TMC SPECIFICATION			NO. QA S-370
REV: A B C			
COMPILED: REB	CHECKED: RBY	APPD:	SHEET 1 OF 14
TITLE:			

TEST PROCEDURE
FOR

ANTENNA TUNING SYSTEM

ATS-2 (50-70)
ATS-2A (50-70)

I. PURPOSE:

A. This procedure specified the method of performing electrical tests for the ATS-2, Antenna Tuning System.

B. This procedure is equally applicable for 50 ohm and 70 ohm calibration by using the appropriate load and RF cables.

C. This procedure is equally applicable for the ATS-2 and the ATS-2A.

D. The ATS-2 shall consist of : CU-2, MCU-2 and TU-2.
The ATS-2A shall consist of: CU-2, MCU-2A and TU-2A.

II. TEST EQUIPMENT REQUIRED:

A. RF Wattmeter, Bird Thruline Model 43 with 2-30 MHz 1 kilowatt and 100 watt plug in elements, or equivalent.

B. General Purpose Transmitter, TMC Model GPT-750, or an equivalent transmitter with a continuous rating of 1 kilowatt, (CW) output, 2-30 MHz.

C. Antenna, RF Dissipator, 50 ohm unbalanced, 1KW average, Bird Model 8833 (with associated RG-8/U, 50 ohm cables), or equivalent.

D. Antenna, RF Dissipator, 70 ohm, unbalanced, 1750 watt average, TMC Model TER-3500-70-U (with associated RG-11/U, 70 ohm cables) or equivalent.

E. ATS-2 interconnecting cable, CA-499.

F. ATS-2 interconnecting cable, CA-541.

G. Alignment tool, TMC TP-119-1.

H. VOM, Simpson Model 260, or equivalent.

III. TEST PROCEDURE:

WARNING

> This procedure requires the use of RF energy from the transmitter. Failure to follow safety precautions may result in serious injury, shock, or even death. Use extreme caution around uncovered RF leads in the coupler unit. Follow instructions carefully. Each time the procedure calls for transmitter power to be off, use the FINAL PLATES switch and turn DRIVE control fully counter-clockwise. Ensure that the transmitter and all components in the test set-up are well grounded.

NOTE

> References in the procedure to the TU and the MCU apply equally to the TU-2, TU-2A, and MCU-2, MCU-2A respectively. An additional test, applicable to the ATS-2A only, will be covered in paragraph III D. 9.

A. PRELIMINARY CHECKS:

*1. MCU - Inspect the unit for mechanical defects, proper type and placement of vacuum tubes, and obvious wiring errors. Set POWER switch to OFF position. If the red and black needles of the VSWR meter do not rest on zero, adjust the screwheads at the needle hubs for a zero indication.

NOTE: Indicate completion and acceptance of portions of this test preceeded by (*), by recording required observed value or by check ( ) mark as required on attached Test Data Sheet.

C302 & C305 are located in the CU2.

The following adjustable potentiometers are located in the MCU-2; R102, R103, R104, R105, R108, R120, R121, & R122.

*2. CU - Inspect the Directional Coupler unit briefly for workmanship, tightness of hardware and good solder joints - particularly at all RF connections. Small soldering defects, such as fine cracks in the solder, a hole or space not being completely filled, or a solder splash left on ceramic insulating spacers, cannot be tolerated in RF connections.

B. NULLING AND EQUALIZING:

1. Connect the dummy load to J302 of the CU. Insert the wattmeter in the coaxial line between the dummy load and the CU-2.

2. Connect the GPT-750 to J301 of the CU.

3. Connect the MCU to the CU-2 using ATS interconnecting cable CA-499. Connect interlock cable from the GPT-750 to J103 of MCU. Place STANDBY/OPERATE switch on the GPT-750 in the STANDBY position. Equipment set-up shall be as shown in Figure 1.

