RCA
Plain Talk
and Technical Tips

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RCA Home Service Handbook

RCA Technical Training has introduced a new "Home Service Handbook" that is designed to assist you in servicing the plug-in module AccuCircuit color television chassis. This comprehensive 98-page publication treats the servicing of these chassis on a symptom/cause basis. Included are color screen photographs that assist the technican in verifying the symptoms encountered. As a further service aid, the "Home Service Handbook" includes a Symptom Index which lists most picture and/or sound symptoms which might be encountered by a technician servicing these chassis.

To use the "Home Service Handbook," the technician simply observes the symptoms displayed by the set he is servicing, finds the appropriate symptom in the "Symptom Index" of the handbook, and turns to the page indicated for that symptom.

The "Home Service Handbook" is divided into eight tab-indexed sections which group together problems associated with specific circuit areas. The tabs are colored to correspond to like colored blocks in the "Symptom-Index." Thus, they serve as convenient section/page locators. For example, a Wrong-Color condition is found in the Color **(COL.)** section of the Handbook. The tab for this section is red and a red color block overlays all symptoms found in this section of the book. Thus the technician with a Wrong-Color problem would find "Wrong Color" in the "Symptom Index," and seeing the red block of color would turn to the red-tab section and locate the Wrong-Color page. This page begins with a screen photograph illustrating the condition of wrong color and a Symptom Description that gives a clue as to possible causes. This is then followed by a step-by-step Service Procedure which allows the technician to quickly repair the problem in the home.

This helpful new publication is available for purchase in one of three ways. The "RCA Home Service Handbook" is furnished **free** with the purchase of a Color TV Module Caddy from your RCA Parts Distributor. Or for those not wanting to purchase a Caddy, the handbook may be purchased at an optional price of $5.95 from your RCA Parts Distributor. Finally, the "Home Service Handbook" may be ordered by mail for $5.95 from RCA Technical Training, 3515 E. Michigan St., Indianapolis, Indiana 46201.

Figure 1—RCA Home Service Handbook

Figure 2—Typical Page

PS
A publication for the service industry prepared by RCA Consumer Electronics

CTC 54 Color Chassis

The new AccuCircuit CTC 54 chassis is used in many deluxe 1972 model year color instruments. Basically, the CTC 54 is similar to the CTC 46 introduced earlier this year. It does, however, feature several firsts for RCA, including new **Varactor** type VHF and UHF tuners. The new tuning system offers complete parity (equal ease of tuning) of VHF and UHF tuning. Twelve VHF and up to eight UHF channels may be programmed for reception

Figure 3—Model GQ 681WR (CTC 54)

by the customer. As the receivers are produced, the eight UHF positions are identified as "A" to "H". In addition, a set of channel indicator numbers is supplied with the instrument so that the customer, after programming UHF channels can insert the appropriate channel number for each UHF channel being received in place of the "A"-"H" inserts. Once programmed in this manner, CTC 54-equipped instruments nearly instantaneously tune the programmed VHF and UHF channels with no separate switching required for UHF operation.

Varactor tuning offers several advantages to the set owner and the service technician. Among these are:

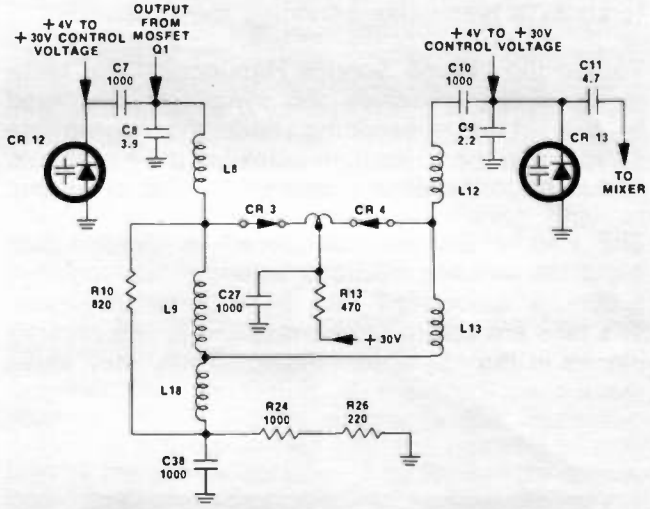
1. There is no rotary mechanical switch for channel change in the actual signal path, as in conventional VHF tuners. This alone virtually eliminates tuner problems caused by dirty or intermittent switch contacts.
2. Since there are no mechanical switches in the varactor tuners, location of the tuners is not dictated by cabinet styling.
3. As previously mentioned, the selection of VHF and UHF channels is equally simple.
4. A single motor is used for remote selection of both VHF and UHF channels.
5. Channel selection is practically noiseless.

