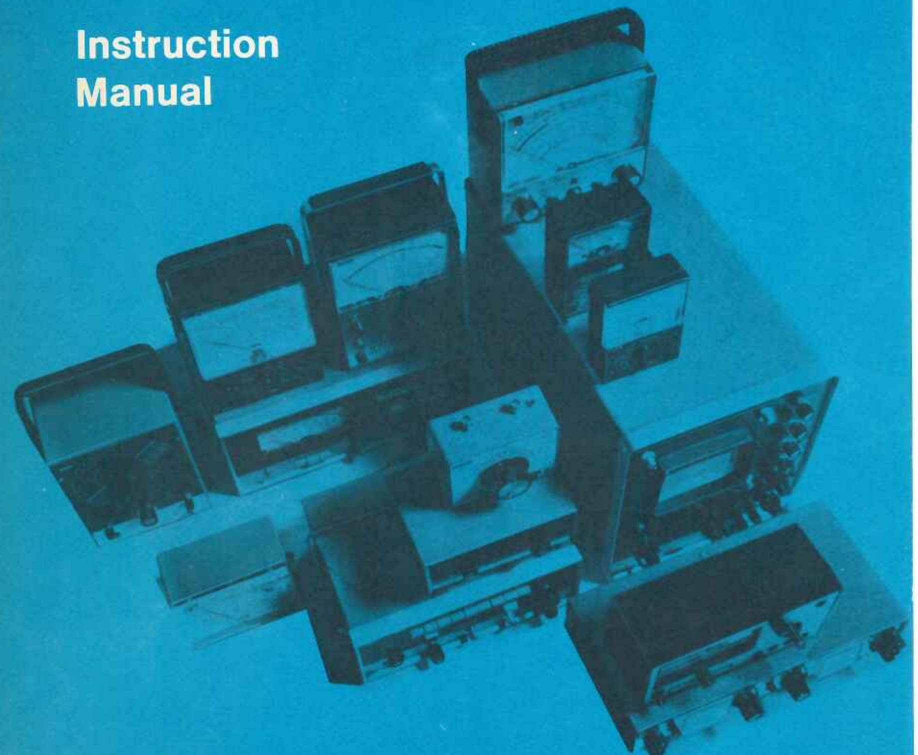
RF Signal Generator
WR-50C

Instruction Manual



VIZ Test Instruments

VIZ Mfg. Co. 335 E. Price St. Phila., Pa. 19144

Optional Price $1.50

SAFETY PRECAUTION

This instrument is equipped with a three-wire power cord which connects the metal case and ground lead to the power-line ground. To prevent lethal shocks or equipment damage when servicing equipment not equipped with a three-wire power cord, ALWAYS ELECTRICALLY ISOLATE SUCH EQUIPMENT WITH AN ISOLATION TRANSFORMER, such as VIZ WP-25A*, WP-26A*, or WP-27A Isotap.

Always become familiar with the equipment under test before working on it, bearing in mind that high voltages may appear at unexpected points in defective equipment.

* Use isolated sockets only.

WR-50C

5/75/76
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CONTENTS

DESCRIPTION

The VIZ WR-50C Solid-State RF Signal Generator is an all-purpose instrument, designed primarily for aligning and servicing radio and television receivers. The generator produces tunable RF output from 85 kHz to 40 MHz, 600 Hz audio output, and sweep output at 455 kHz and 10.7 MHz. A crystal-controlled oscillator is also provided for use with an external crystal.

The variable oscillator covers the fundamental frequencies from 85 kHz to 40 MHz in six ranges. For higher frequencies, the second or third harmonic of the high range can be used. A vernier tuning control permits precise setting of the output frequency. The RF output can be modulated with the internal 600 Hz oscillator, or with an external audio signal. The modulation level is adjustable.

A two-position attenuator switch, together with a variable attenuator control provide complete adjustment of the RF output level.

Sweep output is provided at 455 kHz and 10.7 MHz for sweep alignment of both AM and FM IF circuits. This sweep output makes it possible to obtain a continuous oscilloscope display of IF bandpass characteristics. A return-trace blanking circuit is included to provide a zero-reference line.

The crystal oscillator circuit in the WR-50C enables the instrument to be used as a crystal calibrator. A convenient crystal socket is provided on the panel. This crystal oscillator can be used as a frequency calibration reference for the variable oscillator, or can be used directly as a crystal-controlled signal source.

The generator includes a detachable shielded output cable to minimize radiation and hum pick-up. Phono-type panel jacks are provided for RF and AF output.

The WR-50C has easy-to-read dial scale and markings. The instrument is readily portable, weighing just 3½ pounds, and measuring only 7¾ inches × 4¾ inches × 5⅜ inches.

Accessories Available Separately

Crystals (Order from your local VIZ Distributor)

Frequency	*Stock Number*
100 kHz	WG-480
455 kHz	WG-481
1 MHz	WG-482
4.5 MHz	WG-483
10 MHz	WG-484
10.7 MHz	WG-485

SPECIFICATIONS

(Performance figures with line voltage at 120 volts, 60 Hz)

Sweep Output:
455 kHz, center-frequency
10.7 MHz, center-frequency
Sweep width approximately 10% of center frequency.

Variable Oscillator:
Six Ranges (fundamental frequencies)
A . . . . .85 kHz to 200 kHz
B . . . . .200 kHz to 550 kHz
C . . . . .550 kHz to 1600 kHz
D . . . . .1.5 MHz to 4.5 MHz
E . . . . .4.5 MHz to 14 MHz
F . . . . .14 MHz to 40 MHz

RF Output (all ranges)*
0.05 volt rms (minimum)

Dial Calibration Accuracy . . . . . ±2%

Internal Modulating Frequency
approx. 600 Hz

Percent Modulation
adjustable up to 80%

Audio Output . . . at least 6 volts rms across 15K load

External Modulation
Modulating Frequency 15 kHz max.

Voltage Required for
80% Mod. Using 600 Hz**
approx. 6 volts rms

Impedance at AF IN/OUT
Connector (600Hz)†
approx. 10K ohms

Crystal Oscillator
Maximum Output. .0.02 volts rms
Internal Mod. Percentage
approx. 20%‡
Frequency Range. .100 kHz to 15 MHz (Fundamental)

Attenuator
VFO and Sweep Output
2-step 10-to-1 attenuator switch with potentiometer for fine adjustment.
Crystal Oscillator Output
Additional 7-to-1 attenuator switch

Power Supply§
Voltage Rating . . . . .108-130 volts 50/60 Hz
Power Consumption . . . . . .8 watts

Dimensions
Width . . . . .7¾ in. (19.70 cm)
Height . . . . .5⅜ in. (13.65 cm)
Depth . . . . .4¾ in. (12 cm)
Weight . . . . .3.5 lbs. (7.70 kg)

*Open-circuit value.
**With WR-50C tuned to 1 MHz.
†With "% MOD" control at maximum.
‡Varies with crystal cut and activity.
§May be re-wired for 240 V operation.

FUNCTIONS OF CONTROLS

TUNING DIAL — Tunes through all six ranges (A through F) of the variable RF oscillator.

RANGE SWITCH — Selects 455 kHz or 10.7 MHz sweep, and VFO ranges A through F.

SWEEP/INT MOD/EXT MOD — Three position switch.

SWP — Provides sweep output with retrace blanking when range switch is set to one of the sweep positions.

EXT MOD — Permits external modulation of VFO or crystal oscillator. Removes blanking when used with sweep function.

INT MOD — Modulates VFO or crystal oscillator with 600 Hz signal.

VFO ON/OFF — Turns variable frequency oscillator on or off.

PWR OFF/% MOD — Applies power when turned clockwise from "PWR OFF" position. Varies modulation level. Varies level of 600 Hz output.

MOD AUDIO IN/OUT — Eternal modulating signal can be applied through this jack when "EXT MOD" switch is set to "EXT". Provides 600 Hz output when "EXT MOD" switch is set to "INT".

