BENCH ALIGNMENT PROCEDURE FOR RECEIVER MODEL 4ER24C13

GENERAL

The following instructions cover the procedure for completely aligning the receiver.

Most of the stages in this receiver are designed for either loose or critical coupling and can be tuned by simple peaking methods. The 1st and 2nd IF's (T330 or T331) are overcoupled and must be tuned by the resistor load and peaking method (best) or the peak and dip method.

Peaking Method

An RF signal of the proper frequency is fed to a loosely or critically coupled stage and the stage is then adjusted for maximum meter reading at its output.

Discriminator Adjustment Method

An unmodulated RF signal of the proper frequency (i.e., 290 KC) ±10-KC is applied to the discriminator stage. The signal source should be of a constant amplitude over this ±10-KC deviation. The primary tuning slug (bottom of transformer) is adjusted to obtain equal plus and minus voltages for ±10-KC deviation. At -10 KC the voltage is negative and at +10 KC the voltage is positive.

Resistor Load Method

An RF signal of the proper frequency is fed to an overcoupled stage. Placing the proper load resistors across the coils makes the coils critically coupled, so that they can be tuned by a simple peaking procedure. After peaking, the resistor loads are removed, returning the coils to normal (overcoupled).

Peak and Dip Method

An RF signal of the proper frequency is fed to an overcoupled stage. The first coil is adjusted for maximum, while the second coil is shorted out. The short is removed and then placed on the third coil, while the second coil is tuned for minimum. The remaining coils are also shorted and alternately peaked and dipped. The metering is done across the first coil during the entire procedure.

PRELIMINARY OPERATIONS

5064

Warmup

The receiver should be allowed to warm up for five minutes or more before tuning.

The signal generator may require as much as a half-hour for warmup. See individual signal generator manual for recommended warmup.

Voltage

Check for proper supply voltage (117 VAC).

Discriminator Zero

During the entire alignment, the generator frequency must be checked every few minutes for zero discriminator (after the discriminator has been correctly set at 290 KC). The 290-KC signal should just saturate the second limiter grid. The 290-KC signal can be inserted at any stage ahead of the stage being tuned.

Crystal oven cycling, causing a slight frequency variation with temperature (.0005% of crystal frequency), can be observed when setting the discriminator for zero. When setting for discriminator zero, this cycling can be taken into account by first observing the maximum meter variation and then setting zero for an average of this variation.

Signal Generator Connections

Signals from the signal generator should be applied through a .01-mfd capacitor for all the procedures except when applying the signal to the antenna jack. The leads from the capacitor should be as short as possible. Connect the generator ground probe as close to the point of signal input as possible.

Metering

Before using a 20,000 ohm-per-volt meter or VTVM for metering, make certain that the meter reads exactly zero for the position it is being used. Since adjustments are to be made within 1 - 4 microamperes of zero, it is very important that zero is accurately set.

RECEIVER SENSITIVITY

Noise Current

The 2nd Limiter noise current was 110 microamperes or more when shipped. No loss of receiver sensitivity will occur as tubes age, until the noise current drops below 60% at J303 (2nd Limiter grid). To check for normal gain, make certain that the antenna transformer and RF tanks are both peaked. Replace the antenna with a 50-ohm load resistor. A reading of 100 microamperes or more at the 2nd Limiter grid will indicate normal gain.

Stage Gains

As a means of checking stage gains, the signal levels given in Table I may be used. When applied at the points indicated,

these signal levels will give a reading of 40 microamperes at the 1st Limiter grid. A variation in readings greater than 2 to 1 indicates a possible source of trouble. High noise current in a set may interfere with proper measurement of the first three figures in this table, in which case, both the input and 1st Limiter current may be doubled or tripled to estimate performance.

TABLE I

SIGNAL GENERATOR FREQUENCY	SIGNAL LEVEL IN MICROVOLTS (Approx.)	INPUT POINT
37.2 MC	4	RF grid (XV318-1)
3.2 MC	40	1st Mixer grid (XV302-7).
290 KC	320	2nd Mixer grid (XV319-2).
290 KC	1350	XV305-1
290 KC	100,000	XV306-1

An input to the 1st Limiter grid of 80,000 microvolts will produce 40 microamperes at the 2nd Limiter grid.

