TMC SPECIFICATION

REV: Ø			NO. S 1149
COMPILED:	CHECKED:	APPD:	SHEET 1 OF 13
TITLE:			

typed by vab 11/1/66

TEST AND ALIGNMENT PROCEDURE

FOR

GPR-90 RXDS

TITLE: TEST AND ALIGNMENT FOR GPR-90 RXDS

typed by vab 11/1/66

A. TEST EQUIPMENT REQUIRED:

1. AC VTVM Heathkit Model AV-2 or equivalent.
2. VTVM Heathkit Model V-7A or equivalent.
3. AUDIO GENERATOR Hewlett Packard Model 200C or equivalent.
4. SWEEP GENERATOR Harvey Radio Labs Model 46 or equivalent.
5. RF GENERATOR Measurements Model 82 or equivalent.
6. OSCILLOSCOPE Dumont Model 304 or equivalent.
7. 2-1200 ohm 2 watt resistors in parallel.
8. AUDIO FREQUENCY METER Heathkit Model AF-1 or equivalent.
9. XTAL CALIBRATOR Measurements Model 11B or equivalent.
10. Earphones and Speaker (4 ohms)
11. 47 ohm dummy load, DL100-4.

B. PRELIMINARY:

1. Check unit for mechanical defects.
2. Check for wiring defects.
3. Check B+ lines for shorts to ground.
4. Turn set on and measure B+ lines (250VDC ± 10% and 150VDC ± 5%).
5. SSB switch to OFF position. AUDIO GAIN control to full CW position. RF GAIN control to full CCW position.
6. Connect 600 ohm load across 600 ohms output of E1. Connect AC VTVM across load and adjust HUM BAL control for minimum output qhich should be 0.03 volts or less.

C. AUDIO AMPLIFIER:

1. Radio-Phono switch in Phono position.
2. Connect Audio Generator to Phono input jack and note readings below on output meter.

AUDIO SELECTOR	INPUT	OUTPUT
Normal	0.3V	34.6V
Low-Pass	0.3V	31.0V
1200 cps peak	0.3V	28-50V (Vary the Audio Spread Control)

3. Set AUDIO SELECTOR switch to NORMAL position.

D. IF ALIGNMENT:

1. Set RANGE SELECTOR switch to .54-1.4 position and RF GAIN control to full CW position.
2. Connect VTVM to pin 2 of V6 and adjust IF GAIN control for 1.8 volts on the meter.

3. Set the following switches as shown below. AVC-MANUAL to MANUAL, BFO-OFF to OFF, LIMITER-OFF to OFF, SSB-OFF to OFF, SEND-REC to REC, RADIO-PHONO to RADIO, RF SELECTIVITY to NON XTAL.

4. a. Feed the 455 kHz output of the Harvey Radio Labs Model 46 sweep generator into the signal grid of V3 (pin 1). CRYSTAL SEL. SW. should be in the 2kHz position. Observe output waveform at the detector load (terminal strip junction R 58 and R60). For maximum output as observed on the scope, peak T 8, 7, 6, L20 and T 5, 4. Repeat in this order as many times as is necessary for optimum response. CRYSTAL PHASING CONTROL must be at zero for this alignment. Check relation of this control with condenser setting. With control on zero, condenser should be half open.

b. Connect AC VTVM to J1A (IF. OUT). XTAL PHASE control at zero. The following results should be obtained.

RF SELECTIVITY SWITCH	BANDWIDTH AT 6DB ± 10%
NON XTAL	7000 cps
2.0 KC	2000 cps
1.5 KC	1500 cps
1.0 KC	1000 cps
.5 KC	500 cps
.25KC	250 cps

5. Connect the 455 KC output of the sweep generator to pin 1 of V3. Connect oscilloscope to detector load. Set RF SELECTIVITY switch to 2.0 KC position. Vary the XTAL PHASE control clockwise and counter-clockwise about the zero position and observe waveform on the scope. The rejection notch should move above and below the frequency of the series resonance peak. Compare with response curves. (See MANUAL).

6. Set XTAL PHASE control in the zero position and observe the waveforms for all positions of the RF SELECTIVITY switch.

7. Disconnect scope and connect VTVM in its place. (VTVM remains connected throughout test of the receiver).

8. Connect RF generator to P1 of V3, set at 455 KC and 1000 cps. at 30% modulation. XTAL PHASE control at zero. The following results should be obtained.