KRK 155 Varactor VHF Tuner

The KRK 155 is essentially a four-circuit tuner with RF, mixer, and oscillator circuitry somewhat similar to that used in previous solid-state tuners. The principal difference being in the method of adjusting the resonant frequency of the tuned circuits to the desired channel. In mechanical tuners, this was accomplished with a rotary switch and tapped inductance. This theory is quite simple; with low channels, the entire inductance is in the circuit, thereby establishing a low resonant frequency. As higher channel numbers are selected, increasingly more inductance is switched out of the circuit, raising the resonant frequency. In the varactor tuner, however, the total amount of inductance is fixed for low-band channels 2-6 and high-band channels 7-13. A diode band-switching circuit provides the required inductance for high or low band operation. Connected across the inductance is a variable capacitance diode (varactor) whose capacitance changes with the DC reverse bias applied across it. To tune low channels, the DC bias on the varactor is relatively low, producing a greater capacitance and therefore a lower resonant frequency. As the DC reverse voltage across the diode increases, the capacitance decreases sufficiently to tune the circuit inductance to the desired higher frequency channel.

Continued on Page 4

HIGH VHF CHANNELS



LOW VHF CHANNELS

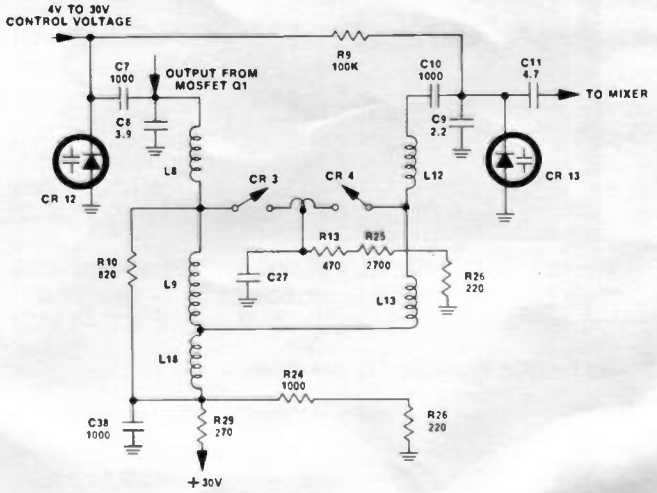


Figure 4—Varactor Tuning and Bandswitching Circuit Example

Varactor Diodes

The technique of using a vacuum tube as a variable reactance was well known many years before the advent of television. Numerous examples of this technique may be found in earlier television receivers; e.g., reactance controlled horizontal oscillators and reference oscillators. The use of a diode instead of a reactance tube allows a simpler circuit with the advantages of solid-state design.

