Type BW-5A

TELEVISION SIDEBAND RESPONSE ANALYZER

MI-34000

RADIO CORPORATION OF AMERICA

ENGINEERING PRODUCTS DEPARTMENT CAMDEN, N. J.

TYPE BW-5A

TELEVISION SIDEBAND RESPONSE ANALYZER

MI-34000

INSTRUCTION MANUAL

Manufactured by
RADIO CORPORATION OF AMERICA
Engineering Products Department
Camden, New Jersey, U.S.A.

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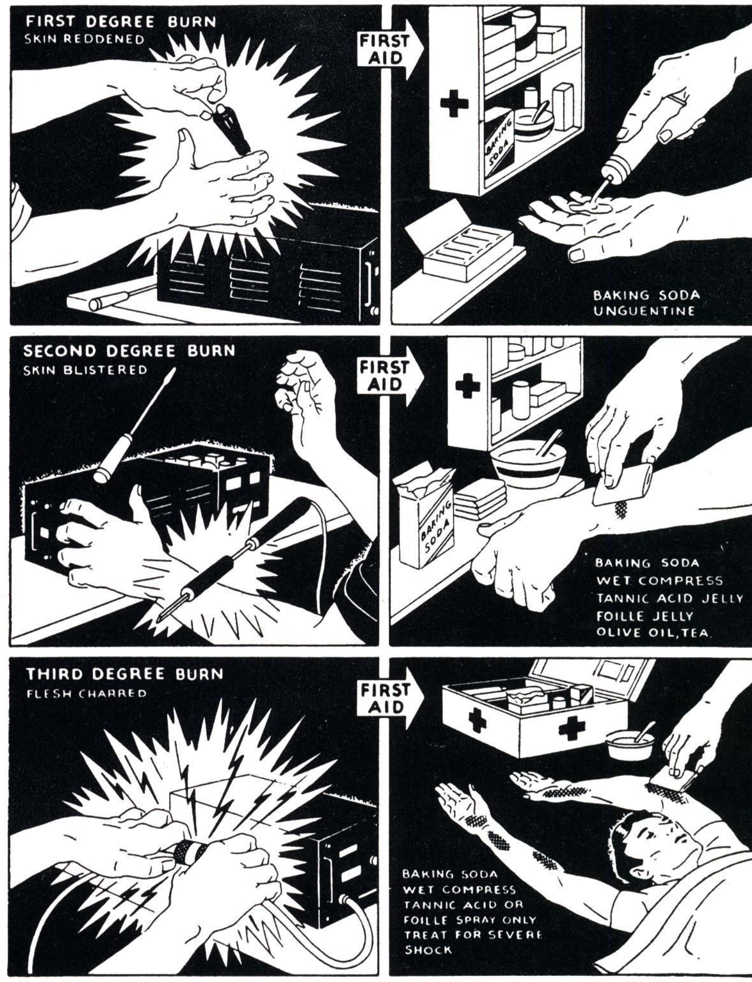
FIRST AID



WARNING!

Operation of electronic equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside the equipment with voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors, etc. To avoid casualties, always discharge and ground circuits prior to touching them.

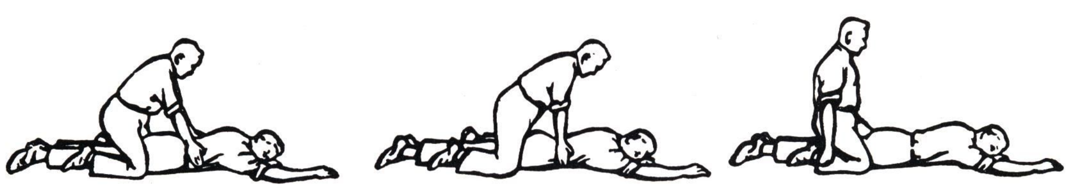
ABOUT FIRST AID

Personnel engaged in the installation, operation and maintenance of this equipment or similar equipment are urged to become familiar with the following rules both **in theory and in the practical application thereof.** It is the duty of every radioman to be prepared to give adequate First Aid and thereby prevent avoidable loss of life.

PRONE-PRESSURE METHOD OF RESUSCITATION

1. PROTECT YOURSELF with dry insulating material.
2. BREAK THE CIRCUIT by opening the power switch or by pulling the victim free of the live conductor.

DON'T TOUCH VICTIM WITH YOUR BARE HANDS UNTIL THE CIRCUIT IS BROKEN.



(A) (B) (C)

3. LAY PATIENT ON STOMACH, one arm extended, the other arm bent at elbow. Turn face outward resting on hand or forearm.
4. REMOVE FALSE TEETH, TOBACCO OR GUM from patient's mouth.
5. KNEEL STRADDLING PATIENTS THIGHS. See (A).
6. PLACE PALMS OF YOUR HANDS ON PATIENT'S BACK with little fingers just touching the lowest ribs.
7. WITH ARMS STRAIGHT, SWING FORWARD gradually bringing the weight of your body to bear upon the patient. See (B).
8. SWING BACKWARD IMMEDIATELY to relieve the pressure. See (C).
9. AFTER TWO SECONDS, SWING FORWARD AGAIN. Repeat twelve to fifteen times per minute.
10. WHILE ARTIFICIAL RESPIRATION IS CONTINUED, HAVE SOMEONE ELSE:
    (a) Loosen patient's clothing.
    (b) Send for doctor.
    (c) Keep patient warm.
11. IF PATIENT STOPS BREATHING, CONTINUE ARTIFICIAL RESPIRATION. Four hours or more may be required.
12. DO NOT GIVE LIQUIDS UNTIL PATIENT IS CONSCIOUS.

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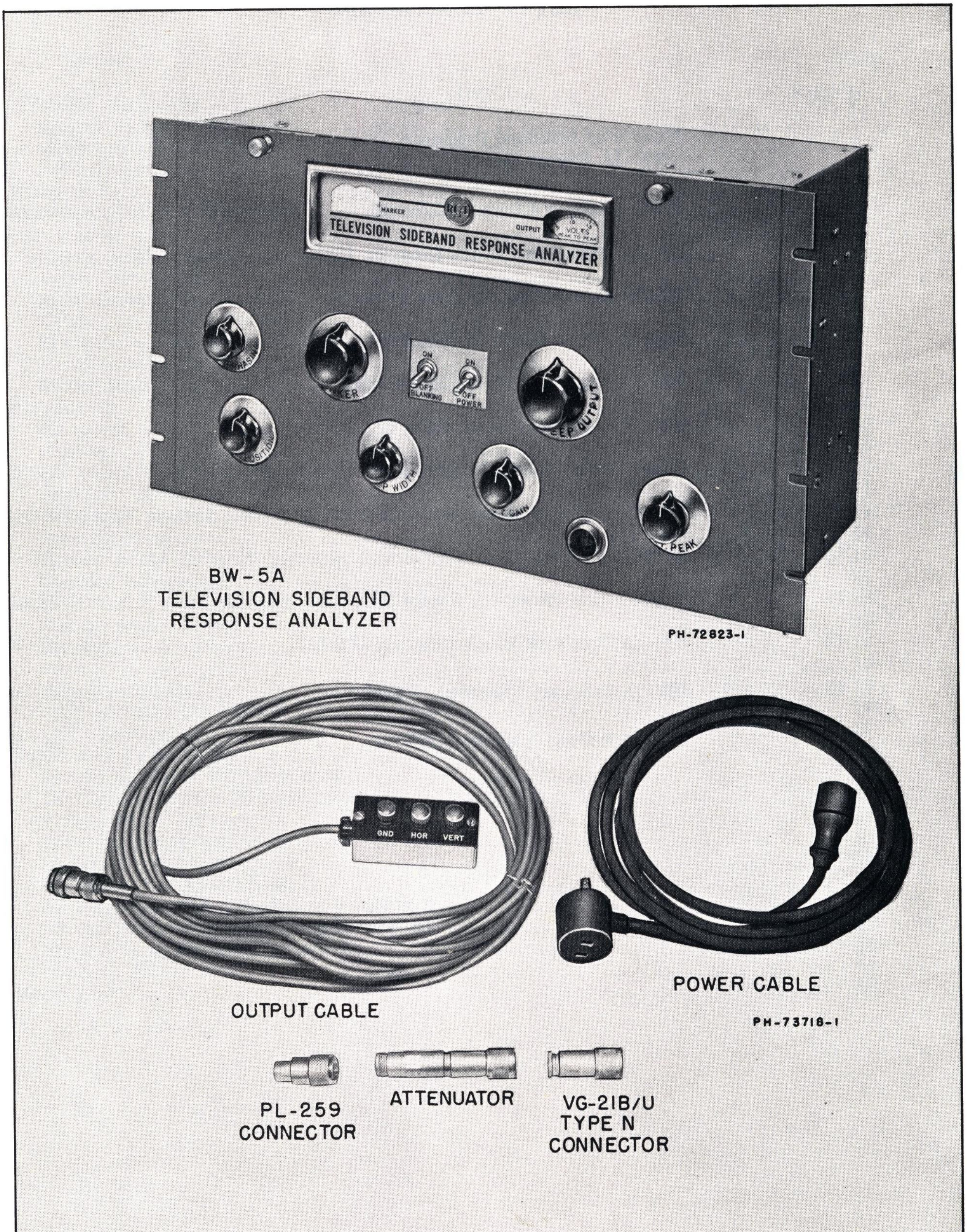

Figure 1. Television Sideband Response Analyzer
BW-5A Equipment

TECHNICAL SUMMARY

ELECTRICAL SPECIFICATIONS

Power Input	
Supply voltage	105-125 volts
Supply frequency	50-60 cycles
Power consumption	200 watts
Operating Conditions	
Ambient temperature	5^oC to 45^oC (41^oF to 113^oF)
Humidity	0 to 95% relative
R-F Input	
Frequency range	55. 25-83. 25 mc (channels 2 to 6) 175. 25-211. 25 mc (channels 7 to 13)
Voltage	0. 5 to 1. 5 volts direct or 1. 0 to 3. 0 volts with 6 db attenuator (RMS carrier voltage)
Input impedance	51 ohms
Standing Wave Ratio	1. 1 maximum
Outputs	
Video Sweep	
Voltage	0 to 2 volts, continuously variable, peak-to-peak
Frequency	10-0-10 mc sweep width continuously variable.
Center frequency	Adjustable $\pm$ 2 mc by panel control
Sweep Rate	Fixed by power line frequency
Repetition Rate	2X power line frequency
Frequency response	$\pm$ 0. 5 db 0. 2 to 4. 0 mc $\pm$ 1. 0 db 0. 2 to 7. 0 mc
Distortion	Less than 3% total harmonic
Hum level	-50 db below 2. 0 volts (peak-to-peak)
Output impedance	72 ohms
Marker accuracy	200 kc throughout range (self-calibration at Fc zero frequency)
Marker range	Fc $\pm$ 10 mc
Receiver Signal	
Maximum output	3. 5 volts, demodulated carrier peak into 500-ohm load with 1. 5 volts r-f input
Sensitivity	0. 5 volts, demodulated carrier peak into 500-ohm load with 0. 5 volts r-f input
Linearity	Less than 3% departure from input at 1. 0 to 3. 0 volts demodulated carrier peak into 500-ohm load
Distortion	Less than 5% at 1. 0 to 3. 0 volts, peak-to-peak, across 500-ohm load
Hum level	Greater than 40 db below 1. 0 volt peak to peak across 500-ohm load
Output impedance	500-ohms