FIGURE 1

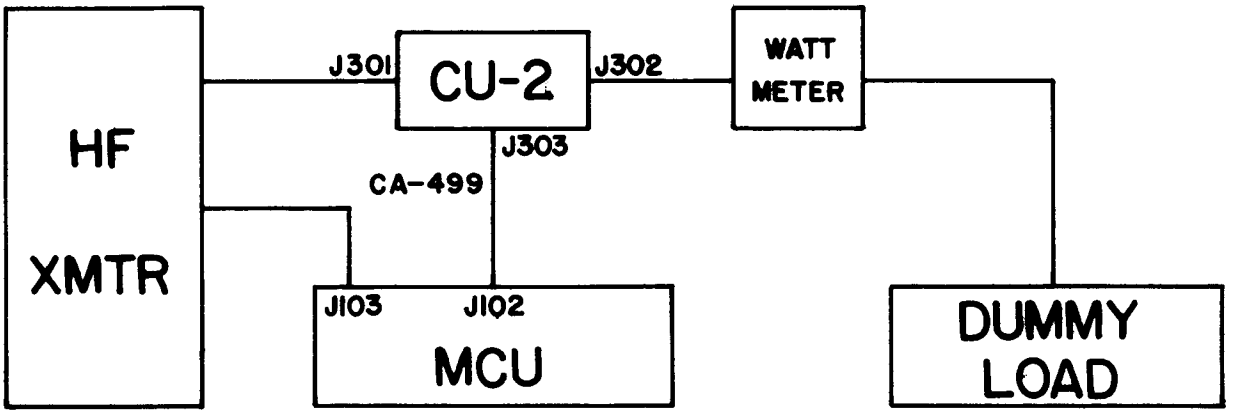

FIGURE 1

NOTE: Indicate completion and acceptance of portions of this test preceeded by (*), by recording required observed value or by check (✓) mark as required on attached Test Data Sheet.

4. Turn all pots located on the MCU chassis fully counter-clockwise.

5. Turn the MCU POWER switch to the X10 position. POWER light on MCU shall energize.

6. Tune the GPT-750 transmitter for a CW output frequency of 15 MHz.

7. With the transmitter output level at minimum, slowly increase the drive until the wattmeter indicates 1000 watts. The FORWARD power (black scale) needle shall indicate approximately half scale; the REFLECTED power (red scale) needle shall indicate near zero.

8. Slowly turn R-104 clockwise until the red needle reads in the upper quarter of the red scale.

*9. Utilizing the TMC alignment tool TP-119-1 adjust the NULL capacitor, C-302, until the REFLECTED power (red needle) indicates minimum. Rotate R-104 clockwise for increased sensitivity and continue adjusting C-302 until a minimum indication has been obtained for the REFLECTED power scale.

10. This completes the NULL adjustment. Turn R-104 completely counter-clockwise.

*11. With the transmitter output at 1KW, and R103 fully CCW, the black needle shall be indicating less than full scale. Slowly rotate R103 clockwise, taking care not to peg the needle. Before the fully CW setting of R103 is reached, the black needle shall exceed the full scale marking. Return R103 to fully CCW.

*12. Decrease the transmitter power output to minimum. Turn MCU power switch to X1 position. Slowly increase the drive until the wattmeter indicates 100 watts. With R102 fully CCW, the black needle shall be indicating less than full scale. Slowly rotate R102 clockwise, taking care not to peg the needle. Before the fully CW setting of R102 is reached, the black needle shall exceed the full scale marking. Return R102 to fully CCW.

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13. Turn the transmitter FINAL PLATES switch to OFF. Reverse the RF cables on the CU-2, by reconnecting the dummy load to J301, and the transmitter to J302. Turn MCU power switch to X10 position.

14. Turn the transmitter FINAL PLATES ON. Increase power until the wattmeter indicates 1000 watts. The REFLECTED power needle shall indicate approximately half scale, and the FORWARD power needle shall indicate near zero.

15. Slowly turn R103 clockwise until the black needle reads in the upper quarter of the scale.

*16. Utilizing the TMC alignment tool TP-119-1, adjust the EQUALIZE capacitor C305, until the FORWARD power needle indicates minimum. Rotate R103 clockwise for increased sensitivity and continue adjusting C305 until a minimum indication has been obtained for the forward power scale.