RF SELECT. SWITCH	MODULATION VTVM OUTPUT	ATTENUATOR
NON XTAL	1000 cps @ 30% 0.35V	80-100 uv
2.0 KC	1000 cps @ 30% 0.35V	160-200 uv
.5 KC	100 cps @ 30% 0.35V	50-70 uv

TURN OFF MODULATION ON RF GENERATOR.

E. 1. Check BFO Switch action. Switch ON, V 13 plate voltage is ON. Switch OFF V 13 plate voltage is OFF.

2. Set BFO PITCH CONTROL on zero (condenser should be half open).

3. Feed an RF Signal Generator set at 455 kHz into pin 1, V3.

4. With BFO SWITCH ON, adjust the BFO tuning slug L22 so that the BFO zero beats with the incoming 455 kHz signal. The zero beating may be ascertained by means of earphones or a speaker.
Connect Audio Frequency Meter across 600 OHMS load and observe 3 KC swing each side of "0" setting of BFO Pitch Control.

F. 3.955 KC IF ALIGNMENT

1. Set RANGE SELECTOR to 5.4-9.6 position. Adjust RF generator for 3.955 KC and 1000 cps modulation.

2. Adjust L19, T2 (top and bottom slugs), and T3 for peak on VTVM.

3. Sensitivity: For 20 uv into Pin 1 of V3 at 3.955 KC should produce .35V at the detector load.

G. RF ALIGNMENT

1. Set BAND SPREAD and ANT. TUNE capacitors at minimum capacity and oscillator trimmers to 1/2 open position. RF SELECTIVITY switch to NON XTAL position.

2. Set the MAIN TUNING capacitor and dial at the top end of the band. (See alignment chart below.)

BAND	HIGH END	LOW END	MIN. SENS. FOR 10DB $\frac{S+N}{N}$
1	1450 KC	540 KC	2.5 uv
2	3.3 MC	1.43 MC	1.0 uv
3	5.6 MC	3.2 MC	2.5 uv
4	9.0 MC	5.8 MC	1.0 uv
5	17.0 MC	10.0 MC	1.0 uv
6	31.0 MC	18.0 MC	1.0 uv

3. Connect RF generator through an appropriate matching network to the ANT 75 OHM connector on the receiver. Set RF generator to the high end of the band as per alignment chart. Tune oscillator slug for maximum audio output and adjust corresponding RF trimmer for maximum output.

4. Set the MAIN TUNING capacitor and dial at the low end of the band. Set RF generator to the low end of the band as per alignment chart. Adjust oscillator, RF, and Antenna tuning slugs for maximum output.

5. Repeat steps 3 and 4 as many times as necessary for optimum output. In repeating step 3 adjust the oscillator trimmer instead of the tuning slug. (Adjust trimmers at high end of band and slugs at low end of band.)

*6. Measure the RF input at the low, middle and high end of the band for .35V across detector load.

*7. Check the dial calibration at the low, middle and high end of the band.

*8. Check the 10 db noise figure at low, middle and high end of the band.

*9. Check the image rejection at the low, middle and high end of the band; it must be no less than 60 db.

10. Repeat steps 2 to 9 of all bands.

*NOTE: PEAK ANT. TUNE CONTROL BEFORE EACH MEASUREMENT.

H. SEND-REC SWITCH OPERATION:

1. Switch in SEND position. The receiver is disabled and B+ is removed from V1 through V7.

2. Switch in REC position. The receiver should operate.

I. AVC SWITCH OPERATION:

1. Connect AC VTVM across 600 OHM load and switch to 0 db range. With AVC switch on AVC adjust RF generator attenuator for 1 uv input and AUDIO GAIN control for 0 db on output meter. Turn RF generator attenuator to 10,000 uv. The output should remain constant within 12 db.

2. With AVC switch on MANUAL the volume will decrease.

J. NOISE LIMITER SWITCH OPERATION:

1. With LIMITER Switch in the OFF position, connect the oscilloscope across the 600 OHM load. Radiate a source of noise pulses (buzzer or vibrator) into the receiver. Observe noise pulses in output waveform. Set the LIMITER switch to LIMITER position, the noise pulses should disappear.

K. RELAY TERMINALS:

1. With SEND-REC switch on SEND, reception should take place only when the RELAY TERMINALS are shorted. (CAUTION: 250V PRESENT)

L. METER CALIBRATION:

1. Tune receiver and RF generator (50 uv output) to 9 MC. AVC switch to AVC position. BFO switch to OFF position. Adjust R50 (S METER ADJ) for a meter reading of S9.

