| DATE 9/28/54 SH. 1 OF 6 COMPILED BY GTO | TMC SPECIFICATION NO. S-223 | |
|---|---|---|
| | TITLE: MODIFICATION OF THE FFR-1 RECEIVER | JOB 170 |
| APPROVED G.T.O | | |

PURPOSE:

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

MODEL FFR RECEIVER

A. Hum Reduction

MODELS FFRD-5, 6, and 7 TUNING DRAWERS

B. Greater HFO Excursions

A-1. Object: Hum Reduction

This change provides for improvement in the reduction of hum level in the Model FFR Communications Receiver when used at the 0 dbm level. This modification reduces the hum from the present specification of 40 db below standard reference of 1/2 watt to 60 db below 1/2 watt. This corresponds to 34 db below 0 dbm.

A-2. Components Required.

| SYM | DESCRIPTION | TMC PART NUMBER |
|---|---|---|
| R126 | RESISTOR, fixed: composition, 240 ohms ±5%, 2 watt. | RC42GF241J |

A-3. Wiring Procedure.

Remove the power supply side cover plate. The choke (L101) lug, directly under the 20 watt resistor R148, contains two red leads. One lead connects both chokes L100 and L101; the second goes directly to a power supply cable. Remove the second lead and connect it to the other lug of L101 (same choke). Replace side cover plate. See Figure 1.

Remove bottom dust cover of the receiver. Remove R126, Resistor, Part RC20GF511J, and replace with new R126, Part RC42GF241J.

Remove R127, Resistor, Part RW109-26, and connect pink cable lead that was attached to R127 bottom lug to pin #6 of V-105. Replace bottom cover.

A-4. Test Procedure

(a). Equipment Required:

1 - AC voltmeter such as Daven Electronic Voltmeter Type 170, or Heathkit Model AV-2
1 - FFR-1 Receiver with a 600 ohm, 10 watt, load connected to barrier strip E101, terminals 3 and 4.

(b). Adjust receiver controls as follows:

RF gain control counter clockwise (minimum RF gain)
Audio gain fully clockwise
Noise-limiter switch - Off
BFO switch - Off

(c). Connect the voltmeter across the 600 ohm load using a high voltmeter range. Plug receiver power cord into 110 volt 60 cycle line. After several minutes of warm-up, measure the residual hum voltage developed across the 600 ohm load using the most sensitive voltmeter range for this measurement. Hum voltage levels should not be greater than approximately .016 volts RMS or 34 db below 0 dbm. For a pictorial diagram of the test set-up, see Figure 2.

B-1. Object: Greater HFO Excursions, Tuning Drawers

Requests from the field have indicated the desirability of increasing the deviation of the receiver HFO when used under certain remote control conditions. The Tuning Drawers as supplied from th factory provide a 1 Kc. per Mc. shift for an input voltage of ±3 volts on the HFO reactance tube. This modification makes possible greater excursions of the HFO.

In each FFRD the total shift as a function of discriminator output will be approximately those figures shown below:

1. FFRD 5 and 6: A total of 4 Kcs. per megacycle for a total control voltage of 9 volts (±4.5 volts)
2. FFRD-7: A total of 3 Kcs. per megacycle for a total control voltage of 9 volts (±4.5 volts)

B-2. Components Required.

1. Model FFRD-5, C525, replace with part CC21SL150J
2. Model FFRD-6. There are no additional components required to make this modification.
3. FFRD-7, C725, replace with part CC21SL470K and, R722, replac with RC20GF822J.

B-3. Wiring Procedure.

(a). Remove bottom plate from the Model FFRD-5 and remove capacitor C525, Part CC21SL470K. This capacitor is wired between pin 5 of reactance tube V503 and a terminal post. Connect Part CC21SL150J between pin 5 of V503 and the grid tap of the oscillator coil L502 as shown in Figure 3. Do not apply too much heat to the coil lug. Replace bottom cover plate.

