

TMC SPECIFICATION

NO. QA S-435

REV:

A B C

COMPILED: REB

CHECKED: RBY

APPD: *LB*

SHEET 1 OF 8

TITLE:

TEST PROCEDURE
FOR

TUNING UNIT
TU-2 (50-70)
TU-2A (50-70)

PART OF
ANTENNA TUNING SYSTEM

ATS-2
ATS-2A

TMC SPECIFICATION

NO. QA S-435

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APPD:

SHEET 2

OF 8

TITLE:

TU-2 and TU-2A

I. PURPOSE:

- A. This procedure specifies the method of performing electrical tests for the TU-2, which is a component of the Antenna Tuning System, ATS-2.
- B. This procedure is equally applicable for both 50 ohm and 70 ohm calibration by using the appropriate load and RF cables.
- C. This procedure is equally applicable for TU-2 and TU-2A testing. The TU-2 must be tested with an MCU-2 and TU-2A with an MCU-2A.

II. TEST EQUIPMENT REQUIRED:

- A. Monitor Control Unit, TMC Model MCU-2, or MCU-2A as applicable.
- B. Directional Coupler, TMC Model CU-2.
- C. RF Wattmeter, Bird Thruline Model 43 with 2-30 MHz 1KW plug in element, or equivalent.
- D. General Purpose Transmitter, TMC Model GPT-750, or an equivalent transmitter with a continuous rating of 1KW (CW) output, 2-30 MHz.
- E. Antenna, RF Dissipator, 50 ohm, unbalanced, 1KW average, Bird Model 8833 (with associated RG-8/U, 50 ohm cables), or equivalent.
- F. Antenna, RF Dissipator, 70 ohm, unbalanced, 1750 watts average, TMC Model TER-3500-70-U (with associated RG-11/U, 70 ohm cables), or equivalent.
- G. ATS-2 interconnecting cable, CA-499.
- H. ATS-2 interconnecting cable, CA-541.
- I. VOM, Simpson Model 260, or equivalent.

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TITLE:

TU-2 and TU-2A

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 Directional Coupler Unit, and the Antenna Tuner Unit. Follow instructions carefully. Each time the procedure calls for transmitter power to be OFF, use the FINAL PLATES switch and turn the DRIVE control fully counter-clockwise. Ensure that the transmitter and all components in the test set-up are well grounded.

NOTE:

References in this procedure to the TU apply equally to both the TU-2 and the TU-2A. An additional test, applicable to the TU-2A only, will be covered in paragraph III. C.6.

A. PRELIMINARY CHECKS:

- *1. Inspect 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.

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

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2. Connect test set-up as shown in Figure 1.

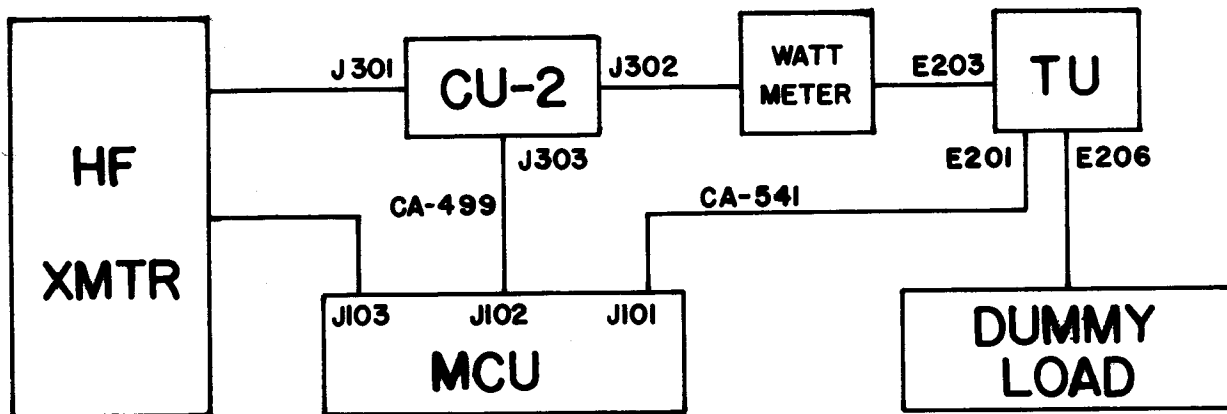


FIGURE 1

B. HUMIDITY SENSING ELEMENT:

1. Disconnect CA-541 from J101 on the MCU. Turn MCU Power switch to the SHORT position.
2. Hold METER switch in the HUM. position. Adjust R108 for a zero indication on the multimeter.
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.)

