

DATE 12/1/54  
SH. 1 OF 7

TMC SPECIFICATION NO. S- 234

COMPILED BY  
P.L.K. P.L.K.

TITLE: MODIFICATION OF TUNING DRAWERS FOR FFR-2 RECEIVER JOB 336

APPROVED

*OMP*

A. PURPOSE

The purpose of this specification is to describe several circuit changes which permit the following improvements:

1. Model FFRD-5,6 Tuning Drawers.
  - (a). Reduction of operating noise level.
2. Model FFRD-5,6,7,8 Tuning Drawers.
  - (a). Greater H.F.O. excursions.

3. Models FFRD-\* so modified shall be nomenclatured with a suffix "A" following the number of the tuning drawer, i.e., FFRD-5A

B. OBJECT

1. This change improves the overall receiver performance by reducing the output noise level with no input signal.
2. The H.F.O. excursions have been increased to meet field requirements. The Tuning Drawers as supplied from the factory provide a 1 Kc per Mc. shift for an input voltage of +3 volts on the H.F.O. reactance tube.

In each FFRD the total shift will be approximately:

- (a). FFRD-5,6; a total of 4 Kcs. per Mc. for a total control voltage of 9 volts D.C. +10% (+4.5 volts swing)
- (b). FFRD-7; a total of 3 Kcs. per Mc for a total control voltage of 9 volts D.C. +10% (+4.5 volts swing)
- (c). FFRD-8; a minimum shift of 30 Kcs. over the band with a total control voltage of 9 volts D.C. +10% (+4.5 volts swing)

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C. COMPONENTS REQUIRED

1. FFRD-5

- (a). C505, C537 replace with part CC-101-3.
- (b). C525 replace with part CC21SL150J.

2. FFRD-6

- (a). C605, C637 replace with part CC-101-2.
- (b). Shunt L601 with part RC20GF332K, or Replace L601 with part CL-108-7
- (c). C625 replace with part CC21SL170K.
- (d). R620 replace with RC20GF332K.

3. FFRD-7

- (a). R720, R722 replace with part RC20GF332K.
- (b). C725 replace with part CC21SL170K.

4. FFRD-8

- (a). R822 replace with part CL-108-6.
- (b). R820 replace with part RC20GF152K.
- (c). C825 replace with part CC21SL170K.

D. WIRING PROCEDURE

1. Remove bottom plate from Model FFRD-5. Remove capacitors C505 and C537 which are connected between feedthru's and plate lugs on R.F. and Mixer coil forms. Rewire in place parts CC21SL221J. Do not apply excessive heat to coil form lugs. Remove capacitor C525 which is wired between pin 5 of Reactance Tube V503 and a terminal post.

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Connect part CC21SL150J between pin 5 of tube V503 and grid top of oscillator coil L502 as shown in figure 1. Replace bottom cover.

2. Remove bottom cover from Model FFRD-6. Remove capacitors C605 and C637 which are connected between feedthru's and plate lugs on R.F. and Mixer coil forms. Rewire in place parts CC21SL151J. Connect part RC20GF332K in parallel with choke L601 which is connected to pin 5 of Reactance Tube V603 and a terminal post or replace choke L601 with CL-108-7. Remove capacitor C625 which is connected between pin 5 of V603 and a terminal post. Replace with part CC21SL470K from pin 5 of V603 to grid lug on oscillator coil form as shown in figure 2. Remove resistor R620 which is connected between pin 7 of V603 and ground. Replace with part RC20GF332K. Replace bottom plate.

3. Remove bottom plate from Model FFRD-7. Remove resistor R720 which is connected between pin 7 of V703 and ground. Replace with part RC20GF332K. Remove resistor R722 which is connected between pin 5 of V703 and a terminal post. Also remove capacitor C725 which is connected between pin 5 of V703 and a terminal post. Replace R722 with part RC20GF332K. Rewire part CC21SL470K from pin 5 of V703 to grid lug on oscillator coil form as shown in figure 3. Replace bottom cover.