ELECTRICAL SPECIFICATIONS (Continued)

Gain	Continuously variable over a 40 db range
Oscilloscope Sweep	
Open circuit voltage	18 volts, peak-to-peak
Frequency	Same as power line
Waveform	Same as power line
Internal impedance	985 to 5600 ohms, varies with phasing control (one side grounded)
Phase adjustment	$\pm$ 70° about nominal 65° leading (135° total change)

MECHANICAL SPECIFICATIONS

Standard 19-inch relay rack mounting	
Width	19 inches
Height	10 1/2 inches
Depth	14 1/2 inches
Weight	58 pounds
Finish	Dark umber gray, smooth

TUBE COMPLEMENT

CIRCUIT SYMBOL	RCA TYPE	FUNCTION
V1	-6J6	Sweep Oscillator
V2	-12AU7	Regenerative Detector-Amplifier
V3	-12AU7	Amplifier-Cathode Follower
V4	-6J6	DC Restorer-Pulse Shaper
V5	-6SQ7	Blanking Amplifier
V6	-6BA6	Oscillator-Doubler
V7	-6AS6	Video Mixer
V8	-6AH6	1st Video Amplifier
V9	-6AH6	2nd Video Amplifier
V10	-6AG7	Cathode Follower
V11	-6AS6	RF Mixer
V12	-6AK6	RF Amplifier
V13	-6C4	RF Oscillator (receiver)
V14	-6AS6	RF Mixer (receiver)
V15	-6BA6	IF Amplifier
V16	-12AU7	Detector-Cathode Follower
V17	-6AS7G	Series Regulator
V18	-6SJ7	DC Amplifier
V19	-VR-150/OD3	Voltage Regulator
V20	-5R4GY	Power Rectifier

EQUIPMENT

The equipment supplied on MI-34000 is listed in Table 1 which also includes other equipment required for some installations. All equipment listed in Table I is identified as ES-34010. Additional equipment required to make a complete installation is listed in Table 2. This equipment is available on separate order.

TABLE 1 EQUIPMENT SUPPLIED

MI-34000

Item	Quan.	Description
1	1	BW-5A Television Sideband Response Analyzer including tubes in place.
2	1	Power cord, 8 feet long with male and female plug
3	1	Output Cable, 35 feet long with 3-prong Amphenol connector on one end and a three Terminal block on other end.
4	1	Connector PL-259 (video output)
5	1	Connector VG-21B/U Type N (r-f input)
6	1	6 db attenuator

MI-19396-1

1	1	Directional Coupler

MI-19396-3

1	1	Section of 3 1/8 inch, 51.5-ohm coaxial transmission line with 1 1/2 inch hole for Directional Coupler

MI-34011

1	1	Connector UG-21B/U Type N

TABLE 2 EQUIPMENT AND MATERIAL AVAILABLE ON SEPARATE ORDER

Item	Quan.	Description	MI or Type	Purpose
1	1	Oscilloscope, RCA Type TO-524-D or equivalent	MI-26500 MI-26500	
2	as req.	Coaxial cable RG-11/U	MI-83	Sweep output to TV transmitter
3	as req.	Coaxial cable RG-8/U	MI-74	R-F input to analyzer
4	1	Pick-up probe	MI-19057-A	Alternate to MI-19396-1 Table 1
5	as req.	Set of spare tubes	MI-34012	

RECOMMENDED TEST EQUIPMENT

VoltOhmyst WV-97A or WV-75A

Measurements Corp. Megacycle Meter, Model 59 (Grid dip meter)

Video Detector arranged as shown in Figure 2

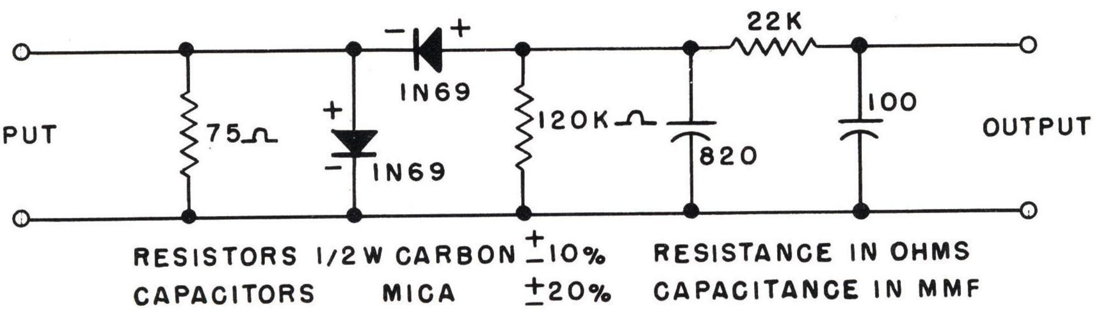

Figure 2. Video Detector Circuit

DESCRIPTION

This equipment provides for the display, on a suitable oscilloscope, of the entire sideband frequency response capabilities of a television transmitter or sideband filter. Such visual presentation permits immediate evaluation of transmitter adjustment without laborious point-to-point curve plotting. It also facilitates transmitter adjustments by indicating the effectiveness of the adjustments as they are made.

Basically the unit functions as shown in the block diagram, Figure 3. It provides modulation for the transmitter by mixing in V7 the output of a 130-mc fixed oscillator V6 with the output of a sweep oscillator V1 which varies in frequency above and below 130 mc to the amount required. The mixer provides a video signal swept at twice power line frequency which is amplified and applied as modulation to the transmitter. The output voltage of this circuit is indicated on a panel meter.

Transmitter modulated output is sampled and mixed in V11 with the sweep oscillator V1 output. Among the many sum and difference frequencies that occur in the output of V11, a constant frequency component will exist due to the combination of the instantaneous sweep frequency with one of the transmitter sideband frequencies.

This component is selected by the fixed-tuned receiver consisting of V12 to V16. The output of the receiver is fed to an oscilloscope, the sweep of which is properly phased to agree with the sweep frequency variations. The resultant pattern displays the transmitter sideband response over the range of modulation frequencies employed.

Circuits are included that develop a marker pulse which can be adjusted to indicate the frequency at any point on the pattern by means of a calibrated dial and knob.

Blanking is provided to eliminate pattern retrace but can be cut off by means of a panel mounted switch. Power supply circuits in the chassis provide heater and regulated plate voltages for the unit.

To provide maximum utility, a portable type oscilloscope is recommended for use with the analyzer. A 35-foot cable is supplied which allows the indicator to be readily moved to any vantage point within the limit of cable length.

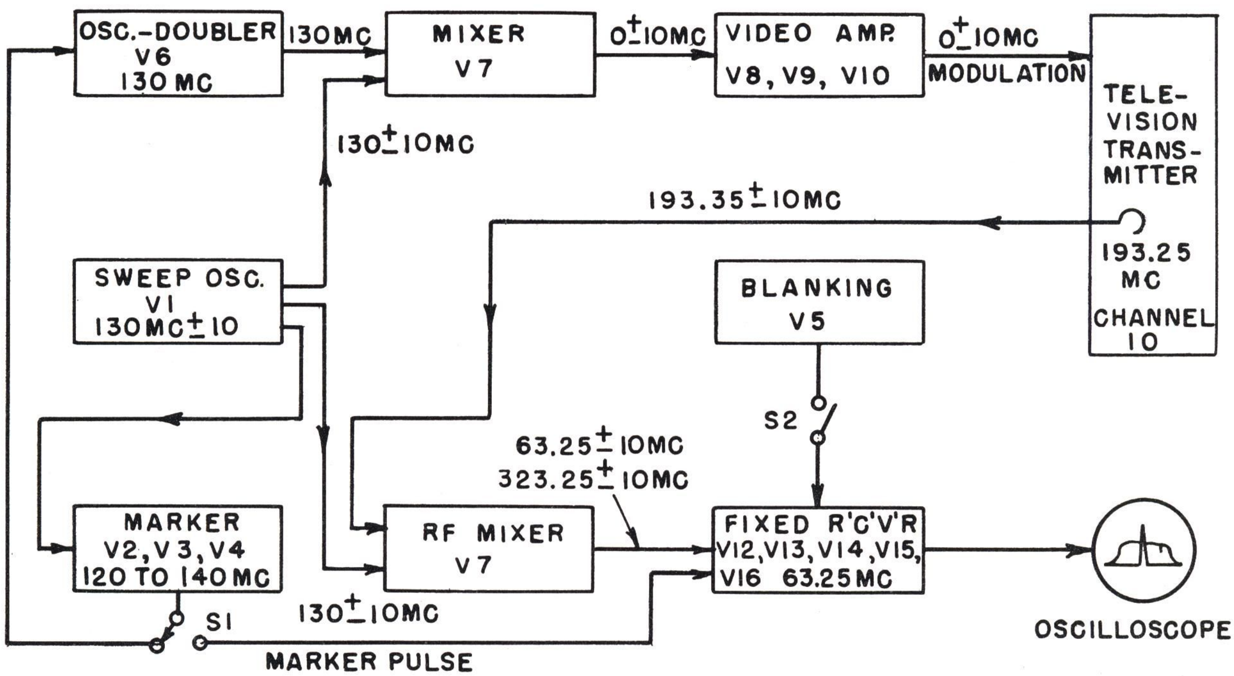

Figure 3. BW-5A Functional Block Diagram

PHYSICAL DESCRIPTION

The components of the unit are assembled on a recessed box chassis with the flanges at the open side notched for mounting the assembly in a relay rack. The panel for the unit is bracketed to the open side of the chassis and forms the front closure for the unit. The panel is held in the closed position by two captive knurled screws at the top edge. The panel can be swung down to give access to the interior of the chassis by loosening the knurled screws and pulling the DET. PEAK knob from its shaft.

The rear of the chassis supports the power supply, video, and blanking circuits with the tubes and larger circuit components extending from the rear of the chassis. The receiver circuits are assembled in a shielded compartment inside the chassis.

The panel proper is fitted at the top with a framed rectangular opening containing a transparent window through which is visible the rear lighted MARKER and OUTPUT meter dials. The sweep oscillator, marker circuits and r-f mixer circuits are assembled in individual shields attached to the rear of the panel.

Operating controls for the unit are all mounted on the front panel and consist of the following.