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5. If there is no indication, breathe on R210 (located below E201 in the TU) or otherwise cause moisture to come in contact with the sensing element, R210. This shall cause a definite increase in the humidity indicator reading.

C. MECHANICAL ALIGNMENT CHECKS:

- *1. Hold 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 reactance meter on the MCU shall read \emptyset and the MCU STOP light shall light.
- *2. Hold MCU REACTANCE switch in the INCR. position. As the roller contact moves up the coil the reactance meter reading shall increase. Watch 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 L-201. The MCU STOP light shall light and the reactance meter shall read 100 or greater.
3. Return L-201 roller contact to its lower limit.
4. Depress RESISTANCE OPERATE switch until position 3 is indicated on meter with METER switch held in RES. position.
- *5. Check S-201 for proper alignment. Contacts for all four wafers shall be checked for positioning as shown in Figure 2. Check for proper MCU resistance meter reading and TU S-201 contact alignment in each of the remaining five positions.

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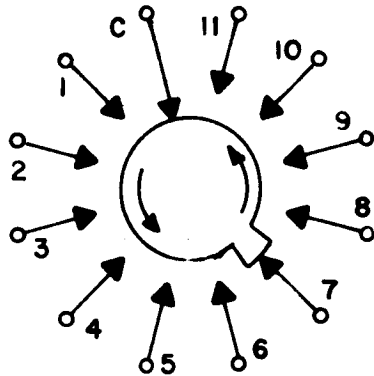
FIGURE 2

S-201 CONTACT POSITIONING

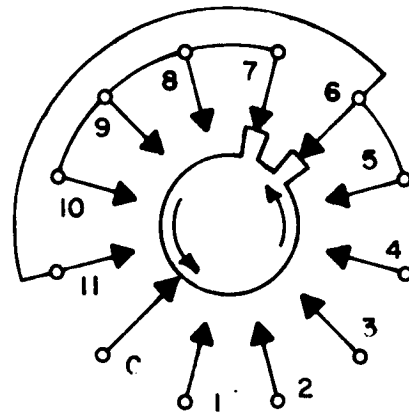
All switches shown in position 3

All switches viewed from switch motor B-202

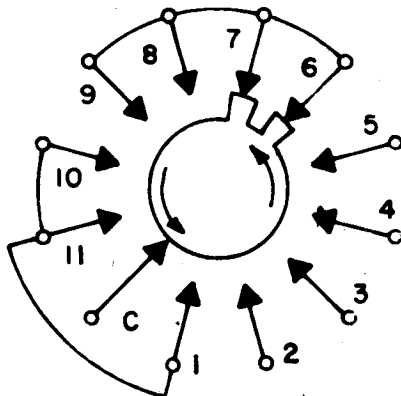
S-201A



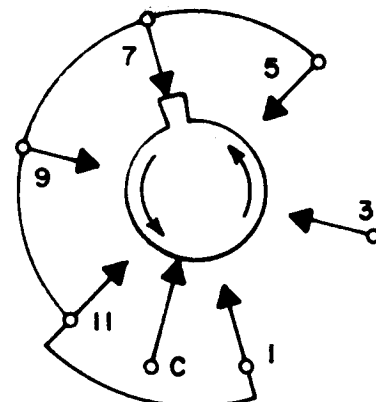
S-201B



S-201C



S-201D



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TITLE: TU-2 and TU-2A

- *6. For the TU-2A only: Motor Braking System Check.
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.

D. OPERATIONAL CHECKS:

1. Tune the transmitter for a CW output frequency of 15 MHz. Tune the ATS system for the minimum VSWR reading.
- *2. Increase transmitter power output until the VSWR meter of the MCU indicates 1000W, 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 D.1 and D.2 at 2 and 30 MHz recording VSWR, resistance and reactance settings.
4. Turn the transmitter FINAL PLATES switch OFF.