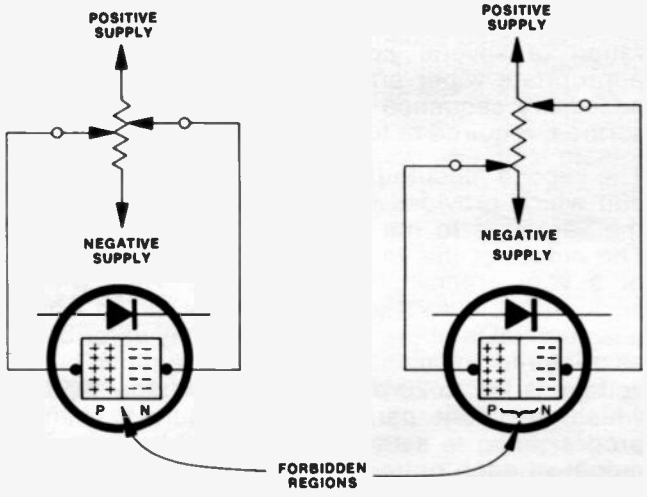


Figure 5—Effect of Increasing Reverse Bias

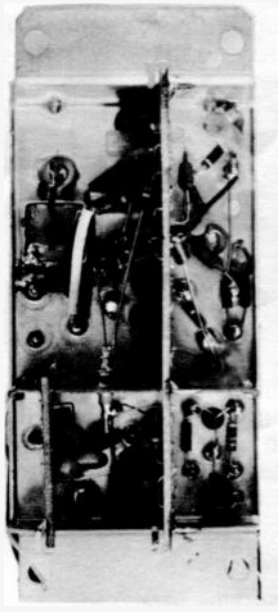


Figure 6—KRK 155 Varactor VHF Tuner

To understand how a varactor diode functions, it is necessary to consider the conditions which exist at its P-N junction with various applied voltages. If the diode is forward biased, current flows, the impedance is very low, and any capacitance which may exist across the junction is effectively short-circuited. Thus, the varactor is operated reverse biased.

The conditions within the varactor diode when it is reverse biased are illustrated in Figure-5. When a positive voltage is supplied to the "N" or cathode material and a negative bias is applied to the "P" or anode material, the current carriers are attracted away from the junction, forming what is called a "forbidden region." Stated simply, this forbidden region is that portion of the semiconductor material on each side of the junction wherein free electrons and holes cannot exist, and therefore the material in this area is essentially an insulator.

As the reverse voltage is increased, the size of the forbidden region also increases. In effect the thickness of the insulating material has been increased by the additional reverse bias. Since the regions of the semiconductor material in which current carriers **can** exist exhibit the properties of conductors, the requirements of a capacitor (two conductors separated by a dielectric) are fulfilled by the reverse-biased diode. Further, the "thickness" of the dielectric, and hence the amount of capacitance, may be controlled by changing the applied voltage. Thus, the reverse-biased diode can be used as a **VAR**iable re**ACTOR,** or **VARACTOR.**

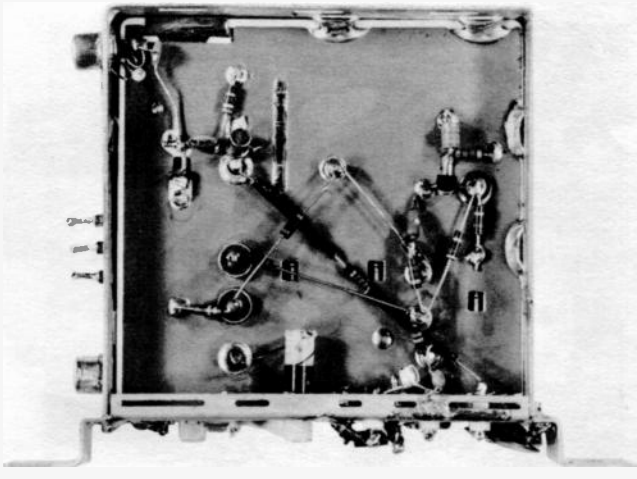


Figure 7—KRK 160 Varactor UHF Tuner

CTC 54 Color Chassis

Continued from Page 2

As a further design and serviceability feature, the IF output circuit (link) of the KRK 155 is designed to match a 50-ohm resistive termination, making it possible for the service technician to interchange tuners in the field without the need for link circuit alignment.

KRK 160 Varactor UHF Tuner

The varactor tuner KRK 160 is also a four-circuit tuner, which sets it apart from earlier RCA UHF tuners in respect that the KRK 160 features a tuned RF stage for enhanced performance. The four varactor tuned circuits include the antenna (RF input), RF output, mixer input, and the local oscillator.

The KRK 160 also features another first, in that it is constructed on an alumina substrate to precise mechanical and electrical tolerances. This method of construction allows the frequency-critical components to be created by photo-mechanical process which assures a degree of performance and uniformity hitherto virtually impossible to achieve in UHF tuners.