17. This completes the EQUALIZE adjustment. Turn R103 completely counter-clockwise.

*18. With the transmitter output at 1KW, and R104 fully CCW, the red needle shall be indicating less than full scale. Slowly rotate R104 clockwise, taking care not to peg the needle. Before the fully CW setting of R104 is reached, the red needle shall exceed the full scale marking. Return R104 to fully CCW.

*19. Decrease the transmitter power output to minimum. Turn the MCU power switch to the X1 position. Slowly increase the drive until the wattmeter indicates 100 watts. With R105 fully CW, the red needle shall be indicating less than full scale. Slowly rotate R105 clockwise, taking care not to peg the needle. Before the fully CW setting of R105 is reached, the red needle shall exceed the full scale marking. Return R105 to fully CCW.

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C. VSWR METER AND POWER OVERLOAD CALIBRATION:

INITIAL SETTINGS:

Power Switch in the X1 position

TUNE/OPERATE switch in the TUNE position

R104 set at maximum CCW

R105 set at maximum CCW

Dummy load connected to J301

Transmitter connected to J302

*1. Slowly increase the drive until the wattmeter indicates 100 watts. Adjust R105 for a 100 watt reading on the REFLECTED power (red scale) meter.

2. Decrease the transmitter power output to minimum. Turn the MCU Power switch to the X10 position. Place the TUNE/ OPERATE switch in the OPERATE position.

*3. Slowly increase the drive until the wattmeter indicates 1KW. Adjust R104 for a 1000 watt reading on the REFLECTED power (red scale) meter.

4. Decrease the transmitter power output to minimum. Place the transmitter FINAL PLATES switch in the OFF position.

5. Reverse the RF cables on the CU-2, by reconnecting the Dummy Load to J302, and the transmitter to J301.

*6. Place the transmitter FINAL PLATES in the ON position. Slowly increase the drive until the wattmeter indicates 1000 watts. Adjust R103 for a 1000 watt reading on the FORWARD power (black scale) meter.

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7. Decrease the transmitter power output to minimum. Turn the MCU Power switch to the X1 position. Place the TUNE/OPERATE switch in the TUNE position.

*8. Slowly increase the drive until the wattmeter indicates 100 watts. Adjust R102 for a 100 watt reading on the FORWARD power (black scale) meter.

9. Increase the drive until the wattmeter indicates 120 watts.

10. Turn R122 clockwise until K103 trips. The MCU OVERLOAD light shall energize, and the TRANSMITTER PLATES light shall de-energize.

11. Reduce drive to minimum. Press MCU RESET switch. The MCU OVERLOAD light shall de-energize, and the TRANSMITTER PLATES light shall energize.

12. Increase drive for a 100 watt reading on the wattmeter, and re-adjust R102 for a 100 watt reading on the FORWARD (black) scale.

13. Increase drive slowly until K103 trips.

*14. Repeat the steps in paragraphs 11 through 13 until K103 trips at 120 watts and R102 is set for a full scale 100 watt reading on the FORWARD scale when the wattmeter indicates 100 watts..

15. Decrease transmitter output power to minimum; turn MCU POWER switch to X10, TUNE/OPERATE switch to OPERATE. Place the 2-32 MHz, 1KW plug in element in the wattmeter.

16. Slowly increase the transmitter drive until an output level of 1200 watts is obtained. The black needle shall exceed full scale by approximately 1/4 of an inch.

17. Turn R121 clockwise until K103 trips. The MCU OVERLOAD light shall energize, and the TRANSMITTER PLATES light shall de-energize.

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18. Reduce drive to minimum. Press RESET switch. MCU OVER-LOAD light shall de-energize and the TRANSMITTER PLATES light shall energize.

19. Increase drive for a 1000 watt reading on the wattmeter, and re-adjust R103 for a 1000 watt reading on the FORWARD scale.

20. Increase drive slowly until K103 trips.

* 21. Repeat the steps in paragraphs 18 through 20, until K103 trips at 1200 watts and R103 is set for a full scale reading of 1000 watts on the FORWARD scale, when the wattmeter indicates 1000 watts.

