD Indy)

NAWC-AD Indy will develop and implement the test plan. NAWC-AD Indy will ensure availability of test instrumentation as follows:

Item Description	Uss Saipan Quantity	Comments
Bit-Error-Rate Tester (BERT)	1 EA	Primary means of confirming adequate digital data transfer is a bit-error-rate (BER) <=1%
BERT Interface	1 EA	Translate between BERT and RT signal levels
RT Transmit Keyer	1 EA	Used to activate PTT on SINCGARS RTs
Variable RF Attenuator	1 EA	Used to reduce BERT transmit RT signal level to achieve simulated range reception
Fixed Attenuators	1 LOT	Used as required to set desired RF levels
Connector Adapters.	1 LOT	Used to connect between various connector types
RF Cables	1 LOT	Used as required for interconnection
40dB Dual Coupler	1 EA	Used to sample and combine RF into antenna lead
Handset	2 EA	Used for communication with remote site
Spectrum Analyzer	1 EA	Recording of spectral information

Following completion of the testing, NAWC-AD Indy shall provide a test report discussing results, implications, and recommendations.

2.2 Naval In-Service Engineering Center-East, Charleston (NISE-East Charleston)

NISE-East Charleston shall ensure that the TD-1456s, TD-1289s (fixed-frequency multicouplers), SINCGARS radios and other VHF components are properly installed and in proper working order. NISE-East Charleston shall also provide test coordination with the ships and other test sites.

2.3 Naval Research Laboratory (NRL)

NRL shall provide consultation, guidance, data analyses, and recommendations as required.

3. OVERVIEW OF TESTING

3.1 Equipment Descriptions

The TD-1456 is a frequency-hopping VHF (30MHz to 87.975MHz) multiplexer which combines up to four SINCGARS radios to a single antenna. The TD-1456 was designed for the Army primarily for voice communications and is automatically tuned via the SINCGARS radio SNAP information. The TD-1289 is capable of combining up to five SINCGARS radios to a single antenna but is limited to single-channel operation and must be manually tuned. The AS-3226A and AS-4366 are broadband (30 MHz to 88 MHz) antennas utilized in the system. The AS-3226A is physically identical to its predecessor but extends the upper frequency range from 70MHz to 88MHz and can handle an average power of 800 Watts. The AS-4366 is physically identical to the vehicular AS-3900A except the whip spring is replaced by a rigid collar.

3.2 Testing Scenario

The TD-1456s procured for this testing are development models. A known limitation of these units which is being addressed in the production models is an internal noise problem which can desensitize a receiver. The performance level improves from Port A to Port D as a part of the problem is the routing of some of the cables. To minimize the effects of this limitation on the testing, Port D will be used when receiver measurements are to be made. The noise problem has little effect on the transmit characteristics of the unit. The channel priority was found to significantly lower the performance capabilities of the remaining four channels while affording only a marginal increase in the priority channel performance. As such, only the "Equal" priority setting will be used during this testing.

The performance of the TD-1456 shall be evaluated in the shipboard electromagnetic environment which includes local antenna isolation, broadband noise, and topside intermodulation distortion. The SOI levels from distant transmitters will be simulated locally at the receive antenna terminal. Simulation of SOI levels helps optimize the control over test parameters outside the laboratory. Controllable conditions will be varied to parameterize the achievement of 1% BER.

4. TEST DESCRIPTIONS

4.1 Antenna Isolation

4.1.1 Objective

To establish the isolation between the TD-1456 antenna port and the antenna ports of other VHF multicouplers (TD-1289s). If time and availability for test permits, the isolation to other antennas (HF and UHF) should also be recorded.

4.1.2 Data Required

The transmit power and receive power must be recorded at various frequencies across the band for each antenna pairing.

4.1.3 Test Method

Using the setup of Figure 4.1, measure the power output of the transmit radio at 5MHz frequency spacings across the SINCGARS band. Then connect the transmit radio to a SINCGARS antenna and measure the received power at each of the other SINCGARS antennas. Repeat for each remaining antenna pair.

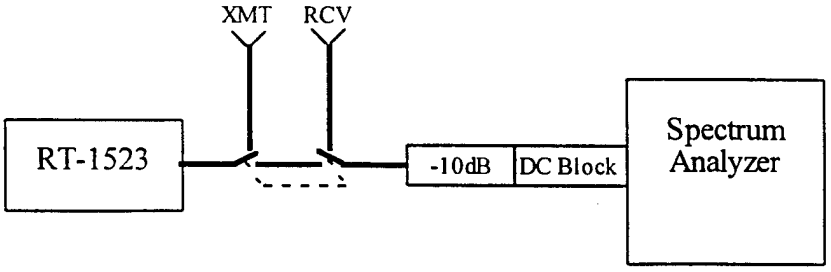

Figure 4.1

4.2 SOI Attenuation Levels

4.2.1 Objective

This test is to establish the required attenuation settings to obtain the desired SOI levels (-20dB through -100db in -10dB increments) at the receive antenna port.

4.2.2 Data Required

The setting of the variable attenuator to achieve each desired SOI level.

4.2.3 Test Method

Using the setup of Figure 4.2, adjust the attenuator to achieve each of the desired SOI levels and record the corresponding attenuation values for each desired level.

