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Date: June 2011 **MIP** 4560 **MRC:** 61 FNEY N **Periodicity:** R-2W
Series:

Location:

Ship System: Surveillance Systems 450
System: Multiple Mode/Function Radar 456
SubSystem: Radar, Multiple Mode AN/SPY-1A/B/B(V)/D/D(V) 45601
Equipment: Transmitter Groups OT-102, OT-130, OT-156, OT-146, OT-188

Rates	Man- Hours	Rates	Man- Hours	Rates	Man- Hours
FC2 1119/1113	1.0	FC3 1119/1113	1.0		
Total Man- Hours:	2.0	Elapsed Time:	1.0		

MAINTENANCE REQUIREMENT DESCRIPTION

1. Perform Transmitter Phase and Power Tests.
 2. Evaluate Collected Data.
 3. Perform Transmitter Phase and Power Tests (SPY-1D, SPY-1D(V)).
 4. Evaluate Collected Data (SPY-1D, SPY-1D(V)).
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SAFETY PRECAUTIONS

1. Forces afloat comply with NAVOSH Program Manual for Forces Afloat, OPNAVINST 5100.19 series; shore activities comply with NAVOSH Program Manual, OPNAVINST 5100.23 series.
 2. Before radiating, ensure all safety precautions listed in latest CG 47/DDG 51 Class Advisory No. XX-XX: HERP/HERO Guidance and Computer Program Description Document (CPDD) are adhered to.
 3. A potential RF radiation hazard to personnel topside can exist if D/PD phase alignment or quadrature does not meet minimum specification.
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TOOLS, PARTS, MATERIALS, TEST EQUIPMENT**MATERIALS**

1. [02277] Pad, writing paper
2. [02278] Pencil

MISCELLANEOUS

1. [01365] Technical manuals/drawings/forms (Afloat Electronic Spectrum Operations Program (AESOP))
2. [02200] Conditional Related Maintenance MRC (2W-2 (FMVG))
3. [02200] Conditional Related Maintenance MRC (S-4 (FMWE))
4. [02200] Conditional Related Maintenance MRC (S-6 (FUVZ))
5. [02200] Conditional Related Maintenance MRC (R-1 (FMXG))
6. [02200] Conditional Related Maintenance MRC (U-24 (FUSU))
7. [02348] Calculator, electronic, hand-held

NOTE: Numbers in brackets can be referenced to Standard PMS Materials Identification Guide (SPMIG) for identification.

PROCEDURE

NOTE 1 : Accomplish this maintenance requirement when any of the following periodicities or situations occur.
a. While at sea, weekly.

Preliminary

- a. When in-port, ensure MRC R-1 (FMXG) or U-24 (FUSU) (D(V) only) has been accomplished or quadrature/phase alignment meets or exceeds minimum specification prior to performance of this MRC.

NOTE 2 : Observe Afloat Electromagnetic Spectrum Operations Program (AESOP) restrictions for local operating area.

WARNING: Before radiating, ensure all safety precautions listed in latest CG 47/DDG 51 Class Advisory No. XX-XX: HERP/HERO Guidance and Computer Program Description Document (CPDD) are adhered to.

- b. All systems verify the following with Combat System Maintenance Central (CSMC):

NOTE 3 : If ship is running BMD operations, then that is considered the normal operational program for this MR.

- (1) AN/SPY-1() and ORTS have been initialized.
 - (2) Normal operational programs are loaded.
- c. SPY-1A/B(B(V))/D/D(V): man Radar Room No. 2 (No. 5) and request CSMC to enable Remote Data Terminal (RDT) and to establish communication:
- (1) Baseline 3A/6.1/6.3/7.1: ensure TAC/DTS-1 in radar room is enabled as the ORTS MASTER CONSOLE.
- d. From CSMC, obtain permission to radiate high power on desired frequency band N for applicable system arrays.
- e. Ensure transmitter(s) are in REMOTE CONTROL (CIC), in RADIATE, and in HIGH POWER.

NOTE 4 : SPY-1A/B(V) systems, perform steps 1.a. through 1.o. SPY-1B systems, proceed to step 1.p. SPY-1D/D(V), proceed to Maintenance Requirement (MR) 3..

1. Perform Transmitter Phase and Power Tests.

NOTE 5 : For all keyboard entries, wait for cursor to reposition and approximately 3 more seconds to ensure process is completed before continuing with entries.

NOTE 6 : N = 1-9 for bands 1-9; 0= band 10.