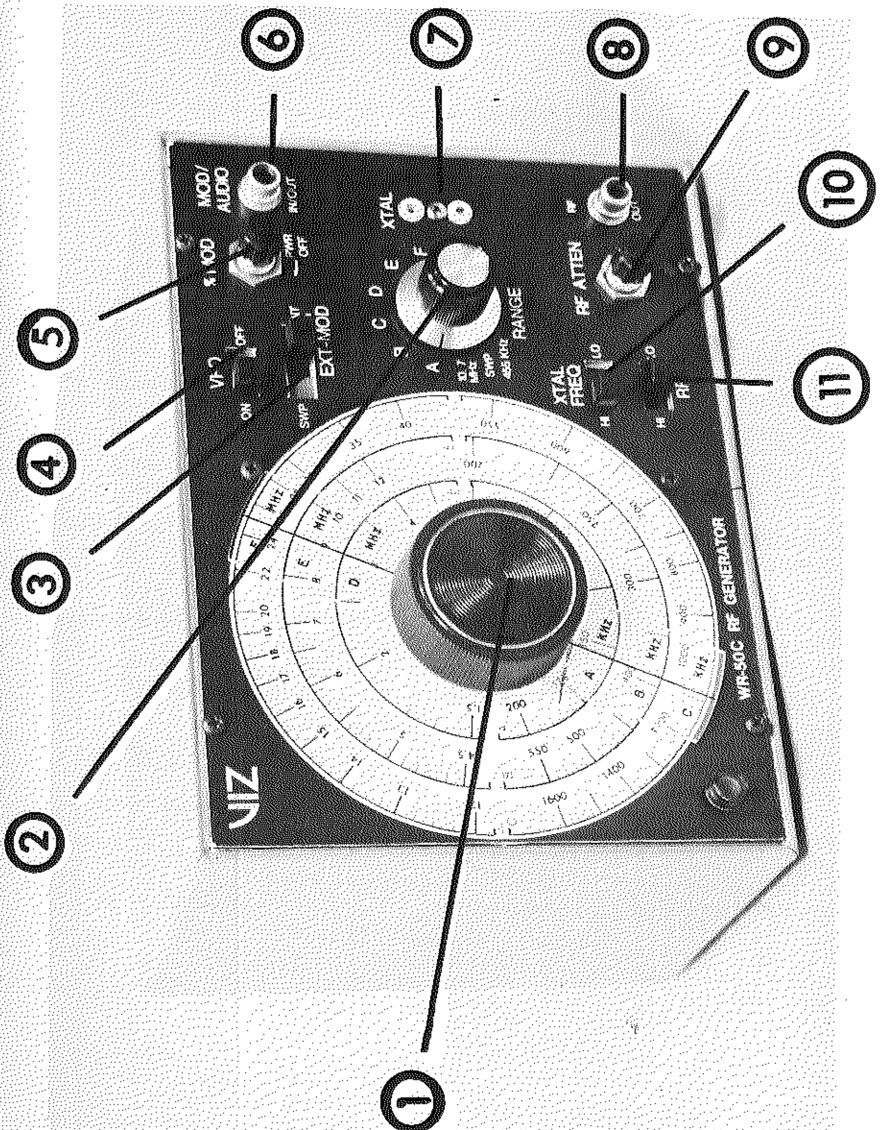
XTAL — Crystal socket. Accepts crystals with HC-6U type base. Inserting crystal activates crystal oscillator.

RF OUT — RF output cable jack.

RF ATTEN — Provides fine RF attenuation adjustment.

XTAL FREQ HI/LO — Provides additional attenuation of crystal output.

RF HI/LO — Attenuates RF (VFO, crystal, and sweep) output when set to LO position.



OPERATION

General

Plug the power cord plug into a 120 volt, 60 Hz AC outlet. Turn "% MOD" control clockwise to turn the instrument on. Plug the output cable into the "RF" or "MOD/AUDIO" connector, as required.

Variable Frequency Oscillator (VFO) Output

1. Set the range switch to the range that includes the desired frequency, as follows:

Range	*Frequency*
A	85 kHz to 200 kHz
B	200 kHz to 550 kHz
C	550 kHz to 1600 kHz
D	1600 kHz to 4.5 MHz
E	4.5 MHz to 14 MHz
F	14 MHz to 40 MHz

Note: Frequencies higher than 40 MHz can be obtained by using second or third harmonics of the fundamental F band frequencies. For example, the second harmonic of the F band produces frequencies from 28 MHz to 80 MHz; the third harmonic produces frequencies from 42 MHz to 120 MHz; etc.

2. Turn the "TUNING DIAL" to the desired frequency on the dial scale. Set the "VFO" switch to "ON".

3. If internal 600 Hz modulation is desired, set the "EXT MOD" switch to "INT." If external modulation is to be applied, or if no modulation is desired, set switch to "EXT".

4. Adjust output level with the "RF" switch and "RF ATTEN" control.

Sweep Output

1. Set the "RANGE" switch to "455 kHz" to "10.7 MHz" and the "VFO" switch to "ON." Set the "EXT MOD" switch to "SWP" for sweep output with retrace blanking.

2. Set "EXT MOD" switch to "EXT" to remove blanking for adjusting oscilloscope phase.

3. Adjust output level with the "RF" switch and the "RF ATTEN" control.

4. A marker can be inserted in the sweep trace by inserting a crystal of the marker frequency in the crystal socket. Adjust marker size with the "XTAL FREQ" switch.

Refer to page 14 for further information regarding the use of sweep output.

Crystal Oscillator Output

1. Insert a crystal with a frequency between 100 kHz and 15 MHz in the "XTAL" jack. Use a crystal with HC-6U type base (pin diameter, .05"; pin space, .486"). (Specify for use in parallel resonant circuit, with 32 pf loading.) Crystals for several frequencies are available from VIZ. See page 7.

Note: Crystals with other types of basing can be used by connecting short leads from crystal pins to the socket.

2. If the VFO is not to be used with the crystal oscillator, set the "VFO" switch to "OFF". Set the "EXT MOD" switch to "INT" for

modulation with the 600 Hz internal oscillator, and to "EXT" for no modulation or if external modulation is to be applied.

3. Adjust modulation level with "% MOD" control. Adjust output level with "RF" switch, "XTAL FREQ" switch, and "RF ATTEN" control.

600 Hz Output

1. Set "EXT MOD" switch to "INT". 600 Hz output will be available at "MOD/AUDIO" jack. Output level is adjustable with the "% MOD" control.

Checking Modulation Output

If it is desired to check the modulation percentage of the RF output signal from the WR-50C directly, it may be checked by observing the output waveshape on an oscilloscope, providing the RF frequency is within the frequency range of the oscilloscope. As the "% MOD" control is varied, the degree of modulation on the waveform will change. The oscilloscope and direct probe may also be used to measure the peak-to-peak value of the audio voltage at the "MOD/AUDIO" connector. The peak-to-peak value of the audio output voltage may also be read directly on either the ADD-VIZ WV-77E Volt-Ohmyst® or the ADD-VIZ WV-98C Senior VoltOhmyst®, which have separate peak-to-peak scales.

In most applications in signal tracing, the "RF" switch is set to the "HI" position, and adequate attenuation can be obtained with the "RF ATTEN" control. When a low-gain stage or amplifier section is tested however, the switch should be set to the "LO" position.

Using the Crystal Oscillator

The crystal-controlled oscillator of the WR-50C is operated simply by inserting a crystal of the desired frequency into the socket on the front panel of the instrument. Set the "VFO" switch to the "OFF" position to remove the variable frequency oscillator signal.

This crystal oscillator circuit features the ability to operate over a wide range of frequencies, with a rich production of harmonics. For this reason the WR-50C can be conveniently used for calibration purposes.

For extreme accuracy, crystals which oscillate at a fundamental mode, and are designed for operation in the type of circuit used in the WR-50C should be used. In this circuit, overtone crystals will oscillate at their fundamental mode—approximately one-third of their designated frequency.

The WR-50C may be utilized effectively as a crystal-calibrated signal generator by using the crystal oscillator circuitry of the instrument to calibrate the variable oscillator.

There are several methods of using the crystal oscillator in this manner. Two of these methods are described below. In these examples a 1000 kHz crystal is used, however any "fundamental-cut" crystal in the range from 100 kHz to 15 MHz can be used in a similar manner.

Example 1: Connect the "RF OUT" cable of the WR-50C to a diode circuit as shown in Figure 1. Connect the diode circuit to an audio amplifier and speaker. The amplifier circuit of a radio receiver having two stages of audio amplification can be used for this purpose. If a receiver is used, connect the diode circuit to the volume control, using shielded wire.

Set the "RF ATTEN" control fully clockwise, the "RF" switch to "HI", the "EXT MOD" switch to "EXT", and the "VFO" switch to "ON". Insert a 1000 kHz crystal into the socket on the front panel of the WR-50C. Turn the "RANGE" switch to "C", and tune the "TUNING DIAL" between 950 kHz and 1050 kHz. A zero-beat will be heard in this area.