Panel Designation	Circuit Symbol	Purpose
SCOPE PHASING	R101	Adjusts phasing of scope sweep to match sweep oscillator.
MARKER	C11	Set frequency of marker pip as indicated on MARKER dial.
BLANKING ON-OFF	S2	Inserts pattern blanking during retrace.
POWER ON-OFF	S3	Switches power on or off equipment.
VIDEO SWEEP OUTPUT	R47	Sets level of video output as indicated on OUTPUT meter.
SWEEP POSITION	C3	Shifts range of sweep oscillator by adjusting center frequency.
SWEEP WIDTH	R7	Controls sweep width up to 10 mc
DET. GAIN	R93	Sets gain of receiver circuits.
DET. PEAK	C79	Adjusts frequency of receiver oscillator for peak output.

A three-contact connector J4 on the panel provides for connection to an oscilloscope. Other connections to the unit are made at the rear of the chassis; r-f input at RF connector J3; video output at VIDEO connector J2; and power input at P2.

CIRCUIT DESCRIPTION

Block Diagram Figure 12
Schematic Diagram Figure 13

The circuits in the unit can be classified according to function as follows:

Video sweep generating circuits to provide transmitter modulation

Calibrated marker circuits to develop a continuously variable frequency marker

Synchronized Receiver circuits to develop vertical deflection for the oscilloscope and to insure a narrow passband for a high definition sideband response presentation

Sweep generating circuits, which include retrace, blanking, and phasing facilities, to develop horizontal deflection for the oscilloscope

Power supply circuits

The sweep oscillator is common to first four groups and serves to synchronize their operation.

VIDEO GENERATING CIRCUITS

These circuits provide a constant amplitude sine-wave signal, the frequency of which is swept by a straight-line capacitor varying at a sinusoidal rate from maximum frequency to zero and back to maximum frequency again during a time interval equal to one-half cycle of the power line frequency. The sweep is repeated during the next half-cycle unless blanking is applied, in which case the output is cut off during the retrace time on the scope. The sweep frequency range is continuously variable from 10 mc down to zero and the output voltage of the circuits adjustable from zero to two volts peak-to-peak. The output voltage is indicated directly on the panel OUTPUT meter.

The sweep generator consists of a frequency modulated oscillator VI operating push-pull. The frequency is swept through a maximum range of 120 to 140 megacycles by tuning capacitor C4 which has one plate vibrated by L6 at power line frequency. The amplitude of capacitor vibration and hence sweep frequency range is adjustable by means of SWEEP WIDTH control R7. Resistor R8 sets the voltage applied across R7 and thus adjusts the range of the SWEEP WIDTH control up to $\pm$ 10 mc. Center frequency of the oscillator and thus the sweep position is adjustable by means of SWEEP POSITION control C3.

The output of V1 is link-coupled to V2, V7, and V11. The input to mixer V7 is mixed with the output of V6, a modified Hartley oscillator, election coupled, which has its grid circuit operating at approximately 65 mc and its plate circuit tuned to 130 mc. The difference frequency in the output of V7 provides the basic video sweep frequency of 0 $\pm$ 10 mc. This frequency is amplified by video amplifiers V8 and V9 and applied to cathode follower V10. The output of V10 is connected to J2 to provide modulation for the transmitter.

The output of V10 is also connected to crystal rectifiers CR1 and CR2 to actuate the OUTPUT panel meter M1 which indicates output voltage, peak-to-peak with blanking on. Meter sensitivity is set by R63. Output voltage is adjustable by means of VIDEO OUTPUT control R47.

CALIBRATED MARKER CIRCUITS

These circuits provide a calibrated frequency marker pulse. The pulse is generated in V2 which is a regenerative detector and an amplifier. The regenerative detector section includes L9, C9, and can be tuned over a 120-to-140 mc range by C11 which is coupled to a calibrated MARKER dial on the panel. Regeneration in the circuit is set by means of R18.

The regenerative action in the circuit gives rise to a negative resistance characteristic which gives the effect of increased Q and sharpens the resonance curve.

In operation, regeneration is set at a point just below the point at which the circuit will go into oscillation. The output of the sweep oscillator V1 is terminated by R9 which is oriented so some energy is coupled into the tank circuit L9, C9. Thus, each time the sweep oscillator sweeps through the frequency to which the tank circuit is tuned by C11, a negative going grid signal will cause a positive pulse on plate 1 of V2. Thus by varying the setting of C11, the frequency at which the pulse is generated can be set. This pulse is amplified and inverted in the second section of V2 which operates as a class A amplifier.

The pulse output of V2 is amplified in the first section of V3 and fed through the MARKER amplitude control R23 to the second section of V4 for further sharpening.

A portion of the output of the first section of V3 is applied to the grid 7 of V3, which section functions as a cathode follower. The positive going output of cathode 8 of V3 is applied to the diode connected first section of V4 which acts as a d-c restorer and applies automatic bias on the grid 5 of V4 so only positive peaks on this grid are amplified to give sharp marker pulses. Successive pulses appearing across diode resistor R24 develop a voltage proportional to the amplitude of the pulses and automatically control the gain in the second section of V4. Automatic bias is necessary to compensate for variation in amplitude of the output of V2 over its tuning range and to assure a constant marker pulse output.

The negative going pulse in the output of V4 can be inserted as a marker pip into the video sweep amplifier at the grid of V6 pin 6 or into the grid pin 7 of cathode follower V16 (output of receiver) by the desired operation of S1, located on the rear of the chassis.

SYNCHRONIZED RECEIVER CIRCUITS

The function of these circuits is to mix a sample of the transmitter modulated output with signals from the sweep oscillator to provide input for the fixed-tuned receiver circuits. Since the transmitter modulation frequencies and the sweep oscillator frequencies are swept simultaneously the output of the mixer will contain a fixed frequency component for a given carrier frequency. It is necessary to tune the circuits of the mixer and receiver for the carrier frequency of the transmitter with which it is used. (See Table 3).

The modulated transmitter output is sampled and mixed in V11 with sweep oscillator V1 output. Among the combinations of frequencies that occur in the output V11, a fixed frequency component will exist due to the combination of the instantaneous sweep frequency with one of the transmitter sideband frequencies. The modulating frequency is produced from the same sweep frequency source as the sweep frequency mixed with modulated transmitter output in V11, hence the fixed frequency component in the output of V11 will be the same for all combinations of instantaneous sweep frequency and corresponding sideband frequencies.

Accordingly the output circuit of V11 is sharply tuned by a narrow-band tank circuit to the fixed frequency component, the exact frequency of which may be determined at the instant of zero modulation. This occurs at the instant that the sweep oscillator frequency is the same as the heterodyne oscillator V6 output frequency. A receiver tuned to transmitter carrier frequency $\pm$ heterodyne oscillator frequency will be correctly tuned to receive the transmitter carrier at this instant.

At other instantaneous sweep frequencies, the receiver will respond only to the sideband frequency which will give the same fixed frequency component to which the mixer output and receiver are tuned.

The fixed component in the output of V11 is fed to V12, the r-f input to the narrow-band receiver circuits. (Refer to Table 3 for data on frequency settings required in the various circuits for different TV channel frequencies.) The output of V12 is applied to mixer V14 where it is mixed with a local receiver oscillator V13 output to produce an i-f frequency of 10.7 mc. Mixer V14 output is amplified by V15 and applied to the diode connected section of V16 for detection. The rectified output of V16 appears across R86 and is applied to grid 7 of the cathode follower section of V16. R-F gain is set by DET. GAIN control R93.

The cathode output of V16 is connected through choke L32 to pin 3 of J4 to provide vertical deflection for the CR oscilloscope.

SWEEP GENERATING CIRCUITS

These circuits provide horizontal deflection voltages for the CR oscilloscope of correct frequency and phase to form a sinusoidal time base for display. Circuits that provide blanking are included in this group.

A sinusoidal sweep voltage is developed by a phase-shift network comprising T6, T7, C106, and R101. One side of the network is grounded and a total phase variation of approximately 130^{o} is obtainable throughout the range of adjustment OF SCOPE PHASE control R101. A sweep voltage of 18 volts peak-to-peak is available at pin 2 to ground of output jack J4.

Blanking pulses are generated by blanking amplifier V5. The high voltage across the secondary of T6 is applied to a bleeder and phasing network in the grid circuit of V5 with phasing adjustable by means of R31. In operation, R31 is adjusted so that the signal blanks out at maximum video frequency each side of zero frequency for a given setting of the SWEEP WIDTH control R7.

The sine wave signal is amplified and clipped by the diode section of V5 to form a 60-cycle square wave. The negative portion of the square-wave output is applied to the grid of V6 to bias the tube to cut off during retrace time of the oscilloscope. Blanking can be switched on or off by BLANKING switch S2 on the panel which cuts off plate voltage from V5 when blanking is not required.

POWER SUPPLY CIRCUITS

These circuits provide all voltages including the regulated 260-volt d-c voltage required for the operation of the unit.

Line voltage connected in at P2 is fed through a filter network, fuses F1, F2, and POWER switch S3 to transformer T6. The high-voltage secondary is fed to the full-wave rectifier V20. The positive side of the output is connected through an LC smoothing filter to a series regulator tube V17 which acts as a variable resistor to control the output voltage.

Conduction through V17 is controlled by the d-c amplifier V18. The latter has its cathode fixed with respect to ground by the voltage regulator V19. Grid 6 of V18 is connected to a bleeder network connected across the positive output and cathode 5.

Normally, the potential on grid 4 of V18 is set by R95 so that with nominal load and input voltage, plate 8 of V18 will bias the grids of V17 and conduction through V17 at the correct value to provide 260 volts at the output.

Any variation in output voltage due to change in load or primary voltage will appear across R95. A decrease in output will make grid 4 of V18 more negative, increase plate 8 voltage and make the grids of V17 more positive to increase conduction and raise the output voltage. An increase in output voltage will have the opposite effect.

A neon bulb E1 is used to prevent an excessive use in output voltage when the equipment is switched on and control tubes are warming up. During this time the neon bulb breaks down to limit the high bias that appears on the grids of V17. The tube de-ionizes when the control tubes take control.

INSTALLATION

Upon receipt the equipment should be unpacked immediately and checked against the shipping list to make certain all items are received. Inspect all parts carefully for damage that may have occurred during shipment so proper claims can be filed at once.

MOUNTING

The BW-5A analyzer is shipped with all tubes in place and can be installed directly in a standard 19-inch rack without further preparation. A position in the rack should be selected that will permit convenient operation of the controls and provide access to the rear of the chassis for servicing and adjustment.

CABLING

Cable the unit to other equipment as shown in Figure 4.

An eight-foot power input cord, fitted with two plugs, is furnished with the equipment and is used to connect input plug P2 on the rear of the analyzer to a 115-volt a-c power receptacle.

For connecting the oscilloscope, a three conductor cable is furnished fitted at one end with a connector that mates connector J4 on the panel of the instrument. The other end of the cable is fitted with a three terminal block, terminals of which are connected to the scope inputs by short jumper leads as shown.