- a. At RDT, type IOT/1.12.1.7.9N (forward) or IOT/1.12.3.7.9N (aft); then press PFK 16 and press ENTER. Repeat for all authorized bands.
- b. Type IOT/1.12.2.7.9N (forward) or IOT/1.12.4.7.9N (aft); then press PFK 16 and press ENTER.
- c. Press PFK 10 and press ENTER to print FD reports as needed to perform step 1.n. and MR 2..
- d. Repeat steps 1.a. through 1.c. for all authorized bands.

NOTE 7 : Steps 1.e. through 1.g. reconfigure D/PD for next test.

- e. At A1 control panel for D/PD being inactivated, press LOCAL CONTROL-REMOTE/LOCAL pushbutton for LOCAL. Observe LOCAL indicator is lit.
- f. Press READY pushbutton; observe READY indicator is lit.
- g. At RFM A1 control panel, observe waveguide switch indicators have connected inactivated D/PD to DUMMY LOAD.
- h. Repeat steps 1.a. through 1.d. for next test.

NOTE 8 : Steps 1.i. through 1.k. reconfigure D/PDs for next test.

- i. At A1 control panel of inactive D/PD, press LOCAL CONTROL-RADIATE pushbutton observe RADIATE indicator is lit green before continuing. Then, press REMOTE/LOCAL pushbutton for REMOTE and observe REMOTE indicator is lit.
- j. Repeat steps 1.e. through 1.h.
- k. Return system (forward or aft) under test to readiness condition.
- l. Repeat steps 1.a. through 1.k. for next system (forward or aft) to be tested.
- m. Verify printouts are legible. Darken with pencil as required.
- n. Check status (ST) column on each printout for not tested (NT) notations. Wherever NT appears, check ERR instruction, per table 1.
- o. SPY-1A/B(V) systems proceed to MR 2..
- p. TAC console:
 - (1) At upper left hand corner of screen, under AWS OPERABILITY, point to and select, by left clicking trackball, any one of four SPY array quadrant icons.
 - (2) Observe SPY OPERABILITY Status Display page surfaces.

NOTE 9 : AVERAGE TRANSMIT POWER 1 block is located beneath STBD ARRAY OPERABILITY box; AVERAGE TRANSMIT POWER 2 block is located beneath FWD ARRAY OPERABILITY box, etc.

- (3) Move cursor to AVERAGE TRANSMIT POWER 1 block; right click and hold to surface Tests popup menu; while holding right trackball button, drag cursor to select Tests, then release.
 - (4) Observe TESTS PANEL window is displayed.
 - (5) Select all frequencies by pointing cursor to SELECT ALL box and left clicking trackball. Observe all frequencies in TESTS PANEL window are highlighted.
 - (6) To run test, point cursor to RUN SELECTED TEST(S) and left click. Observe COMMAND VERIFICATION WINDOW is displayed.
 - (7) Observe 1 COMMAND VERIFICATION window for each frequency run.
- q. To print results:
- (1) Left click trackball on OPERATOR SUPPORT icon to display pull down menu.
 - (2) Left click on WINDOW DUMP to print top most window.
 - (3) When window has printed, close window by clicking QUIT.
- r. Repeat step 1.q. to print remaining windows.
- s. When finished printing, select QUIT to close TEST(S) PANEL window and return to SPY OPERABILITY Status Display window.
- t. Repeat steps 1.p.(3) through 1.s. for FWD (AVERAGE TRANSMIT POWER 2), PORT (AVERAGE TRANSMIT POWER 3) and AFT (AVERAGE TRANSMIT POWER 4).

NOTE 10 : Steps 1.u. through 1.w. reconfigure D/PD for next test.

- u. At A1 control panel for D/PD being inactivated, press LOCAL CONTROL-REMOTE/LOCAL pushbutton for LOCAL. Observe LOCAL indicator is lit.
- v. Press READY pushbutton; observe READY indicator is lit.
- w. At RFM A1 control panel, observe waveguide switch indicators have connected inactivated D/PD to DUMMY LOAD.
- x. Repeat steps 1.p.(3) through 1.t. for next test.

NOTE 11 : Steps 1.y. through 1.z. reconfigure D/PDs for next test.