NOTE: A zero-beat can be identified as follows: As the dial approaches the zero-beat point, the sound starts from a high pitch, then reduces in frequency until it reaches "zero" and little or no sound can be heard. As the dial indicator passes beyond the zero-beat point, the sound again raises in pitch to beyond audibility.

The zero-beat occurs when the frequency of the variable oscillator is the same as the fundamental crystal frequency. Thus, this zero-beat point indicates the WR-50C variable oscillator is set at exactly 1000 kHz.

Since the crystal oscillator used in the WR-50C is rich in harmonics as mentioned above, the variable oscillator can be calibrated in a similar manner using the harmonics of the fundamental crystal frequency, such as 100 kHz, 125 kHz 250 kHz, 333 kHz, 500 kHz, and 2 MHz, 3 MHz, 4 MHz, etc.

Example 2: The calibrating method described below is similar to that of example 1, except that an oscilloscope rather than an amplifier is used as the zero-beat indicator. The equipment is connected as shown in Figure 2.

Set the internal sweep of the oscilloscope to one of the high horizontal sweep ranges, with the internal sync "OFF". As the variable oscillator of the WR-50C is tuned in close to the crystal frequency, a "band-type" trace will be noted. At actual zero-beat, the band changes to a straight line. As the variable oscillator is turned past zero-beat, the band again appears until the beat frequency becomes high enough to be out of the scope and detector response range.

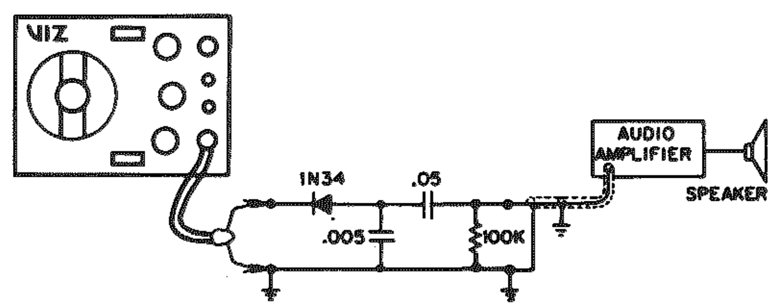


Figure 1. Using AF amplifier to crystal calibrate the WR-50C.

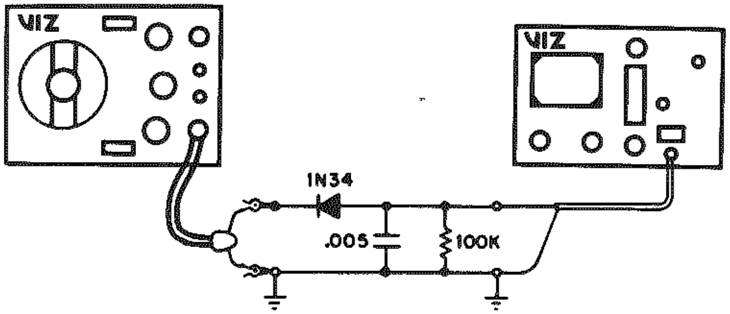


Figure 2. Using oscilloscope to crystal calibrate the WR-50C

Using the Sweep Output

The sweep output provided by the WR-50C permits checking and aligning both AM and FM intermediate-frequency (IF) amplifier circuits. Sweep alignment of the 10.7 MHz IF amplifier circuits is recommended by many manufacturers of FM receivers. Although the IF amplifiers in most AM receivers are aligned using the "peak" alignment method, the service notes for some sets, including newer transistor models, do specify sweep alignment.

Sweep alignment techniques enable the bandpass characteristics (frequency response) of a tuned circuit to be observed on an oscilloscope. This is accomplished by passing the sweep signal, which consists of a band of frequencies, through the circuit. Those frequencies amplified by the circuit will cause vertical deflection of the oscilloscope trace, thus forming the frequency response curve of the amplifier. Through the use of frequency markers, the circuit can be aligned to produce the necessary bandpass characteristics.

The Sweep Signal

A sweep signal is formed by repeatedly increasing and decreasing (sweeping) the frequency of an oscillator.

The basic frequency of the oscillator, before it is "swept," is known as the *center frequency*. The WR-50C has two separate sweep signals; one with a center frequency of 455 kHz (for AM IF alignment), and the other with a center frequency of 10.7 MHz (for FM IF alignment).

The total amount of frequency variation above and below the center frequency is called the *sweep width* (or bandwidth). The WR-50C sweep signals have a sweep width of about 10% of the center frequency. The 455 kHz sweep signal varies in frequency (sweeps) from approximately 432 kHz to 478 kHz. The 10.7 MHz sweep signal varies from approximately 10.2 MHz to 11.2 MHz.

The signal is swept back and forth through the band of frequencies a certain number of times per second. This is known as the *sweep rate*. The sweep rate of the WR-50C sweep signals is 60 times per second.

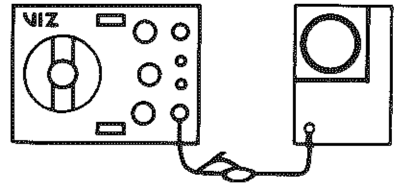


Figure 3. Equipment hookup for observing sweep output directly from WR-50C

Observing Sweep Output Directly

The following procedure will help you become familiar with the technique of using the WR-50C sweep signal.

It is essential to have an oscilloscope with 60 Hz horizontal sweep and with a phase control, such as the VIZ WO-33B or WO-535A, for any application using sweep signals. It is helpful to have a detector probe* for the oscilloscope, since it permits observing the detected sweep output directly from the generator.

Frequency markers can be inserted on the sweep trace either by using the WR-50C crystal oscillator, or an external marker generator. A separate RF generator, similar to the WR-50C can be used for this purpose.

Adjust the WR-50C and oscilloscope controls as follows:

Turn on equipment. Set WR-50C "RANGE" switch to "455 kHz" "VFO" switch to "ON", EXT MOD" switch to "EXT", "RF" switch to "HI", and "RF ATTEN" control fully clockwise.

Connect detector probe of oscilloscope to the WR-50C output cable. Set the scope sweep selector switch to "60 Hz" or "LINE", and adjust for a pattern as shown in Figure 4. Note that scope is set to 60 Hz sweep, the same sweep rate as the WR-50C sweep signal. This detected sweep trace is simply a horizontal line, since all frequencies in the sweep signal are at the same voltage level.

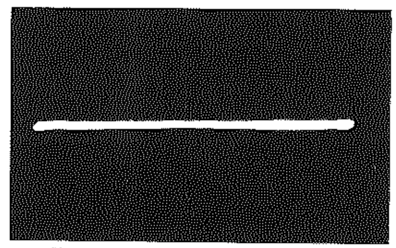


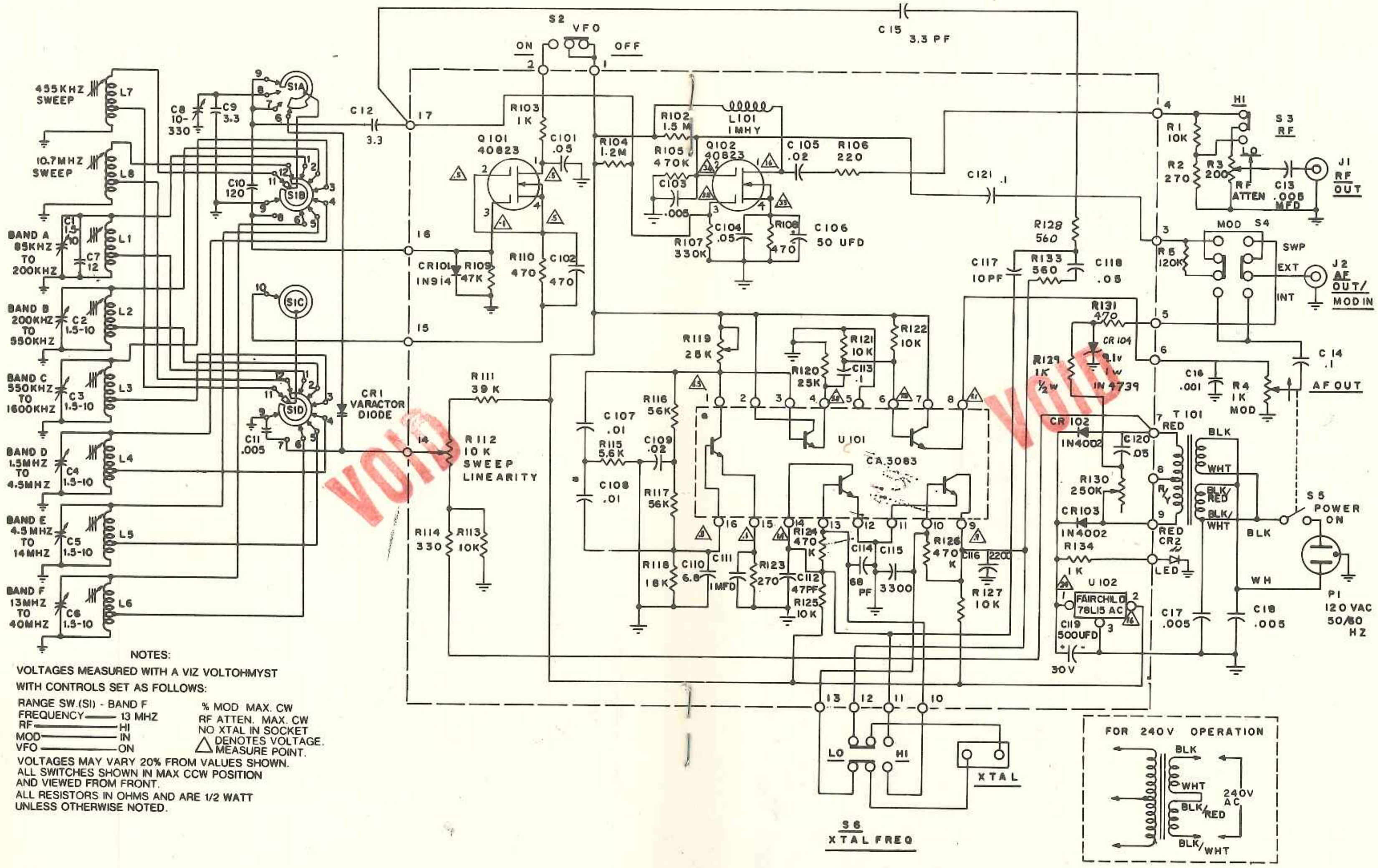
Figure 4. Detected sweep signal, without blanking