2. Reduce RF generator to zero output and adjust IF GAIN (R106) control to 0 reading on S meter.

3. Repeat steps 1 and 2 to have meter remain on 0 and S9.

M. 100 KC CALIBRATOR:

Connect XTAL CALIBRATOR to ANT input of receiver and switch to 100 KC range. Set CAL switch to CAL and adjust CAL ADJ trimmer for zero beat with standard. When this is corrent the S meter will pulse.

N. PHONE JACK:

Plug in earphones in PHONE jack. The phones will work and the speaker will not.

O. AUDIO OUTPUT TERMINALS AND PHONO INPUT JACK:

1. Set RADIO-PHONO switch to PHONO, AUDIO SELECTOR switch to NORMAL, AUDIO GAIN control to full CW position.

2. Connect Audio Generator to PHONO input jack. Set generator to 1000 cps and for 34.6 V across the 600 ohm load. Read the voltagr on the following terminals:

16 ohms - 6.65 volts
8 ohms - 4.8 volts
4 ohms - 3.0 volts

P. RXDS SECTION:

1. Check continuity between xtal sockets and HFO switch positions.

2. Insert crystal in sockets as shown in Table I.

3. Tuning:
   a. Select crystal.
   b. Tune receiver to desired signal frequency.
   c. Tune RF generator to obtain maximum output at the receiver.
   d. Set HFO switch in VAR position and tune receiver to obtain maximum output.
   e. Set HFO switch in XTAL position and take sensitivity and signal to noise ratio.
   f. Set HFO switch in EXT position. Connect another RF generator to EXT. HFO jack. Set input to 1 volt and tune it to the HF oscillator frequency. Take sensitivity and signal to noise ratio.
   g. Feed a 3.5 MC signal to the IFO input jack on rear apron. (This test valid only for HFO switch on the EXT. position.)

Q. SSB SWITCH:

Feed into Antenna Terminals (75 ohms) a 10 uv signal at 14.5 mHz. Listen or measure audio output of receiver. Then switch SSB SWITCH from OFF to ON and observe audio to cease.

R. IF OUTPUT JACK:

Measure MIN. .5V v.a.c. on the Hi Z IF OUTPUT JACK with 47 ohm Termination on Low Z IF output jack.

S. SPURIOUS BEATS:

Ground ANT. connector. Set BFO switch to ON position. RF GAIN and AUDIO GAIN controls should be at maximum. Tune through each band listening for spurious beats. There should be no beats of appreciable magnitude which are audible.

T. LISTENING TEST:

Connect an outside antenna to the ANT. input of the receiver and listen in on all bands throughout the range.

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TABLE I

TYPICAL PERFORMANCE DATA IN XTAL POSITION

Sensitivity must be less than 1 uv on bands 2, 4, 5 and 6. Less than 2.5 uv on bands 1 and 3.

SIGNAL FREQUENCY	XTAL SOCKET	XTAL FREQUENCY	MODE	SENSITIVITY
30.045	3	17	Xtal / Ext.	.35
16.045	4	20	Xtal / Ext.	.20
9.045	5	13	Xtal / Ext.	.20
4.545	8	5	Xtal / Ext.	.20
3.045	9	3.5	Xtal / Ext.	.25
0.995	10	1.35	Xtal / Ext.	.50

TABLE II

TYPICAL BAND SPREAD TEST

AMATEUR BAND	MAIN TUNING DIAL CHECK POINTS	BANDSPREAD DIAL CHECK POINTS	MAX. DIVISION ERROR
160 M	2.0 MC	Every 100 KC	1/4 Div.
80 M	4.1 MC	Every 100 KC	1/4 Div.
40 M	7.4 MC	Every 100 KC	1/2 Div.
20 M	14.5 MC	Every 100 KC	1/4 Div.
15 M	21.8 MC	Every 100 KC	1/2 Div.
10-11 M	30.0 MC	Every 100 KC	1/2 Div.

TABLE III

TYPICAL IF BANDWIDTH RESPONSE

IF BANDWIDTH - MIXER GRID

Signal Generator Connected to Pin #1 of V3

BAND 1 455 KC Mod. 30% at 1,000 cycles.
400 cycles. *
100 cycles. **

TABLE IV

BANDWIDTH CONTROL SETTING		6 DB
**	.25 KC (Xtal Phase-0)	.15 - .35 KC
**	.5 KC (Xtal Phase-0)	.4 - .6 KC
*	1.0 KC (Xtal Phase-0)	.7 - 1.1 KC
*	1.5 KC (Xtal Phase-0)	.9 - 1.6 KC
	2.0 KC (Xtal Phase-0)	1.5 - 2.3 KC
	Non-Xtal	6 - 8 KC

THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N.Y.