4. Remove bottom cover from Model FFRD-8. Remove R820 which is wired between pin 7 of V803 and ground. Replace with part RC20GF152K. Remove R822 which is connected between pin 5 of V803 and terminal post. Remove C825 which is connected between pin 5 of V803 and lug on oscillator coil form.

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Replace R822 with part CL-108-6. Wire in part CC21SL470K from pin 5 of V803 and grid tap on oscillator coil form as shown in figure 4.  
Replace bottom cover.

E. TEST PROCEDURE

1. Equipment required:

- (a) FFR-2 Receiver with a 600 ohm 10 watt resistor connected to terminals 2 and 3 on E101.
- (b) Standard signal generator.
- (c) Variable Frequency Oscillator, TMC Model VOX.
- (d) Speaker or headphones.
- (e) Reactance control voltage figure 5

2. Receiver Controls Set:

- (a) R.F. Gain control adjusted as required.
- (b) Audio Gain adjusted as required for monitoring.
- (c) BFO switch ON.
- (d) BFO Master Slave Switch on BFO.

3. VOX Controls Set:

- (a) Power on.
- (b) HFO on.

4. Procedure; Reactance tube adjustment:

- (a) Connect reactance control voltage to terminals 1 and 2 of terminal strip E102. Connect speaker to terminals 1 and 2 of E101. After a reasonable warm up time of equipment and Tuning Drawer, loosely couple the VOX output to the receiver antenna terminals. It may be necessary to adjust the RF Gain control to prevent receiver overload.

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Reactance tube balance adjustment is necessary after modification and is carried out at the low end of the receiver tuning range. Once a symmetrical or nearly symmetrical frequency shift of the HFO is obtained at the low frequency end, the mid range and high frequency end of the Tuning Drawer is checked for shift.

(b) Reactance tube adjustment: FFRD-5. With VOX tuned to 2 Mcs, reactance control voltage zero, tune FFRD-5 to 2 Mcs and zero beat. The receiver oscillator slug may need adjusting to enable receiver to tune to 2 Mcs. Set reactance control voltage to + 4.1 volts tune VOX until zero beat is again obtained and note VOX frequency. Set reactance control voltage to - 4.1 volts and retune VOX to zero beat. The total VOX frequency change times the correct multiplying factor gives the receiver HFO frequency change. If this is inadequate, adjustment of the reactance tube balance will provide sufficient shift. After the proper shift is obtained checking of shift at mid range and high frequency end of band is required. Tune VOX to 3 Mcs and FFRD-5 to zero beat at 3 Mcs. Check HFO shift for minimum requirements. If the shift is under, a slight adjustment of the reactance tube balance trimmer will produce the desired result. Check the shift at 4 Mcs in the same manner. If the receiver does not tune to 4 Mcs adjustment of the oscillator trimmer C527 will tune it correctly. Note that by tuning the receiver approximately 900 Kcs below this frequency the image should be found. If not the oscillator must be retuned at 4 Mcs to bring the image to its proper position.

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(c) FFRD-6,7,8. The same procedure is used for obtaining proper H.F.O. shift in Tuning Drawers FFRD-6,7,8. With the VOX tuned to 2 Mcs the correct harmonic frequency change is obtained by using the proper multiplier with the dial reading. See figure 6.

5. FFR-2 Sensitivity Check:

(a) Receiver controls set.

1. R.F. Gain maximum.
2. BFO Off.
3. Noise limiter off.

(b) Standard Signal Generator controls set.

1. Modulating frequency - 1000 cps.
2. Modulation 30%.
3. Frequency 455 Kc.
4. Output approximately 115 microvolts.

(c) Connect Standard Signal Generator to pin A<sub>4</sub> of J107 with Tuning Drawer removed. Tune Signal Generator to maximum receiver output at approximately 455 Kcs. With bottom cover removed adjust C100 for 1 volt A.C. across diode load, pin 6 of E101 and ground with approximately 115 microvolts input from the signal generator.

6. FFRD- Alignment Procedure:

Each Tuning Drawer must be realigned according to the FFR Instruction Book under Section IV Maintenance, Part 2, Circuit Alignment.

IF IT IS FOUND DESIRABLE TO CHANGE ANY TOLERANCE OR OTHER DETAIL SPECIFIED ON THIS DRAWING NOTIFY THE PURCHASER PROMPTLY.