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TITLE: Test Data Sheet

TECHNICAL MATERIEL CORPORATION

TEST DATA SHEET FOR
TU-2 () _____

PART OF ATS
ANTENNA TUNING SYSTEM

MFG # _____

SERIAL # _____

- A. 1. Inspection _____
- B. 4. Humidity Indicator _____
- C. 1. Stop Light Indicator @ 0 _____
- C. 2. Stop Light Indicator @ 100 _____
- C. 2. Reactance Indicator _____
- C. 5. Resistance Switch Indicator _____
- C. 6. Motor Braking System _____

D. Operational Checks

<u>FREQ.</u>	<u>VSWR</u>	<u>RESISTANCE</u>	<u>REACTANCE</u>
2 MHz	_____	_____	_____
15 MHz	_____	_____	_____
30 MHz	_____	_____	_____

TESTED BY: _____

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of ATS - 2/ 50 (70)

AMB4-1 CALIBRATION4-1-1 VSWR METERCAUTION

THIS SECTION REQUIRES THE USE OF RF ENERGY FROM THE TRANSMITTER. FOLLOW INSTRUCTIONS CAREFULLY. EACH TIME THE PROCEDURE CALLS FOR TRANSMITTER POWER TO BE OFF, USE THE FINAL PLATES SWITCH OR ITS EQUIVALENT.

Have the following equipment available for use:

Adjustment tool, TMC #TP-110, supplied with ATS-2

DIRECTIONAL COUPLER

CONTROL MONITOR

70 Ω , 1000 watt Resistive Load for ATS (70)-2

50 Ω , 1000 watt Resistive Load for ATS (50)-2

See Note following step X

Transmitter used with system

RF VTVM

- A. Connect the 50 Ω resistive load to J302 of the DIRECTIONAL COUPLER.
- B. Complete system cabling according to figure 3-1. The RF TUNER is not used.
- C. Turn R102, and R103 of the CONTROL MONITOR to ~~minimum~~ resistance (fully clock-wise). Turn R104 and R105 of the CONTROL MONITOR to maximum resistance (fully counter clock-wise). Remove V102 from its socket. The tube will be returned to its socket in a later step. Keep the tube in a safe place.
- D. If pointers of the VSWR meter do not rest on zero, adjust them to zero by slowly turning screwheads at pointer hubs.
- E. Turn POWER switch to X1 position.
- F. Tune the Transmitter to AM output frequency of 6.0 Mc on low power (less than 100 watts).
- G. With Transmitter output level at minimum, slowly increase the drive until VSWR Meter indicates 100 on the FORWARD power black scale

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of ATS -2 / 50 (70)

- H. Adjust the Null capacitor, C302, of the DIRECTIONAL COUPLER until the reflected power red scale of the VSWR Meter indicates minimum.
- J. Turn the Transmitter OFF. REVERSE the RF cables on the DIRECTIONAL COUPLER by connecting the 50 Ω load to J301 and the Transmitter to J302.
- K. Turn the transmitter ON. Increase power until the REFLECTED power scale of the VSWR meter reads 100.
- L. Adjust the EQUALIZER capacitor, C305, on the DIRECTIONAL COUPLER until FORWARD power reads minimum.
- M. Turn the Transmitter final plats OFF. Restore cable connection of the DIRECTIONAL COUPLER to normal operating positions (Transmitter to J301; load to J302.
- N. Connect the RF VTVM across the 50 Ω resistive load at J302 of the DIRECTIONAL COUPLER.
- O. Turn the Transmitter ON and adjust its output level until the RF VTVM indicates 70.7 volts on the ATS (50) -2 or 83.7 volts on the ATS (70) -2.
- P. Adjust R102 of the CONTROL MONITOR until FORWARD power of th VSWR meter reads 100.
- Q. Turn the Transmitter OFF. Reverse RF connections to th DIRECTIONAL COUPLER as before so that the Transmitter connects to J303.
- R. Turn the Transmitter ON. Adjust power output to read 70.7 volts on the ATS (50) -2 83.7 volts on the ATS (70) -2.
- S. Adjust R105 of the CONTROL MONITOR until REFLECTED power of the VSWR meter reads 100.
- T. Turn the Transmitter OFF. Restore the RF cable and load of the DIRECTIONAL COUPLER to their normal operating position.
- U. Turn the POWER switch of the DIRECTIONAL COUPLER to X10 position.
- V. Turn the Transmitter ON and adjust its output level to 224 volts on the ATS (50) -2 or 265 volts on the ATS (70) -2 as read on the RF VTVM.