*Note: Detector Probes for VIZ Oscilloscopes are the WG-350A for the WO-33B, and WG-302A for the WO-505A or WO-535A.

Blanking

The illustration shown in Figure 4 is a sweep trace without retrace blanking. The signal sweeps from its lowest frequency up to its highest frequency, then sweeps back downward to the lowest frequency again, retracing the same waveform. When the sweep signal and retrace are properly phased, the two traces, which are identical, will overlap and appear as a single trace. Such a curve is useful for observing the general frequency response characteristics and for making phase adjustments, but it does not indicate relative amplitude (voltage) because there is no base line or zero voltage reference.

A base line can be produced in the generator by cutting off, or blanking, the sweep oscillator output during the retrace portion of the sweep cycle. The retrace will then form a base line at the bottom of the curve which will correspond to zero voltage level.



NOTES:

VOLTAGES MEASURED WITH A VIZ VOLTOHMYST
WITH CONTROLS SET AS FOLLOWS:

RANGE SW.(S1) - BAND F
FREQUENCY —— 13 MHZ
RF —— HI
MOD —— IN
VFO —— ON

% MOD MAX. CW
RF ATTEN. MAX. CW
NO XTAL IN SOCKET
△ DENOTES VOLTAGE MEASURE POINT.

VOLTAGES MAY VARY 20% FROM VALUES SHOWN.
ALL SWITCHES SHOWN IN MAX CCW POSITION AND VIEWED FROM FRONT.
ALL RESISTORS IN OHMS AND ARE 1/2 WATT UNLESS OTHERWISE NOTED.

WR-50C Schematic Diagram

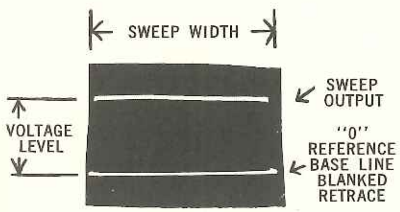


Figure 5. Detected sweep signal, with blanking

To obtain a sweep trace with retrace blanking, set the WR-50C "EXT MOD" switch to "SWP". A trace similar to that in Figure 5 should be obtained. Observe that the trace now consists of two parallel horizontal lines. The lower line represents the zero voltage level, or base line, and the upper line is the sweep output. The distance between the lines corresponds to the relative voltage amplitude of the sweep signal, and can be adjusted using either the WR-50C "RF" switch and "RF ATTEN" control or the scope vertical input gain controls. Note: If the polarity of the diode in the detector is reversed, the trace will appear upside-down, with the base line at the top. Some scopes are equipped with a polarity switch that can be used to reverse the trace polarity.

The horizontal length of the sweep trace indicates the sweep width, or frequency variation of the signal, with the lowest frequency at one end, and the highest frequency at the other end. The high and low end of the sweep trace can be interchanged by reversing the power cord plug on either the oscilloscope or the generator.

Frequency Markers

To fully interpret the characteristics of a sweep signal or response curve, it is necessary to use frequency markers. A marker can be inserted on the sweep trace simply by inserting a crystal of the marker frequency into the crystal socket on the WR-50C panel. The size of the marker can be adjusted with the "XTAL FREQ" switch. Figure 6 shows a 455 kHz sweep trace with a 455 kHz marker. Note that the marker is in the center of the sweep trace, indicating that the signal is sweeping above and below the marker frequency. Figure 7 shows a 10.7 MHz sweep trace with a 10.7 MHz marker.

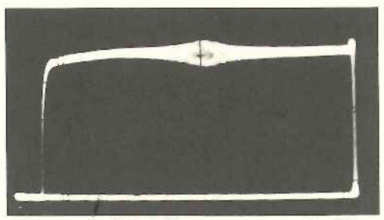


Figure 6. 455 kHz sweep signal with 455 kHz marker

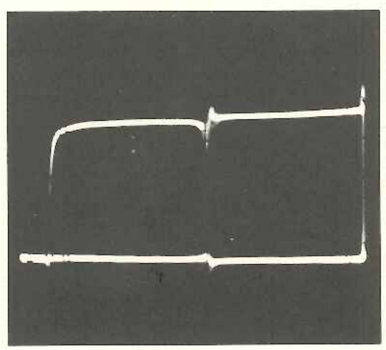


Figure 7. 10.7 MHz sweep signal with 10.7 MHz marker

The sweep width of the signal can be measured if a variable marker source is available, such as a separate RF generator. Connect the output of the marker generator to the oscilloscope detector probe, along with the WR-50C cable. Tune the marker generator one side of 455 kHz to position the marker at one end of the sweep trace. Note the frequency of the marker generator. Tune the marker generator to position the marker at the other end of the trace, and note the frequency. The difference between these frequencies is the sweep width of the signal.

APPLICATIONS

Radio Servicing

Troubleshooting Using Signal Injection

The signal injection technique is one of the fastest, most reliable methods of troubleshooting radio circuits. The WR-50C provides the signals required for checking audio stages, AM and FM IF stages, and AM RF circuits.

Checking Audio Stages

1. Connect the ground lead of the WR-50C AF output cable (MOD/AUDIO) to the ground of the circuit under test. Connect the audio signal from the cable to the various test points through a 0.1 ufd capacitor.

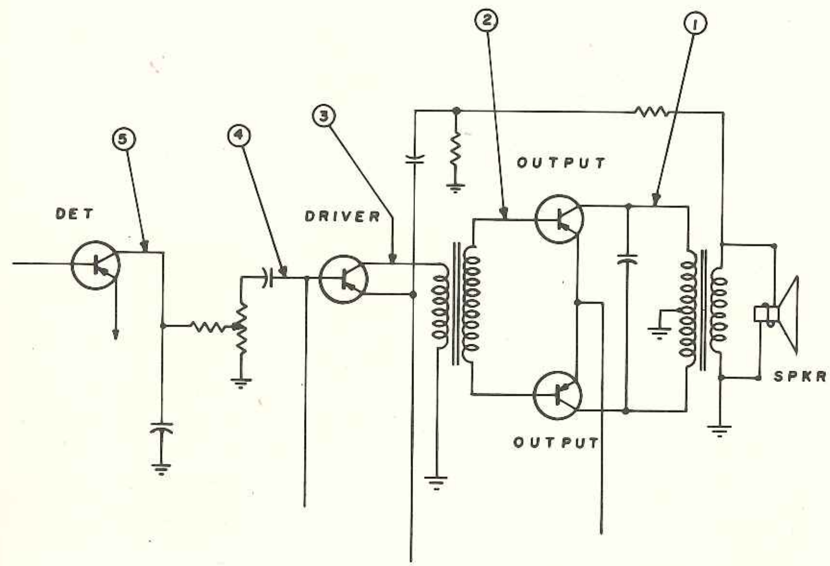


Figure 8. Checking audio stage

2. Refer to Figure 8. Connect the audio signal to the collector terminal of the output stage (test point 1). Set the "EXT MOD" switch to "INT", and adjust the "% MOD" control to produce an audible tone from the speaker.