(b). Remove bottom plate from the Model FFRD-6 and remove capacitor lead C625 from oscillator terminal post and reconnect it directly to grid tap of the oscillator coil L602. It may be necessary to increase the lead length to perform this operation.

(c). Tuning Drawer FFRD-7 requires removal of capacitor C725, CC26SL101K, replace with capacitor C725, CC21SL470K, which is wired between pin 5 of V703 and grid tap of the oscillator coil L702. See Figure 3. R722, RC20GF303J, is directly replaced with R722, RC20GF822J.

B-4. Test Procedure.

(a). Equipment Required:

1 - Variable Frequency Oscillator, TMC Model VOX.
1 - FFR-1 Test Receiver with a 455 Kcs. crystal in BFO.
1 - Speaker or pair of earphones.
1 - Reactance tube control voltage. See Figure 4.

(b). Receiver Controls Set:

RF gain control adjusted as required. See text.
Audio gain - as required for monitoring.
Noise-limiter - Off
BFO switch - On
BFO selector - XTAL
AVC switch - On

(c). VOX Controls Set:

HFO - On
Tuning - 3 Mcs.
Range - 2 - 4 Mcs.

(d). Connect reactance control voltage cable to terminals 1 and 2 of barrier strip E102; speaker connected to receiver output, if phones are used, place a 600 ohm 10 watt load at receiver output. Plug test receiver and VOX power cords into 110 volt 60 cycle line. After a reasonable warm-up time, this also appli s to ach Tuning Drawer to be tested, loosely couple th VOX output to the r iver antenna terminals. It may be nec ssary to adjust th RF gain to prevent rec iver overload.

B-4. Test Procedure (continued)

(e). FFRD-5 Tuning Drawer Controls Set:

Reactance tube balance adjustment is necessary after modification and is generally carried out in mid-receiver tuning range. Once a symmetrical or nearly symmetrical frequency shift of the HFO is obtained by means of reactance balance control C523 at mid-range (3 Mcs.) the band ends (2 Mcs. and 4 Mcs.) are checked for shift and symmetry.

(f). Tune VOX to 3 Mcs. (300 on Veeder Root counter, 0000 on the dial); tune receiver until a zero beat is obtained. Set the reactance control voltage to 4.5 volts and retune VOX dial for zero beat again. The frequency shift from 3 Mcs., as a result of the applied 4.5 volts, is read on the dial. Each dial rotation corresponds to 10 K s. or any fraction thereof of 10 Kcs. for a proportionate rotation. Note this amount of shift, then switch control voltage back to zero. Re-establish zero beat at 3 Mcs. and then apply 4.5 volts control voltage. This time measure the shift in the opposite frequency direction by zero beat method. The total frequency excursion is the sum of both shifts obtained with the 4.5 volts control voltage and should not be less than 12 Kcs. If the shifts about 3 Mcs. are asymmetrical, a slight adjustment of C523 is required. After mid-band adjustment, a check is required at 2 and 4 Mcs.; keeping in mind to set the VOX to the proper frequency when checking these frequencies. A large asymmetry at extreme ends of the band may require a compromise in the setting of C523. A total shift of 8 Kcs. and 16 Kcs. is required at 2 and 4 Mcs. respectively. Failure to obtain symmetry or sufficient HFO frequency may necessitate changing reactance tube V503. Once reactance tube balance is attained, a frequency check is made at 4 Mcs. A very slight adjustment of C527 (the HFO trimmer) at 4 Mcs. will bring the receiver into frequency alignment and maximum sensitivity. This alignment can be made by using a standard signal generator, with 1000 cycle 30% modulation; suitable coupled by a dummy antenna to the receiver input terminals. The receiver AVC control in the off position and the RF gain at maximum. HFO alignment has no disturbing effect upon the reactance tube.

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B-4. Test Procedure (continued)

A similar procedure is used in Tuning Drawers 6 and 7; and for convenience, a tabulation of frequency shifts required, VOX frequency setting, etc., appears in Figure 5.

Attach Supporting Drawing CK-276