- y. At A1 control panel of inactive D/PD, press LOCAL CONTROL-RADIATE pushbutton and observe RADIATE indicator is lit green before continuing. Then, press REMOTE/LOCAL pushbutton for REMOTE and observe REMOTE indicator is lit.
- z. Repeat steps 1.u. through 1.x.
- aa. Return system (forward or aft) under test to readiness condition.
- ab. Repeat steps 1.p. through 1.aa. for next system (forward or aft) to be tested.
- ac. Verify printouts are legible. Darken with pencil as required.
- ad. Check status (ST) column on each printout for not tested (NT) notations. Wherever NT appears, check ERR instruction, per tables 1 and 2.

Error Code	Reason/Symptom	Operator Action
01	Time out occurred before receipt of dwell return.	Rerun test.
02	Time out occurred before receipt of point response from ORTS.	Rerun test.
03	Test terminated by ORTS.	Find reason and, if permitted, rerun test.
04	Parity error/no measured value on TP 951 - channel counter.	Rerun test; if error persists, run EII 7.8.6.2 (forward), 7.8.7.2 (aft). If no fault is found, manually fault isolate DAC A13.

Error Code	Reason/Symptom	Operator Action
05	Channel counter not incrementing or contains wild channel numbers.	Rerun test; if error persists, manually fault isolate A7 (A8) channel select/ decoding logic or DAC A13.
06	High power requested but not achieved.	Rerun test; if error persists, run transmitter FI test EII 1.4.11 (forward), 1.5.11 (aft), 1.20.11 (SPY-1D)
07	Data block code contains all ones (1's) in 35 word command, radiation not verified, or transmitted frequency differs from requested frequency.	1. Verify transmitter state. 2. Run IOB synchronizer test EII 1.15.9.2. 3. Reload SPY computer program.
08	Disallowed frequency.	Determine if necessary to run on this frequency. If needed, obtain permission to change doctrine.

Table 1 Transmitter Phase and Power Test Display Error Code Definitions

Error Code	Reason/Symptom	Operator Action
09	I Vector = Q Vector = 0 A,C,P,I,Q - Flags Set	Rerun test; if error persists, manually fault isolate monitoring circuitry and DAC A13.
10	Parity error/no measured value on TP 948 - power or amplitude.	See error code 04.
11	Parity error/no measured value on TP 949 - Q Vector.	See error code 04.
12	Parity error/no measured value on TP 950 - I Vector.	See error code 04.
13	Parity error/no	See error code 04.

	measured value on TP 887 - driver/predriver.	
14	Parity error/no measured value on TP 894 - TWT.	See error code 04.
15	Configuration changed during test.	Inspect transmitter fault indicators; if no fault indication, put transmitter in desired configuration and rerun test.
16	All amplitudes for channels 1 thru 16 failed.	Rerun test; if error persists, run EII 1.4.11 (for forward) or EII 1.5.11 (for aft).
17	All amplitudes for channels 17 thru 32 failed.	Rerun test; if error persists, run EII 1.4.11 (for forward) or EII 1.5.11 (for aft).

Table 2 Transmitter Phase and Power Test Display Error Code Definitions

2. Evaluate Collected Data.

NOTE 12 : Objective of this procedure is to establish severity of indicated faults in order to determine necessary corrective action(s).

- a. Algebraically subtract DELTA MEAN QUAD (DMQ) angle of forward (aft) array from DMQ angle of starboard (port) array. Observe results are between 160 and 200° (180° optimum). (Example: starboard DMQ = 88.45, forward DMQ = -90.42. $88.45 - (-90.42) = 88.45 + 90.42 = 178.87^\circ$).
- b. For all FD reports, verify flags A, C, P, I and Q = 0.

NOTE 13 : For BMD ORDALT 20321 systems, ETP must be greater than -0.5dB/4MW.

- c. Verify EFF XMIT PWR is greater than -1dB/4 MW.
- d. Verify isolation of -10dB or larger negative value.
- e. If above limits are met for all conditions, proceed to step 2.q.
- f. If all 3 pairs of FD reports for forward or aft transmitter fail criteria of step 2.a., manually fault isolate T38 (forward) or T39 (aft) RFM monitoring circuitry and repair. A13 DAC is probable faulty component.
- g. If 2 pairs of FD reports do not meet criteria in step 2.a., determine common D/PD. Minus 90° phase shifter feeding common D/PD is probable faulty component.
- h. Repeat steps 1.a. through 1.f. for failed configuration after manual fault isolation and correction steps 2.f. or 2.g. have been performed.
- i. If any FD reports fail criteria of step 2.b., manually fault isolate T38 (forward) or T39 (aft) RFM and repeat steps 1.a. through 1.f. for failed configuration.
- j. If any FD reports fail criteria of steps 2.c. or 2.d., examine DMQ and individual channel data. DMQ between odd numbered arrays and between even numbered arrays must be within 30° of quadrature. Individual channel power readings must be 85 kW minimum and absolute value of PHASE DELTA must be less than 35°. If DMQ is within criteria given above, or if less than 5 individual channels do not meet criteria, return equipment to readiness condition.

