

DATE 5 January 1965

SHEET 1 OF 13

TMC SPECIFICATION NO. S-897

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J.P.
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TITLE:

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FINAL TEST PROCEDURE

for

DDR-5L SYSTEM

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A. PRELIMINARY

1. Test Equipment Required

- a. Frequency Counter - HP 524C or equivalent.
- b. Signal Generator (1) - Measurements Corp. Model 82 or equivalent,
- c. AC VTVM - Ballantine 314 or equivalent.
- d. PTE-4 Spectrum Analyzer.
- e. Sonic Analyzer LP-1A or equivalent.
- f. 50 ohm, 20 db attenuator pad.
- g. VOM - Simpson 260 or equivalent.

2. It is assumed that individual units have been aligned and tested, that all units are installed in the cabinet, and that all inter-connections have been made.

3. Connect the power cable to a 117V, 60 cps single phase source.

4. Place all switches and controls in the following positions:

* a. HFP-1 (Both Units):

STANDBY-OFF Toggle Switch at rear to STANDBY. The main blowers on both units should commence to run. The GREEN STANDBY indicators should light. OVEN indicators on both MCG-1 units should commence to cycle.

b. MSA-1 (Both Units):

- (1) STANDBY-ON switch to STANDBY.
- (2) AGC DECAY Controls - 1/4 TURN CW.
- (3) SQUELCH Controls - fully CCW.
- (4) MONITOR LEVEL control - fully CCW.
- (5) MONITOR SELECT switches - A₁
- (6) LINE LEVEL controls - 1/4 turn CW, except A₁ control of RCVR #1 which should be 1/2 turn CW.

c. MCG-1 (Both Units):

INT-AFC-SYN switches to SYN.

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A. PRELIMINARY - Cont'd

d. AFC-3 (Both Units):

- (1) SENSITIVITY controls - fully CW.
- (2) TUNING KCS controls - "0".
- (3) CARRIER SELECTOR switches - OSC.

e. HFR-1A (Both Units):

- (1) BAND - BAND 1 (2-3 mcs).
 - (2) NOISE SILENCER-OFF-ALIGNMENT SIGNAL switches to ALIGNMENT SIGNAL.
 - (3) TUNE-SYNC-OPERATE switches - (a) RCVR #1 - SYNC and (b) RCVR #2 - TUNE (left in this position at all times).
 - (4) TUNE controls: (a) RCVR #1 - 2 mcs and (b) RCVR #2 - 2.5 mcs.
- f. HFS-1 (Control Settings insignificant at this time).

g. BSP-6:

- (1) RCVR-1 - A₁.
- (2) RCVR-2 - A₁.
- (3) VOLUME controls (both) 1/2 turn CW. These VOLUME controls may be adjusted to any convenient listening level during the test.

B. CHECKOUT PROCEDURE

* 1. On both MSA-1 units, place STANDBY-ON-POWER switches to ON. The YELLOW time delay indicators should light, and the GREEN standby indicators should go out. After approximately 60 seconds, both YELLOW time delay indicators should go out, and the RED operate indicators should come on. At the same time, the following should occur:

- a. both HFRA-1A dials should be illuminated,
- b. the NIXIE indicators on the HFS-1 should light,
- c. the GREEN channel indicators on both MSA-1 units should light,
- d. the SYNC indicator on HFR-1A #2 should light. This indicator is of no significance in a diversity system, and will remain on at all times.

* 2. With a Simpson 260 VOM, measure the voltage at the convenience outlets on the HPP-1 panel. It should be 117V, AC, +10%.

* 3. Pull out both HFP units. Measure the d-c voltage at test points TP8001 and TP8002 with a VOM. It should be +200V, exactly. If necessary, adjust the appropriate potentiometer(s) located adjacent to the test point(s). Replace both HFP-1 drawers.