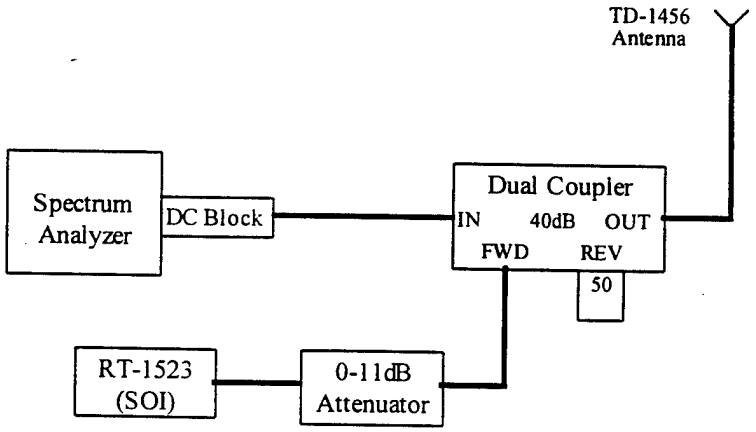

Figure 4.2

4.3 SINCGARS FH Mode Baseline Performance (No TD-1456)

4.3.1 Objective

This test series is designed to determine the BER corresponding to various SOI levels and numbers of interfering radios for the FH mode receive radio connected directly to the frequency-hopping antenna. All radios will be operating at 16 kbps with all but the SOI receiver/transmitter pair in SC mode.

4.3.2 Data Required

The bit-error-rate (BER) shall be recorded for each combination of SOI level and interferers.

4.3.3 Test Method

Using the setup in Figure 4.3, activate the PTT of a combination of interferers and check the BER for each level of attenuation for the desired SOI levels. The combinations are up to the tester but must include no interferers, each individual interferer going through the TD-1456, all interferers going through the TD-1456, one individual interferer on each remaining multicoupler

in turn, and all possible interferers. The BER measurement will consist of six consecutive measurements which will be averaged together.

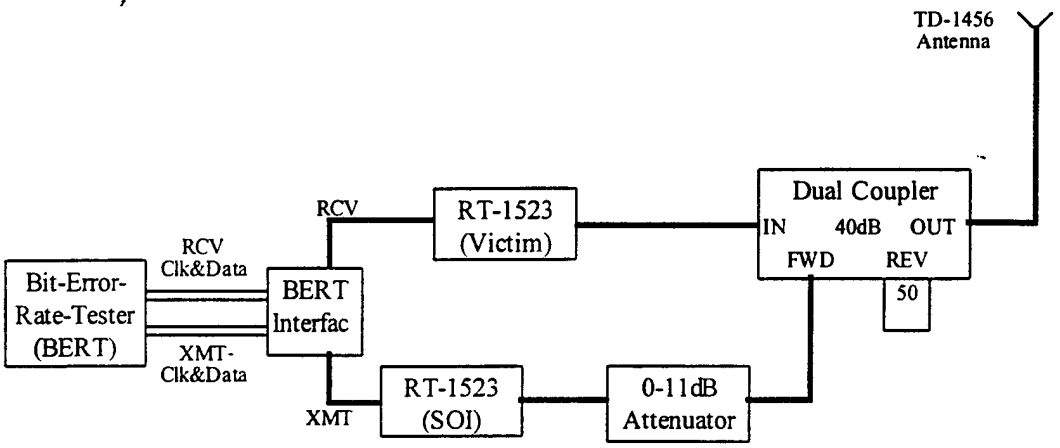

Figure 4.3

4.4 SINCGARS FH Mode Performance With the TD-1456

4.4.1 Objective

This test series is designed to determine the BER corresponding to various SOI levels and numbers of interfering radios for the FH mode receive radio connected through the TD-1456 to the frequency-hopping antenna. All radios will be operating at 16 kbps with all but the SOI receiver/transmitter pair in SC mode.

4.4.2 Data Required

The bit-error-rate (BER) shall be recorded for each combination of SOI level and interferers.

4.4.3 Test Method

Using the setup in Figure 4.4, activate the PTT of a combination of interferers and check the BER for each level of attenuation for the desired SOI levels. The combinations are up to the tester but must include no interferers, each individual interferer going through the TD-1456, all interferers going through the TD-1456, one individual interferer on each remaining multicoupler in turn, and all possible interferers. The BER measurement will consist of six consecutive measurements which will be averaged together.

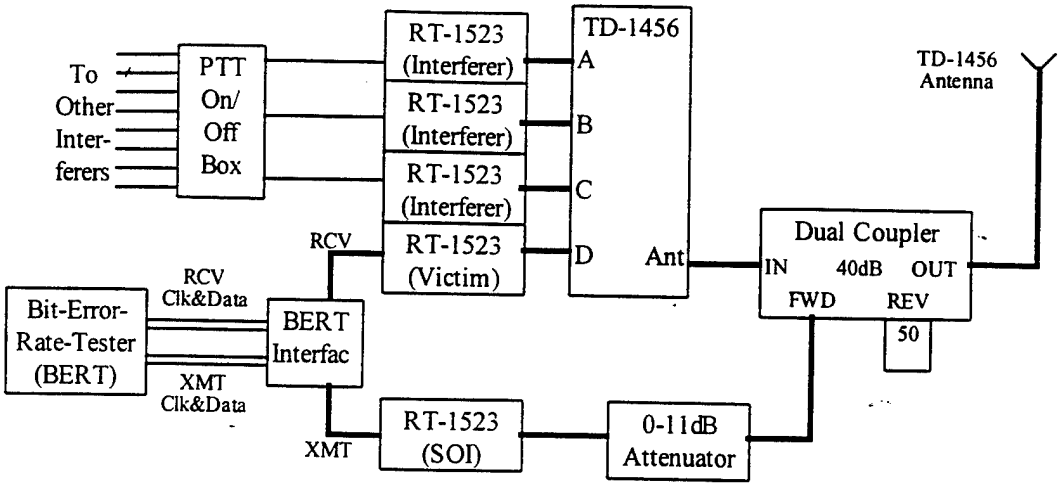

Figure 4.4

5. OPTIONAL TESTS

The test operator is encouraged to perform these additional tests as time and resources permit. The importance of these tests increases as the primary performance results decrease. As such, these tests may be used as a means of parameterizing the points at which the desired BER is achieved. The data collected and the test methods should be similar to those described in section 4.4.