The four tuned circuits of this UHF tuner consist of printed strip-line inductors which are each tuned by one of the four varactors. In-as-much as the spectrum occupied by the UHF channels is slightly over one octave, it is not necessary to band-switch the UHF tuner as was done with the previously described VHF tuner. Consequently with a tuning voltage input, ranging between 4 and 28 volts, UHF channels 14-83 are continuously tuned.

Tuner Control System

Although the VHF and UHF tuners have been briefly described, the tuning system of the CTC 54 is not complete without the control circuits. As you will recall from the description of the VHF tuner, to tune a channel it is necessary to select high or low band operation and provide a tuning voltage to the varactor diodes. Band switching within the VHF tuner is accomplished by applying a bias voltage to the correct control line to activate the band switching diodes for either low-band or high-band operation. In addition, a precise voltage must be applied to the varactor to adjust its capacitance to exactly that required to tune the desired channel frequency. Thirdly, the tuner control system must provide like functions for the operation of the UHF tuner.

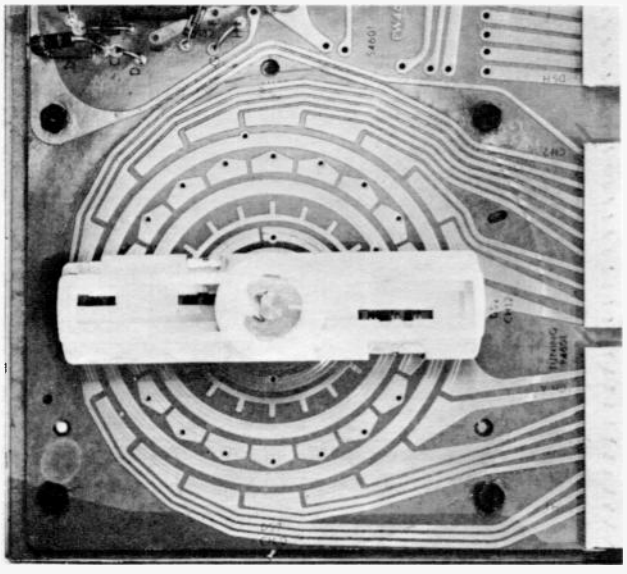


Figure 8—Motor Driven Switch

The tuner control circuit consists mainly of two plug-in modules. One is module MAP which serves to control the operation of the channel selector motor. The channel selector motor may be operated in either direction by front panel controls or by the remote hand unit. The initiation of an up or down command (locally or remotely) inserts a "start" pulse to the motor control module, causing the motor to run until a "stop" pulse is received to indicate that the channel switch has arrived at the next programmed channel. The motor-driven channel switch is an interesting printed circuit configuration of several concentric slotted rings with appropriate wiper arms. This switch provides the necessary sequence of operation, as will be described, required to tune the 20 available channels.

The second module (MAJ) is a voltage control circuit which provides the 4 to 28 volts that adjusts the varactors to the required channel frequency. The output of the voltage control module consists of a very precisely regulated +28 volts with a small variable AFT voltage inserted which drives absolute value of the +28 volts slightly up or down as required to maintain correct fine-tuning. This voltage is fed to 20 potentiometer voltage dividers which are front panel adjusted during channel programming to set-up the desired channels. The output of each potentiometer is connected to the appropriate segment of the channel-change switch so that as the switch rotates, the channels are sequentially tuned.

Summarizing, operation of the local or remote channel UP or DOWN advances the motorized switch to a programmed channel position, a portion of the switch supplies a band switching voltage which determines the band being received (low-VHF, high-VHF, or UHF). Another section of the switch supplies a precise value of tuning voltage to the varactors in the activated tuner. This tuning voltage, with AFT inserted, is divided down from +28 volts by the tuning potentiometer.

As a customer convenience during the set-up of the VHF and UHF channels, a tuning meter is provided which provides an approximate visual indication of the channel to which the instrument is being tuned. This meter is merely a voltmeter with suitable calibration and scales that is connected across the tuning voltage so that adjustment of the tuning knob produces a corresponding deflection of the meter that indicates the channel being tuned.

RCA Consumer Electronics

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