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NOTE

If a 1000 watt dummy load is not available,
see table 5 for alternative voltages and
powers.

- W. Adjust R103 of the CONTROL MONITOR until the FORWARD power scale of the VSWR Meter reads 1000 (100 X 10).
- X. Turn the Transmitter OFF. Reverse the connections to th DIRECTIONAL COUPLER.
- Y. Turn the Transmitter ON and check 224 volts for the ATS (50)-2 or 265 volts for the ATS (70)-2 output level on the RF VTVM.
- Z. Adjust R104 of the CONTROL MONITOR until REFLECTED power scale of the VSWR Meter indicates 1000 watts.
- AA. Turn the Transmitter OFF. Restore connections to the DIREC-TIONAL COUPLER to their normal operating positions. See figure 3-1.
- BB. Replace V102 in its socket.

4-2 OVERLOAD CIRCUIT ADJUSTMENT

4-2-1 EQUIPMENT REQUIRED

Complete ATS-2
Transmitter
VTVM
1000 watt dummy load, if available

4-2-2 PROCEDURE

- A. Make connections as shown in Figure 3-1. (If 1000 watt dummy load is available.)
- B. Turn POWER switch on the CONTROL MONITOR to the X1 position
- C. Set the TUNE/OPERATE switch on the CONTROL MONITOR to TUNE position.
- D. Allow 2 minutes for tube warm-up.
- E. Turn R120, R121 and R122 on the CONTROL MONITOR fully counter clockwise for maximum resistance.
- F. Adjust the transmitter for 100 watts output. Use a fr quency which will allow the transmitter to be tuned for a standing wave ration of unity (1:1). For example 6 Mc might be used.

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- G. Turn R122 clockwise until the latching relay K103 of the unit trips to cut transmitter power.
- H. Reduce transmitter power. Press RESET switch on the CONTROL MONITOR to reset K103. Increase transmitter power slowly until the power required for this step is reached. When 100 watts is reached, K103 will again trip to cut the transmitter off. If this does not occur, readjustment of R122 is necessary. Repeat the above until R122 is correctly adjusted.
- J. When R122 is correctly set, carefully tighten its lock nut.
- K. Turn POWER switch on the CONTROL MONITOR to the K10 position. Turn TUNE/OPERATE switch to OPERATE position.
- L. Adjust the transmitter output to 1200 watts. Note that the FORWARD power indication of the VSWR meter will exceed full scale by approximately 1/4 inch. If the transmitter available is not rated for 1000 watts output, tune the transmitter used for maximum output.
- M. Turn R121 counter-clockwise until K103 trips to cut transmitter power. Proceeds as in step H above until R121 is properly adjusted.
- N. When R121 is correctly set, carefully tighten its lock nut.
- P. Press the RESET switch to reset K103 and reactivate the transmitter.
- Q. Reduce transmitter power to 1000 watts. If transmitter available is not rated for 1000 watts, leave its output at maximum.
- R. Using the REACTANCE switch on the CONTROL MONITOR, vary the inductance until the VSWR meter indicates a standing wave ratio of 3 to 1.
- S. Turn R120 counter-clockwise until K103 trips to cut transmitter power. Proceed as in step H above until R120 is properly adjusted.
- T. When R120 is properly set, carefully tighten its lock nut.