5.1.1 Alternate Data Rates

This test involves the same measurements described in the performance tests except that the radios are set for an alternative data rate. The rate of most interest would be 4.8kbps.

5.1.2 Interferer Duty Cycle

This test involves the same measurements described in the performance tests except that the radios are set to transmit at various duty cycles. This can best be used where the desired BER is not achieved with the current number of interferers.

5.1.3 Four frequency-hoppers (expect poor performance)

During this set of measurements all four RTs connected to the TD-1456 will be set for frequency-hopping mode. This will require four different hopsets (or at least modification of net Ids). This mode is of interest because it simulates an SRC-54 installation of Type 2 (three to four frequency-hoppers). It is expected that the large number of transmitting frequency-hopping circuits will make achieving the desired BER difficult if not impossible. The data collected, however, may be useful in finding a solution for this type installation.

5.1.4 SC Mode BER with One FH Mode Interferer in TD-1456

In this test the SOI pair are set to operate in SC mode while one of the interferers in the TD-1456 is in FH mode. This will allow the analysis of the FH effect on the other SC channels passing through the TD-1456.

5.1.5 Four SC Mode Radios Through the TD-1456

During this test all four radios connected to the TD-1456 will be set to single-channel mode. This mode will cover many installations where there are no frequency-hopping circuits required. In general it is expected that the performance here will only improve over the single frequency-hopper scenario.

5.1.6 SINCGARS Performance Through the TD-1289

Connecting the SOI victim to a TD-1289 and operating in the SC mode, repeat the data and collection method of the performance tests described in section 4.4. This will provide a comparison of TD-1456 and TD-1289 performance.

6. RELATIONSHIP TO DT TESTING

As the TD-1456 will be installed in the operational SINCGARS suite aboard the DT ships, it will likely be involved in that testing. Those tests will focus on operational aspects of the system as a whole. Any concerns or comments about the TD-1456 performance should be addressed in the DT report. Inclusion of such information in the report for this testing is dependent on the availability of the DT data to the report writer.

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APPENDIX B

AN/SRC-54 Shipboard SINCGARS Performance Status

AN/SRC-54 SHIPBOARD SINCGARS PERFORMANCE STATUS

		WASP	WHIDBEY ISLAND	SHREVEPORT	NASSAU	ASHLAND	SAIPAN	TOTAL
A.	TOTAL NO. PLATFORMS W/SINCGARS	1	1	1	1	1	1	6
B.	TOTAL NO. RT-1730's INSTALLED	12	9	9	2	2	12	46
C.	TOTAL RT-1730 OPERATIONAL HRS	29,783.7	14,069.0	20,286	MTRs NOT INSTALLED	17716	MTRs NOT INSTALLED	
D.	AVG RT-1730 OPERATIONAL HRS	2,481.9	1,563.2	2,254	"	5905	"	
E.	TOTAL EST HRS DAILY VOICE COMMS	48	96	NOTE 6	NOTE 11	8	00	
F.	TOTAL EST HRS DAILY DATA COMMS	N/A	12	"	N/A	N/A	00	
G.	PERCENTAGE OPERATION CLEAR MODE	50%	44%	30%	100%	NOTE 20	00	
H.	PERCENTAGE OPERATION SECURE MODE	50%	56%	70%	NOTE 12	NOTE 20	00	
I.	IMBEDDED COMSEC OR KY-58/SAS	KY-58	KY-58	KY-58	NOTE 13	NOTE 20	KY-58	
J.	MAX OBSERVED COMMS RANGE SHIP-SHIP	18 NM	1 NM	NTR	10-12 NM	16-17 NM	NONE	
K.	MAX OBSERVED COMMS RANGE SHIP-SHORE	14 NM	18 NM	23 NM	10-12 NM	16-17 NM	NONE	
L.	OBSERVED/SUSPECTED SOURCES OF RFI	NONE	NONE	FREQS WITHIN 5 MHZ	NONE	NONE	NONE	
M.	PLATFORMS HAVING USED FH MODE	NO	NO	NO	NOT AVAIL	NOT AVAIL	NO	
N.	SYSTEM FAILURES	NONE	NONE	NONE	NONE	NOTE 21	N/A	
O.	REPLACEMENT PARTS/APL ADEQUACY	NOTE 1	ADEQUATE	5 MHZ NOTE 7	NOTE 7	NOTE 21	N/A	
P.	ADEQUACY OF BIT IDENTIFYING FAILURES	OUTSTANDING	NTR	NTR	NOT USED	NOT USED	N/A	

		WASP	WHIDBEY ISLAND	SHREVEPORT	NASSAU	ASHLAND	SAIPAN
Q.	PMS, OPERATOR/MAINT MANUALS ADEQUACY	NOTE 2	SUFFICIENT	NOTE 8	NOTE 14	NOTE 22	NOTE 18
R.	ADEQUACY OF OJT TRAINING	NOTE 3	SUFFICIENT	NOTE 9	NOTE 15	NOTE 23	EXCELLENT
S.	EVIDENCE OF SYSTEM INCOMPATIBILITIES	NONE	NONE	NONE	NOTE 16	NOTE 24	NONE
T.	OBSERVED SAFETY HAZARDS	NONE	NONE	NONE	NONE	NONE	NONE
U.	SYSTEM PERFORMANCE COMPARED TO VRC-46	NOTE 4	NOTE 5	NOTE 10	NOTE 17	NOTE 25	NOTE 19

NOTE 1: NO REPLACEMENT PARTS ON-BOARD/PRELIMINARY APL NOT COMPREHENSIVE.

