

DATE <u>5-19-61</u>	TMC SPECIFICATION NO. S-561	REV A
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COMPILED BY <i>[Signature]</i>	TITLE: TEST & ALIGNMENT PROCEDURE FOR GPR-90 RXD	JOB
APPROVED <i>[Signature]</i>		

1. Check B⁺ line for shorts to ground. (both +250 v and +150 lines)
2. Turn set on and measure B⁺ (should be +250 v.d.c. and +150 v.d.c.)
3. Connect a 600 ohms resistor across the 600 ohms winding of the output transformer. Measure the hum level across this resistor with a high impedance A.C.V.T.V.M. for the following conditions: (Hum should measure under 0.03 v.r.m.s. across 600 ohms) SSB Switch on OFF position. AUDIO GAIN control -full on.

RADIO-PHONO SWITCH in		RADIO	PHONO
AUDIO SEL. SW. IN	NORMAL		NORMAL
AUDIO SEL. SW. IN	LO-PASS		LO-PASS
AUDIO SEL. SW. IN	1200cps (NAR.)		1200 cps

4. Audio Amplifier Gain Measurements: Feed a 1000 cps signal from an audio (HP200C) oscillator into the PHONO input jack (RADIO-PHONO SWITCH in PHONO position) AUDIO GAIN control should be completely clockwise. Measure the input voltage which will produce an output voltage of 34.6 v.rms. n an A.C. VTVM across the 600 ohms load resistance in normal position.

AUDIO SEL. SW. IN NORMAL	0.3 v. rms	----	34.6 volts
AUDIO SEL. SW. IN LO-PASS	0.3 v. rms	----	31.0 volts
AUDIO SEL. SW. IN 1200cps (NAR.)	0.3 v. rms	----	28-50 volts

5. I.F. Alignment (455 kc. I.F. with BAND SWITCH in Band 540 kc-1.4 mc.).

A. Adjust R106 for 1.8 Volts on Pin #2 of v6

- SWITCHES
- AVC-OFF
 - N.L.-OFF
 - S.R.-REC.
 - BFO-OFF
 - SSB-OFF
 - RAD/PH-RAD.

B. Feed the 455 kc. 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 2kc position. Observe output waveform at the detector load (terminal strip junction R 58 and R 60). For maximum output as observed on the scope, peak T 8,7,6, L20, & T5,4. 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.

C. When the above alignment has been completed vary the CRYSTAL PHASING CONTROL clockwise and counterclockwise 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.

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- D. Put CRYSTAL PHASING CONTROL in the zero position and observe the waveforms for all positions of the CRYSTAL SELECTIVITY SWITCH. Compare with response curves.
- E. Disconnect scope and connect VTVM in its place. (VTVM remains connected throughout test of the receiver.)
- F. Feed a Measurements 65-B or 82 signal generator into pin 1 of V3 and measure the 6 db. bandwidths of all positions of the CRYSTAL SEL. SW. The following results should be obtained: (CRYSTAL PHASING contr 1 at zero) (All frequency readings $\pm 10\%$.)

Non-Crystal	7000 CPS
2 KC.	2000 CPS
1.5 KC.	1500 CPS
1 KC.	1000 CPS
.5 KC.	500 CPS
.25 KC.	250 CPS

- G. With signal generator modulated 1000cps at 30% mod., measure the 455kc output in the NON CRYSTAL position to produce .35 v. rms across the detector load (input signal between 80-100 uv).
2 kc position 160-200 uv. .5 kc position 50-70 uv.
6. Check the BANDSPREAD dial calibration in several places throughout each band.

B.F.O. Operation

- a. Check B.F.O. Switch action. Switch ON-V 13 plate voltage is on. Switch OFF V 13 plate voltage is off.
- b. Set B.F.O. PITCH CONTROL on zero (condenser should be half open).
- c. Feed an R.F. Signal Generator set at 455 KC. into pin 1, V3. +
- d. With B.F.O. SWITCH ON, adjust the B.F.O. tuning slug L22 so that the BFO zero beats with the incoming 455 KC. 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.
7. 3.955 I.F. Alignment (Bandswitch in Band 4).
- Feed 3.955 KC from signal generator to pin #1 of V3 (adjust output from signal generator accordingly).
- a. Align L19 for peak on VTVM.
- b. Align T2 t p and bottom slugs.

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c. Align T3 bottom slug.

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

8. R.F. Alignment

(Bandspread and Antenna Tuning Capacity at minimum capacity and osc. trims. 1/2 open)

- a. . . Set the MAIN TUNING condenser and dial at the top end of the band. See alignment chart below.
- b.. Feed into the ANTENNA terminals (75 ohms), through an appropriate matching network from a Measurements 82 or 65 -B signal generator a frequency corresponding to the high end of band alignment frequency. Tune oscillator slug for maximum audio output. Adjust the corresponding R.F. trimmer for maximum audio output.
- c. Set the MAIN TUNING condenser and dial at the low end of band calibrating frequency. Feed in an R.F. signal corresponding to this. Adjust oscillator, R.F. and Antenna tuning slugs for maximum output.
- d. Repeat (b) and (c) as many times as necessary for optimum output. In repeating (b) adjust the oscillator trimmer instead of the tuning slug. i.e. adjust trimmers at high end of band and slugs at low end of band.
- * e. Measure the R.F. input at several points in the band for .35uv rms across the det. load.
- * f. Check the dial calibration at several points in the band.
- * g. Check the 10 db noise figure at several points in the band.
- * h. Check the image rejection at several points in the band, must be no-less than 60 db.
- i. Repeat (a) - (h) for all bands.