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B. CHECKOUT PROCEDURE - Cont'd

* 4. Check of Synthesizer, HFO Circuits (both RF heads) & Synthesizer Stability

a. Remove the plug from J1313 on HFR-1A #2 - connect the frequency counter to J1313.

b. Set the NIXIE selectors on HFS-1 to 02.0000.

c. Carefully move the TUNE control on #1 RF head around 2.0 mcs until an audible zero beat is obtained. The SYNC light may chatter during this operation.

d. Place TUNE-SYNC-OPERATE switch (RCVR #1) to OPERATE. The SYNC indicator (RCVR #1) should come on and remain on. Move the TUNE control on RF head #1 so that the SYNCHRONIZE meter reads "0" center scale.

e. Carefully move the TUNE control on RF head #2 around 2 mcs until a NULL is found. On either side of the NULL, an audible "BEEP" will be heard. Move the TUNE control to a position midway between the "BEEPS". The system is synchronized. The counter should read 3.75 mcs. As with SYNC LIGHT #2, SYNCHRONIZE Meter #2 has no meaning in a diversity system.

f. Place the TUNE-SYNC-OPERATE switch on RF head #1 to SYNC. Place the 100 KC selector on HFS-1 to Position 1. Carefully move the TUNE control on RF head #1 until an audible zero beat at 2.1 mcs is obtained. Place the TUNE-SYNC-OPERATE switch on RF head #1 to OPERATE. SYNC LIGHT #1 should come on.

g. Carefully move the TUNE control on RF head #2 until the dial pointer rests midway between the 2 audible "BEEPS" at 2.1 mcs. The counter should read 3.85 mcs.

h. Continue this procedure for the remaining positions of the 100 KC selector as shown in the following table. Move the NIXIE selector to the position shown. With the #1 TUNE-SYNC-OPERATE switch at SYNC, move the #1 TUNE control until a zero beat is obtained, then throw the switch to OPERATE, and note that the #1 SYNC indicator comes on. Then find the NULL with the #2 TUNE control and read the counter.

<u>100 KC SELECTOR</u>	<u>TUNE CONTROL</u>	<u>FREQ. COUNTER</u>
2	2.2 mcs	3.95 mcs
3	2.3 mcs	4.05 mcs
4	2.4 mcs	4.15 mcs
5	2.5 mcs	4.25 mcs
6	2.6 mcs	4.35 mcs
7	2.7 mcs	4.45 mcs
8	2.8 mcs	4.55 mcs
9	2.9 mcs	4.65 mcs

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B. CHECKOUT PROCEDURE - Cont'd

i. Place the 10 KC NIXIE selector to position 1. Repeat the foregoing procedure with the TUNE controls at 2.91 mcs. The counter should read 4.66 mcs. Continue this procedure through the remaining positions of the 10 KC selector switch, in accordance with the following table:

<u>10 KC SELECTOR</u>	<u>TUNE CONTROL</u>	<u>FREQ. COUNTER</u>
2	2.92 mcs	4.67
3	2.93 mcs	4.68
4	2.94 mcs	4.69
5	2.95 mcs	4.70
6	2.96 mcs	4.71
7	2.97 mcs	4.72
8	2.98 mcs	4.73
9	2.99 mcs	4.74

j. Place the 1 KC NIXIE selector to position 1. Repeat the foregoing procedure with the TUNE controls at 2.991 mcs. The counter should read 4.71 mcs. Continue this procedure through the remaining positions on the 1 KC selector switch in accordance with the following table:

<u>1 KC SELECTOR</u>	<u>TUNE CONTROL</u>	<u>FREQ. COUNTER</u>
2	2.992 mcs	4.742 mcs
3	2.993 mcs	4.743 mcs
4	2.994 mcs	4.744 mcs
5	2.995 mcs	4.745 mcs
6	2.996 mcs	4.746 mcs
7	2.997 mcs	4.747 mcs
8	2.998 mcs	4.748 mcs
9	2.999 mcs	4.749 mcs

k. Place the .1 KC NIXIE selector to position 1. Repeat the foregoing procedure with the TUNE controls at 2.9991 mcs. The counter should read 4.7491 mcs. Continue this procedure through the remaining positions of the .1 KC selector switch in accordance with the following table:

<u>.1 KC SELECTOR</u>	<u>TUNE CONTROL</u>	<u>FREQ. COUNTER</u>
2	2.9992 mcs	4.7492 mcs
3	2.9993 mcs	4.7493 mcs
4	2.9994 mcs	4.7494 mcs
5	2.9995 mcs	4.7495 mcs
6	2.9996 mcs	4.7496 mcs
7	2.9997 mcs	4.7497 mcs
8	2.9998 mcs	4.7498 mcs
9	2.9999 mcs	4.7499 mcs

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B. CHECKOUT PROCEDURE - Cont'd

l. Place the NIXIE selectors to 03.0000. Repeat the synchronization procedure at this frequency. The counter should read 4.75 mcs.

m. Move the BAND control on both RF heads to Band #2 (3-4 mcs). Repeat the synchronization procedure at 3 mcs. The counter should read 4.75 mcs.

n. Continue this procedure for the remaining positions of the MC NIXIE selector switch, conducting the check at the high and low ends of each band. In each case, the counter should read 1.75 mc above the selected RF frequency.