NOTE 2: EXCELLENT MAINT MANUALS, GOOD OPERATOR MANUALS.
STEP BY STEP CHECKLISTS REQUIRED TO CARRY OUT BASIC OPERATOR FUNCTIONS.

NOTE 3: REQUIRES MORE DETAILED INITIAL TRAINING PACKAGE - PARTICULARLY TUNING PROCEDURES.

NOTE 4: LESS MAINTENANCE REQUIRED THAN FOR VRC-46.
SINCGARS GETS LESS RANGE DUE TO POWER SETTINGS, BUT SETTINGS ARE MORE FLEXIBLE IF MAX RANGE IS NOT A REQUIREMENT.
PROPER TUNING IS MORE DIFFICULT TO ACHIEVE WHEN WORKING WITH FREQUENICIES TOO CLOSE TOGETHER - ANTENNA COUPLER REDESING TO LIMIT RT UNITS TO 2 PER ANTENNA MAY SOLVE THIS PROBLEM.
SHIP HAS NO AUTOMATED INTERFACE TO TAKE ADVANTAGE OF EMBEDDED CRYPTO.
OVERALL IMPRESSEION OF SINCGARS SYSTEM IS FAVORABLE.

NOTE 5: TUNING AND RECEIVER OPERATION MORE RELIABLE.

NOTE 6: SRC-54's IN CONSTANT USE WHEN WITHIN RANGE.

NOTE 7: NO REPLACEMENT PARTS HELD ON BOARD ; OR AVAILABLE TO SHIPS FORCE

NOTE 8: PRESENTLY HAVE ALL PMS/MAINT. MANUALS ON BOARD

NOTE 9: OPERATOR TRAINING NEEDED

NOTE 10: SINGARS RADIO'S, SINCE INSTALLATION, HAVE SHOWN TO BE MORE RELIABLE AND DURABLE THAN VRC-46'S

NOTE 11: 2 HRS FOR EACH RADIO DURING AMMO ONLOAD/TSTA I FTG UNDERWAY PERIOD 09-14 JAN 96, 22-31 JAN 96. TRANSCEIVERS OPERATED ON BOAT 'A'/ BOAT 'B' UNSECURE CRKTS.

NOTE 12: USED DURING TESTING AND INSTALLATION ONLY

NOTE 13: USED INSTALLED KY-58'S, WHICH PROVIDE ADEQUATE SUPPORT. DO NOT RECOMMEND USE OF EMBEDDED CRYPTO, DUE TO LOGISTICS/SECURITY ISSUE (TRANSPORT OF KEYMAT BETWEEN SPACES, TRANSCEIVER LOCKING FRAMES AND S & G 6720 LOCK REQUIREMENT

NOTE 14: FINAL TECH. MAN. DUE 2QFY96; PMS COVERAGE NOT PROVIDED, NO CONFIGURATION CHANGE SUBMITTED; OPERATOR CARDS PROVIDED TO TECH.

NOTE 15: NAVY INTERACTIVE COMPUTER/CD ROM TRAINING DEVELOPED BUT NOT CURRENTLY AVAILABLE. OJT TRAINING CONSIDERED ADEQUATE. HIGHLY RECOMMEND IMPLEMENTING INTERACTIVE TRAINING.

NOTE 16: YES - ONE AN/SRC-54 WAS INSTALLED/ WIRED TO THE RED SA-2112 AND OPERATED CORRECTLY. THE SECOND AN/SRC-54 WAS WIRED TO THE BLACK SA-2112 AND DID NOT OPERATE WITH EXTERNAL KY-58/TSEC EQUIP. SHIPS FORCE MOVEDUNIT FROM THE BLACK TO RED SA-2112 AND OPERATIONS WERE SATISFACTORY.

NOTE 17:
1) AN/SRC-54 IS MORE RELIABLE AND DOES NOT REQUIRE AS MANY MECHANICAL ADJUSTMENTS TO OPERATE.
2) EXPERIENCED ZERO CASUALTIES DURING MARG 1-95. EQUIP WAS POWEREDUP DURING ENTIRE DEPLOYMENT (100% AVAIL)
3) STRONGLY RECOMMEND REPLACEMENT OF NASSAU'S REMAINING THIRTEEN (13) AN/VRC-46 EQUIPMENT WITH AN/SRC-54'S TO BETTER SUPPORT BLUE/GREEN MISSIONS.
4) RECOMMEND STANDARD INSTALLATION INCLUDE A MINIMUM OF TWO(2) AN/SRC-54 UNITS WITH FH CAPABILITY.
5) RECOMMEND REPLACEMENT OF AN/SRA-60 MULTICOUPLER WITH STATE-OF-THE-ART MULTICOUPLER THATALLOWS FH CAPABILITY

NOTE 18: ONLY PRELIMINARY PMS ONBOARD, OPERATORS MANUALS AVAIL., NO MAINTENANCE TECH. MAN. HELD

NOTE 19: THE AN/SRC-54 IS RELIABLE AND EASIER TO TUNE AND OPERATE.
****** NO VHF CRKTS ACTIVE. THE SRC-54'S PRIMARY USE IS FOR MARINE FORCES.
PRESENTLY, THERE ARE NONE ON BOARD ******
EQUIP. ON LINE (PWR ON) 416 HRS TO DATE

NOTE 20: 030670A - 98% PLAIN/CLEAR; 2% SECURE (KY-58)
018708A - 98% PLAIN/CLEAR; 2% SECURE (EMBEDDED)
020946A - 0% PLAIN/CLEAR; 0% SECURE

NOTE 21: REPLACEMENT PARTS AVAILABILITY: HAD TO CASREP AND CONTACT NISEEAST TO HAVE PARTS SENT TO ASHLAND DURING UNITAS 35-94 DEPLOYMENT IN JULY 1994. APL ADEQUACY: ORIG'S SINCGARS INSTALLED MAR 94 FOR OP EVAL. NO EXISTING APL SUPPORT.