For video output, a coaxial cable must be made up of sufficient length to connect the analyzer to the video amplifier of the television transmitter. A plug PL-259 is furnished which should be attached to one end of the length of RG-11/U cable for connections to J2 on the analyzer. The video output impedance is 72 ohms and should be terminated accordingly at the video input to the transmitter.

At the video input to the transmitter, the coaxial cable may be connected to terminals or the cable fitted with a connector and a mating connector installed at the video input as preferred.

To connect the cable to terminals, remove the jacket for five inches, unravel the braided outer conductor and twist it into a pigtail. Strip the inner conductor for a distance of two inches and tin. Connect the leads to video amplifier input terminals making certain the braid connection goes in the ground side of the input.

Where a connector assembly is preferred, mount a VHF connector type SO-239 on the video amplifier and connect to the input. Fit the cable with a type PL-259 connector and attach to the connector on the amplifier.

The r-f input is to be made up from a sufficient length of RG-8/U coaxial cable fitted at the analyzer end with the UG-21B/U Type N connector furnished with the equipment. The attenuator should be attached to RF connector J3 at the rear of the analyzer and the UG-21B/U connector plugged into the attenuator. Do not connect the r-f input cable to the BW-5A analyzer until initial adjustments have been made on the BW-5A and the voltage input level has been checked.

Connections at the transmitter output will depend upon the type of pickup loop used. Some transmitters and amplifiers have built-in inductive or capacitor pick-up units. These may be used to feed the BW-5A if it is not necessary to distinguish between incident and reflected waves. A more accurate indication of the incident wave form is obtained by the use of a directional coupler.

The Directional Coupler MI-19396-1 is available on separate order and requires for installation a length of 3 1/8 inch (51.5 ohm) transmission line MI-19396-3 in which a 1 1/2 inch hole is cut to permit insertion of the coupler.

In either case the r-f cable must be fitted with a mating connector to make connection to the the type of pick-up used. Adjustment of pick-up is made during initial adjustments.

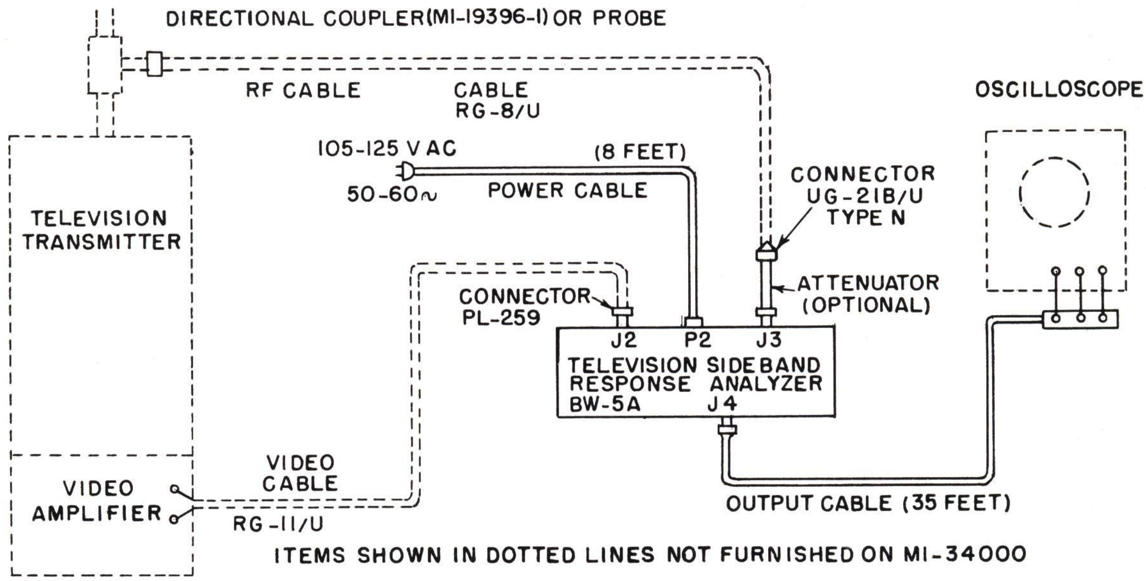

Figure 4 BW-5A Installation Diagram

INITIAL ADJUSTMENTS

After installation, the sideband analyzer must be adjusted to operate with the channel frequency employed in the television transmitter.

WARNING

THIS UNIT EMPLOYS VOLTAGES DANGEROUS TO LIFE. EMPLOY ALL SAFETY PRECAUTIONS WHILE MAKING ADJUSTMENTS AND DO NOT CHANGE CONNECTIONS WITH POWER ON THE EQUIPMENT.

As the first step in making these settings, adjust the voltage output of the power supply circuits as follows: Loosen the knurled screws at the top of the panel, remove DET. PEAK knob, and swing panel out and down. Connect a voltmeter set for 300 volt scale, positive terminal to cathode, pins 3 or 6, of V17 and to ground.

Move POWER switch S3 to ON and as power supply circuits stabilize, adjust DC VOLTAGE control R95 on top rear of chassis to obtain a meter indication of 260 volts. Switch off power and remove voltmeter.

RECEIVER TUNING PROCEDURE

The receiver circuits have high selectivity and narrow bandpass and must be tuned carefully for optimum results. The receiver tuning adjustments and their location are as follows:

RF Mixer	MIXER	C70	Knob on RF Mixer shield at rear of panel
RF Amplifier	R. F. AMP	C77	Top knob at left edge at rear of chassis
RF Oscillator (Receiver)	RCVR OSC.	C78	Bottom knob at left edge at rear of chassis
RF Oscillator (Receiver)	DET. PEAK	C79 C79	Front panel knob

Table 3 shows the proper frequency settings of the three receiver controls for each of the 12 VHF television channels.

TABLE 3 TUNING CHART

Channel No.	Carrier Freq. MC	R-F Mixer Adjust C70 MC	R-F Amp. Adjust C77 MC	Receiver Oscillator Adjust C78 MC
2	55.25	74.75	74.75	64.05 or *85.45
3	61.25	68.75	68.75	58.05 or *79.45
4	67.25	62.75	62.75	52.05 or 73.45
5	77.25	52.75	52.75	42.05 or 63.45
6	83.25	46.75	46.75	36.05 or 57.45
7	175.25	45.25	45.25	34.55 or 55.95
8	181.25	51.25	51.25	40.55 or 61.95
9	187.25	57.25	57.25	46.55 or 67.95
10	193.25	63.25	63.25	52.55 or 73.95
11	199.25	69.25	69.25	58.55 or 79.95
12	205.25	75.25	75.25	64.55 or 85.95
13	211.25	81.25	81.25	70.55 or 91.95

*Recommended to avoid spurious signal

With all cables connected, except the r-f input cable, proceed to make the adjustments as follows: Set the three receiver tuning controls MIXER C70, R.F. AMP C77, RCVR OSC. C78 to the frequency settings for each control as given in Table 3 for the carrier frequency of the television transmitter with which it is to be used.

Set DET. PEAK panel control to mid-point.
Set the remaining panel controls as follows:

SCOPE PHASING	R101	Midpoint
SWEEP POSITION	C3	Midpoint
MARKER	C11	Fc
SWEEP WIDTH	R7	Midpoint
DET. GAIN	R93	Clockwise
VIDEO SWEEP OUTPUT	R47	Midpoint
DET. PEAK	C79	Midpoint
BLANKING	S2	OFF

Set the marker switch S1 on the rear of the chassis to RCVR.

Operate the POWER switch on the panel to ON and switch on the oscilloscope. Allow the equipment to warm up while the r-f input is being checked.

Excessive r-f input will damage the input attentuator. Arrange a 50-ohm resistor as termination for the r-f input cable and connect the VoltOhmyst across the resistor. Voltage across the r-f cable termination should be approximately 2 volts. Adjust r-f sampling loop or pick-up probe in the directional coupler in accordance with the instructions furnished with these units until the desired value is obtained.

If it is impossible to obtain an r-f input greater than one volt it will be necessary to remove the attenuator from the r-f input connector J3 of the BW-5A analyzer. This should be avoided if possible on the higher TV channels since the input impedance of the BW-5A alone may deviate from the desired 51.5 ohms on the higher frequencies. Remove the resistor and connect the cable to the unit.

With the oscilloscope vertical gain set at maximum one or two carrier frequency pips should be visible on the screen if reasonable care has been taken in setting the receiver tuning controls for the proper television channel. A slight adjustment of the DET. PEAK control C79 may be necessary to bring the pip into view.

If pip fails to appear, return DET. PEAK control C79 to midpoint and very carefully adjust RCVR OSC. C78 control in an effort to obtain the carrier frequency pip. These two controls operate in parallel, the DET. PEAK control acting as a vernier. Thus when the pip is observed, precise adjustment can be made by means of the DET. PEAK control.

Failure to locate the carrier pip after the above adjustments will require checking of the frequency settings of MIXER C70, R. F. AMP C77, and RCVR OSC. C78 by means of a grid dip meter as described in the maintenance section.

When the carrier pips are seen, two usually appear, the oscilloscope gain control, and DET. GAIN R93 may be adjusted to obtain a clear display of suitable size.

Rotate the SCOPE PHASING control R101 until the pips overlap and then operate BLANKING switch S2 to ON.

Since sideband response will only occur when the receiver is tuned precisely to the correct frequency and a carrier pip can be observed either side of the optimum frequency setting by an amount dependent upon the sweep width, it is now necessary to tune the receiver tentatively with the pip position as a guide.

At optimum tuning, the carrier pip will appear at approximately the center of the trace. To locate this point accurately, check that MARKER dial is at Fc and observe the marker notch which should be present on the trace. If the carrier pip does not coincide with the marker, touch up MIXER control C70, R. F. AMP control C77, and RCVR OSC. control C78 as necessary to cause the carrier pip to coincide with the marker. These adjustments should be done carefully, always keeping the carrier pip in view, with DET. GAIN control R93 being adjusted as necessary to prevent overloading.

With the receiver at optimum tuning observe the scope for signs of sideband response. This trace will appear above the baseline and the VIDEO SWEEP OUTPUT control R49 should be adjusted as necessary to bring it into view.

The method outlined for tentatively setting optimum receiver tuning using the dial marker as outlined above will only be as accurate as the dial calibration. In some cases this may not be sufficiently precise to give maximum sideband amplitude but is usually close enough to cause sideband response to appear on the presentation.

With sideband response visible, absolute tuning may then be made by peaking MIXER control C70, R. F. AMP control C77, and RCVR OSC. control C78, with DET. PEAK control C79 set at midpoint, using the sideband response amplitude as the tuning indicator.

The final scope presentation, after adjustments are completed, should show no evidence of the following conditions. Oscilloscope overloading causing a fattened peak on the carrier response pip. Receiver overloading which is evidenced by a change in the contour of the response curve with changes in DET. GAIN control R93 or with increased r-f input to J3. Overmodulation which causes a change in the contour of the response curve beyond 50 percent modulation. Appropriate adjustment of oscilloscope and analyzer controls should be made as required.