4-3 MECHANICAL ADJUSTMENTS

4-3-1 Readjustment of Inductance Drive System

- A. Connect th RF TUNEER to the CONTROL MONITOR as shown in Figure 3-1.
- B. Remove cover from RF TUNER cas

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- C. Loosen set screws that hold worm gear and switch actuating levers to control shaft of R201.
- D. Turn POWER switch to SHORT position.
- E. Hold REACTANCE switch in DECR. position until motor driven tap of L201 is 1/4 turn from end of coil (end away from motor).
- F. Turn R201 control shaft by hand until reading of M102 is zero.
- G. Tighten worm gear set screws.
- H. Turn POWER switch OFF.
- J. Turn lever that actuates S203 until it depresses the switch plunger.
- K. Tighten set screws that lock lever in place on shaft.
- L. Turn POWER switch to SHORT position.
- M. Hold REACTANCE switch in INCR. position until motor driven tap is 1/4 turn from the other end of the coil.
- N. Turn POWER switch OFF.
- P. Turn lever that actuates S202 until it depresses the switch plunger.
- Q. Lock lever in place on shaft by tightening set screws.
- R. The mechanism should now stop automatically when motor driven tap reaches 1/4 turn from either end of the coil.

4-3-2 METER M102

4-3-2-1 HUMIDITY INDICATION

- A. Disconnect cable from J101 on the CONTROL MONITOR.
- B. Turn the POWER switch to SHORT position.
- C. Hold the METER switch in HUM position.
- D. If the meter does not indicate 0, adjust R108 until it does.

4-3-2-2 REACTANCE INDICATION

- A. Connect the 10 wire control cable between the CONTROL MONITOR and RF TUNER.
- B. Turn the POWER switch to SHORT.

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- C. Operate the REACTANCE control in the INCR. position until the STOP indicator lights.
- D. M102 should read 100.
- E. If it does not, adjust R108 until an indication of 100 is reached.

4-4 DESSICANT

A 16 unit bag of dessicant is attached to the inside of th RF TUNER case cover to help prevent moisture from gathering on the components within. Should the humidity indicator show that a change of dessicant is necessary, replace with a fresh bag. Allow a reasonable amount of time for chemical action to register change on humidity meter reading. If the meter does not then indicate a sufficient drop in humidity, check its calibration.

4-5 SPARK GAP

The spark gap is provided for protection of the unit from static charges. The gap will be properly set when the gap is about 1/8 inch.

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TABLE # 1

ROTARY SWITCH OPERATION
FOR ANTENNA MATCHING

<u>RESISTANCE POSITION</u>	<u>T201</u>		<u>COVERS ANTENNA RESISTANCE RANGE</u>	<u>COVERS ANTENNA REACTANCE RANGE</u>
	<u>TAP #</u>	<u>OHMS</u>		
1	1	17	2 - 35	0 to -j850
2*	1	17	2 - 35	0 to -*j750
3	2	70	35 - 140	0 to -j850
4*	2	70	35 - 140	0 to +j750
5	3	250	125 and higher	0 to -j850
6*	3	250	125 and higher	0 to +j750

NOTE: The odd number switch positions are used when the antenna exhibits -j or capacitive reactance.

The even number switch positions are used when the antenna exhibits +j or inductive reactance.

* Indicates 46 uuf (C201) added in series.

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TABLE # 2

35 FT. WHIP ANTENNA MEASUREMENTS

WET CONDITIONS

MC	RESISTANCE OHMS	REACTANCE OHMS	SUGGESTED ANTENNA RES. POSITION #
2	8.0	-j400	1
3	10.8	-j317	1
3.5	16.4	-j287	1
4	17.3	-j237	1
4.5	18.2	-j200	1
5	18.0	-j160	1
6	43	-j33	3
7	54.0	0	4
8	130	+j88	6
9	230	+j152	6
10	492	-j128	5
11	318	-j237	5
12	100	>-j418	3
13	32	>-j385	1
14	30	>-j357	1
15	25	-j292	1
16	13.3	+j23	2
17	38.2	+j188	4
18	22	-j155	1
19	35.5	-j36	3
20	59	-j105	3
22	61.5	-j6.8	3
24	32	-j200	1
26	68.5	>-j190	3
28	43.5	>-j178	4
30	47.2	-j133	4

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NOTE: These measurements were made at a site fairly free from obstructions. It is possible that at other locations there will be variances in both ANTENNA RESISTANCE AND REACTANCE