<u>MC SELECTOR</u>	<u>BAND</u>	<u>TUNE CONTROL</u>	<u>FREQ. COUNTER</u>
4	2	4 mcs	5.75 mcs
4	3	4 mcs	5.75 mcs
5	3	5 mcs	6.75 mcs
6	3	6 mcs	7.75 mcs
6	4	6 mcs	7.75 mcs
7	4	7 mcs	8.75 mcs
8	4	8 mcs	9.75 mcs
8	5	8 mcs	9.75 mcs
9	5	9 mcs	10.75 mcs
10	5	10 mcs	11.75 mcs
11	5	11 mcs	12.75 mcs
12	5	12 mcs	13.75 mcs
12	6	12 mcs	13.75 mcs
13	6	13 mcs	14.75 mcs
14	6	14 mcs	15.75 mcs
15	6	15 mcs	16.75 mcs
16	6	16 mcs	17.75 mcs
16	7	16 mcs	17.75 mcs
17	7	17 mcs	18.75 mcs
18	7	18 mcs	19.75 mcs
19	7	19 mcs	20.75 mcs
20	7	20 mcs	21.75 mcs
21	7	21 mcs	22.75 mcs
22	7	22 mcs	23.75 mcs
23	7	23 mcs	24.75 mcs
24	7	24 mcs	25.75 mcs
24	8	24 mcs	25.75 mcs
25	8	25 mcs	26.75 mcs
26	8	26 mcs	27.75 mcs
27	8	27 mcs	28.75 mcs
28	8	28 mcs	29.75 mcs
29	8	29 mcs	30.75 mcs
30	8	30 mcs	31.75 mcs
31	8	31 mcs	32.75 mcs

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B. CHECKOUT PROCEDURE - Cont'd

o. Set the NIXIE selectors to 31.9999, and conduct the synchronization procedure. The counter should read 33.7499 mcs.

p. Remove the counter from J1313 on RF head #2, and replace the 50 ohm termination.

* 5. Check of AFC-3 Unit #1

a. Synchronize the RF heads at 02.0000 mcs. Leave both NOISE SILENCER-OFF-ALIGNMENT SIGNAL switch on ALIGNMENT SIGNAL.

b. On both MCG-1 units, place INT-AFC-SYNTH switches to AFC.

c. On AFC-3 #1, depress and hold down the RED RESET button, and carefully adjust the TUNING KCS control until the following occur simultaneously:

- (1) Maximum level is noted in the GREEN scale on the CARRIER LEVEL meter.
- (2) The FADE indicator is extinguished.
- (3) The DRIFT meter reads "0" center scale.
- (4) The DRIFT ALARM lamp is extinguished. When the proper conditions are obtained, release the RESET button. The conditions noted above should remain, and the DRIFT METER indicator should be steady at "0" center scale.

d. On AFC-3 #1, place CARRIER SELECTOR switch to RCC. The indications noted in "c" above should be unchanged. Return the CARRIER SELECTOR switch to OSC position.

e. On HFR-1A #1, place the NOISE SILENCER-OFF-ALIGNMENT SIGNAL switch to OFF, and the following conditions should appear on AFC-3 #1:

- (1) The CARRIER LEVEL indication should fall.
- (2) The FADE ALARM should light.

After a wait of approximately ten seconds, return the NOISE SILENCER-OFF-ALIGNMENT SIGNAL switch on RF head #1 to ALIGNMENT SIGNAL. The conditions of Para. 5 "c", (1) through (4), should be restored on the AFC-3 unit without adjustment of controls.

f. On AFC-3 #1, turn the SENSITIVITY control fully CCW. The FADE indicator should light and the CARRIER LEVEL indication should fall. Return the SENSITIVITY control fully CW.

f. Repeat Para. 5 for AFC-3 #2, using Receiver #2.

