

FREQUENCY MODULATION

Broadcasting by the Frequency Modulation method has already proved to be the most satisfactory means of "Local" radio transmission with reduced noise and high fidelity. It is not generally understood that these two features of FM are due in a great measure to the wide frequency band which this method of modulation employs. The FM receiver must be accurately aligned because much of the FM system's noise reducing ability is lost if the FM IF and discriminator circuits are misaligned.

The alignment of FM receivers differs from the familiar AM receiver alignment procedure where a modulated signal from the generator is used and the output is measured with an A.C. voltmeter across the voice coil.

The signal generator for FM alignment must be capable of supplying an unmodulated signal of at least .5 volt at the IF frequencies (4 to 9 Mc.) and a moderate unmodulated signal at the FM RF frequencies (41.5 to 50.5 Mc.) A 50-0-50 microammeter, such as Triplett #321 or #521, makes an excellent output meter when used with our #S9614 four prong plug and cable assembly and a S.P.D.T. switch. (see fig. 1)

The output meter is connected across HALF the diode load resistor for gain alignment and is connected across the FULL diode load resistor for frequency settings. A polarized socket is provided (near the 7A6 tube) which accommodates the output meter plug to facilitate switching the meter across either FULL or HALF the diode load resistor.

IMPORTANT—The FM IF and discriminator alignment must be followed in a stage-by-stage sequence, beginning at the discriminator and working forward to the converter stage. This differs from the conventional AM IF alignment procedure where the signal is applied to the converter grid and all the IFs are aligned simultaneously.

The signal from the generator must be kept just below the point where the limiter action of the receiver begins. To explain further we should consider the purpose of the limiter. It does what its name implies; it limits the amount of signal applied to the discriminator circuit. When the input signal is strong the limiter cuts off, allowing only a portion of the signal to pass, while at low signal levels the limiter acts as an IF amplifier. Therefore, it is easy to understand why the signal input to the receiver and IFs must be held below the limiter operating range during alignment. The most practical way of determining the proper amount of input signal is to watch the output meter (connected across HALF the diode load) while the signal from the generator is increased. The meter will indicate the increase in signal until limiting action begins, from which point on no appreciable increase can be noted on the meter even though the generator signal has been increased considerably. The desired signal input level (from the generator) is just below the limiting point which may be determined by increasing the generator output while watching the output meter, then reducing the generator output slightly when the limiting point is reached.

IF AND DISCRIMINATOR ALIGNMENT

Holes have been placed at the top of all the FM IF transformer shields so that a signal generator may be connected across the transformer secondaries to facilitate alignment. (see fig. 2) A very high input signal will be necessary to get an output indication for the discriminator alignment. Should the generator be unable to supply sufficient signal, the Discriminator input stage may be aligned first in order that its gain may be utilized to raise the input signal to the discriminator.

1. Connect the output meter across the FULL discriminator load. (fig. 1)
2. Feed an unmodulated signal, at the IF frequency, through the dummy antenna (fig. 2) to the 3rd IF transformer secondary. (The IF frequency is stamped on the IF transformer shields.) Adjust the slug B4 for resonance. Rotating the slug B4 through the resonance point will cause the output meter to swing through zero from positive to negative or vice versa. A zero reading on the meter indicates the desired resonance point.
3. Switch the output meter to HALF discriminator load (fig. 1). Adjust trimmer A4 for maximum output keeping the signal input below the point of limiting action.
4. (Meter at HALF load) Connect the generator to the 2nd IF transformer secondary and adjust the 3rd IF trimmers A3 and B3 for maximum output.
5. (Meter at HALF load) Connect the generator across the 1st IF transformer secondary and adjust the 2nd IF transformer trimmers A2 B2 for maximum output.
6. (Meter at HALF load) Connect the generator to the converter grid. A small socket is provided near the converter tube which will accommodate the side pin of the #S9615 Dummy Antenna assembly (Fig. 2) to facilitate this generator connection. Adjust the 1st IF transformer trimmers A1 B1 for maximum output.

FM OSCILLATOR AND RF ALIGNMENT

- 7a. (Meter at FULL load) Connect the generator, through a 100 ohm dummy antenna, to the FM antenna terminals. Set the generator at 50 Mc. and tune in the signal on the receiver. As the pointer passes the 50 Mc. calibration the output meter will swing from negative through zero to a positive reading or vice versa. The resonance point is again at the zero setting. Should the pointer be off calibration more than plus or minus .5 Mc., which is tolerable, the oscillator may be set by adjusting the two flexible green leads between the manual tuning oscillator coil and the band switch. If the pointer is below 50 Mc. it can be raised by bringing the two green leads together and in the same manner the pointer can be lowered by separating the leads.
- 7b. (Meter still at FULL load) Set the generator at 46 Mc. and check the dial calibration (zero on meter). 46 Mc. should be on scale unless the cam on the condenser shaft has been loosened. If the cam has to be adjusted to scale the oscillator at 46 Mc., the 50 Mc. oscillator adjustment must be repeated. The converter stage is aligned after the receiver has been adjusted to scale within the .5 Mc. limits.
- 8a. (Meter at FULL load) With generator connected to the FM antenna terminals through 100 ohm dummy, set the generator at 49 Mc. and tune in signal on receiver to get a zero output meter reading. Switch the meter to HALF load and adjust the generator to give an output just below the limiter action point. Adjust slug P1 for maximum output.
- 8b. (Meter at FULL load) Set generator at 46 Mc. and tune in on receiver. Switch meter to HALF load and adjust "Z" for maximum output.
- 8c. (Meter at FULL load) Set generator at 42.5 Mc. and tune in on receiver. Switch meter to HALF load and adjust P2 for maximum output.

There are no RF adjustments for the FM push buttons when the push buttons are used on automatic. Button #1 is checked at 50 Mc., buttons #2 and #3 checked at 49 Mc., buttons #5 and #6 checked at 42.5 Mc., and button #4 is the manual switch.

In conclusion we again wish to emphasize the importance of keeping the signal from the generator below the point where limiter action begins, that the output meter is connected across the FULL diode load resistor for frequency and calibration operations, and that the output meter is connected across HALF the diode load resistor for gain checks.

This information on alignment of Frequency Modulation circuits is presented with the permission of Zenith Radio Corp. of Chicago.