With receiver at optimum tuning the VIDEO SWEEP OUTPUT control R49 should be adjusted until the height of the sideband response curve is about half that of the carrier frequency pip. This setting is the condition for 100 percent modulation.

Adjustment of the MARKER control will now cause the marker pip to travel along the response curve. The marker pip should align with the carrier frequency pip when the MARKER dial is at Fc, after a sufficient warm-up time has elapsed. It is normal for the marker pip to travel from left to right as the MARKER dial is turned from -10 to +10.

Operation of the SWEEP WIDTH CONTROL will increase or decrease the range of the frequency sweep applied to the transmitter from zero to a maximum of 10 mc. The range of sweep for a given setting of the control can be determined by means of the frequency marker.

This completes the initial adjustments on the unit. The appearance of the oscilloscope presentation affords an indication of the frequency response of the modulated transmitter with information on overloading or other modulation phenomenon.

OPERATION

Since the BW-5A is essentially a piece of test equipment, its operation involves the setting of the controls to properly display the sideband frequency response of the transmitter. The information thus presented is used as a check on the television transmitter operation or for making adjustments.

For the above reasons the use of a portable type oscilloscope is recommended which, being connected to the analyzer by a 35-foot cord, can be moved into a position where it can be observed from any desired point. This scope is also useful for observing video output of the analyzer and for servicing the unit.

However, observance of the sideband response may also be made with a less expensive oscilloscope since the frequency response requirements for this purpose lie in the audio frequency range.

STARTING EQUIPMENT

To put the anlyzer into operation, connect the oscilloscope cable to J4 on the panel and proceed as follows:

Set BLANKING switch S2 to OFF

VIDEO SWEEP OUTPUT control R47 counterclockwise

SWEEP WIDTH control R7 to midpoint

Operate POWER switch S3 to ON and switch on the oscilloscope

Allow the equipment to warm up for at least 20 minutes.

Assuming that the television transmitter is now in operation, adjust the oscilloscope controls so the sweep and carrier frequency pip are of convenient size, centered, and clearly displayed on the screen.

Adjust SCOPE PHASING control R101 slightly if necessary to superimpose carrier frequency pips.

Operate BLANKING switch to ON.

Rotate VIDEO SWEEP OUTPUT control clockwise until a pattern becomes visible above the baseline of the sweep. If not visible with one volt indication of OUTPUT meter, adjust DET. PEAK control C79 until visible.

Adjust DET. GAIN control R93 to a position just below the point at which the receiver starts to overload. Adjust DET. PEAK for maximum pattern amplitude.

Adjust VIDEO SWEEP OUTPUT control so the ratio of sideband amplitude to peak carrier output does not exceed 1/3 at optimum receiver tuning. This will prevent overloading and consequent flattening of the overall response curve due to over modulation. The sideband response should not change as a function of modulating voltage up to the point of overload.

The SWEEP WIDTH control can now be adjusted for the frequency range desired. Accurate setting of this control can be made using the calibrated marker pip as a guide.

The scope now displays the frequency response of the television transmitter at all frequencies within the range of the setting of the sweep width control. Sideband frequency response of the transmitter may then be used as a guide for making necessary adjustments.

With the carrier frequency pip centered, the maximum available sweep either side will be 10 mc. The sweep on one side or the other can be adjusted $\pm$ 2 mc by shifting the carrier pip to the right or left by means of the SWEEP POSITION control.

TYPICAL SCOPE PATTERN

A typical scope pattern is shown in Figure 5.

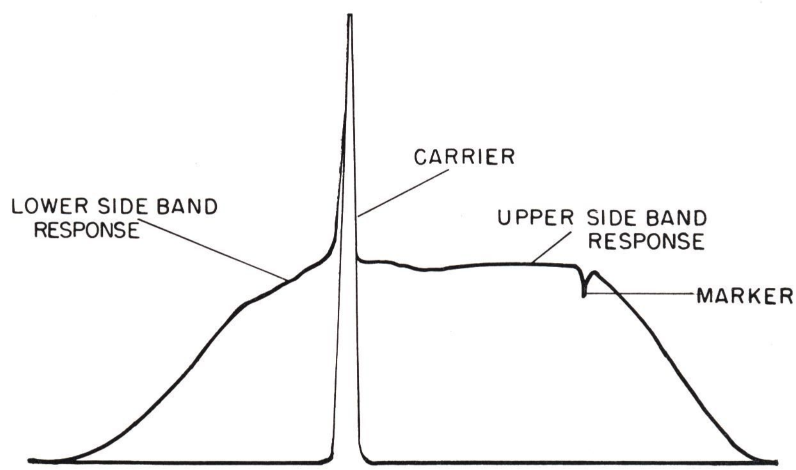

Figure 5. Typical Scope Pattern

STOPPING EQUIPMENT

The equipment is shut down by moving the POWER switch to OFF and switching off the oscilloscope. Disconnect the oscilloscope cable from the panel connector.

ROUTINE MAINTENANCE

Care of the analyzer should be scheduled as a part of routine station maintenance. This will assure the instrument being kept in operative condition and available for use at all times.

Normal use will usually detect tube deterioration and indicate need for their replacement. Routine inspections and tests will often detect other conditions that if not corrected may give rise to undependable operation or serious damage.

At the scheduled servicing periods the unit should be cleaned, carefully inspected and, if not used regularly, given an operation check.

CLEANING

Loosen the two knurled thumb screws at the top of the panel, remove DET. PEAK knob, and lower the panel to a horizontal position.

Remove dust, by means of hand vacuum cleaner, blower, bellows, or dry compressed air jet of not over 20 lbs pressure, from the entire assembly and rear mounted components.

Take care not to disturb wiring or adjustments. Wipe dust off large flat areas with soft clean cloth.

Carefully apply a few drops of light oil to friction surfaces in the brackets.

INSPECTION

Carefully inspect all components for defects as follows:

Fuses - for discoloration and oxidization
Socket pins - for looseness and corrosion
Resistors - for blistering or discoloration
Cords and cables - for cut, cracked or frayed insulation
Terminal boards - for cracks and loose connections
Capacitors - for bulging, breakage
Potted Units - for bulging, leakage of compound
Visible terminals - for loose connections
Potentiometers - for lack of smooth mechanical operation
Switches - for lack of crisp action
Knobs - for looseness
Mountings - for loose screws, bolts or nuts

Loose parts should be tightened and parts showing distress should be checked and if necessary replaced at the first opportunity.

OPERATION CHECK

This must be performed with the transmitter in operation.
Connect an oscilloscope to J4 on the panel
Switch on analyzer and scope.
After 15-minute warm up, check operation as indicated in Table 4.

TABLE 4. OPERATION CHECK CHART

CHECK	OPERATION	CORRECT RESPONSE
Tuning	Rotate DET. PEAK back and forth	Sideband response pattern will appear and disappear
Scope Phasing	With BLANKING at OFF, rotate SCOPE PHASE back and forth	Zero beat notches will move toward and away from each other
Marker	Rotate MARKER over range, from -10 to +10	Marker pip will move from left to right
Video Output	Rotate VIDEO SWEEP OUTPUT control over full range	Output meter will read from 0 to maximum of 2 volts
Blanking	Operate BLANKING switch ON and OFF	a baseline will appear with BLANKING at ON

TROUBLE SHOOTING PROCEDURE

Complete failure of the equipment, with no trace on the scope and dial illumination off, is due to loss of power caused by a blown fuse, power cable or power source defect. When a baseline is obtained on the scope but no carrier frequency pip, pattern or marker output the trouble may be due to a varity of defects. A systematic approach to the identification of these and other defects in operation is given in Table 5 which also lists the action to be taken to locate the defective component.

When faulty operation has been traced to a tube or a particular circuit by means of the trouble chart it is advisable to first check the tubes on a tube tester br by replacing with a tube known to be good if not mentioned as critical in the following paragraph.

Certain circuits will require retuning when tubes are replaced before correct operation can be achieved. This applies to the following tubes:

Regen. Det-Amplifier V2
Oscillator-Doubler V6
RF Mixer V11
RF Amplifier V12
Oscillator V13

Refer to appropriate procedure in each case as given later in this section.

TABLE 5. TROUBLE SHOOTING CHART

Trouble Symptom	Probable Cause	Action to be taken
Panel Lights — ON / OFF: OFF	Fuses F1, F2 blown	See Note A
	Pilot bulbs burned out	Check bulbs
	Power off	Check power source
	Power cord loose	Tighten or replace
Scope Pattern — NO / YES: YES → Double pattern Blanking off — NO / YES: YES	Scope Phasing	Check phasing circuits
Scope Pattern: NO	Power supply circuits	Check voltage output
Baseline — YES / NO: NO	Sweep circuit	Check phasing circuits
	Open lead to scope	Check connections
	Scope deflective	See scope instructions
Carrier Frequency Pip — YES / NO: NO	Carrier off	Check transmitter
	Sweep oscillator	Check V1
	RF Mixer	Check V11
	Receiver circuits	Check V11 to V116
Output Meter Indication — YES / NO: NO	Video circuits	Check V7, V8, V9, V10
	Osc-Doubler	Check V6
Markers — YES / NO: NO	Coupling to V2	Check r-f lead to J1
	Marker circuits	Check V2, V3, V14
	Pulse amplitude setting	Adjust R23
	Regeneration setting	Check R18
Sideband — YES / NO: NO	Receiver incorrectly tuned	Retune receiver
	Transmitter unmodulated	Check transmitter

Note A. The fuses are located on the filter assembly at the rear of the chassis on opposite sides of the power input cable. Use 5-ampere fuses only for replacement. If a fuse blows immediately after replacement, locate and clear trouble before inserting another fuse.

CIRCUIT CHECKING

Some circuits in the analyzer can be checked by conventional signal tracing methods. Thus the marker generating circuits can be checked by first determining if a pulse is present in V2 by connecting a scope across R10. If a pulse is seen, check the circuits by tracing the pulse through V3 and V4. If no pulse is present across R10, check circuits of V2 for defects and frequency range of tank circuit L9 and C11 by means of a grid dip meter.

In the case of the video sweep circuits, a two-to-five megacycle modulated signal can be fed onto the grid 1 of V8 and traced through the circuits. Failure of the oscillator-doubler V6 to function may be checked by injecting a 130-mc signal from the grid dip meter coupled to L12 and observing the presence of a video output indication on the panel meter or on an oscilloscope connected to J2.

If the sweep oscillator V1 is functioning, set the SWEEP WIDTH control fully counterclockwise and feed unmodulated channel frequency into J3. The signal can then be checked through to the output tube V16 if oscillator V13 is functioning. A carrier frequency pip should be seen at the output of V16, available at output jack J4.

Additional circuit checks can be made by employing the voltage and resistance charts given in Table 6 and Table 7 respectively. These checks will serve to locate defective circuit components.