22. Reduce drive to minimum. Place the transmitter FINAL PLATES switch in the OFF position. Place the MCU Power switch in the OFF position.

D. TU MECHANICAL ALIGNMENT CHECKS:

* 1. Inspect the tuning unit briefly for workmanship, tightness of hardware, and good solder joints - particularly at all RF connections. Small soldering defects, such as fine cracks in the solder, a hole or space not being completely filled, or a solder splash left on ceramic insulating spacers, cannot be tolerated in RF connections.

2. Disconnect the RF cable from the dummy load, and connect it to E-203 of the TU. Connect an RF cable from E-206 of the TU to the dummy load. The wattmeter will now be in the RF line between the CU and the TU, as per figure 2. Connect CA-541 interconnecting cable from E-201 of the TU to J101 of the MCU (for the ATS-2A, the eleventh wire in CA-541 is connected to E-208, pin 1, of the TU).

3. With the MCU Power switch in the OFF position, check meter M-102 for mechanical zeroing.

4. Place the MCU Power switch in the X10 position.

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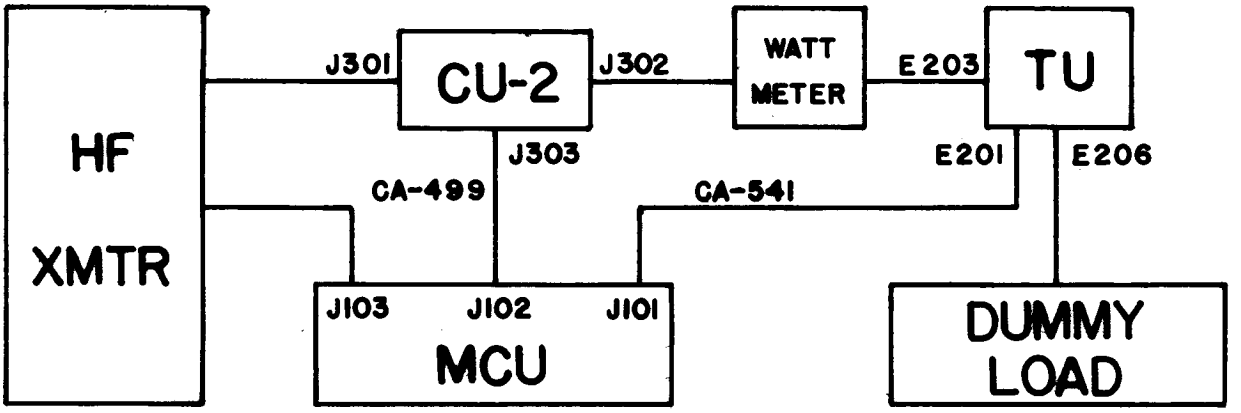

FIGURE 2

*5. Hold the REACTANCE switch in the DECR. position. As the motor driven roller contact of L-201 reaches the lower end of the coil, the lower limit switch shall be activated and the roller contact shall stop approximately 1/4 turn from the end of the coil. The MCU METER shall read Ø in the REACT. position, and the MCU STOP light shall light.

*6. Hold the REACTANCE switch in the INCR. position. As the roller contact moves up the coil, the meter reading in the REACT. position shall increase. Watch the coil for defects such as loose coil, straining motor, etc. At the upper end of coil L-201, the upper limit switch shall be activated and the roller contact shall stop approximately 1/4 turn from the upper end of the coil. The STOP light shall light, and the meter, in the REACT. position shall read 100 or greater.

7. Return L-201 roller contact to its lower limit. Depress the RESISTANCE OPERATE switch until position 3 is indicated on the meter with the METER switch in the RES. position.

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*8. Check S-201 for proper alignment. Contacts for all four wafers shall be checked for positioning as shown in Figure 3. Check for proper MCU resistance meter reading and TU S-201 contact alignment in each of the remaining five positions.

