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Easy FM Alignment Markers

Many stereo FM receivers use double-tuned IF stages to acheive the wide-band response required for low-distortion reception of FM multiplex. Because alignment is critical for lowest distortion, sweep alignment of the IF stages and ratio detector is often specified in service data. Sweep alignment requires the use of 10.6 and 10.8 MHz marker frequencies, which are sometimes difficult to obtain. This article describes an easy way to obtain the required markers.

The test equipment required for proper FM sweep alignment includes, a sweep generator providing a 1-MHz wide sweep centered at 10.7 MHz and a marker generator to obtain 10.6 MHz and 10.8 MHz markers. The RCA WR-514 Channalyst, or WR-69 sweep generator (used with WR-70 Marker Adder) are well suited for the marker insertion technique to be described. The RCA WR-50 RF Signal Generator is used to supply the 10.6 and 10.8 MHz markers.

The sweep generator (WR-514 is illustrated) is connected to the IF input through a DC blocking capacitor, as described in the service data for the receiver, and adjusted to obtain a sweep response curve of correct amplitude. The WR-50, serving as a marker generator, is setup to furnish 10.6 and 10.8 MHz markers in the following manner:

1. Connect marker generator to Chanalyst sweep generator (or marker adder) as shown in Figure-1.
2. Install 10.7 MHz crystal in frontpanel crystal socket of WR-50.
3. Set WR-50 generator's **V.F.O.** dial and range switch to obtain 100 kHz signal.
4. Set **RF OUTPUT** and **XTAL-OSC** switches of WR-50 to "high" and **V.F.O.** switch to "on."
5. Adjust RF attenuator on WR-50 to obtain markers of correct amplitude.

With the conditions described above, the WR-50 is actually feeding two signals (100 kHz and 10.7 MHz) to the **EXTL-MARKER** input of the WR-514 sweep

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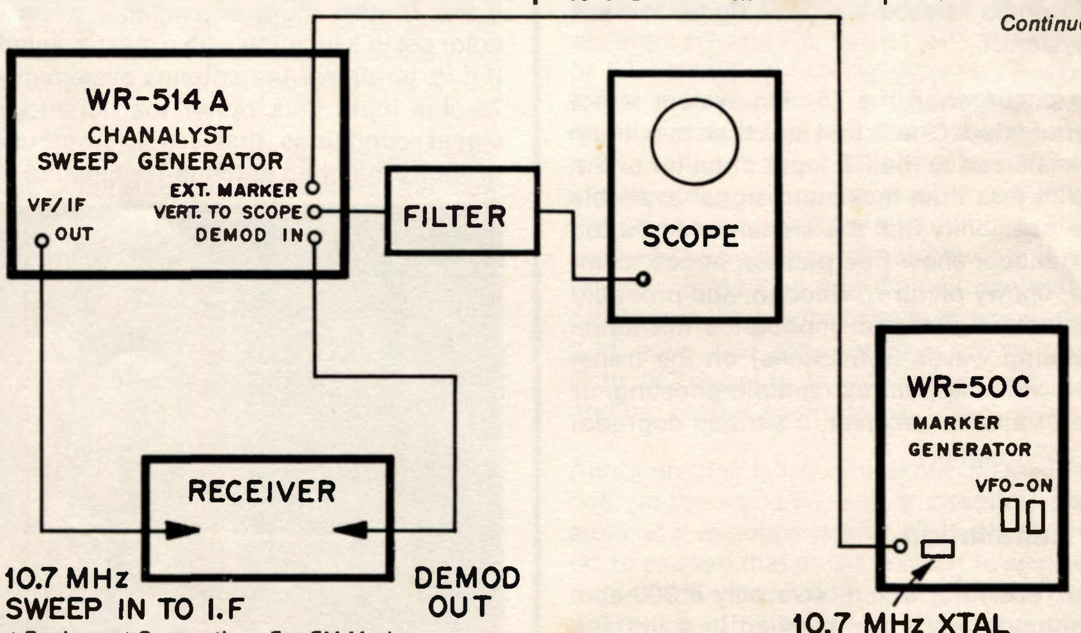

Figure 1—Test Equipment Connections For FM Markers

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Television Antenna Systems and Impedance Matching

Impedance matching is a very important consideration in the design and operation of television master antenna systems. In installations where one receiver operates from a single antenna, impedance matching is relatively simple. The technician merely couples the antenna to the antenna input of the set, using 75- or 300-ohm line. This type antenna installation, produces a good black and white picture with minimum attention to impedance matching.