3. Proceed to inject the signal at test points 2, 3, 4, and 5.

All transformers in a transistor radio have a voltage step-down ratio. Thus, when moving the injected signal from point 2 to 3, a definite drop in volume should be expected. When moving the probe from the collector to base (from point 3 to 4) a large increase in volume should be heard. Always reduce the setting of the "% MOD" control to maintain a low output volume or the effects of AGC or signal overload may hide the true change in volume. Failure to produce an output at any point localizes the trouble between the point where the signal was last heard and the point where no output can be produced. DC voltage checks should then be made to localize the fault to a component.

If an audio output can be produced with a low-level signal applied at the volume control (about 3 millivolts), the audio section is operating, and trouble is indicated in or ahead of the detector.

Checking IF Stages

As with audio stages, the IF stage can be checked by injecting a modulated signal at the IF frequency (455 kHz for AM, 10.7 MHz for FM) at test points proceeding from the input to the detector back through the output and input of each IF stage. Couple a signal from the RF output cable to the test point through an 0.005 ufd capacitor. Set the WR-50C "RF ATTEN" and "% MOD" controls as required to produce an audible tone.

A drop in volume should be noted when the probe is moved from the secondary of a transformer to the primary; and a definite rise in volume should be noted when moving the probe from the output to the input of a stage.

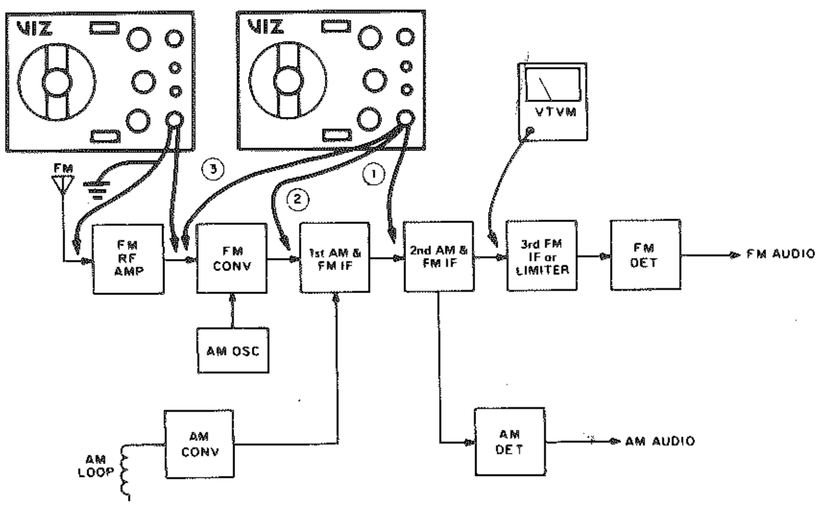


Figure 9. Block diagram showing signal-injection test procedure of a typical AM-FM receiver sharing common IF amplifier stages

Checking RF Circuits

To check RF stages the signal should be injected in such a way that the output resistance of the signal generator does not load the receiver circuit. A suitable coupling system can be made using a loopstick antenna or an air core coil. The latter may consist of 15 to 20 turns of hookup wire wound upon a two-inch coil form. The coil is connected across the output of the signal generator and is positioned about 6 inches to 12 inches away from the loopstick antenna in the receiver under test. The amount of coupling may be adjusted by varying the spacing. This coupling arrangement is also very useful for aligning the RF section of the receiver.

For AM receivers, tune the WR-50C to suitable points within the 550 kHz to 1600 kHz range (B and C). For FM receivers, the WR-50C can be used as a signal source in the 88—108 MHz range in most cases by utilizing the 4th harmonic with the generator tuned to 22—27 MHz frequencies. Adjustment of the WR-50C to 22 MHz will generally provide more than enough output at the 88 MHz harmonic for calibration at the low end of RF tuner circuits. Adjustment to 27 MHz will provide an adequate signal for 108 MHz alignment of the high end of the RF range.

Adjust the WR-50C "RF ATTEN" and "% MOD" controls as required.

Aligning Radio Receivers

It is important that manufacturers' recommendations given in the service notes be followed closely in aligning radio receivers.

Some receivers use over-coupled IF transformers which ordinarily require a sweep generator for alignment. It is possible to use the peak alignment if the degree of coupling is reduced by use of a shunt resistor across the windings. For over-coupled stages, a resistor of about 1000 ohms or less should be connected across the transformer winding opposite the winding being tuned.

AM Receivers—Peak Alignment

See page 22 for AM sweep alignment.

1. Set up a VIZ VoltOhmyst® to measure DC voltage and connect it to the output of the second detector, shown as point "1" in Figure 10.

2. Disable the AGC circuit of the receiver. If necessary, use fixed bias as described in Figure 12. Set the radio dial to a quiet point near 1600 kHz.

3. Connect the RF output cable of the generator to the input of the last IF stage, shown as point "2" in Figure 10 and tune the WR-50C to the intermediate frequency of the receiver (usually 455 kHz). Apply modulation and use only enough output to produce a useable meter reading.

4. With a suitable alignment tool, adjust the secondary IF T3 for peak indication on the VoltOhmyst®. Then adjust the T3 primary for peak reading.

5. Move the RF output cable to point "3" and adjust the T2 secondary and primary respectively, for peak reading of the VoltOhmyst®.

6. Move the RF output cable to the grid of the mixer and adjust T1 secondary and primary for peak reading on the VoltOhmyst®.

Oscillator Alignment

7. With the receiver antenna connected and placed in approximately the same position it will occupy when installed in the receiver cabinet, lay the output cable of the generator near enough to the antenna so a low level radiated signal will be picked up.

8. Tune the receiver to its highest frequency, approximately 1600 kHz for most types, and set the generator to this same frequency. With an insulated screw driver, adjust the trimmer capacitor on the receiver oscillator for maximum reading on the VoltOhmyst®.

9. Return the generator and receiver to approximately 1400 kHz. Adjust the antenna trimmer for peak indication on the meter.

10. Retune the receiver and the generator to 600 kHz, rock the tuning gang slightly, and adjust the oscillator coil for maximum reading on the meter.

FM Receiver Alignment

Ratio Detector Stage Peak Alignment

Fig. 11 shows the test points to which the instruments are connected for adjusting this stage both for maximum gain and proper signal phase relationship.

Connect a VIZ VoltOhmyst® to Test Points AA and AB. The WR-50C, set to 10.7 MHz, is connected through a 0.01-ufd capacitor to the base of the last IF transistor. The primary of transformer T2 is then adjusted for maximum DC voltage.

The second adjustment, is to set the 10.7-MHz signal at the exact center frequency of the sweep. The pointer of the meter is set to the zero center of the scale and the test leads are connected to Test Points AB and AC. The secondary of transformer T2 is then adjusted for zero voltage. The pointer should swing to either side of the zero center when the transformer adjustment is rotated back and forth. When the pointer is directly centered it indicates that the transformer is tuned to the 10.7-MHz signal from the WR-50C.

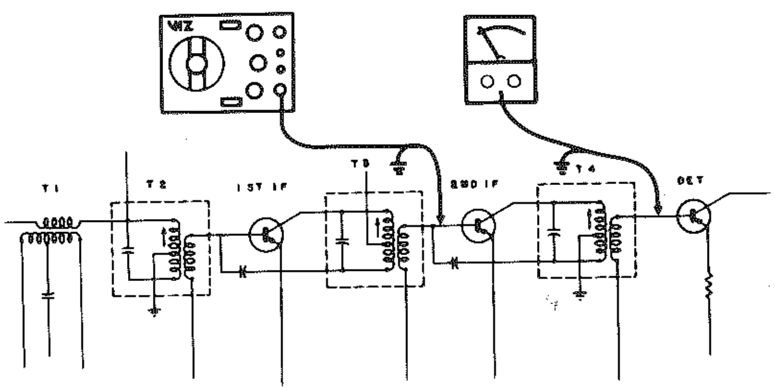


Figure 10. Setup for IF alignment of AM broadcast receivers

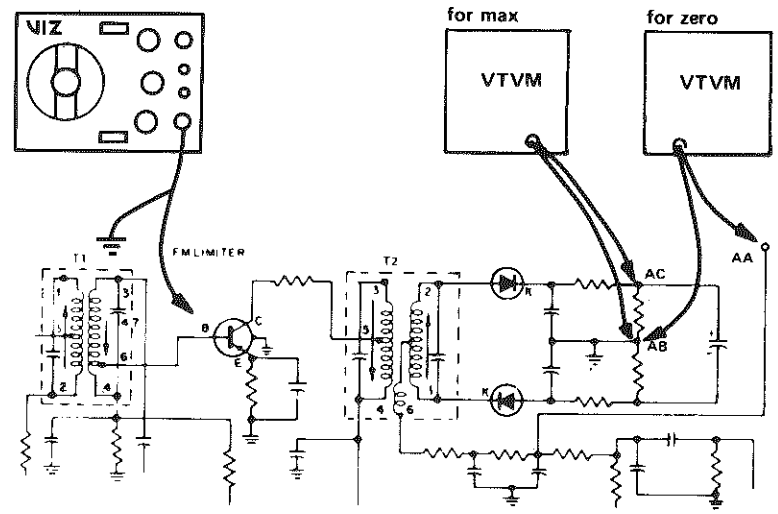


Figure 11. Test equipment connection points for peak alignment of a typical FM ratio detector