DISCRIMINATOR ALIGNMENT

Equipment Required

1. A non-metallic screwdriver.
2. A 0 - 3 VDC meter. (20,000 ohm-per-volt or VTVM).
3. A 290-KC calibrated signal source.

Procedure

1. Apply 290 KC ±.002% signal through .01-mfd capacitor to XV307-1. Use a signal strong enough to saturate the 2nd Limiter grid.
2. Connect voltmeter between DISC jack (J304 - Orange) and ground.
3. Remove 3490-KC crystal (Y304) to prevent signals or noise from interfering with alignment.
4. Tune top slug (secondary of discriminator transformer (T308) for zero reading on voltmeter.
5. Turn signal generator dial to 280 KC and note value of negative voltage on meter.
6. Turn signal generator dial to 300 KC and note value of positive voltage on meter.

7. Positive and negative voltages noted in steps 4 and 5 must be equal in amplitude. If not equal, tune bottom slug (primary) of discriminator transformer (T308) until the voltages are equally positive and negative within 0.1 volt on a 0 - 3 voltmeter. Adjusting the primary slug will require that the secondary be readjusted.

IF ALIGNMENT

3.2-MC IF TRANSFORMER (T316)

Equipment Required

1. A non-metallic screwdriver.
2. A 0 - 3 VDC meter.
3. A 3.2-MC signal source.

Procedure

1. Apply a 3.2-MC signal through a .01-mfd capacitor to XV302-7. Do not saturate the 1st LIMiter. Keep signal zeroed to discriminator. (Remove the 1st Osc. crystal).
2. Connect meter between LIM-1 jack (J302-green) and ground.
3. Leave the 3490-KC crystal (Y304) in its socket.
4. Tune the four coils of the transformer for maximum meter reading.

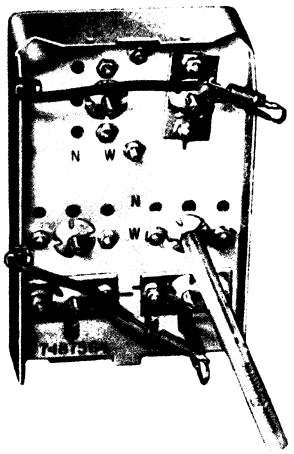
Discriminator Idling

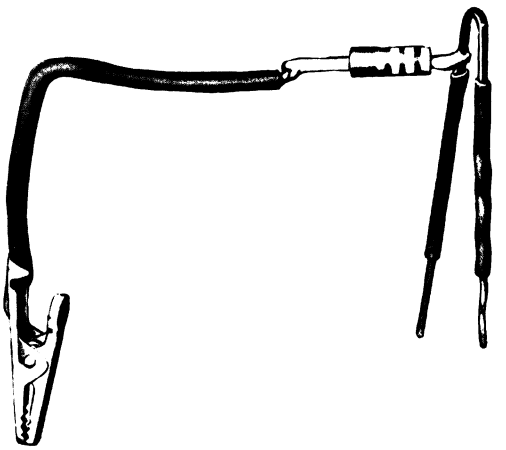
When a set has been completely and properly aligned, the no signal reading of the discriminator (noise only) should be within 0.2 volt on a 20,000 ohms-per-volt meter. Whenever a receiver has been phase tuned (seesection on Phase Tuning), the discriminator idling is determined by the phase tuning adjustment.

290-KC IF TRANSFORMERS (T330 & T331)

Equipment Required

1. A non-metallic screwdriver.
2. A 0 - 100 microampere DC meter (G-E Type EX-1-C).
3. A 290-KC signal source.
4. Two load resistor assemblies made up as shown in Figure 1 for resistor loading method (22,000 ohm-resistors).





MATERIAL

1/4 watt resistor, common bobbypin, insulating sleeving for bobbypin, alligator clip and a 3-inch piece of test lead.

CONSTRUCTION

Flatten the tips of the bobbypin together so that they are flush, then spread the bobbypin legs out to form a "V". This is done so that when the bobbypin is inserted into the pin jack it will spread out and bind in the test jack for good electrical contact. Solder one lead of the resistor to one leg of the bobbypin near its loop, and solder the other resistor lead to the test lead terminated in an alligator clip. Clean and tin the bobbypin ends to prevent corrosion and to assure good electrical contact. Slide insulating sleeving over the bobbypin ends to prevent shorting. Sleeving should be tight enough to prevent slipping.