With color reception, good antenna installation becomes more important. In a black and white system, an impedance mismatch merely causes ghosting, of which a certain amount is often tolerated by the viewer. With a color receiver, however, the same mismatch conditions produce phase distortion of the chroma signals that result in smearing and colored ghosts which are an intolerable situation for the viewer.

In areas where large numbers of sets are installed (such as apartments, motels, etc.), a master antenna and signal distribution system is used to deliver RF signal to each receiver. In order to provide convenience and noise immunity in the signal distribution system, 75-ohm coaxial cable is usually used to route signal from the master amplifier to each set. Therefore it becomes exceedingly important that each run of 75-ohm coaxial cable is properly terminated with its characteristic impedance of 75 ohms to assure proper signal to each set in the system.

Two things occur when the 75-ohm system is not properly terminated: One is that less than maximum signal is transferred to the RF input circuitry of the receiver. With less than maximum signal available there is the possibility that the signal could be too weak to produce a snow-free picture; hence, complaints of a "snowy picture." Second, and probably more prevalent, is that the impedance mismatch causes standing waves (reflections) on the transmission line which appear as multiple ghosting, or in the case of a color receiver, a serious degradation of the color signal.

Receiver Installation

When older receivers, which have only a 300-ohm balanced antenna input are installed in a system, it is necessary to terminate the 75-ohm system with a 75/300-ohm matching transformer (balun). Ideally the balun will present the required 75 ohms terminating impedance for the system when connected to the 300-ohm antenna input of the TV receiver. Unfortunately there are antenna matching transformers on the market which do not present the exact 75 ohms required to terminate the system. When these matching transformers are used, less than maximum signal is transferred to the set. Also "ghosting" and color distortion often result from using these balun transformers.

Several years ago RCA, realizing that many color receivers are being used with master antenna systems, incorporated a feature to provide dual antenna input capabilities; i.e. 75 or 300 ohms. This was easily accomplished since RCA television RF tuners normally have a 75-ohm input. In the past, a balun transformer was mounted on the rear of the tuner to step-down the 300-ohm antenna to the 75 ohms required to match the input of the tuner. Beginning with the CTC 38 chassis, the balun was moved to the antenna terminal board. A coaxial connector was installed beside the two antenna screws and a movable link was provided to allow selection of either the 300-ohm or 75-ohm inputs. This is possible because the tuner has been designed to have exactly 75 ohms input impedance. Thus the 75-ohm system matching is achieved without the necessity of going through an intermediate transformer.

It would be wise for the service technician to check the antenna terminals on the rear of the set to see if the 75-ohm input is available when installing a color set in a location with a master antenna system. If it is, terminate the antenna system directly to the 75-ohm input jack rather than chancing the poor signal conditions that result from using an improperly matched antenna-terminating transformer.

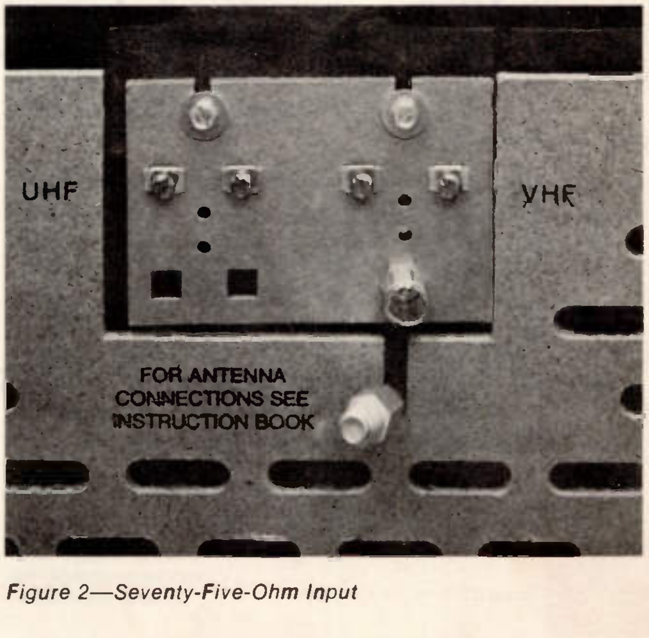

Figure 2—Seventy-Five-Ohm Input

The Schmitt Trigger

As solid-state switching becomes common in RCA products, service technicians will be required to deal with various switching circuits. Although this circuitry may appear to be complex, it is not if the technician is familiar with the "building blocks." As in all electronic circuits, switching systems, however complex, are merely a collection of simple circuits working together to provide the desired function. The Schmitt Trigger, is one commonly used "building block." Figure-3 illustrates the simple two-transistor Schmitt Trigger, which is often used as a voltage sensitive switch to regenerate or "clean-up" pulse waveforms.