Ratio Detector Stage Sweep Alignment

Set up the WR-50C to provide 10.7 MHz sweep with a 10.7 MHz provided by an external crystal. See pages 11 to 13.

Sweep Alignment—Fig. 12 shows the test equipment connection points for sweep aligning a typical FM ratio detector stage. The generator, set to sweep around the 10.7-MHz center frequency with a 10.7-MHz crystal to provide a marker, is coupled through a 0.01-ufd capacitor to the base of the last IF transistor Q1 (also referred to in the schematic diagram as the limiter). The 'scope is connected to the output of the detector at a point where the "s" curve can be observed on the screen (Test Points AA and AB).

If the stage is functioning and aligned properly, an "s" trace resembling the curve shown in Fig. 13 should be seen on the 'scope. The 10.7-MHz blip should be centered at the zero base line as the curve in Fig. 13 indicates. If the s-shaped waveform as indicated does not appear, adjust the secondary of transformer T2 until proper alignment is achieved.

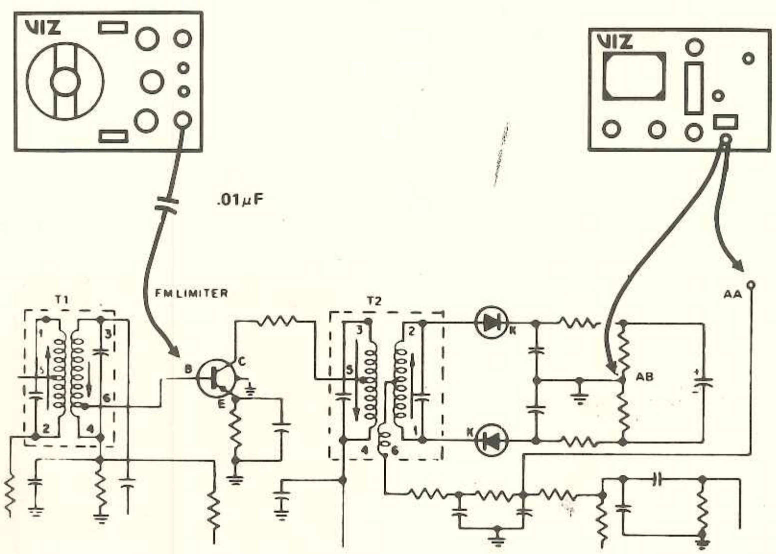


Figure 12. Test equipment connection points for sweep-signal alignment of a typical FM ratio detector

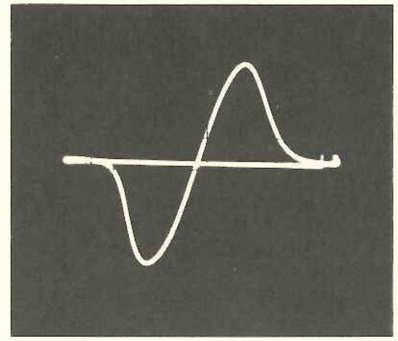


Figure 13. FM detector "S" curve

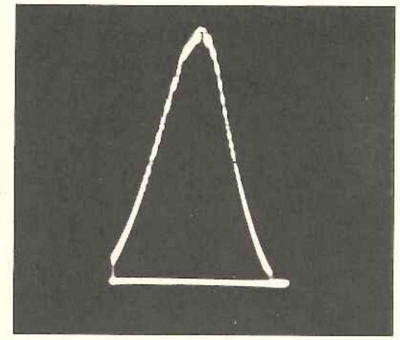


Figure 14. Typical AM IF response curve. Note that 455 kHz marker is spread over entire top half of the curve, with the center of the marker at the peak.

FM and AM IF Sweep Alignment

Many different types of receiver circuits are used by the various manufacturers. For this reason, it is not possible to provide an alignment procedure that will apply to all receivers. The procedure supplied by the manufacturer for the particular model of receiver should be followed.

For both AM and FM IF alignment, the basic procedure is to connect an oscilloscope to the output of the detector (or before the detector, but using a detector scope probe), then align each stage separately, starting with the last stage. The sweep and marker signals are applied to the input of the stage being aligned. Figure 14 shows a typical waveform obtained from a properly aligned AM IF stage. Figure 15 shows an FM IF waveform, which is similar. Note that in each trace, the waveform is peaked at the center of the center-frequency marker.

Figure 13 indicates an example of an "S" curve obtained in sweep aligning an FM detector stage.

In any sweep alignment procedure, it is good practice to keep the sweep signal as low as possible. The attenuator controls on the WR-50C are used for this purpose. If a marker generator is used, it is important that the output of the generator be coupled to the amplifier in a manner that does not distort the sweep waveform.

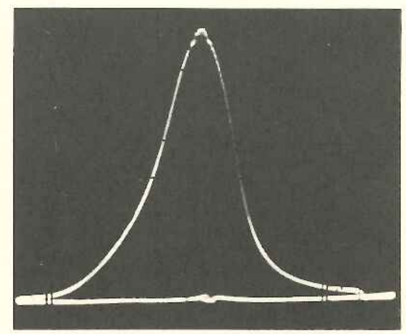


Figure 15. Typical FM IF response curve, with 10.7 kHz marker.

Television Servicing With the WR-50C

Although a general purpose RF Generator is not normally considered as an instrument for use in TV servicing, there are helpful TV service checks that can be made with the WR-50C.

For example, if you apply output from the audio output cable of the generator to the input of the video amplifier, horizontal bars will appear on the TV screen. This indicates that the circuit from the video detector on are functioning. If no bars can be obtained, it is likely that the loss of picture occurs prior to the video stage, in the tuner or IF stage.

The IF stage can be checked by applying the RF output of the generator to the IF input. Tune the generator to the picture IF frequency. If the IF stage is operating, horizontal bars will be produced. If the bars can not be obtained, chances are the problem is in the tuner stage.

MAINTENANCE

The WR-50C chassis can be taken out of the case by removing the #6 screw on the rear of the case, and the four #4 screws from the front panel.

Indicator Adjustment

The clear plastic tuning indicator on the WR-50C can be adjusted by removing the instrument from the case, and loosening the set screws on the indicator shaft. Turn the tuning capacitor to fully meshed position. Set the indicator so that the F index line is aligned with the short reference mark between the upper and lower panel scales. Tighten the two set screws on the shaft of the indicator.

Frequency Alignment

The generator has six internal trimmer capacitors and eight inductance adjustments as shown in Figure 16. These internal adjustments are located on S-1, the Range Switch.

VFO Alignment Procedure

Equipment required:

General-coverage communications receiver, capable of tuning the range from 540 kHz to 36 MHz.

Crystal, 100 kHz.
Crystal, 1.0 MHz.
Crystal, 10.0 MHz.

In this alignment procedure, the receiver is tuned to a specified frequency or harmonic from the crystal oscillator in the WR-50C. The variable oscillator is then tuned to this frequency, and the internal adjustments of the instrument are set so that a zero-beat signal is heard from the receiver.

The complete alignment procedure is given in tabulated form on page 25. The following steps provide a more detailed description of this procedure.

1. Remove the access plate from the rear of the case.

2. Connect the equipment as shown in Figure 17. Plug the 100 kHz crystal into the WR-50C socket. Turn the "% MOD" switch fully counterclockwise, and the "VFO" switch to "OFF".