When the above checks fail to locate the cause of defective operation in a suspected circuit, particularly where resonant circuits are involved, tuning or adjustment should be checked by means of the appropriate procedure. When resonant circuits have components replaced they should also be checked for proper operation.

ADJUSTMENT PROCEDURES

To perform these procedures it is usually desirable to dismount the unit from the rack and place on a work bench with the panel propped open and the top plate removed as shown in Figure 6.

WARNING

THIS UNIT EMPLOYS VOLTAGES DANGEROUS TO LIFE. TAKE ALL SAFETY PRECAUTIONS WHILE MAKING ADJUSTMENTS.

SWEEP OSCILLATOR V1 ADJUSTMENT

Set SWEEP WIDTH control R7 fully counterclockwise to minimum sweep position.

Set tuning slug of L1 and capacitor C3 at midposition.

Couple frequency meter to the circuits and switch on the equipment.

Check oscillator frequency for 130 mc and bend end turns of L2 to obtain correct frequency.

Set SWEEP WIDTH control fully clockwise to maximum sweep position.

Adjust R8 until sweep oscillator covers the range of 120 to 140 mc as indicated by the grid dip meter. Rebend the end turns of L2 and adjust C3 as necessary to obtain accurate range coverage.

Flatness check may be made by connecting an oscilloscope to pin 1 of V11 through an isolating resistor and adjusting L1 for optimum flatness of rectified grid current waveform.

TABLE 6. TUBE SOCKET VOLTAGE CHART

DC voltage to ground except where otherwise noted.
DC measurements taken with VoltOhmyst with 120K isolating resistor.
AC measurements taken with WV73A Audio Voltmeter.

Line voltage 115 volts.

TUBE		PIN NUMBER								
SYMBOL	TYPE	1	2	3	4	5	6	7	8	9
V1	-6J6	240	240	0	6.3*	-9.5	-9.5	0	-	-
V2	-12AU7	33	-	0	0	0	94	-	3.6	6.3*
V3	-12AU7	79	15.5	18	0	0	190	-	12.5	6.3*
V4	-6J6	-60	255	0	6.3*	-60	-60	0	-	-
V5	-6SQ7	0	20*(10)	0	40*(1)	40*(1)	40*(1)	-	-	-
					-35	-35	145			
V6	-6BA6	-9	0	0	6.3*	210	115	0	-	-
V7	-6AS6	0	(2)	0	6.3*	(3)	(4)	-	-	-
V8	-6AH6	-	(5)	0	6.3*	(6)	(7)	(8)	-	-
V9	-6AH6	-	0.6N	0	6.3*	250	110	0.6N	-	-
V10	-6AG7	0	0	0	3.5	10.5	250	6.3*	250	-
V11	-6AS6	-	0	0	6.3*	93	105	0	-	-
V12	-6AK6	0	9.2	0	6.3*	142	160	9.2	-	-
V13	-6C4	185	-	0	6.3*	185	-8.5N	0	-	-
V14	-6AS6	0	1.7	0	6.3*	185	90	-7N	-	-
V15	-6BA6	0	2.7(9)	0	6.3*	150	115	2.7(9)		
V16	-12AU7	0	0	0.6	0	0	230	0.6N	11.5	6.3*
V17	-6AS7G	220	370	260	220	370	260N	150(11)	150(11)	
V18	-6SJ7	0	150(12)	150	149.5N	150	150	150(12)	220	0
V19	-OD3	-	0	395	-	150	-	395	-	-
V20	-5R4GY	-	415(13)	-	410*	400	410*	400	415(13)	-

*A-C N-Nominal

(1) With Blanking switch S2 at ON. Drops to zero with S2 at OFF
(2) 0.3 Nom., 1.3 max
(3) 35 Nom., 0 to 100
(4) 25 Nom., 0 to 90 Varies with VIDEO SWEEP OUTPUT control R47 Setting
(5) 0.1 Nom., 0.8 max
(6) 75 Nom., 124 to 260
(7) 52 Nom., 0 to 120
(8) 0.1 Nom., 0.8 max
(9) DET. GAIN control R93 clockwise
(10) Varies with setting of Blanking Phase control R31
(11) 6.3 volts AC between pins 7 and 8
(12) 6.3 volts AC between pins 2 and 7
(13) 5 volts AC between pins 2 and 8

TABLE 7. TUBE SOCKET RESISTANCE CHART

Resistance in ohms to ground. K=1000, M=megohm
Cables disconnected.
Measurements made with VoltOhmyst.
BLANKING S2 at ON. VIDEO SWEEP OUTPUT R47 and DET. GAIN R93 maximum clockwise.

TUBE		PIN NUMBER								
SYMBOL	TYPE	1	2	3	4	5	6	7	8	9
V1	-6J6	30K	30K	0	0	165K	16.5K	0	-	-
V2	-12AU7	95K	22K	0	0	0	105K	1M	1800	0
V3	-12AU7	65K	1M	3300	0	0	40K	1M	22K	0
V4	-6J6	1M	62K	0	0	2M	1M	0	-	-
V5	-6SQ7	0	82K	0	155K	155K	128K	0	0	-
V6	-6BA6	60K	0	0	0	40K	110K	0	-	-
V7	-6AS6	0	270	0	0	96.5K	96K	26	-	-
V8	-6AH6	180K	68	0	0	40.5K	84K	68	-	-
V9	-6AH6	180K	68	0	0	30K	110K	68	-	-
V10	-6AG7	0	0	0	100K	28	28K	0	28K	
V11	-6AS6	22K	0	0	0	61K	61K	51	-	-
V12	-6AK6	0	820	0	0	38K	84K	820	-	-
V13	-6C4	34K	NC	0	0	34K	22K	0	-	-
V14	-6AS6	0	270	0	0	55K	84K	22K	-	-
V15	-6BA6	0	270	0	0	38K	96K	270	-	-
V16	-12AU7	0	0	100K	0	0	36K	100K	3300	0
V17	-6AS7G	inf	inf	28K	inf	inf	28K	42K	42K	-
V18	-6SJ7	0	42K	42K	28K	42K	45K	42K	inf	-
V19	-0D3	70K	0	inf	-	42K	-	inf	-	-
V20	-5R4GY	NC	inf	NC	38	inf	38	inf	inf	-

NC- No contact   inf- infinity
Pins marked inf may show lower resistance until capacitors charge.

OSCILLATOR-DOUBLER V6 ADJUSTMENT

Switch equipment on and adjust the core of L11 until the circuit resonates at 65 mc as indicated by the grid dip meter.

Using the grid dip meter, adjust the core of L12 for maximum output at 130 mc. Repeak L11 if necessary to obtain maximum response. With video output indicated on the panel meter, L12 may be peaked using the meter reading as an indication.

VIDEO CIRCUIT ADJUSTMENT.

Connect vertical deflection of oscilloscope to J2 through detector network shown in Figure 2.

Connect sinusoidal sweep voltage output, pins 1 and 2 of J4 to horizontal deflection of scope.

Set SWEEP WIDTH control R7 fully clockwise to maximum and set SWEEP POS control C3 at midposition.

Switch on equipment and allow to warm up for 20 minutes.

With a pattern on the scope, switch BLANKING to OFF and superimpose the double pattern on the scope by adjusting SCOPE PHASE control R101.

The carrier frequency pip shoudl fall in the center of the pattern. Check the symmetry of the pattern by coupling the frequency meter, operating as an osiclaltor at about 5 mc, to mixer V7. Two markers will appear on the pattern equidistant from the carrier pip. Slowly increase meter frequency which will cause the markers to move toward the ends of the pattern. If the pattern is symmetrical, both markers should reach the end of the pattern and disappear simultaneously. If this does not occur, recheck oscillator-doubler V6 frequency and adjust L11 if found other than 130 mc. If pattern still remains unsymmetrical, recheck frequency sweep range of V1 and adjust the end turns of L2, with SWEEP POS control centered, for a sweep range of 120 to 140 mc with SWEEP WIDTH control R7 at maximum.

Connect scope directly to J2.

Set VIDEO SWEEP OUTPUT control R47 to give two volt indication on OUTPUT meter.

Observe pattern for signs of smearing or streaking. This indicates distortion due to overloading of mixer V7 if it cannot be eliminated by reducing VIDEO SWEEP OUTPUT control R47. Overload in the video stages following the mixer V7 will usually occur for output voltages in excess of 2 volts peak-to-peak, meter off scale, with blanking.

If overloading is present, it may be corrected by adjusting coupling of L37. Loosen cement which holds coil in position and adjust coupling for maximum output as indicated on the scope just short overloading. Use glyptal to recement coil in position.

Reconnect detector network in scope input, set VIDEO SWEEP OUTPUT control to provide 2 volts output and switch BLANKING to ON.

Adjust peaking coil L17 for most uniform pattern.

VIDEO OUTPUT METER CALIBRATION.

Connect a 72-ohm terminating resistor to VIDEO output connector J2. Connect the vertical input probe of the oscilloscope directly across this termination. Using the internal voltage-calibration circuits of the oscilloscope measure the peak-to-peak voltage of the video envelope in the medium frequency section of the sweep range with blanking ON and sweep width control set at approximately 7 mc. (This assumes that the oscilloscope has reasonably flat response over a substantial portion of the video range. This is an approximate calibration check and should not be considered a reliable method of adjusting meter indication. A precise vacuum tube voltmeter should be used if the rough check indicates serious disagreement.

MARKER CIRCUIT ADJUSTMENT

First check the position of the dial with respect to capacitor C11. The long calibration mark on the dial should line up with the pointer when C11 is at maximum capacity.

Check the tuning range of marker tank circuit L9, C9, C10, and C11 by means of the grid dip meter.

Rotate MARKER control C11 to -10 and adjust core of L9 to obtain an exact frequency of 120 mc as indicated on the meter.

Rotate MARKER control to +10 setting and adjust trimmer capacity C9 for exact setting of 140 mc.

Repeat these settings until the -10 and +10 settings give exact frequency settings of 120 and 140 mc respectively.

Connect an oscilloscope to J5 with horizontal sweep connected to terminals 1 and 2 of J4.

Set **SWEEP WIDTH** control R7 fully clockwise for maximum sweep and **BLANKING** at **ON**.

With equipment on, a pulse should appear on the scope.

Rotate regeneration control R18 slowly clockwise until V2 goes into oscillation as indicated by bottom of pulse sweeping below the baseline. Back off on R18 until oscillation stops. Rotate **MARKER** control slowly over its full range, noting if V2 goes into oscillation at any point. If oscillation occurs at any point, back off on R18 until it stops. When oscillation does not occur at any position of the **MARKER** control adjust R18 about 5^{o} counterclockwise to provide a slight margin of safety.

Transfer the scope input to center arm of marker selector switch S1 on the chassis. With **BLANKING** at **OFF** adjust marker pulse amplitude control R23 clockwise until two pulses appear. Continue clockwise rotation until the higher of the two pulses just starts to overload as indicated by flattening of the peak.

