

F-M Alignment

Step-by-Step Analysis Using a 88-Kc to 120-Mc Signal Generator and a VTVM or a 20,000 Ohms-Per-Volt Multi-Range Meter

IN ALIGNING AN F-M receiver (using limiter and discriminator circuit) with a signal-generator, the discriminator circuit receives initial attention.

The alignment procedure for this circuit is similar to that used for an afc system, it being absolutely essential that the discriminator tube and the i-f stages be adjusted at *exactly* the same frequency.

In the first step, the coaxial output cable leads of the generator should be connected between grid and ground of the limiter tube, and as in the case of the afc discriminator, a 20,000-ohms-per-volt multi-range meter or a vtvm is connected across the two cathodes of the discriminator. An *unmodulated* test signal is employed and the signal generator dial is set to the i-f specified in the manufacturers' data sheets. Then, just as with the afc discriminator, the primary and secondary trimmers of the discriminator transformer are adjusted until *zero voltage* is read on the meter scale.

To elaborate a little more fully on this adjustment, the discriminator transformer *primary* trimmer is first aligned for *maximum* meter reading. Following this the *secondary* trimmer

is rotated until *zero* voltage is obtained.

It will be found that incorrect adjustment of the trimmers can result in either a positive or negative meter reading, dependent upon the manner in which the discriminator circuit is unbalanced.

Without touching the signal generator tuning dial, the coaxial output cable leads are then transferred back to the r-f input grid of the first detector or mixer.

The super-sensitive multi-range tester is now set for either the 60 or 300 microampere range (depending on receiver and test signal intensity) and is connected directly in *series* with the ground return of the grid resistor of the limiter tube. The i-f trimmer alignment is started with the trimmer at the input of the limiter stage and thereafter, back through the trimmer across the output of the first detector (mixer). Each trimmer is adjusted for maximum reading on the 60 or 300 microampere scale of the test meter.³

The foregoing trimmer adjustments should be *repeated* in the same order, with great care given to obtaining *exact peak adjustment*. Doing this will insure symmetrical response of the i-f stages to the incoming frequency-modulated signal. In other words, the output of the discriminator will be ap-

proximately the same on both sides of the average carrier frequency.

When desired, a good way in which to check for symmetry of response is to place the 20,000-ohms-per-volt meter back across the diodes of the discriminator tube. With the signal generator set to the frequency of the i-f system, the reference meter should, as before, read zero. However, shifting the frequency of the signal generator, 50 to 100 kc (.05 to .1 mc) on either side of the specified i-f, should give equal, or nearly equal, but opposite meter readings.

Another way to test for symmetrical response is to leave the meter in the limiter tube grid return and note the change in current reading while the tuning dial of the signal generator is moved 50 to 100 kc on either side of the specified i-f. Approximately the same change in meter reading should occur on both sides of the specified i-f frequency.

If this symmetry does not occur, it is important that each of the i-f stages be again adjusted, because good f-m receiver performance depends upon

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²Precision Apparatus Co. series E-200-C Signal Generator used in this step-by-step analysis.

³If the band-pass characteristics of the i-f transformers are such as provide two consecutive peaks while the individual trimmers are rotated, then it is necessary to adjust for the minimum between these two peaks.

¹From a chapter on *The Adjustment of F-M Receivers*, appearing in the book *Servicing by Signal Substitution*, written by G. N. Goldberger and published by Precision Apparatus Co., Inc.

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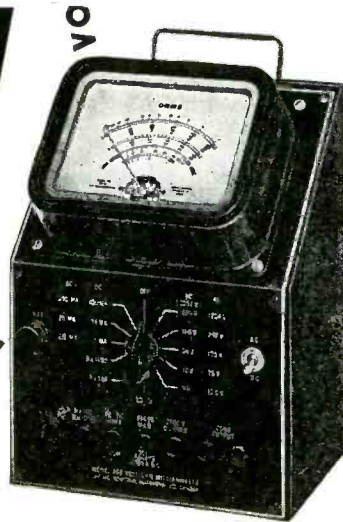
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best possible symmetrical response of the i-f and discriminator circuits.

The remaining few adjustments are not very critical and are much the same as those associated with the alignment of the first detector and oscillator of regular high frequency bands. The signal generator is set in accordance with the receiver manufacturers' service notes, to let us say, 90 mc, and the oscillator trimmer and r-f input trimmer adjusted for maximum reading of the resonance indicator which is still a microammeter in series with the limiter stage grid resistor return. The receiver dial is, of course, tuned for the reception of the same frequency at which the signal generator is set.

Note of Caution

This completes the adjustment of the receiver. However, there is one note of caution in connection with the operation of an f-m receiver once it has been installed with the proper antenna system; tuning of an f-m set is a bit different from the process usually associated with the tuning of receivers designed for amplitude-modulated carriers.

F-M Tuning

When tuning for and approaching an f-m station carrier, the speaker output will slowly become louder and louder, and in the event that external noises are present, these noises will at the same time be quite discernible. However, continuing the tuning process, a point will be reached where the station signal will seem to grow a bit weaker, but simultaneously the noise level will almost automatically and practically disappear. At this point the receiver is properly tuned and if the operator continues to turn the dial the signal will again appear to increase but with consequent increase in noise level. Then as tuning is continued further past the station, the signal will slowly pass out entirely.

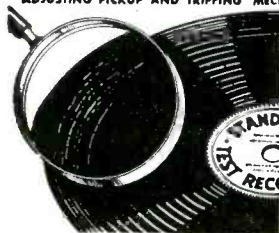
If the f-m receiver incorporates a single or multiple shadow tuning eye, the operator should then tune, per the set manufacturer's instructions for the required eye pattern, instead of by ear.

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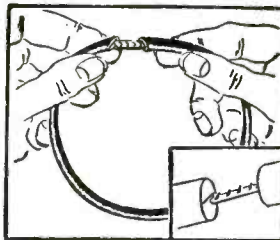
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