NOTE 22: PRELIMINARY MAINTENANCE MANUALS WERE CONDSIDERED INCOMPLETE, WITH INADEQUATE SCHEMATICS, REDUCING SIGNIFICANTLY SF CAPABILITY TO TROUBLESHOOT. PMS COVERAGE RECEIVED IN SFR 2-95. CONDUCTED LIGHT OFF CHECKS FROM TECH AS WELL AS QUARTERLY POWER OUT CHECKS TO MONITOR RELIABILITY OF AMPLIFERS PRIOR TO RECEIVING PMS COVERAGE.

NOTE 23: OJT SF RCVD WAS ADEQUATE FOR EXPERIENCED TECHS. FOR INEXPERIENCED TECHS, RECOMMEND 1-2 WEEK COURSE TAUGHT AT FTSCLANT OR 'C' SCHOOL INTERFACED WITH KY-58 AND SAS, AND STAND ALONE WITH SAS.

NOTE 24: A PROBLEM WITH INTERFACE OF SINCGARS (EMBEDDED CRYPTO) UNIT AND SAS WAS DISCOVERED DURING CSRR. WHILE INTERFACED WITH SAS, CYHPER LIGHT ON TA-970 WILL NOT LIGHT WHEN IN CYPHER MODE. SINCGARS HAS OPERATED SATISFACTORILY WITH BOTH AN/VRC-46 AND PRC-77 TRANSCIEVERS.

NOTE 25: SINCGARS IS A DEFINITE IMPROVEMENT OVER THE AN/VRC-46. THE DOWN TIME, MAINTENANCE TIME, AND MAINTAINABILITY COSTS FOR SINCGARS IS NEGLIGIBILE WHEN COMPARED TO THE AN/VRC-46. SINCGARS IS TRULY A "PATCH AND FORGET SYSTEM"

****** PROBLEMS OCCURED DURING OPERATION EVALUATION ******

USS WHIDBEY ISLAND - DURING OPERABILITY TESTS AN/SRC-54 NO. 6 WAS FOUND TO HAVE NO PRIMARY POWER. TROUBLESHOOTING REVEALED AMPLIFIER ADAPTER AM/7516 TO HAVE A FAULTY POWER SUPPLY. REPAIR PART NOT AVAILABLE

WITHIN ARG. IMPACT ONE OF NINE VHF SINCGARS TRANSCEIVERS OOC. ABLE TO MEET ALL MISSION REQUIREMENTS. NO JAGMAN DEEMED NECESSARY.
REPAIR SYSTEM WHILE AWAITING DELIVERY OF DL01. DL01 NOT RECEIVED. REQUIRE DL01 TO EFFECT REPAIR TO AM-7516 AMPLFIER ADAPTER AND REIMBURSE NISEEAST DET NORVA. MILSTRIP REQN TO REMAIN OUTSTANDING. 10 MANHOURS TO CORRECT. FIRST FAILURE THIS EQUIPMENT, CONTINUOUS USE UNDERWAY. OPTEST SAT. PROBLEM WAS AS FIRST IDENTIFIED. DID NOT GROW INTO CASCADING PARTS PROBLEM. NO NEC THIS EQUIPMENT, TECH TRAINING PROVIDED THRU NISEEAST BY TEXCOM INC. CORRECT APL WAS AVAILABLE.

USS SHREVEPORT - 21 DAYS DELAY IN RECEIPT OF PARTS-TECH ASSIST. 8 HOURS TO CORRECT CASUALTY. UNKNOWN DAYS SINCE LAST FAILURE. INTERMITTENT USE.
OPTEST SAT. CASUALTY WAS AS FIRST IDENTIFIED. CORRECT APL WAS AVAILABLE. CASUALTY DID NOT CASCADE INTO PARTS PROBLEM. PROPER NEC NOT AVAILABLE. OUTSIDE TECH ASSIST PROVIDEDBY MILCOM. TECH ASSIST ONBOARD ONE DAY AND CORRECTED CASUALTY.

APPENDIX C

DT-IIB Situation Reports (SITREPs) 1 - 5

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For Jim Key -
Sit Reps #1 & 2
+
Freq Ext Msg.

Bob

Pg 1 of 6

PRIORITY

P 261905Z APR 96

FM USS SAIPAN

TO COMSPAWARSYSCOM WASHINGTON DC//PMW 176-21G//

INFO COMOPTEVFOR NORFOLK VA//N3/N4/N5/N6/N8//
NISEEAST CHARLESTON SC//431TT/532//

UNCLAS //N03965//

MSGID//GENADMIN/USS SIAPAN/-/APR//

SUBJ/CNO PROJECT 0706-01 AND 0706-02 NAVY SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS) DT-IIB TECHNICAL EVALUATION SITREP NO. 1//

REF/A/DOC/TEMP 0706-01

REF/B/DOC/TEMP 0706-02

REF/C/DOC/TP 0706-01

REF/D/DOC/TP 0706-02

NARR/REFS A AND B ARE TEST AND EVALUATION MASTER PLANS (TEMPS) FOR NAVY SINCGARS SHIPMENT (AN/SRC-54) AND AIRBORNE RELAY SEGMENT (AN/ARQ-53) RESPECTIVELY. REFS C AND D ARE TEST PLANS (TP) FOR THE AN/SRC-54 AND AN/ARQ-53 RESPECTIVELY.//
POC/V. KOPEK/TEST DIRECTOR/NISEEAST (532VK)/-/TEL: (804) 445-6422 TEL:DSN 961-6422 EXT 322/FAX (804) 487-7349//

RMKS/1. THE FOLLOWING SYSTEM PERFORMANCE DATA IS PROVIDED IAW REFS A THRU D.