GPR-90 RDXS TEST DATA SHEET

SERIAL NO._____
MFG. NO._____

IF SENSITIVITY AT MIXER GRID FOR .35VAC ACROSS DETECTOR LOAD

BAND 1	455 KC	30% Mod at 1,000 cycles	Non-Xtal_____uv
BAND 1	455 KC	30% Mod. at 1,000 cycles	2 KC Xtal_____uv
BAND 1	455 KC	30% Mod. at 100 cycles	.5 KC Xtal_____uv
BAND 4	3.955 MC	30% Mod. at 1,000 cycles	Non-Xtal_____uv

IF BANDWIDTH - MIXER GRID

BAND L 455 KC Mod. 30% at 1,000 cycles
400 cycles *
100 cycles **

BANDWIDTH CONTROL SETTING	6 DB
** .25 KC (Xtal Phase-0)	
** .5 KC (Xtal Phase-0)	
* 1.0 KC (Xtal Phase-0)	
* 1.5 KC (Xtal Phase-0)	
2.0 KC (Xtal Phase-0)	
Non-Xtal	

BFO

\+ _____cps

\- _____cps

IF OUTPUT _____VOLTS

SSB SWITCH _____OK

GPR-90 RXDS TEST DATA SHEET #2

AVC _____OK

S-METER ADJ _____OK

SEND-RECEIVE _____OK

RELAY _____OK

NOISE LIMITER _____OK

PHONES _____OK

HUM-RADIO _____VOLTS PHONO _____VOLTS

SPEAKER 4 OHM (.4v) _____ 8 OHMS (.6v) _____ 16 OHMS (.8v) _____ 600 OHMS (.4v) _____

UTILITY SOCKET _____OK

B+ _____VOLTS

REG. B+ _____VOLTS

PHONO _____ 2 watts Power Output: Audio Input _____volts.

AUDIO SELECTOR Normal _____volts

Low Pass _____volts

1200 Cycles Peak _____volts

AUDIO SPREAD

NARROW 10 DB BW _____OK

BROAD 10 DB BW _____OK

GPR-90RXDS TEST DATA SHEET #3

BAND	FREQ. MCS	MICROVOLT INPUT FOR .35 ACROSS DET. LOAD	MIRCOVOLT INPUT FOR 10DB SIGNAL TO NOISE RATIO	IMAGE RATIO	MAX. FREQ. ERROR
1	.56				
	1.00				
	1.40				
2	1.50				
	2.40				
	3.20				
3	3.30				
	4.40				
	5.50				
4	5.60				
	7.40				
	9.50				
5	9.80				
	13.50				
	17.5				
6	18.0				
	24.0				
	31.0				

Check for Beats at 7.0 MC and 10.5 MC _____ OK

Check for Beats at 1.82 MC, 2.275 MC, 2.73 MC, 3.18 MC, 3.64 MC _____ OK

Intermodulation at 5.0 MC + .880 MC = 5.88 MC _____ DB

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GPR-90 RXDS TEST DATA SHEET #4

AMATEUR BAND	MAIN TUNING DIAL CHECK POINTS	BANDSPREAD DIAL CHECK POINTS	MAX. FREQUENCY ERROR
160 M	2.0 MC	Every 100 KC	
80 M	4.1 MC	Every 100 KC	
40 M	7.4 MC	Every 100 KC	
20 M	14.5 MC	Every 100 KC	
15 M	21.8 MC	Every 100 KC	
10-11 M			

RXD SECTION

SIGNAL FREQUENCY	XTAL SOCKET	XTAL FREQUENCY	MODE	SENSITIVITY	S/N
30.045	3	17	Xtal		
			Ext.		
16.045	4	20	Xtal		
			Ext.		
9.045	5	13	Xtal		
			Ext.		
4.545	8	5	Xtal		
			Ext.		
3.045	9	3.5	Xtal		
			Ext.		
0.995	10	1.35	Xtal		
			Ext.		

AIR TEST _____ OK

DATE: _____

TESTER: _____

REVISION SHEET

THE TECHNICAL MATERIEL CORP.
MAMARONECK NEW YORK

S 1149
LIST NO.

DATE	REV.	SHEET	EMN #	DESCRIPTION	APP.
12/8/66	ø			ORIGINAL RELEASE FOR PRODUCTION	

TMC FORM MLR-1 2-65—AINS.