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TABLE #2

35 FT. WHIP ANTENNA MEASUREMENTS

DRY CONDITIONS

MC	RESISTANCE OHMS	REACTANCE OHMS	SUGGESTED ANTENNA RES. POSITIONS #
2	7.8	-j430	1
3	9.2	-j350	1
3.5	12.7	-j293	1
4	13.2	-j244	1
4.5	13.4	-j190	1
5	13.7	-j159	1
6	40	-j67	3
7	50	+j16	4
8	149	+j109	7
9	288	+j90	6
10	438	-j22	5
11	308	-j246	5
12	45	> -j418	3
13	30	> -j385	1
14	25	> -j350	1
15	23	-j283	1
16	28	+j84	2
17	34.6	+j77	2
18	18.9	-j134	1
19	33	-j163	3
20	52.8	-j60	3
22	114	-j50	3
24	28	-j160	1
26	94	> -j193	3
28	40	> -j180	4
30	35.5	-j136	4

> - GREATER THAN

NOTE: These measurements were made at a site fairly free from obstructions. It is possible that at other locations there will be variances in both ANTENNA RESISTANCE AND REACTANCE.

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TABLE 3

<u>VOLTAGE ACROSS RESISTIVE LOAD MEASURED WITH RF VTVM</u>		<u>CORRESPONDING READING OF FORWARD WATTS SCALE</u>
ATS (50)-2	ATS (70) -2	
224	265	1000
200	237	800
173	205	600
141	167	400
100	118	200
86.6	102	150
70.7	83.7	100

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ATS - 2

TEST DATA SHEET

Serial No/ _____

1.0 MECHANICAL INSPECTION:

1.1 Directional Coupler _____

1.2 Control Monitor _____

1.3 RF Tuner _____

2.0 ELECTRICAL INSPECTION:

2.1 Directional Coupler _____

2.2 Control Monitor _____

2.3 RF Tuner _____

3.0 DIRECTIONAL COUPLER: (AT 6 Mc)

3.1 Null _____

3.2. Equalize _____

4.0 CONTROL MONITOR

4.1 X1 Power Scales _____

4.2 X10 Power Scales _____

5.0 Directional Coupler connected to Control Monitor, 1000 W 50 Ω Dummy Load and 1000 W Transmitter: (Record Voltage vs frequency for 100 W input to load.

5.1	32 Mc	_____	VOLTS
5.2	24 Mc	_____	VOLTS
5.3	16 Mc	_____	VOLTS
5.4	8 Mc	_____	VOLTS
5.5	6 Mc	_____	VOLTS
5.6	4 Mc	_____	VOLTS
5.7	2 Mc	_____	VOLTS

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6.0 R.F. Tuner, Directional Coupler. Control Monitor, 1000 W Transmitter, 1000 W 50 Ω load all connected to form a complete system. Record the frequency vs voltage to obtain a 1000 W reading on the forward power meter. Also record the reactance and switch reading for minimum SWR.

6.1	MC	VOLTS	VSWR	SW.POS.	REACTANCE
	32	_____	_____	_____	_____
	24	_____	_____	_____	_____
	16	_____	_____	_____	_____
	8	_____	_____	_____	_____
	6	_____	_____	_____	_____
	4	_____	_____	_____	_____
	2	_____	_____	_____	_____

7.0 OPERATIONAL FUNCTIONS:

1000 Watt Forward Power Range _____

1000 Watt Reflected Power Range _____

100 Watt Forward Power Range _____

100 Watt Reflected Power Range _____

Humidity Meter Range _____

Stop Lite Operation at 0 _____

Stop Lite Operation at 100 _____

Power Pilot Light _____

Reactance at 0 _____

Reactance at 100 _____

DATE _____
SH. 13 OF 13
COMPILED BY
P.A.

TMC SPECIFICATION NO. S-435

TITLE: TEST DATA SHEET FOR TU-2/ATS-50(70)

JOB _____

APPROVED

B)

& MCU-2/ATS-50 (70)

SERIAL NO. _____

1.0 Mechanical Inspection _____

2.0 Electrical Inspection _____

3.0 System Alignment _____

DATE _____

TESTED BY _____