3. Tune the receiver to 900 kHz and locate the exact point on the receiver dial where the effect of the unmodulated crystal oscillator harmonic frequency is noted (100 kHz x 9). Set the "XTAL FREQ" switch and

the "RF ATTEN" control so that the output is attenuated as much as possible, yet the effect of the crystal oscillator signal can still be heard.

NOTE: The unmodulated crystal oscillator signal can be identified by a "deadening" of the receiver background noise. If the receiver is equipped with an "S" meter, the meter will indicate a rise at the crystal-oscillator frequency (or harmonic). As a check to be sure that it is the unmodulated crystal frequency being heard, remove the crystal from the WR-50C. The crystal oscillator signal will disappear when this is done.

4. Set the WR-50C "RANGE" switch to position "A", and tune the indicator to 90 kHz on band A (the 10th harmonic of 90 kHz is 900 kHz). Set the "VFO" switch to "ON". Adjust the coil, L-1, so that the zero-beat signal is heard.

5. Retune the receiver to 1000 kHz. Set the WR-50C "VFO" switch to "OFF", and locate the exact point on the receiver dial where the 1000 kHz harmonic of the 100 kHz crystal oscillator frequency is heard (100 kHz x 10). If necessary, adjust the "RF" switch and the "RF ATTEN" control for minimum useable signal.

6. Tune the WR-50C to 200 kHz on band A (the 5th harmonic of 200 kHz is 1000 kHz). Set the "VFO" switch to "ON". Adjust the trimmer capacitor, C-1, so that the zero-beat signal is heard.

7. As a check, repeat steps 3 through 6.

8. In a similar manner, align the remaining five frequency ranges as indicated in the tabulation on page 25.

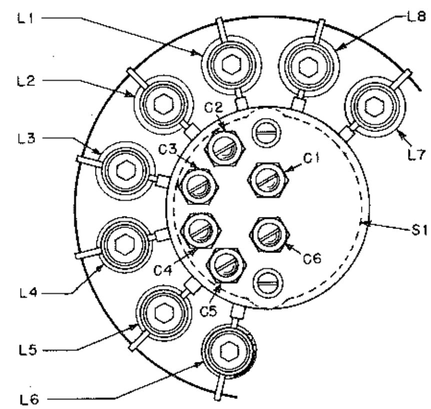


Figure 16. Location of coil adjustments L1-L8 and capacitor adjustments C1-C6

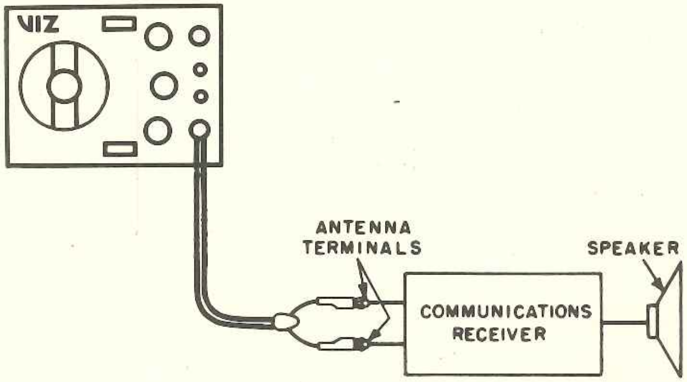


Figure 17. Recommended test setup for alignment of WR-50C

WR-50C Frequency Alignment Procedure

	WR-50C Range	WR-50C Dial	XTAL	Receiver Dial	WR-50C Adj.
A	(low frequency end)	90 kHz	100 kHz	900 kHz	L–1
	(high frequency end)	200 kHz	100 kHz	1000 kHz	C–1
B	(low frequency end)	225 kHz	100 kHz	900 kHz	L–2
	(high frequency end)	550 kHz	100 kHz	1100 kHz	C–2
C	(low frequency end)	600 kHz	100 kHz	600 kHz	L–3
	(high frequency end)	1600 kHz	100 kHz	1600 kHz	C–3
D	(low frequency end)	1600 kHz	100 kHz	1600 kHz	L–4
	(high frequency end)	4000 kHz	1.0 MHz	4000 kHz	C–4
E	(low frequency end)	5.0 MHz	1.0 MHz	5.0 MHz	L–5
	(high frequency end)	14.0 MHz	1.0 MHz	14.0 MHz	C–5
F	(low frequency end)	14.0 MHz	1.0 MHz	14.0 MHz	L–6
	(high frequency end)	40.0 MHz	10.0 MHz	40 MHz	C–6

Sweep Circuit Alignment

Equipment required:
VTVM, VIZ VoltOhmyst® or equiv.
Oscilloscope, VIZ WO-33B, WO-527A, or equiv.

Detector Probe for oscilloscope, VIZ WG-302B, WG-350A, or equiv.
Crystals—455 kHz
10.7 MHz

1. Remove the instrument from the case. Apply power and allow a warm-up time of several minutes. Set the controls as follows:
"MOD" . . . . "EXT"
"VFO" . . . . "ON"
"RF" . . . . "HI"
"XTAL OSC" . . . . "HI"
"RF ATTEN" . . full clockwise
"RANGE" Switch
455 kHz "SWP"

2. Connect detector probe from oscilloscope to the RF output probe of WR-50C. Adjust oscilloscope sweep selector to 60 Hz line sweep, and the range switch to maximum sensitivity.

3. Adjust RII until the trace is as flat as possible.

4. Insert 455 kHz crystal in crystal socket. Adjust phase control of oscilloscope so that patterns overlap.

5. Set "EXT MOD" switch to "SWP". Adjust core of coil L-7 so that 455 kHz marker appears in the center of the trace, as shown in Figure 18. The marker will be quite broad, as shown. Reduce marker size by setting "XTAL FREQ" switch to "LO".

6. Remove 455 kHz crystal from crystal socket, and insert 10.7 MHz crystal. Set the Range Switch to 10.7 MHz "SWP". Adjust core of coil L-8 so that 10.7 MHz marker is in center of trace, as shown in Figure 19.

°If instrument is badly misaligned, adjust core fully counterclockwise, then clockwise until marker appears.

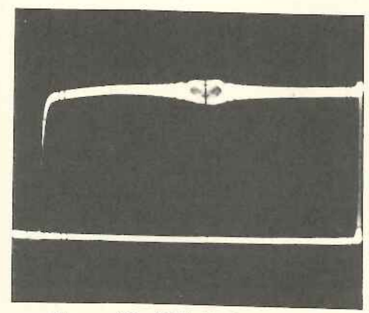


Figure 18. 455 kHz Sweep Trace

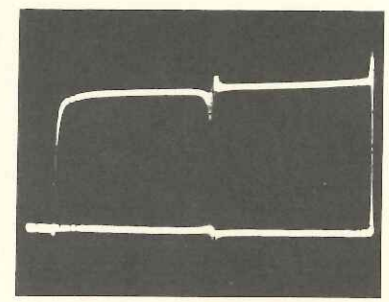


Figure 19. 10.7 MHz Sweep Trace

SPARE PART POLICY

It is VIZ's policy to make replacement parts available to its customers at the least cost and as quickly as possible. All items where a part number is listed in **bold face** are available from VIZ. Please use the VIZ part number when ordering. All other items listed are standard parts available at most Electronic Distributors. Please order these parts by the description as listed from your distributor.