NOTE: A FURTHER TEST OF THE AFC-3 UNITS WILL BE MADE IN CONJUNCTION WITH THE MSA-1 UNITS.

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B. CHECKOUT PROCEDURE - Cont'd

6. Check of MSA-1 Units (in conjunction with AFC-3 & BSP-6)

- a. Ascertain that both receivers are still synchronized at 2.0000 mcs.
- b. On HFR-1A #1, place NOISE SILENCER-OFF-ALIGNMENT SIGNAL to NOISE SILENCER.
- c. On MSA-1 #1, rotate each SQUELCH control fully CCW.
- d. On MSA-1 #1, manipulate each LINE LEVEL control until the appropriate LINE LEVEL meter reads approximately -10VU.
- e. On MSA-1 #1, move each SQUELCH control slowly CW, until the appropriate channel just cuts off, as indicated by the extinction of the GREEN Channel light.
- f. On HFR-1A #1, place NOISE SILENCER-OFF-ALIGNMENT SIGNAL switch to ALIGNMENT SIGNAL.
- g. With INT-AFC-SYN switch on MCG-1 #1 still in AFC position, hold down the RESET button on AFC-3 #1, and move TUNING KCS control to the +3KC position. Release RESET button. Channel B₂ LINE LEVEL meter should indicate, and the B₂ GREEN channel indicator only should light.
- h. As the TUNING KCS control on AFC-3 #1 is moved slowly CCW to the -3 KC position, Channels B₁, A₁ and A₂ should activate in turn, to the exclusion of the other channels. Leave the TUNING KCS control at -3 KC with Channel A₂ activated.
- i. Plug headphones into the MONITOR jack on MSA-1 #1, and rotate the MONITOR LEVEL control fully CW. Put MONITOR SELECTOR switch in the A₂ position.
- j. On BSP-6, RCVR #1 side, place RCVR #1 selector to A₂, and advance GAIN control CW for a convenient listening level. A tone should be heard in both phones and monitor speaker.
- k. Slowly move the TUNING KCS control on AFC-3 #1 CW toward +3 KC. As Channels B₁ and B₂ activate, move the MONITOR SELECTOR switch on MSA-1 #1 and the RCVR #1 selector on the BSP-6 to the appropriate position, and listen for a tone in the phones and monitor speaker. Leave AFC-3 TUNING KCS control at +3 KC.
1. Repeat Steps of Para. 6, using units of Receiver #2.

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B. CHECKOUT PROCEDURE - Cont'd

* 7. Dynamic AGC Check

a. Receiver #1:

(1) Set controls on Receiver #1 as follows

(a) HFR-1A -

BAND - BAND #1 (2-3 mcs)

TUNE - 2.5 mcs

NOISE SILENCER-OFF-ALIGNMENT SIGNAL - OFF

TUNE-SYNC-OPERATE - SYNC

(b) HFS-1 -

NIXIE SELECTORS - 02.5000

(c) MCG-1 -

INT-AFC-SYN switch - SYN

(d) MSA-1 - No Adjustment

(2) Connect an RF signal generator to antenna jack on HFR-1 via a 20 db, 50 ohm pad. Adjust signal generator for 100,000 uv at 2.5 mcs.

(3) Synchronize the RCVR #1 system at 2.5 mcs, and lock the TUNE control on HFR-1.

(4) Vernier tune the signal generator to activate Channel A₁, MSA-1.

(5) Adjust Channel A₁ LINE LEVEL control on MSA-1 until Channel A₁ level meter reads 0 VU.

(6) Reduce signal generator output to 10 uv (on signal generator calibrated attenuator). The indication on Channel A₁ level meter, MSA-1, should not fall below -3 VU.

(7) Repeat Para. B7 at: 3.5; 5; 7; 10; 14; 20 and 28 mcs.

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* 7. Dynamic AGC Check

b. Receiver #2:

Repeat Para. 7 for units of RCVR #2. At each frequency to be checked, HFR-1A #2 must be "slaved" to HFR-1A #1 and the HFS-1.

8. Signal Plus Noise/Noise Check (Sensitivity)

a. Receiver #1:

(1) Synchronize the RCVR #1 system at 2.5 mcs. Lock the TUNE control on HFR-1A, and leave the TUNE-SYNC-OPERATE switch at OPERATE.