2. NAVY SINCGARS DT-IIB PROGRESS/STATUS AS OF 26:0600Z APR 96
2.A. AN/SRC-54 EFFECTIVENESS TESTS (E-TESTS):
2.A.1. RANGE (TEST E-1): 40NMI SHIP-SHIP BETWEEN [illegible] AND C IN SC AND FH MODES EACH IN PT AND CT. ERF WAS NISC ACCOMPLISHED AT THIS RANGE.
2.A.2. SURVIVABILITY (TEST E-2): NO PROBLEM ENCOUNTERED.

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Date In: 04/29/96

261905Z APR 96
Time In: 02:04:07

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2.A.3. ELECTROMAGNETIC COMPATIBILITY (TEST E-3): NO PROBLEM EN NTERED.

2.B. AN/SRC-54 SUITABILITY TESTS (S-TESTS)

2.B.1. RELIABILITY (TEST S-1): NO PROBLEM ENCOUNTERED

2.B.2. MAINTAINABILITY (TEST S-2): NO PROBLEM ENCOUNTERED

2.B.3. AVAILABILITY (TEST S-3): 100 PERCENT

2.B.4. LOGISTIC SUPPORTABILITY (TEST S-4): NO PROBLEM ENCOUNTERED

2.B.5. COMPATIBILITY (TEST S-5): NO PROBLEM ENCOUNTERED

2.B.6. INTEROPERABILITY(TEST S-6): NO PROBLEM ENCOUNTERED

2.B.7. TRAINING (TEST S-7): OJT ONGOING

2.B.8. HUMAN FACTORS (TEST S-8): NO PROBLEM ENCOUNTERED

2.B.9. SAFETY (TEST S-9): NO PROBLEM ENCOUNTERED

2.B.10. DOCUMENTATION (TEST S-10): NO PROBLEM ENCOUNTERED

3. TEST DIRECTOR COMMENTS: ARQ-53 RELAY TESTING FOR PERIOD OF 27 THRU 30 APRIL 96 TERMINATED DUE TO CHANGE IN SCHEDULE OF SHIP A. RELAY HAS BEEN REMOVED FM SHIP A PENDING AVAILABILITY FOR ADDL TESTING.

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2.A.2. SURVIVABILITY (TEST E-2): NO PROBLEM ENCOUNTERED.
2.A.3. ELECTROMAGNETIC COMPATIBILITY (TEST E-3): NO PROBLEM ENCOUNTERED.
2.B. AN/SRC-54 SUITABILITY TESTS (S-TESTS)
2.B.1. RELIABILITY (TEST S-1): NO PROBLEM ENCOUNTERED
2.B.2. MAINTAINABILITY (TEST S-2): NO PROBLEM ENCOUNTERED
2.B.3. AVAILABILITY (TEST S-3): 100 PERCENT
2.B.4. LOGISTIC SUPPORTABILITY (TEST S-4): NO PROBLEM ENCOUNTERED
2.B.5. COMPATIBILITY (TEST S-5): NO PROBLEM ENCOUNTERED
2.B.6. INTEROPERABILITY(TEST S-6): NO PROBLEM ENCOUNTERED
2.B.7. TRAINING (TEST S-7): OJT ONGOING
2.B.8. HUMAN FACTORS (TEST S-8): NO PROBLEM ENCOUNTERED
2.B.9. SAFETY (TEST S-9): NO PROBLEM ENCOUNTERED
2.B.10. DOCUMENTATION (TEST S-10): NO PROBLEM ENCOUNTERED

3. TEST DIRECTOR COMMENTS: EXAMINING POSSIBILITY FOR ARQ-53 RELAY TEST ON 14 MAY 96 BETWEEN FT STORY AND SHIPS AT SEA. RELAY IS CURRENTLY LOCATED AT NISE EAST DET NORFOLK PENDING AVAILABILITY FOR TEST.

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Date In: 04/29/96

Time In: 08:26:47

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SEMCOR, INC. 001/002

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PRIORITY . ROUTINE

P F)1900Z APR 96

FM USS SAIPAN

TO COMSPAWARSYSCOM WASHINGTON DC//PMW 176-21G//

INFO COMOPTEVFOR NORFOLK VA//N3/N4/N5/N6/N8//
NISEEAST CHARLESTON SC//431TT/532//

UNCLAS //N03965//

MSGID//GENADMIN/USS SAIPAN/-/APR//

SUBJ/CNO PROJECT 0706-01 AND 0706-02 NAVY SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS) DT-IIB TECHNICAL EVALUATION SITREP NO. 3//

REF/A/DOC/TEMP 0706-01

REF/B/DOC/TEMP 0706-02

REF/C/DOC/TP 0706-01

REF DOC/TP 0706-02

NARR/REFS A AND B ARE TEST AND EVALUATION MASTER PLANS (TEMPS) FOR NAVY SINCGARS SHIPMENT (AN/SRC-54) AND AIRBORNE RELAY SEGMENT (AN/ARQ-53) RESPECTIVELY. REFS C AND D ARE TEST PLANS (TP) FOR THE AN/SRC-54 AND AN/ARQ-53 RESPECTIVELY.//
POC/V. KOPEK/TEST DIRECTOR/NISEEAST (532VK)/-/TEL: (804)485-6422
TEL:DSN 961-6422 EXT 322/FAX (804) 487-7348//

RMKS/1. THE FOLLOWING SYSTEM PERFORMANCE ... PROVIDED IAW REFS A THRU D.