SPARE PARTS LIST

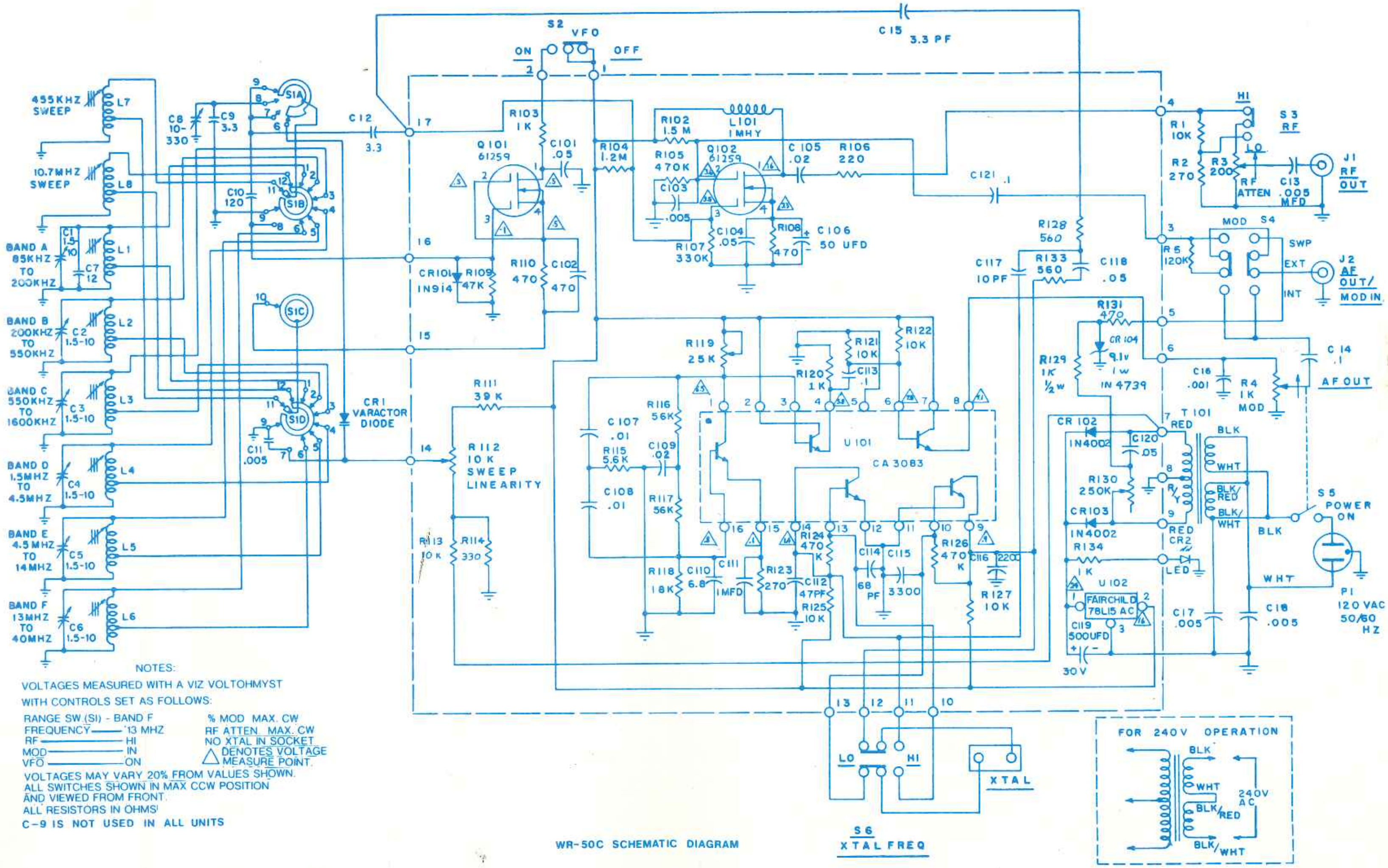
Symbol No.	Description	Stock No.
	Capacitors	
C1	Trimmer, 1.5-10 PF	**219975**
C7	Ceramic, 12 PF, 10%, 500V	**235386**
C8	Variable, 10-330 PF	**226326**
C9, C12, C15	Ceramic, 3.3 PF, 20%, 500V	**235385**
C10	Mica, 120 PF, 20%, 500V	**59481**
C11, C13, C17, C18	Ceramic, .005 MF, GMV, 500V	73473
C14, C113, C123	Ceramic, .1 MFD, +80 −20%, 50V	9450-48
C16	Ceramic, .001 MFD, 20%, 1000V	9450-88
C101, C104, C118, C120	Ceramic, .05 MFD, 20%, 100V	9450-201
C102	Ceramic, 470 PF, 10%, 100V	9450-222
C103	Ceramic, .005 MFD, 20%, 1000V	9415 ~~9450~~-213
C105	Ceramic, .02 MFD, +80 −20%, 50V	9450-202
C106	Electrolytic, 47 MFD, 10 VDC	9180-023
C107, C108	Mylar, .01 MFD, 5%, 100V	9450-204
C109	Mylar, .022 MFD, 5%, 100V	9450-205
C110	Ceramic, 6.8 PF, 10%, 1000V	9415-216
C111	Electrolytic, 1 MFD, 50V	9450-206
C112	Mica, 47 PFD, 10%, 500V	9450-207
C114	Ceramic, 68 PFD, 10%, 1000V	9450-208
C115	Mica, 3300 PFD, 10%, 500V	9450-209
C116	Mica, 2200 PFD, 10%, 500V	9450-211
C117	Ceramic, 10 PFD, 10%, 1000V	9450-212
C119	Electrolytic, 470 MFD, 35 VDC	9450-213
	Resistors	
R1, R27	10K, 5%, 1/2 W	16-081030
R2	270 OHMS, 1/2 W, 5%	16-082710
R3	Variable, 200 OHMS	**9200-45**
R4	Variable, 1K, w/Switch	**9200-46**
R5	120K, 1/2 W, 10%	16-071240
R102	1.5 MEGOHMS, 1/4 W, 5%	16-051551
R103, R120	1K, 1/4 W, 5%	16-051021
R104	1.2 MEGOHMS, 1/4 W, 5%	16-051251
R105, R124, R126	470K, 1/4 W, 5%	16-054741
R106	220 OHMS, 1/4 W, 5%	16-052211
R107	330K, 1/4 W, 5%	16-053341
R108, R110	470 OHMS, 1/4 W, 5%	16-054711
R109	47K, 1/4 W, 5%	16-054731

Symbol No.	Description	Stock No.
	Resistors	
R111	39K, 1/4 W, 5%	16-053931
R112	Variable, 10K, 30%	**9404-129**
R113, R121, R122, R125, R127	10K, 1/4 W, 5%	16-051031
R114	330 OHMS, 1/4 W, 5%	16-053311
R115	5.6K, 1/4 W, 5%	16-055621
R116, R117	56K, 1/4 W, 5%	16-055631
R118	18K, 1/4 W, 5%	16-051831
R119	Variable, 25K, 30%	**9450-214**
R123	270 OHMS, 1/4 W, 5%	16-052711
R128, R133	560 OHMS, 1/4 W, 5%	16-055611
R129	1K, 1/2 W, 5%	16-081021
R130	Variable, 250K, 30%	**9450-215**
R131	470 OHMS, 1/2 W, 5%	16-084711
	Coils	
L1	85-200 kHz	**226378**
L2	200-550 kHz	**226329**
L3	550-1700 kHz	**226330**
L4	1.5-4.5 MHz	**226331**
L5	4.2-14 MHz	**226332**
L6	12-40 MHz	**226333**
L7	550 kHz	**226329**
L8	10.7 MHz	**236387**
L101	1 MHy	**9450-216**
	Semiconductors	
Q101, Q102	Transistor, FET 61259	**1180-260**
CR3	Diode Varactor	**235383**
CR101	Diode, Type 1N914A	239164
CR102, CR103	Diode, Type 1N4002	234761
CR104	Diode, Type 1N4739	11-473900
U101	I.C.	**9450-217**
U102	I.C.	**9450-218**
	Miscellaneous	
S1	Switch, Range	**235380**
S2, S3	Switch, Slide SPDT	**235381**
S4	Switch, Slide DP/3 Pos.	**9450-61**
S6	Switch, Slide DPDT	**227560**
T101	Power Transformer	**9450-65**
	Case Assy	**9450-60**
	Led	**9450-128**
	Indicator Assy	**227583**
	Crystal Socket	**56262**
	Knob Rubber	**94878**
	Knob Pointer	**9200-001**
	Knob w/Set Screw	**226689**
	Connector Mod in/out & RF out	**232121**
	Circuit Board	**9450-220**
	Panel	**9450-86**
	Output Cable, WG-474A	**9874**

WR-50C ADDENDUM

Please note the following changes to this Instruction Manual.

Page 8:	Delete "additional 7 to 1 attenuator switch".
Page 9:	Change the function of XTAL Freq. HI/LO switch to read: "This switch should be set on the HI position for crystals over 1MHz and on LO for crystals 1MHz or lower in frequency".
Page 16 & 17:	New Schematic.



NOTES:

VOLTAGES MEASURED WITH A VIZ VOLTOHMYST

WITH CONTROLS SET AS FOLLOWS:

RANGE SW (SI) - BAND F		% MOD MAX. CW
FREQUENCY	13 MHZ	RF ATTEN. MAX. CW
RF	HI	NO XTAL IN SOCKET
MOD	IN	△ DENOTES VOLTAGE MEASURE POINT.
VFO	ON	

VOLTAGES MAY VARY 20% FROM VALUES SHOWN.
ALL SWITCHES SHOWN IN MAX CCW POSITION AND VIEWED FROM FRONT.
ALL RESISTORS IN OHMS.
C-9 IS NOT USED IN ALL UNITS

WR-50C SCHEMATIC DIAGRAM