USING LOAD RESISTOR ASSEMBLY

Fasten the alligator clip to the chassis and insert the bobbypin into the pin jack. Two loading resistor assemblies can be used simultaneously while peaking coils in the six coil transformer assembly.

(RC-444A)

Figure 1 Loading Resistor Assembly

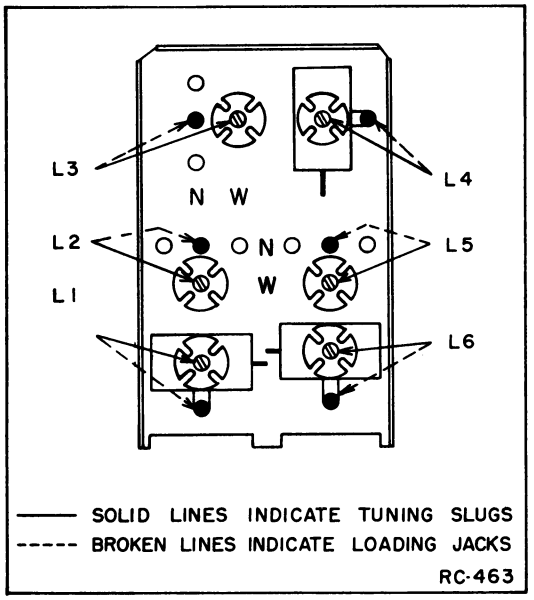


Figure 2 Location of Tuning Slugs & Jacks, 290-KC IF Transformers T330 & T331

Resistor Loading Procedure (Best)

1. Apply a 290-KC signal through a .01-mfd capacitor to XV319-2, when aligning the 1st LO IF, or to XV305-1 when aligning the 2nd LO IF.

2. Connect meter between LIM-1 jack (J302-green) and ground.

3. Refer to Figure 1 for proper use of load resistors and to Figure 2 for location of coils and loading jacks.

4. Load L-2 and peak L-1.

5. Remove load from L-2. Load L-1 and L-3 and peak L-2.

6. Remove loads from L-1 and L-3. Load L-2 and L-4. Peak L-3.

7. Remove loads from L-2 and L-4. Load L-3 and L-5. Peak L-4.

8. Remove loads from L-3 and L-5. Load L-4 and L-6. Peak L-5.

9. Remove loads from L-4 and L-6. Load L-5 and peak L-6.

10. Remove load resistor from L-5.

11. Repeat steps 4 to 10 to insure proper alignment.

Peak & Dip Procedure

1. Locate tuning slugs and pin jacks as shown on Figure 2.

2. Connect meter between L-1 pin jack and ground.

3. Short coils with jumper wire and tune as in the following table:

Short	Tune	Meter Reading
L-2	L-1	Peak
L-3	L-2	Dip
L-4	L-3	Peak
L-5	L-4	Dip
L-6	L-5	Peak
None	L-6	Dip

FRONT END TUNING

The frequency of the receiver may be changed by replacing the 1st oscillator crystal and retuning the oscillator and RF stages.

Equipment Required

1. A non-metallic screw driver.

2. A 20,000 ohm-per-volt voltmeter with a 0 - 3-volt scale.

3. A crystal of the proper frequency for the first oscillator.

4. A signal generator with a 25 - 50-MC range, such as a Measurements Corp. Model 80, a Boonton 202-C and Model 100C. If a generator is not available when tuning the receiver in the field, connect the proper antenna to the receiver and transmit a weak signal from the transmitter with which the receiver is intended to operate.

Procedure

Meter readings listed below are to be taken between the jacks indicated and ground.

1. Turn the receiver on and allow it to warm up for five minutes. Be sure that the supply voltage is normal.

2. Insert the First Oscillator crystal/s in the First Oscillator crystal socket/s (on two-frequency receiver, the Channel A crystal should be plugged between pins 4 and 6 of the octal socket. The Channel B crystal should be plugged between pins 2 and 8).

3. Connect a 0 - 3-volt meter to the OSC-1 jack, J305 (green - negative).

Fundamental Crystal Oscillator

1. Tune the oscillator tank coil, Z304, for maximum oscillator grid meter indication. If there is any doubt about being on the correct peak, turn the adjustment fully counter-clockwise, then clockwise to the first peak. Note the reading and turn the iron core counter-clockwise until the meter reads 80% of the maximum grid metering voltage. A 0 - 500 μa meter (G-E Test Set, Type EX-1-C) may be used for these measurements and will generally read 240 microamperes or greater, at the peak. However, not all microammeters will give the same readings, depending on the internal resistance of the meter. The reading equivalent to 240 μa on a 0 - 3-volt meter is .75 volt. Other multimeters may read as much as two to one lower, depending on the internal resistance of the meter.