2. NAVY SINCGARS DT-IIB PROGRESS/STATUS AS OF 301700Z APR 96
2.A. AN/SRC-54 EFFECTIVENESS TESTS (E-TESTS).
2.A.1. RANGE (TEST E-1): 20 TO 42 NMI SHIP-SHIP ... 28 TO 35 NMI SHIP-SHORE. COMMS ACCOMPLISHED IN SC AND FH MODES, EACH IN PT AND CT. ERF ACCOMPLISHED AT 28 NMI. SHORE ... IS AN/VRC-90A WITH 50W OUTPUT. 10 TO 12 NMI SHORE-SHIP WHEN SHORE IN HI AND MED POWER OUTPUT RANGES.

for Jim Key
-Rept #3

PG 1 of 2

Post-it® Fax Note 7671

Date		Pages	
To	B. DREWS	From	
Co./Dept.	VITRO	Co.	
Phone #	(703) 553-1967	Phone #	
Fax #	(703) 553-1424	Fax #	

/122
Date In: 05/01/96

301900Z APR 96
Time In: 06:15:16

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2.A.2. SURVIVABILITY (TEST E-2): NO PROBLEM ENCOUNTERED.
2.A.3. ELECTROMAGNETIC COMPATIBILITY (TEST E-3): NO PROBLEM ENCOUNTERED.
2.B. AN/SRC-54 SUITABILITY TESTS (S-TESTS)
2.B.1. RELIABILITY (TEST S-1): NO PROBLEM ENCOUNTERED
2.B.2. MAINTAINABILITY (TEST S-2): NO PROBLEM ENCOUNTERED
2.B.3. AVAILABILITY (TEST S-3): 100 PERCENT
2.B.4. LOGISTIC SUPPORTABILITY (TEST S-4): NO PROBLEM ENCOUNTERED
2.B.5. COMPATIBILITY (TEST S-5): NO PROBLEM ENCOUNTERED
2.B.6. INTEROPERABILITY(TEST S-6): NO PROBLEM ENCOUNTERED
2.B.7. TRAINING (TEST S-7): OJT ONGOING
2.B.8. HUMAN FACTORS (TEST S-8): NO PROBLEM ENCOUNTERED
2.B.9. SAFETY (TEST S-9): NO PROBLEM ENCOUNTERED
2.B.10. DOCUMENTATION (TEST S-10): NO PROBLEM ENCOUNTERED

3. TEST DIRECTOR COMMENTS: NONE.

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Date In: 05/01/96

301900Z APR 96

Time In: 06:15

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PRIORITY ROUTINE

R 0317482 MAY 96

FM USS SAIPAN

TO COMSPAWARSYSCOM WASHINGTON DC//PMW 176-210//

INFO COMOPTEVFOR NORFOLK VA//N3/N4/N5/N6/N8//
CTSEEAST CHARLESTON SC//431TT/532//

UNCLAS //N03965//

MSGID//GENADMIN/USS SAIPAN/-/MAY//

SUBJ/CNO PROJECT 0706-01 AND 0706-02 NAVY SINGLE CHANNEL GROUND
/AND AIRBORNE RADIO SYSTEM (SINCGARS) DT-IIB TECHNICAL EVALUATION
/SITREP NO. 4//

REF/A/DOC/TEMP 0706-01

REF/B/DOC/TEMP 0706-02

REF/C/DOC/TP 0706-01

REF/D/DOC/TP 0706-02

NARR/REFS A AND B ARE TEST AND EVALUATION MASTER PLANS (TEMPS)
FOR NAVY SINCGARS SHIPBOARD (AN/SRC-54) AND AIRBORNE RELAY SEGMENT
(AN/ARQ-53) RESPECTIVELY. REFS C AND D ARE TEST PLANS (TP) FOR
THE AN/SRC-54 AND AN/ARQ-53 RESPECTIVELY.//
POC/V. KOPEK/TEST DIRECTOR/CTSEEAST (532VK)/-/TEL: (804)485-6422
/TEL:DSN 961-6422 FAX/TEL: (804) 487-7349//

RMKS/1. THE FOLLOWING SYSTEM PERFORMANCE DATA IS PROVIDED IAW
REFS A THRU D.

2. NAVY SINCGARS DT-IIB PROGRESS/STATUS AS OF 021700Z MAY 96
2.A. AN/SRC-54 SHIPBOARD TESTS (S-TESTS):
2.A.1. RANGE (TEST S-1): TO 20 NMI SHIP-SHIP ACCOMPLISHED
SINCE LAST SITREP. [illegible] ACCOMPLISHED IN SC PT AND CT INCLUDING
USE OF OK-637 SINCGARS [illegible] UNITS.
2.A.2. SURVIVABILITY (TEST S-2): NO PROBLEM ENCOUNTERED.

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.A.3. ELECTROMAGNETIC COMPATIBILITY (TEST E-3): NO PROBLEM
NCOUNTERED.
.B. AN/SRC-54 SUITABILITY TESTS (S-TESTS)
.B.1. RELIABILITY (TEST S-1): 13,020 HRS OF OPERATION
CCUMULATED FOR DT-IIB TEST PLATFORMS.
.B.2. MAINTAINABILITY (TEST S-2): NO PROBLEM ENCOUNTERED.
.B.3. AVAILABILITY (TEST S-3): 100 PERCENT.
.B.4. LOGISTIC SUPPORTABILITY (TEST S-4): AN/SRC-54 PMS, GPETE,
LSP, ULSS, NTP, IS ON HAND ON ALL DT-IIB SHIPS.
.B.5. COMPATIBILITY (TEST S-5): SYSTEM COMPATIBLE WITH SAS/BAS
ND KY-58'S. SHIPS COOLING SYSTEMS CONTINUE TO SUPPORT SYSTEM
PERATION.
.B.6. INTEROPERABILITY(TEST S-6): SYSTEM HAS SUCCESSFULLY
OMMUNICATED WITH AN/VRC-12 FAMILY ON LCU'S AND VHF EQUIPMENT ON
CAC'S IN SC VOICE AND SC/FK CT AND PT VOICE WITH SINCGARS
N/VRC-90A.
.B.7. TRAINING (TEST S-7): OJT ONGOING, 17 HRS TO DATE.
.B.8. HUMAN FACTORS (TEST S-8): POSITIVE INFORMAL COMMENTS
ECEIVED FM EMBARKED MARINES CONCERNING OK-637 AND EASE OF
ONTROLLING AND MONITORING THEIR COMM CKTS. HUMAN FACTORS
UESTIONNAIRES HAVE BEEN PROVIDED TO PERSONNEL ON SHIPS B AND C.
.B.9. SAFETY (TEST S-9): NO PROBLEM ENCOUNTERED.
.B.10. DOCUMENTATION (TEST S-10): NO PROBLEM ENCOUNTERED.