ALIGNMENT CHART

Band	High End	Low End	Min. Sens.
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

CRYSTAL SEL. - NON CXTL

- * Peak ANTENNA TUNE capacity before each measurement. Compare results with standard charts.

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9. SEND-RECEIVE SWITCH OPERATION

- a. Switch in RECEIVE position- Receiver should operate.
- b. Switch in SEND position- Receiver is disabled and B+ is removed from V1 thru V7.

10. AVC SWITCH OPERATION

- a. With AVC ON- Tune in a station.
- b. With AVC OFF- Notice volume decrease.
- c. With AVC ON check a few points on the AVC characteristic curves.

11. NOISE LIMITER SWITCH OPERATION

With N.L. SW.-OFF

- a. Feed any 1000 cps 30% modulated R.F. signal into the Antenna Terminals, and observe waveform on the output 600 ohms load resistor. Then radiate a source of noise pulses from a vibrator power supply into the receiver. Observe noise pulses in output waveform. Then throw N.L. SW.-ON and observe the disappearance of the noise pulses without distorting the sinewave output.

12. RELAY TERMINALS

- a. With SEND-RECEIVE SWITCH on SEND, reception should take place only when the RELAY TERMINALS are shorted.

13. METER CALIBRATION

- a. Tune receiver and signal generator (50 uv output) to 9 mcs. A.V.C. SW. ON. BFO, OFF. Adjust R50 for an "S" meter reading of S.9.
 - b. Reduce generator to zero output and adjust R106 to (0) reading on A Meter.
 - c. Repeat steps B and C to have S meter to remain on (0) and S9.
14. Adjust 100 kc marker crystal for zero beat with standard. When this is correct the "S" meter will pulse.

15. AUDIO GAIN CONTROL

- a. Check clockwise rotation for maximum volume.

16. R.F. GAIN CONTROL

- a. Check clockwise rotation for maximum volume.

17. PHONE JACK

- a. Plug in earphones and hear reception. Speaker should disable.

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18. AUDIO OUTPUT TERMINALS & PHONO INPUT JACK

- a. Feed a 1000 cps audio signal into the PHONO INPUT JACK, (RADIO PHONO SWITCH in the PHONO position, AUDIO SEL. SW. in NORMAL, AUDIO GAIN on full) of sufficient magnitude to give 34.6 v.a.c. across the 600 ohms load resistor on the 600 ohms OUTPUT TERMINALS. Then read the a.c. voltage on the following terminals:

16 ohms	-	6.65 v.a.c.
8 ohms	-	4.8 v.a.c.
4 ohms	-	3.0 v.a.c.

19. SINGLE SIDE BAND SWITCH & I.F. OUT JACK

- a. Feed into Antenna Terminals (75 ohms) a 10 uv signal at 14.5 mc. Listen or measure audio output of receiver. Then switch SSB SWITCH from OFF to ON and observe audio to cease. Measure N.L.T. .5V v.a.c. on the I.F. OUT JACK using the HP 410 B VTVM.

20. GPR-90 RXD TEST PROCEDURE

1. HFO switch check - Check continuity between xtal sockets and switch positions.
2. Insert crystal in sockets as shown on test data sheet.
3. Tuning -
 - a. Select crystal.
 - b. Tune receiver to desired signal frequency.
 - c. Tune generator to obtain maximum output of receiver.
 - d. Place HFO switch in variable position and tune receiver to obtain maximum output.
 - e. Place HFO switch in xtal position and take sensitivity and signal to noise ratio.
 - f. Place HFO switch in External position. Connect another signal generator to the External socket. Set input to 1 volt and tune it to the HF oscillator frequency. Take sensitivity and signal to noise ratio.
 - g. Connect 3.5 signal to IFO input jack on rear apron. (This test valid only on the Ext. position).

21. TYPICAL PERFORMANCE DATA IN XTAL POSITION

- a. Sensitivity must be less than 1 uv on bands 2,4,5 & 6, less than 2.5 uv on bands 1 & 3.

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

22 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.

23. TYPICAL I.F. BAND WIDTH 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. **

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

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24. FINAL TEST OF RECEIVER PERFORMANCE

SPURIOUS BEATS

Turn BFO ON and tune through each band listening for spurious beats. R.F. GAIN & AUDIO GAIN controls should be at maximum. ANTENNA TERMINALS should be grounded. There should be no beats of appreciable magnitude which are audible.

LISTENING TEST

Put an outside antenna on the ANTENNA TERMINALS of the receiver and listen in on all band throughout the range. Use all controls on front panel and observe effect.