2. Connect a signal generator to pin 7 of XV302, using maximum generator output, zero generator to discriminator. This zeroing should coincide with an increase in LIM-1 meter indication.

3. Reduce the signal generator output until the LIM-1 meter indicates below saturation, but above noise.

4. Peak T329 as follows:

   a. For frequencies above 37 MC, retract the iron core slug

from the coil and turn slug clockwise for three turns, then peak trimmer T329-C1 for maximum first limiter meter indication.

b. For frequencies below 37 MC, set trimmer T329-C1 at maximum capacity and peak, using the iron core slug of T329, tuning for maximum 1st limiter meter indication.

RF & ANTENNA TRANSFORMER

1. Connect signal generator to pin 1 of XV318. With generator adjusted to zero discriminator and output below limiting, peak the three circuits of T315. Care must be exercised in peaking the third tuned circuit of T315 (C7 and L3 located from underside of chassis) as in some instances the circuit can be tuned to the crystal frequency. For operating frequencies above 37 megacycles retract the slug of L3 (turn slug all way to left) and tune T315-C7 for maximum First Limiter current (largest peak). For frequencies below 37 megacycles turn trimmer to maximum capacity (using dot of solder on ceramic rotor of trimmer as the pointer) and tune T315-L3 for maximum First Limiter current (larger peak). Use the same procedure for tuning T315-L2 and T315-C4 of the second circuit and T315-L1 and T315-C1 of the first circuit.

2. Move signal generator to antenna jack (J1 on antenna transformer). Use 50 ohm T pad (or equivalent) of Signal Generator accessories for a dummy antenna.

3. With meter at LIM-1 (J302) and signal on operating frequency applied, peak antenna transformer (T314) trimmers C1 and C3 (top and bottom of housing).

4. Recheck the RF and multiplier tuning. If possible monitor an unmodulated signal from a system transmitter for this check using the system antenna to pick up the signal.

   a. Recheck the tuning of Z304 (meter connected to J305, OSC.)

   b. Recheck the adjustment for discriminator "O" (trimmer C365 and C366).

   c. With meter connected to J302, LIM-1, recheck the peaking of C1 and C3 of T314.

   d. With meter connected to J302, LIM-1, recheck the peaking of T329.

   e. Tune T314 for maximum quieting whenever maximum quieting and maximum sensitivity do not occur together. This may be noticeable at frequencies below 37 megacycles.

CODAN ADJUSTMENT

Equipment Required

1. RF signal generator.
2. Audio voltmeter.
3. Coaxial tee with pin of cross-arm removed.
4. Dummy plug.

CODAN Threshold Adjustment

1. Insert dummy plug in the LINE IN jack to prevent carrier indication.
2. Turn CODAN dropout control fully clockwise and CODAN threshold fully counterclockwise.
3. With antenna connected, loosely couple an RF signal generator (adjusted to the correct frequency) to the receiver input. Use the tee having the center pin in the line to the generator removed.
4. With the generator output set to minimum, measure audio noise at the receiver output. Depressing the audio test button (S502) will place noise on the line even though the CODAN is not operated.
5. Increase the signal generator output level until the desired noise quieting is obtained (between 15 and 30 db). Release the audio test button. Advance the threshold control slowly until the CODAN relay operates. Note the level of the generator output.

CODAN Drop-Out Adjustment

1. Reduce the level of the signal generator by an amount equal to the desired differential between CODAN threshold and drop-out points. If no other value is specified, this differential should be 6-db. (Minimum drop-out should never be set below 12-db quieting).
2. Adjust drop-out potentiometer counterclockwise until the receiver mutes.
3. Check operation by turning up the level of the signal generator until the receiver unmutes then reducing the level until the receiver mutes, noting the quieting and signal generator values to see that all are as specified. If not, repeat the adjustments.
4. Remove the signal generator and dummy plug and restore the receiver to normal service.

COMMUNICATION PRODUCTS DEPARTMENT
GENERAL ELECTRIC COMPANY
LYNCHBURG, VIRGINIA Printed in U.S.A.