MAXIMUM ALLOWABLE TOLERANCES HAVE BEEN DETERMINED AND DEVIATIONS WILL BE CAUSE FOR REJECTION. REMOVE ALL BURRS AND SHARP EDGES

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FIG. 6

TUNING DRAWER				V O X		
NO.	TOTAL FREQ SHIFT/MC	FREQ	TOTAL SHIFT	FREQ MC	MULT	FREQ OUT MC
5	4 KC/MC	2 MC	8 KC	2	1	2
		3 MC	12 KC	3	1	3
		4 MC	16 KC	4	1	4
6	4 KC/MC	4 MC	16 KC	2	2	4
		6 MC	24 KC	2	3	6
		8 MC	32 KC	2	4	8
7	3 KC/MC	8 MC	24 KC	2	4	8
		12 MC	36 KC	2	6	12
		16 MC	48 KC	2	8	16
8	MIN. SHIFT OF 32 KC THROUGHOUT THE BAND	16 MC	32 KC	2	8	16
		24 MC	32 KC	2	12	24
		31 MC	32 KC	2	16	32

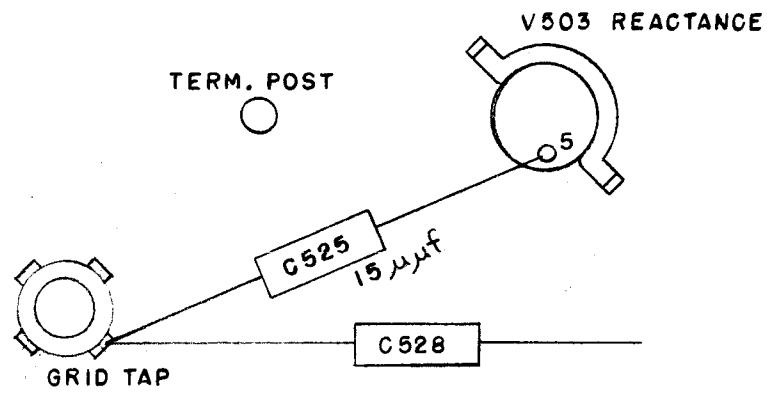


FIG. 1

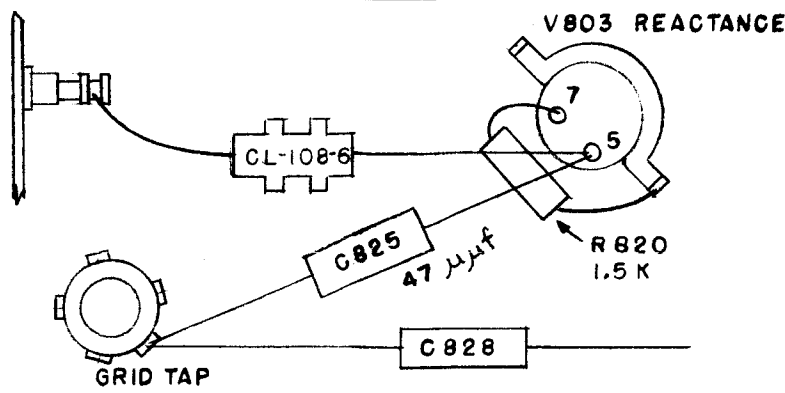


FIG. 4

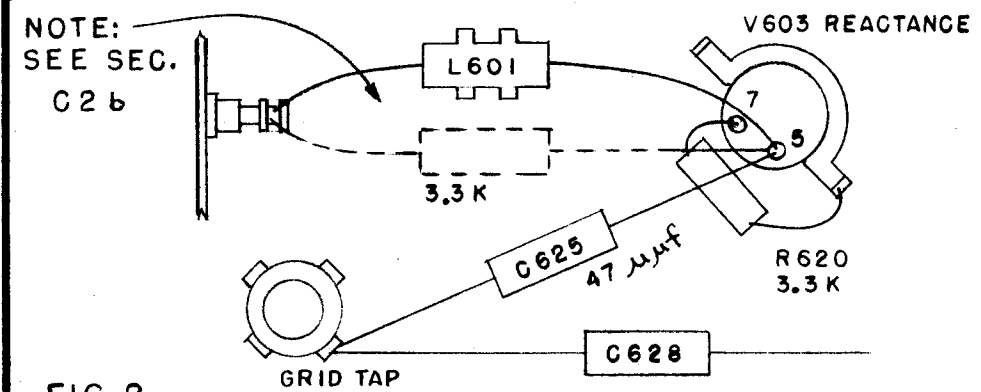


FIG. 2

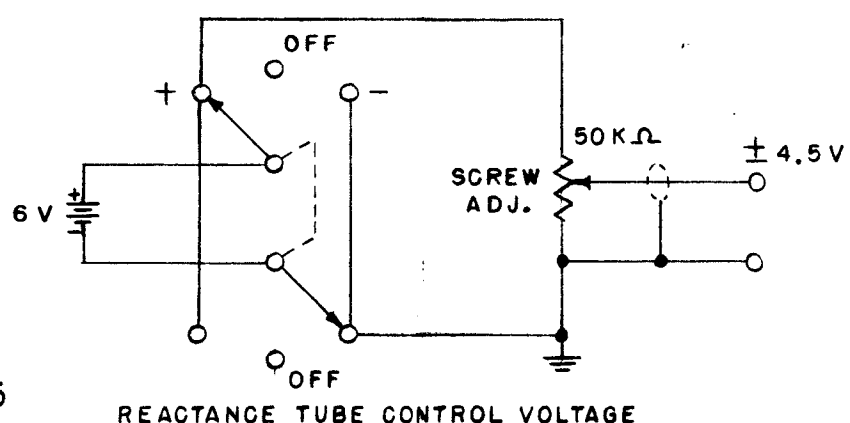


FIG. 5