FOR ATS-2A ONLY:
MOTOR BRAKING
SYSTEM CHECK

*9. Connect a DC voltmeter between terminals 2 and 3 of E-208, with the positive lead on terminal 2. Depress the RESISTANCE OPERATE switch long enough to get a steady reading on the voltmeter. While the RESISTANCE OPERATE switch is depressed, the voltmeter shall indicate 160 to 175 VDC. When the RESISTANCE OPERATE switch is released, and B202 stops, the DC voltage across terminals 2 and 3 shall immediately drop to zero.

E. HUMIDITY SENSING ELEMENT:

1. Disconnect CA-541 from J101 on the MCU.

2. Hold METER switch in the HUM. position. Adjust R-108 for a zero indication on the meter.

3. Reconnect CA-541 to J101.

*4. Hold METER switch in the HUM. position. Meter shall indicate in lower quarter of the scale. (This reading is determined by the ambient relative humidity level).

5. If there is no indication, breathe on R-210 (located below E-201 in the TU) or otherwise cause moisture to come in contact with the sensing element, R-210. This shall cause a definite increase in the humidity indicator reading.

F. VSWR OVERLOAD ALIGNMENT:

1. Connect the ATS as shown in Figure 2.

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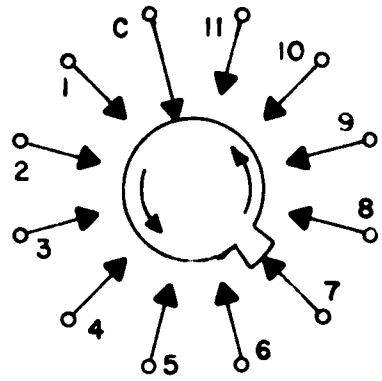
FIGURE 3

S-201 CONTACT POSITIONING

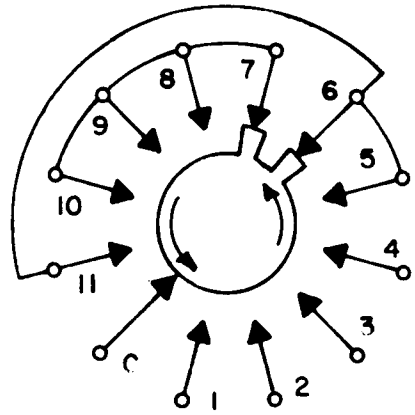
ALL SWITCHES SHOWN IN POSITION 3

ALL SWITCHES VIEWED FROM SWITCH MOTOR B-202

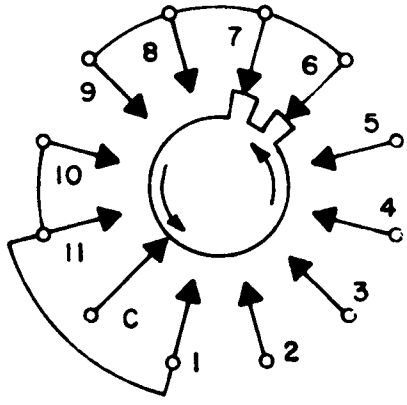
S-201A



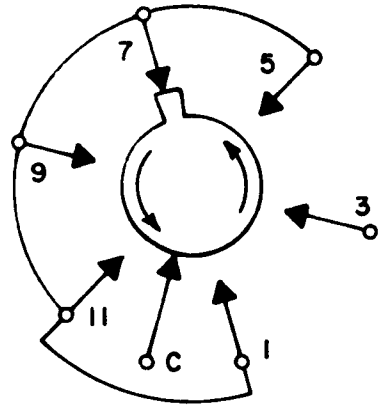
S-201B



S-201C



S-201D



3. Increase the drive for an output of 1000 watts. Using the REACTANCE switch, change the TU inductance until the VSWR meter indicates a standing wave ratio of 3.0:1. Check the transmitter plate current and screen current meters for excessive readings. The drive should be decreased slightly to keep the FORWARD power reading at 1000 watts as the inductance is changed for a higher VSWR reading.