NOTE 14 : The following steps cover fault localization/fault isolation procedures.

- k. For SPY-1A/B(V): at CSMC, Test Monitor Control Right (TMCR), for faulty transmitter, type IFI/1.4.11 (forward) or IFI/1.5.11 (aft); then press PFK 16 and press ENTER; for SPY-1B at TAC3 console:
 - (1) Click on MAINTENANCE icon located on MODE MENU BAR to surface AWS MAINTENANCE Display.
 - (2) Click on SPY box to display SPY MAINTENANCE Status Display.
 - (3) Select and click on FWD TRANSMITTER or AFT TRANSMITTER block depending upon faulty transmitter to test.
 - (4) Observe FWD (AFT) TRANSMITTER Display is displayed.
 - (5) Select T38 (T39); right click and hold trackball button to display pop up menu; drag to Tests and release button to display TESTS PANEL.
 - (6) Select test(s) to run by left clicking trackball to highlight.
 - (7) Click on RUN SELECTED TEST(S); observe COMMAND VERIFICATION WINDOW is displayed with test(s) status.
 - (8) When test(s) is/are completed, click on OPERATOR SUPPORT icon, select WINDOW DUMP to print results or click on QUIT box to close COMMAND VERIFICATION WINDOW and return to TESTS PANEL window to continue fault isolation.
 - (9) Repeat steps 2.k.(2) through 2.k.(8) as necessary to isolate fault.
- l. Observe Failed-Item Alert message. Comply with work package denoted by microfiche address or if PERFORM PHASE ALIGNMENT message is observed, proceed to step 2.m.
- m. For defective channels noted on FD report, measure switch tube currents, per MRC 2W-2 (FMVG), and perform FPA phase alignment, per MRC S-4 (FMWE). If there are no defective channels on FD report, proceed to step 2.o.

WARNING: A potential RF radiation hazard to personnel topside can exist if D/PD phase alignment or quadrature does not meet minimum specification.

- n. Repeat steps 1.a. through 1.f.
- o. If results are still not satisfactory, examine FD reports to determine common offending element. If a D/PD is at fault, 2 D/PD pairs will be affected where element appears; perform quadrature test and alignment MRC R-1 (FMXG) for D/PD pair.
- p. Repeat MRs 1. and 2..
- q. Return equipment to readiness condition.

3. Perform Transmitter Phase and Power Tests (SPY-1D, SPY-1D(V)).

NOTE 15 : For all keyboard entries, wait for cursor to reposition and approximately 3 more seconds to ensure process is completed before continuing with entries.

NOTE 16 : N = 1-9 for bands 1-9; 0= band 10.

- a. At RDT, type IOT/1.12.1.7.9N (fwd/stbd) then press PFK 16, and press ENTER.
- b. Type IOT/1.12.2.7.9N (fwd/port) then press PFK 16, and press ENTER.
- c. Press PFK 10 and press ENTER to print FD reports as needed to perform step 3.s. and MR 4..
- d. Type IOT/1.12.3.7.9N (aft/port) then press PFK 16, and press ENTER.
- e. Type IOT/1.12.4.7.9N (aft/stbd) then press PFK 16, and press ENTER.
- f. Press PFK 10 and press ENTER to print FD reports as needed to perform step 3.s. and MR 4..
- g. For TAC3/TAC4/DTS-1 console:
 - (1) At upper left hand corner of screen, under AWS OPERABILITY, point to and select, by left clicking trackball, any one of four SPY array quadrant icons.
 - (2) Observe SPY OPERABILITY Status Display page surfaces.

NOTE 17 : AVERAGE TRANSMIT POWER 1 block is located beneath STBD ARRAY OPERABILITY box; AVERAGE TRANSMIT POWER 2 block is located beneath FWD ARRAY OPERABILITY box, etc.