(2) Connect a Ballantine Model 314 VTVM (or equivalent) to terminals 7 and 8 (A_1 audio output) of terminal board E6501 at rear of MSA-1.

(3) Advance all SQUELCH controls on MSA-1, except A_1 control, fully CW. Leave A_1 SQUELCH control fully CCW.

(4) Connect an RF signal generator, at 2.5 mcs, via a 20 db, 50 ohm pad, to the antenna input on HFR-1A. Set signal generator frequency at 2.5 mcs, output to minimum.

(5) On MSA-1, adjust Channel A_1 LINE LEVEL control for a reading of -20 VU on the A_1 LINE LEVEL meter. Note the DB indication on the Ballantine meter at this time.

(6) On BSP-6, RCVR #1 side, place RCVR #1 selector to A_1 , and advance the RCVR #1 GAIN control for a convenient listening level.

(7) Adjust signal generator output to 1000 uv, and vernier tune the signal generator to obtain, approximately, a 1 KC tone in Channel A_1 .

(8) Adjust signal generator output until Ballantine meter reads 15 db above the reading obtained in Step (5). Read the signal generator output, and divide by 10. The reading must be 1 uv or less.

(9) Repeat the signal plus noise/noise check as required on Test Data Sheet.

b. Receiver #2:

Repeat Para. 8 for Receiver #2, "slaving" RF head #2 to the master system at 2.5 mcs.

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9. AF Distortion/Hum Level/Intermodulation (Adjacent Channel)

(a) AF Distortion:

(1) Connect TTG RF tones through attenuator to J6501 on MSA-1.
Set attenuator for 60 db in.

NOTE: The TTG should have such RF crystals as to produce a 1KC separation between tones: eg. 2000KC and 2001KC.

(2) Set up signal generator to 1.75MC with 1V output. Connect to J6502 on MSA-1.

(3) Connect Sonic Analyzer LP-1A to Channel B2, J6510.

(4) Vary generator for indication on B2 VU meter. Set LINE LEVEL for 0 VU with one RF tone.

(5) Slowly vary generator to center two tones on analyzer.

(6) Set tones on analyzer for zero db reference.

(7) Increase tones 20 db. AF distortion should be 40 db or better.

(8) Leave equipment connected. DO NOT CHANGE ANY SETTINGS.

(b) Hum Level:

(1) With equipment and settings the same as in previous steps, turn off the RF tones on the TTG.

(2) Hum level on analyzer should be down 50 db or better.

(3) Turn on RF tones. DO NOT REMOVE EQUIPMENT.

(c) Intermodulation (Adjacent Channel):

(1) Vary signal generator to obtain an indication on the adjacent channels VU meter. Set for 0 VU.

(2) Any tones on analyzer must be down 60 db or better.

(3) Leave all test equipment connected.

(4) Repeat parts 9-a,b, and c for Channels B1, A1 and A2.

(5) Upon completion of Step d, disconnect all test equipment and re-connect all cables to proper jacks.

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THE TECHNICAL MATERIEL CORP.
MAMARONECK, N.Y.

TEST DATA SHEET #1

MFG. NO.: _____

SERIAL NO. _____

		RCVR #1	RCVR #2
A-4a	Blowers operate	_____	_____
	GREEN STANDBY indicators	_____	_____
	MCG-1 oven indicators	_____	_____
B-1	YELLOW time delay indicators	_____	_____
	RED operate indicators	_____	_____
B-2	Conv. outlet voltage	_____	_____
B-3	Voltage at TP8001 & 8002	_____	_____
B-4	SYNTH, HFO, STABILITY	_____	_____
B-5	Check of AFC-3	_____	_____
B-6	Check of MSA-1	_____	_____
B-7 and 8	AGC & SENSITIVITY (-3db or less)(luv or less)		

FREQ.	AGC CHECK		SENSITIVITY	
	RCVR #1	RCVR #2	RCVR #1	RCVR #2
2.5 mcs	_____	_____	_____	_____
3.5 mcs	_____	_____	_____	_____
5 mcs	_____	_____	_____	_____
7 mcs	_____	_____	_____	_____
10 mcs	_____	_____	_____	_____
14 mcs	_____	_____	_____	_____
20 mcs	_____	_____	_____	_____
28 mcs	_____	_____	_____	_____

DATE: _____

TESTER: _____