Connect the detector circuit shown in Figure 2 to **VIDEO** output J2 and connect the oscilloscope to the detector output. With **SWEEP WIDTH** control at maximum clockwise and **BLANKING** at **OFF** a double trace should appear on the screen. Adjust **SCOPE PHASING** control until zero beat pips coincide.

Inject the marker by moving marker selector switch S1 to **SWEEP**. The marker pulse should move from left to right across the sweep trace as **MARKER** dial is rotated from -10 mc to +10 mc. At the Fc calibration mark on the dial, the marker should coincide with the zero beat notch on the trace.

Adjust size of marker pip by means of **PULSE AMP.** control R23 until it equals approximately 10% of pattern height.

Calibration of the marker dial can be checked by coupling the megacycle meter operating as an oscillator in close proximity to V7. Symmetrical markers will appear on the scope trace at any setting of the meter between 2 and 10 mc which can be used to check the **MARKER DIAL** by setting the marker to coincide with megacycle meter markers and comparing dial indication and meter setting. Precise calibration at +10 mc and -10 mc can be made by repeated adjustments of L9 and C9 respectively so that calibration is exact at these points. Settings of **MARKER** dial and megacycle meter should agree within 125 kc or half a division throughout the dial scale.

RF MIXER V11 ADJUSTMENT

Couple frequency meter as grid dip meter to T2.

Set knob of C70 to maximum capacity. Adjust core of T2 for resonance at 38 mc as indicated by the grid dip meter.

Calibration markings on the chassis for C70 should agree closely over the range indicated with actual resonant frequencies.

RF AMPLIFIER V12 ADJUSTMENT

Couple frequency meter as grid dip meter to T3.

Set knob of C77 to maximum capacity. Adjust core of T3 to 36 mc as indicated by the grid dip meter.

Calibration markings on the chassis should agree closely with actual resonant frequencies over the range indicated.

RF OSCILLATOR V13 ADJUSTMENT (Receiver heterodyne)

Couple frequency meter as grid dip meter to L23.

Set knob of C78 to maximum capacity. Adjust core of L23 until circuit resonates at 33.8 mc as indicated on the grid dip meter.

Calibration markings on the chassis should agree closely with actual resonant frequencies over the range indicated.

MIXER V14 ADJUSTMENT (Receiver)

Connect a signal generator set for 10.7 mc, 30% modulated, to grid pin 1 of V14.

Connect an oscilloscope to plate pin 5 of V15.

Set DET. GAIN control R93 fully clockwise to maximum.

Maximum output of generator may be required, (due to loading by T3). Adjust both oores to T4 for maximum output as indicated on the oscilloscope (10.7 mc envelope).

Transfer oscilloscope to pin 3 of J4 and adjust both cores of T5 for maximum detected output on oscilloscope. Reduce generator input as necessary to prevent overloading as circuits come into resonance.

Touch up adjustment of core of T4 and then T5 for maximum output.

BLANKING ADJUSTMENT

Blanking should occur at the ends of the trace, equally distant from the carrier frequency pip (or the zero-beat notch if the video sweep is considered). This can be checked by switching BLANKING to OFF. Adjust the SCOPE PHASING control to produce a single trace. Throw the BLANKING switch to ON. The vertical sides of the blanked pattern should fall exactly on the ends of the response trace. If this is not the case, adjust BLANKING PHASE control R31 on the rear of the chassis until the proper pattern is obtained.