. TEST DIRECTOR COMMENTS: EMBARKED MARINES HAVE INFORMALLY
EQUESTED TEST DIRECTOR TO INVESTIGATE MEANS OF PROVIDING REMOTE
INCGARS CAPABILITIES TO EMBARKED COMMANDER STATEROOM.
ADDITIONAL OK-637 IS RECOMMENDED FOR DEBARK CONTROL FOR MORE
FFICIENT USE OF RADIO ASSETS.

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IORITY ROUTINE

R 050030Z MAY 96

4 USS SAIPAN

3 COMSPAWARSYSCOM WASHINGTON DC//PMW 176-21G//

NFO COMOPTEVFOR NORFOLK VA//N3/N4/N5/N6/N8//
ISEEAST CHARLESTON SC//431TT/532//

NCLAS //N03965//

SGID//GENADMIN/USS SAIPAN/-/MAY//

UBJ/CNO PROJECT 0706-01 AND 0706-02 NAVY SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS) DT-IIB TECHNICAL EVALUATION SITREP NO. 5//

EF/A/DOC/TEMP 0706-01

EF/B/DOC/TEMP 0706-02

EF/C/DOC/TP 0706-01

EF/D/DOC/TP 0706-02

NARR/REFS A AND B ARE TEST AND EVALUATION MASTER PLANS (TEMPS) FOR NAVY SINCGARS SHIPMENT (AN/SRC-54) AND AIRBORNE RELAY SEGMENT (AN/ARQ-53) RESPECTIVELY. REFS C AND D ARE TEST PLANS (TP) FOR THE AN/SRC-54 AND AN/ARQ-53 RESPECTIVELY.//
POC/V. HOPER/TEST DIRECTOR/NISEEAST (532VK)/-/TEL: (804)485-6422 /TEL:DSN 961-6422 EXT 322/FAX (804) 487-7349//

RMKS/1. THE FOLLOWING SYSTEM PERFORMANCE DATA IS PROVIDED IAW REFS A THRU D.

2. NAVY SINCGARS DT-IIB PROGRESS/STATUS AS OF 041900Z MAY 96
2.A. AN/SRC-54 EFFECTIVENESS TESTS (E-TESTS):
2.A.1. RANGE (TEST E-1): 21 NMI SHIP-SHIP AND 17 NMI SHIP-SHORE WITH AN/PRC-119 ON SHORE ACCOMPLISHED SINCE LAST SITREP. COMMS DEMONSTRATED IN SC FL AND CT INCLUDING USE OF GX-637 REMOTE UNITS.

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A.2. SURVIVABILITY (TEST E-2): NO PROBLEM ENCOUNTERED.
A.3. ELECTROMAGNETIC COMPATIBILITY (TEST E-3): NO PROBLEM
ICOUNTERED.
B. AN/SRC-54 SUITABILITY TESTS (S-TESTS)
.B.1. RELIABILITY (TEST S-1): 14,820 HRS OF OPERATION
:CUMULATED FOR DT-IIB TEST PLATFORMS.
.B.2. MAINTAINABILITY (TEST S-2): NO PROBLEM ENCOUNTERED.
.B.3. AVAILABILITY (TEST S-3): 100 PERCENT.
.B.4. LOGISTIC SUPPORTABILITY (TEST S-4): AN/SRC-54 AND AN/ARQ-
3 PMS, GPETE, ILSP, ULSS, NTP, ARE ON HAND ON ALL DT-IIB SHIPS.
.B.5. COMPATIBILITY (TEST S-5): SYSTEM COMPATIBLE WITH SAS/BAS
ND KY-58'S. SHIPS COOLING SYSTEMS CONTINUE TO SUPPORT SYSTEM
PERATION.
.B.6. INTEROPERABILITY(TEST S-6): COMMS CONTINUE TO
UCCESSFULLY COMMUNICATE WITH AN/VRC-12 FAMILY ON LCU'S, AN/PRC-
19 MANPACK, AND LCAC VHF EQUIPMENT IN SC VOICE IN FT AND CT.
C/FH CT AND PT VOICE ESTABLISHED WITH AN/VRC-90A AND OTHER
N/SRC-54'S.
.B.7. TRAINING (TEST S-7): OJT ONGOING, 24 HRS TO DATE.
.B.8. HUMAN FACTORS (TEST S-8): HUMAN FACTORS QUESTIONNAIRES
AVE BEEN PROVIDED TO PERSONNEL ON ALL THREE DT-IIB PLATFORMS.
.B.9. SAFETY (TEST S-9): NO PROBLEM ENCOUNTERED.
.B.10. DOCUMENTATION (TEST S-10): NO PROBLEM ENCOUNTERED.

. TEST DIRECTOR COMMENTS: POTENTIAL SOLUTION TO SUPPORT U.S.
ARINE REQUESTS FOR REMOTE SINCGARS CAPABILITIES TO EMBARKED
OMMANDER AND DEBARK CONTROL MAY BE THE ARMY SINCGARS CONTROL
ONITOR. INVESTIGATION ONGOING.

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