4. With a VSWR of 3.0:1, turn R-120 clockwise until K-103 trips.

5. Reduce drive to minimum. Depress the RESET switch. Retune the TU for a minimum VSWR, using the REACTANCE switch.

*6. Increase transmitter drive until the FORWARD Power scale indicates approximately 900 watts. Increase the inductance by using the REACTANCE switch, until a VSWR of 3.0:1 is once again obtained and the FORWARD Power scale indicates 1000 watts. Relay K-103 shall trip. If it doesn't, repeat the steps in paragraphs F.2 through F.6 until this setting is achieved.

7. Reduce drive to minimum and place the FINAL PLATES switch in the OFF position.

G. ATS SYSTEM OPERATION:

1. Place the transmitter FINAL PLATES switch in the ON position. Tune the transmitter for a CW output frequency of 15 MHz. Tune the ATS system for the minimum VSWR reading.

* 2. Increase the drive until the FORWARD power meter indicates 1000 watts, ensuring that the VSWR is at a minimum. The VSWR shall be no greater than 2.5:1. Record the VSWR, resistance and reactance settings.

* 3. Repeat the steps in paragraphs G.1 and G.2 at 2 and 30 MHz, recording VSWR, resistance and reactance settings.

4. Place the FINAL PLATES switch in the OFF position, and remove all power from the transmitter.

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TMC SPECIFICATION

NO. S -370

REV: A B C

COMPILED: REB | CHECKED: RBY | APPD: | SHEET 14 OF 14

TITLE: Test Data Sheet for ATS-2 ( ) ____ Antenna Tuning System

ATS-2 ( ) _____ Serial No. _____

MCU # _____ CU # _____ TU # _____

A. INSPECTION

A.1 MCU _____ A.2 CU _____

B. NULLING, EQUALIZING AND RANGING

B.9 Null _____ B.11 X10 Forward _____ B.12 X1 Forward _____

B.16 Equalize _____ B.18 X10 Reflected _____ B.19 X1 Reflected _____

C. VSWR METER AND POWER OVERLOAD CALIBRATION

C.1 100W Reflected _____ C.3 1000W Reflected _____ C.6 1000W Forward _____

C.8 100W Forward _____ C.14 100W Overload _____ C.21. 1000W Overload _____

D. TU MECHANICAL ALIGNMENT

D.1 Insp. _____ D.5 L201, Stop light @ ∅ _____ D.6 L201, Stop light @ 100 _____

D.8 S-201 Alignment _____ D.8 Resistance Meter _____

D.9 For ATS-2A ONLY: Motor Braking Voltage _____ VDC

E.4 Humidity Sensing _____ F.6 VSWR Overload _____

G. OPERATIONAL CHECKS:

FREQ	VSWR	RESISTANCE	REACTANCE
2 MHz	_____	_____	_____
15 MHz	_____	_____	_____
30 MHz	_____	_____	_____

Tested By: _____ Date: _____

REVISION SHEET

THE TECHNICAL MATERIEL CORP.
MAMARONECK NEW YORK

S-370
LIST NO.

DATE	REV.	SHEET	EMN #	DESCRIPTION	APP.
12/14/66	A	----	17499	Revised per EMN	
2/24/69	B	3,8	19336	Revised per EMN.	
11/75	C	8		REVISED PER EMN 21318	

DATE 6/17/58 SH. 1 OF 2 COMPILED BY	TMC SPECIFICATION NO. S-370	
	TITLE: TEST DATA SHEET ATS SYSTEM TEST PROCEDURE	JOB
APPROVED	VOLTAGE CHARTS	

ATS Coupler

MC	Volts Full Scale 100 Watts 50 ohm	
32		
24		
16		
12		
8		
6		
4		
2		

ATS Complete System

MC	Volts per 1000 Watts	R pos.	L.pos.	V swr
32				
24				
16				
12				
8				
6				
4				
2				

DATE 4/16/58 SH. 2 OF 2 COMPILED BY	TMC SPECIFICATION NO. S-370	
	TITLE: TEST DATA SHEET	JOB
APPROVED	ATS SYSTEM TEST PROCEDURE	

Serial No. _____

DATE _____

TESTED BY _____