Circuit Operation

Let's begin the discussion by considering first what the Schmitt Trigger does and then how it does it. Because the circuit can be thought of as a voltage sensitive switch, let's assume that the circuit is designed to switch "on" and "off" at a 2-volt level when an input signal such as the ill-defined pulse shown in Figure-3 is applied. Consider now what happens as the waveform increases in a positive direction from 0 to its peak of 10 volts. Notice at time T1 the circuit switches "on" as the input waveform passes the 2-volt trigger level and remains "on" until the input signal drops below 2 volts at T2. Thus from time T1 to T2 the output is a well defined pulse.

The circuit operation depends on biasing transistor Q2 into saturation so that the emitter current of Q2 develops 1.2 volts at the emitter of Q1, which is cutoff because there is no base bias. Thus, in order for Q1 to conduct, the base of the transistor must be biased in excess of 2.0

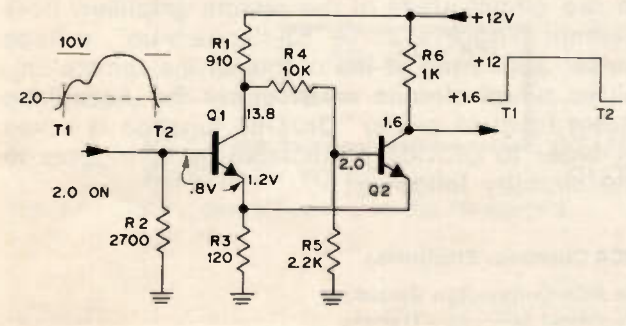

Figure 3—Schmitt Trigger Circuit

volts—1.2V. emitter voltage plus .8V. base/emitter potential. When Q1 is "off," the base of transistor Q2 receives sufficient bias, via R4 (10K) R1 (910 ohms), to cause the voltage at the collector of Q2 to assume a value of about +1.6 volts as determined by the emitter voltage of 1.2 volts plus the saturated collector/emitter voltage drop of .4 volts. In the absence of an input signal to the base of Q1, the circuit is stable with Q1 cut off and Q2 saturated. Under these conditions, the operating current of Q2 has been established at 1 mA; thus, developing +1.2 volts at the emitters of both transistors. When an input signal voltage is applied to the base of Q1 it will not conduct until the base voltage exceeds 2.0 volts. At this voltage transistor Q1 becomes forward biased and its collector voltage begins to drop. This reduces the base bias of Q2 and the emitter voltage at the junction of R3, forcing increased conduction of transistor Q1 to re-establish the 1.2-volt emitter voltage. This regenerative action means at the instant Q1 goes into conduction, the decrease in the collector voltage of Q1 rapidly drives Q2 to cutoff as Q1 saturates. The cutoff of Q2 drives the collector positive to +12 volts for the duration of the time interval (T1 to T2) that transistor Q1 is held in saturation.

Notice the disparity in values of collector load resistors R1 and R6. In the "off" state, the 1K value of R6 sets an operating current of approximately 1 mA that yields the +1.2 volts at the common emitter connections of the transistors. When Q1 is driven "on," the reduced value of R1 (910 ohms) allows a saturation circuit of about 1.1 mA which indicates a base voltage of 2.14 volts. Thus, as long as the base voltage of Q1 exceeds 2.14 volts, it will remain conductive and Q2 will continue to be cut off. At time T2, the input voltage has dropped below 2.14 volts and regenerative action switches the Schmitt Trigger to its resting state with Q2 saturated and the output again drops to zero.

Although ideally the circuit should switch "on" and "off" at the same voltage, in practice this is impossible as it is necessary for the operating current of Q1 to exceed that of Q2 in order to assure sufficient regenerative feedback so the circuit will operate with all possible component tolerances considered. The small difference between "off" voltage and "on" voltage is known as the hysteresis voltage of the circuit, and with good circuit design is usually so small that it is insignificant.