- (3) Move cursor to AVERAGE TRANSMIT POWER 1 block; right click and hold to surface Tests popup menu; while holding right trackball button, drag cursor to select Tests, then release.
- (4) Observe TESTS PANEL window is displayed.
- (5) Select all frequencies by pointing cursor to SELECT ALL box and left clicking trackball. Observe all frequencies in TESTS PANEL window are highlighted.
- (6) To run test, point cursor to RUN SELECTED TEST(S) and left click. Observe COMMAND VERIFICATION WINDOW is displayed.
- (7) Observe 1 COMMAND VERIFICATION window for each frequency run.

- h. To print results:
 - (1) Left click trackball on OPERATOR SUPPORT icon to display pull down menu.
 - (2) Left click on WINDOW DUMP to print top most window.
 - (3) When window has printed, close window by clicking QUIT.
- i. Repeat step 3.h. to print remaining windows.
- j. When finished printing, select QUIT to close TEST(S) PANEL window and return to SPY OPERABILITY Status Display window.
- k. Repeat steps 3.g.(3) through 3.j. for FWD (AVERAGE TRANSMIT POWER 2), PORT (AVERAGE TRANSMIT POWER 3) and AFT (AVERAGE TRANSMIT POWER 4).
- l. Repeat steps 3.a. through 3.f. for all authorized bands.

NOTE 18 : Steps 3.m. through 3.o. reconfigure D/PDs or Drivers (D(V) only) for next test.

- m. At control panel for D/DP or Driver being inactivated, press LOCAL/REMOTE pushbutton for LOCAL; observe LOCAL indicator is lit.
- n. Press READY pushbutton; observe READY indicator is lit.
- o. At RFM A1 control panel, observe waveguide switch indicators have positioned inactive D/DP or Driver to DUMMY LOADS.
- p. Repeat steps 3.a. through 3.l. for next test.

NOTE 19 : Steps 3.q. and 3.r. reconfigure D/PDs or Drivers (D(V) only) for next test.

- q. At control panel of inactive D/DP or Driver, press LOCAL/REMOTE pushbutton for REMOTE; observe REMOTE and RADIATE indicators are lit.
- r. Repeat steps 3.m. through 3.p.
- s. Check status (ST) column on each printout for not tested (NT) notations. Wherever NT appears, check ERR instructions per tables 1 and 2.
- t. Return system to readiness condition.

4. Evaluate Collected Data (SPY-1D, SPY-1D(V)).

NOTE 20 : Objective of this procedure is to establish severity of indicated faults in order to determine necessary corrective action(s).

- a. For all FD reports, verify flags A, C, P, I, and Q = 0.

NOTE 21 : For BMD ORDALT 20321 systems, ETP must be greater than -0.5dB/4MW.

- b. Verify ETP (effective transmitted power) is greater than -1 DB/4MW. For BMD ORDALT 20321 systems, verify ETP is in accordance with NOTE 21.
- c. Verify ISOL (isolation) values of -10 dB or larger negative value.
- d. If above conditions are met, proceed to step 4.m.
- e. If any FD reports fail criteria of step 4.a., manually fault isolate T38 and repeat steps 3.a. through 3.l. for failed configuration.
- f. If any FD reports fail criteria of step 4.b. or 4.c., examine individual channel data. Individual channel power readings must be 85 KW minimum, and absolute value of PHASE DELTA must be less than 35°. If less than 5 individual channels do not meet criteria, return equipment to readiness condition.

NOTE 22 : The following steps cover fault localization/fault isolation procedures.

- g. At CSMC, Test Monitor Control Right (TMCR), type IFI/1.20.11, then press PFK 16, then press ENTER.
- h. Observe Failed Item Alert Message. Comply with work package denoted by microfiche address, or if PERFORM PHASE ALIGNMENT message is observed, proceed to step 4.i.
- i. For defective channels noted on FD report, measure switch tube currents and CFA currents per MRC 2W-2 (FMVG) and perform FPA phase alignment per MRC S-4 (FMWE) or S-6 (FUVZ) (D(v) only). If there are no defective channels on FD report, proceed to step 4.k.

WARNING: A potential RF radiation hazard to personnel topside can exist if D/DP phase alignment or quadrature does not meet minimum specification.

- j. Repeat steps 3.a. through 3.l.

- k. If results are still not satisfactory, perform D/PD phase alignment MRC R-1 (FMXG) or Driver phase alignment MRC U-24 (FUSU) (D(V) only).
- l. Repeat MRs 3. and 4..
- m. Return equipment to readiness condition.