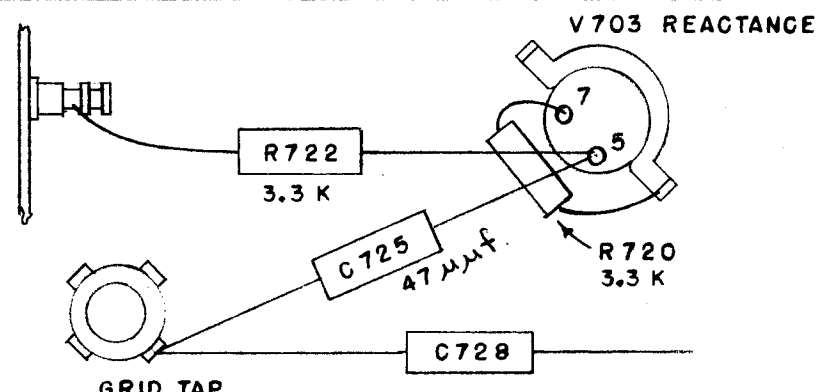


FIG. 3

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REQ.	ITEM	PART NO.	DESCRIPTION	SYMBOL
<b>THE TECHNICAL MATERIEL CORP.</b> MAMARONECK, NEW YORK				
STOCK SIZE				
TUNING DRAWER MODIFICATION				
FOR FFR-2				
MATERIAL		WEIGHT PER PC.	CDD 11/15/54	M.H.S.
TYPE & TEMPER			DRAWN	ELEC. DES. APP. MECH. DES. APP.
HEAT TREAT. SPEC.			P.L.K. 1-5-55	MECH. DES. APP.
FINISH & SPEC. NO.			CHECKED	FINAL APPROVAL
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ISSUE	ITEM	CHANGED FROM	DATE	CN. N.	DRAFTS	CHECKER	ENG. APP.
TOLERANCES							
ALL OTHERS				SCALE:			
DEC. DIM. ±				DRILL, PUNCH, COMMERCIAL STOCK			
FRAC. DIM. ±				SIZES AND MANUFACTURERS			
ANGULAR DIM. ±				TOLERANCES ARE NOT INCLUDED.			
MODEL		PROJECT NO.		ASS'Y. NO.		DATE	
USED ON							