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Easy FM Alignment Markers

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generator. These signals enter the marker-adder section of the generator, where because of the relatively high signal levels, cross modulation produces 10.6 MHz (10.7 MHz − 100 kHz) and 10.8 MHz (10.7 MHz + 100 kHz) products plus the original 100 kHz and 10.7 MHz inputs. The output signal of the marker adder is the normal sweep response curve plus prominent 10.6 and 10.8 MHz marks, and a residual 100 kHz component which is filtered out by the pi-section filter in series with the scope input—see Figure-4.

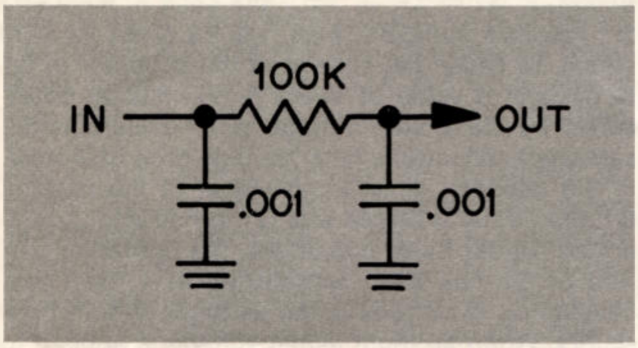

Figure 4—Pi-Section Filter

With practice this test equipment combination will provide the service technician with a straight-forward alignment technique for FM stereo receivers.

Kelvin Color Temperature

The **color temperature** of the raster on a color picture tube refers to the tint of white or gray produced by the raster and not to its brightness level. To reproduce color and black-and-white pictures properly on a color television receiver, it is necessary that the raster be set up to a specific color temperature. This provides the background upon which the picture can be reproduced. RCA Service Data specifies the proper screen color temperature in degrees Kelvin.

The Kelvin temperature scale is used in reference to light, as a means of establishing the hue (coloration—yellowish, bluish, etc.) of a light source. Most light is produced by thermal-radiation (matter being raised in temperature until it emits light). The hue of this light is directly related to the absolute temperature of the heated, light-emitting object. Thus, this temperature is a quality of light that can be readily measured.

The Kelvin scale (°K) is somewhat like the centigrade scale; but, provides for a greater range in the degrees of represented temperature without going below zero. The Kelvin scale uses absolute zero (−273°C) as its starting point, while the centigrade scale uses the freezing point of water as its zero. Hence zero degrees centigrade is +273° Kelvin.

In using Kelvin temperature as a means of measuring the color of light, black is the color that an absolute black body would emit at zero degrees Kelvin (absolute zero). As the temperature of the black body is increased, the color of the light emitted changes. When the temperature of the black body reaches the range of 9,000 to 10,000 degrees Kelvin, the color of light emitted approaches the white that is seen in the raster of a television picture tube. The Kelvin Color Temperature of several of the more common light sources is shown in the color temperature chart, Figure-5. This table is included to provide some relationship between this visual appearance of a light source and its Kelvin temperature. RCA color television receivers normally call for a color temperature of 9300° Kelvin, which is a bluish-white screen color.

Light Source	Kelvin Temperature
Ordinary Candle	1900-1950
Common Household Lamp	2750-2850
Moonlight	4100
Sunlight	5300-5800
Daylight (Sun & Clear Sky)	5800-6500
Daylight (Overcast Sky)	6300-7200
Clear Blue Sky	14000-50000

Figure 5—Color Temperatures

The technician, knowing the meaning of the Kelvin temperature scale, will realize the importance of adjusting the color receiver to produce the proper white raster.

When the screen temperature of a color television receiver is adjusted to too high, a loss of red in the picture detail will result, and the overall picture will take on a metallic appearance. Conversely, too low a color temperature results in the picture having a reddish-brown cast. Thus, this short discussion should illustrate the importance of good color picture tube set-up as means of optimizing the performance of a color receiver.

The Schmitt Trigger

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Practical applications of Schmitt Trigger are included in the CTC 54 color chassis where it is found in two circuit areas of the remote amplifier. Both Schmitt Triggers serve to "square-up" voltage pulses appearing at the output of the remote amplifier tuned circuits when either the **AccuMatic Reset** function or the **"On/Off"** function is keyed in order to provide predictable input triggers to the circuitry following.

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