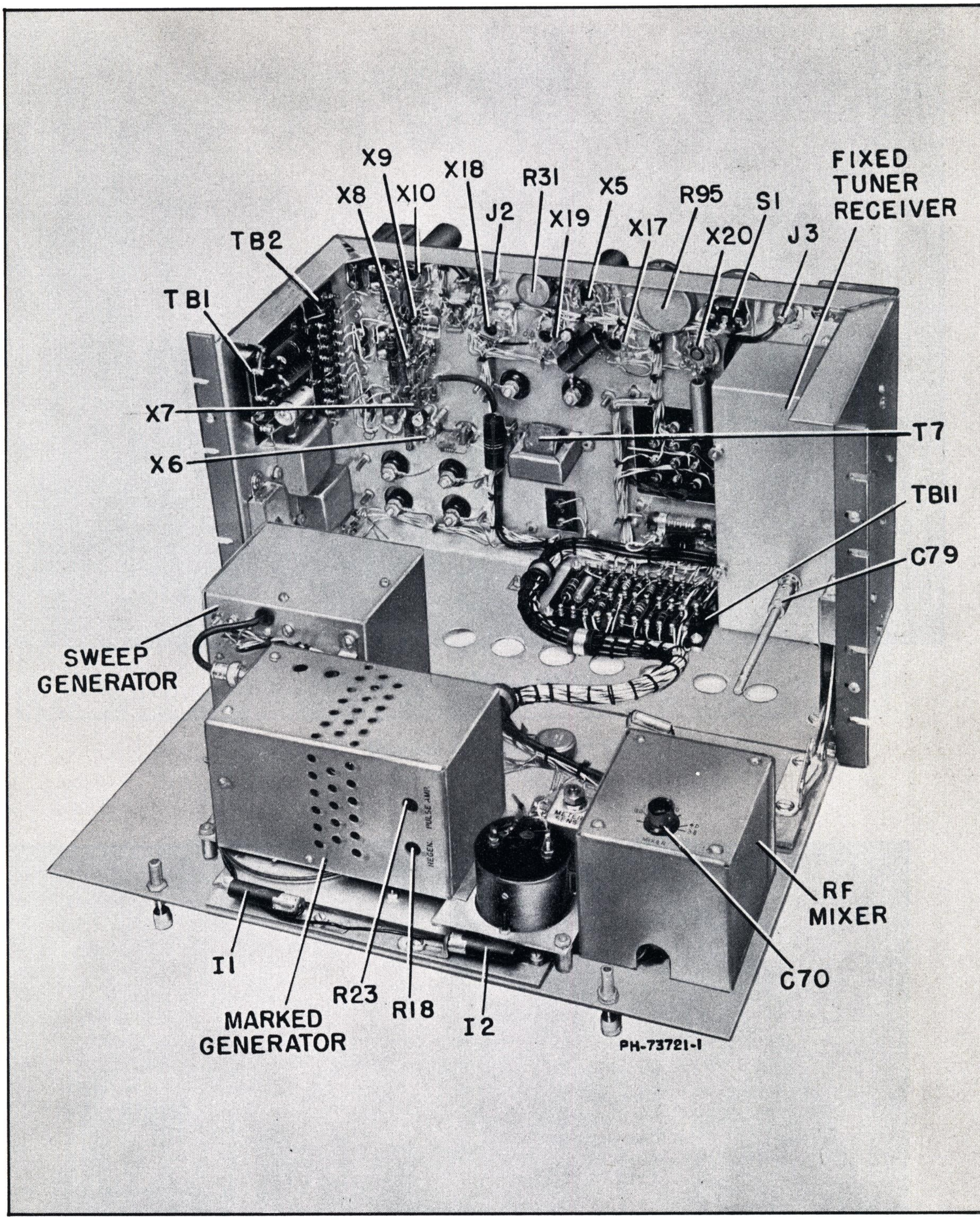

Figure 6. BW-5A Front Panel Open

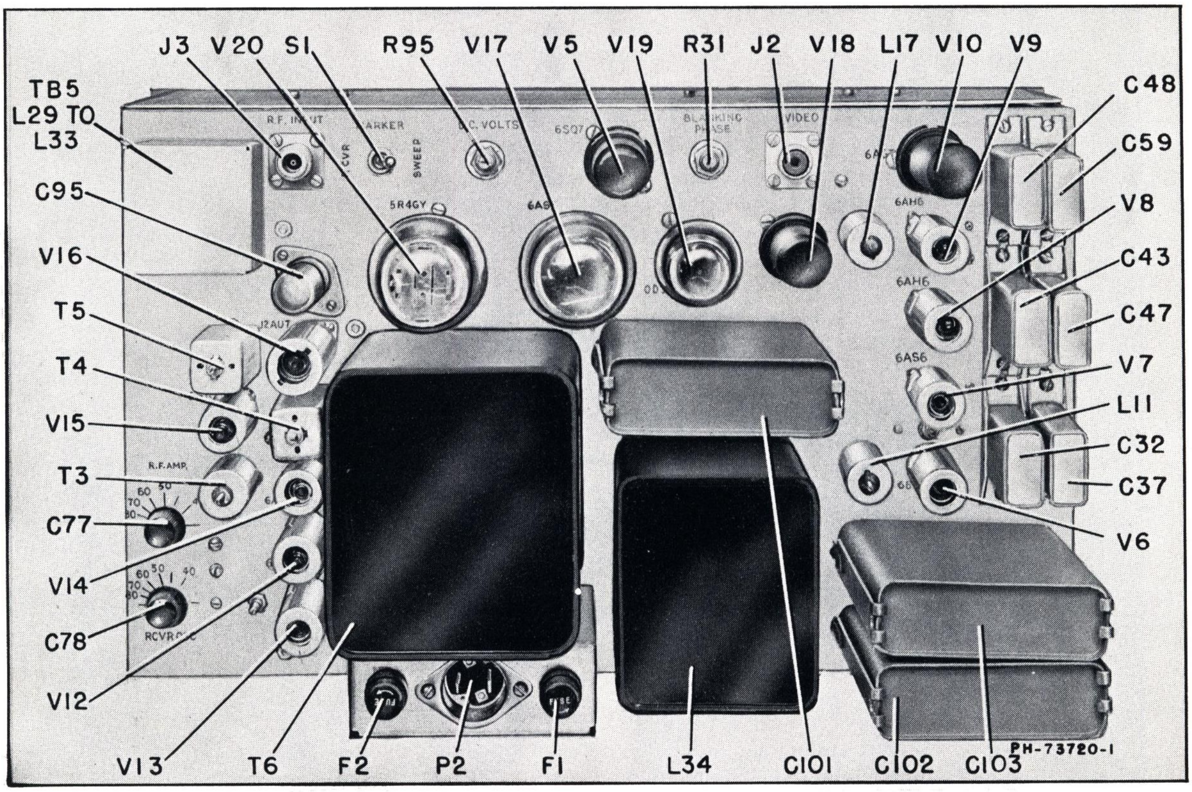

Figure 7. BW-5A Rear View

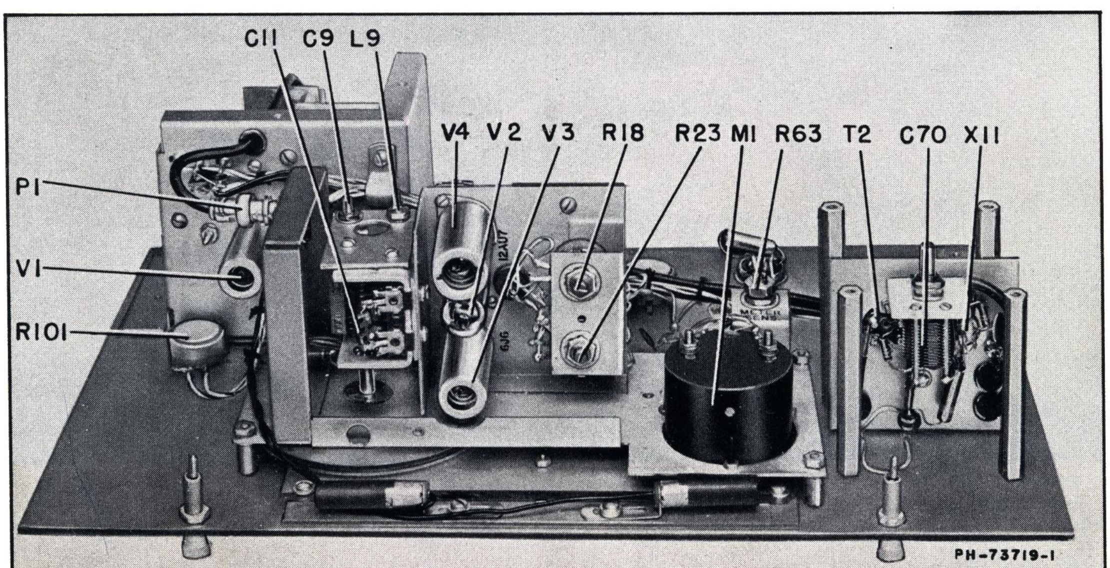

Figure 8. Panel, Rear Mounted Units, Shields Removed, Top View

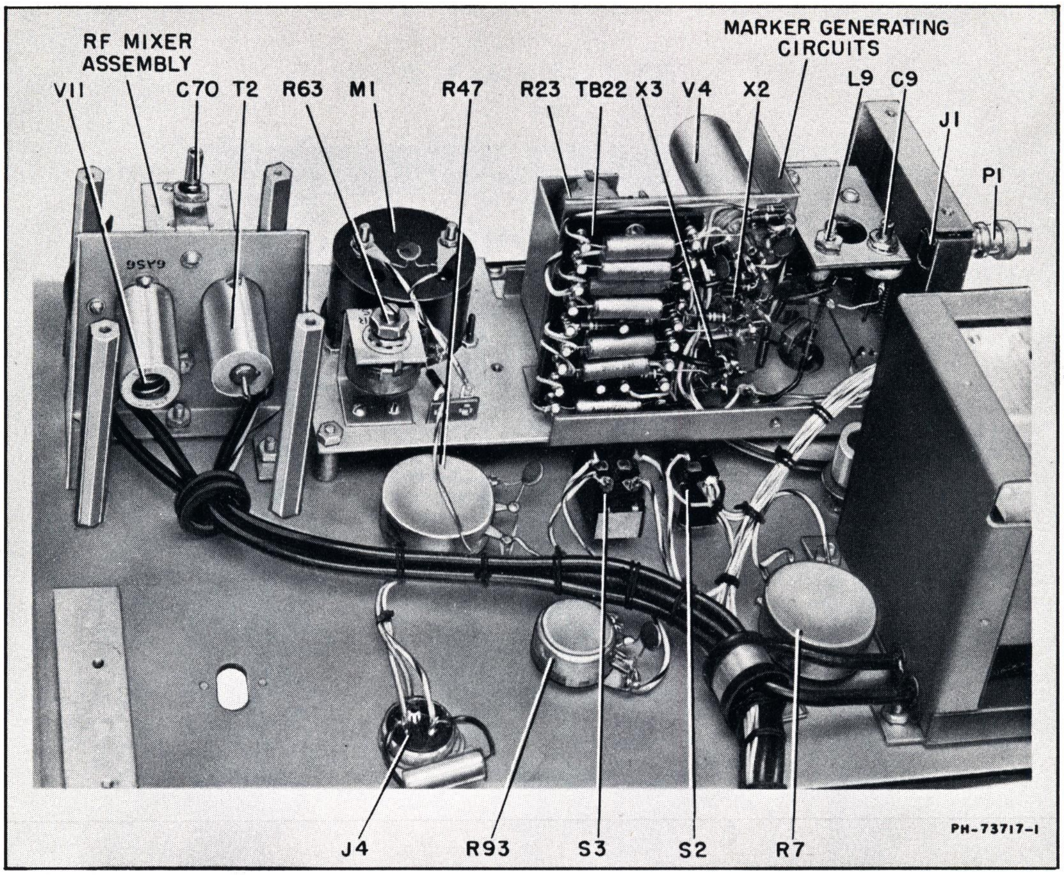

Figure 9. Marker and RF Mixer Units, Shields Removed, Top View

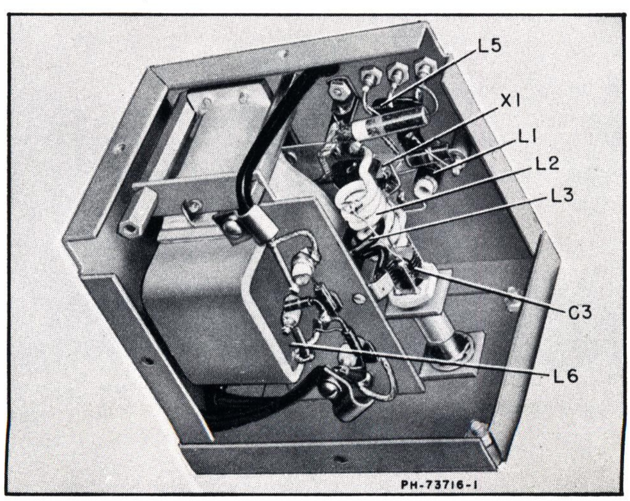

Figure 10. Sweep Oscillator, Shield Removed, Interior View

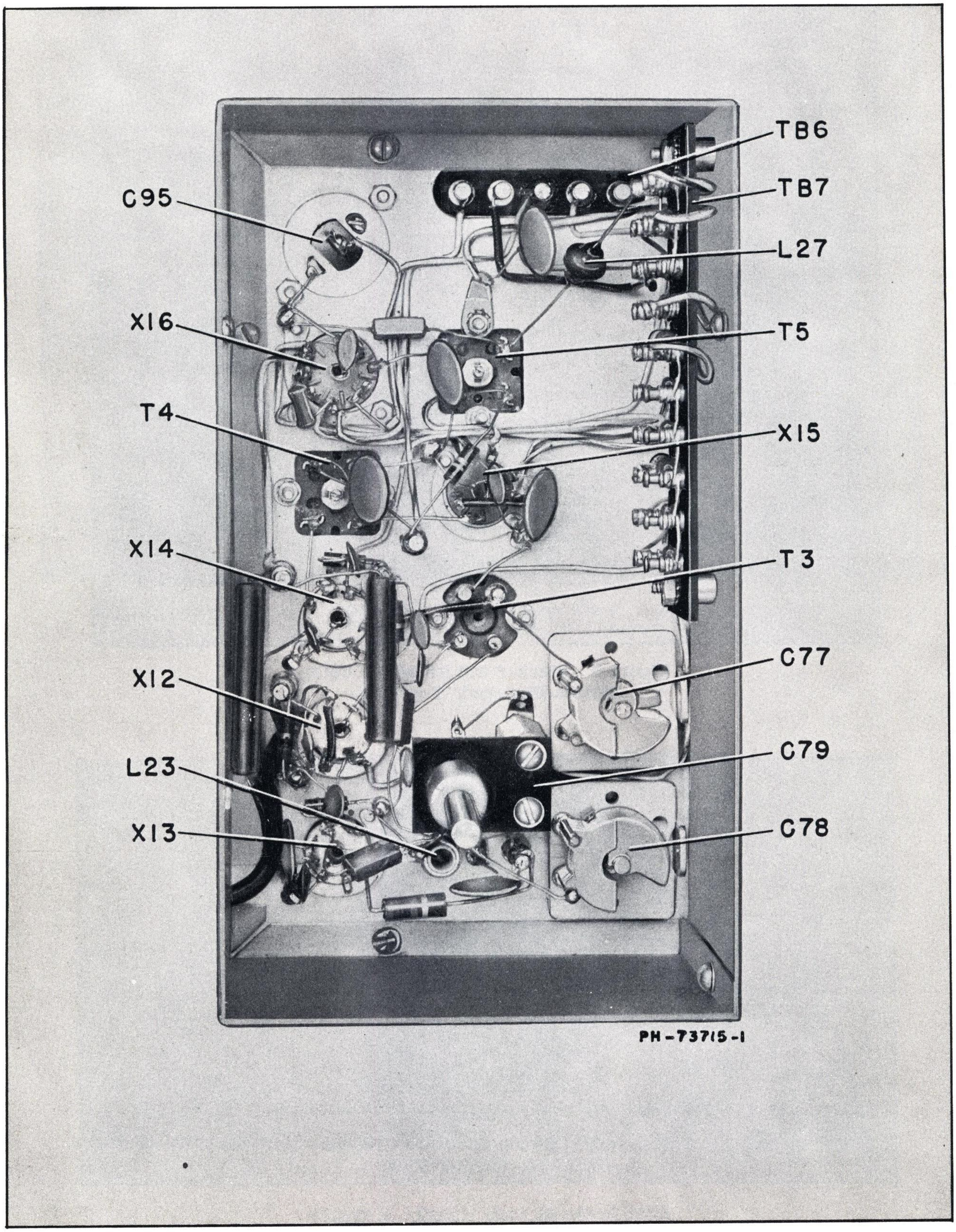

Figure 11. Fixed Tuned Receiver, Shield
Removed, Interior View

REPLACEMENT PARTS AND ENGINEERING SERVICE

When ordering replacement parts, please give symbol, description, and stock number of each item ordered.

The part which will be supplied against an order for a replacement item may not be an exact duplicate of the original part. However, it will be a satisfactory replacement differing only in minor mechanical or electrical characteristics. Such differences will in no way impair the operation of the equipment.

The following tabulations list service parts, electron tube, and field engineering service ordering instructions according to the geographical location of the station.

SERVICE PARTS

STATION LOCATION	OBTAIN SERVICE PARTS FROM
Continental United States or Alaska	Local Broadcast Equipment Sales Representative, his office, or directly from the Service Parts Order Service, Bldg.60, 19th and Federal Streets, Camden 5, N. J. Emergency orders may be telephoned, telegraphed, or teletyped to RCA Emergency Service, Bldg.60, Camden, N.J. (Telephone: Woodlawn 3-8000).
Dominion of Canada	Local Broadcast Equipment Sales Representative, his office, or directly from RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec.
Outside of Continental United States, Alaska, and the Dominion of Canada	Local Broadcast Equipment Sales Representative, or Service Parts Order Service, RCA International Division, Gloucester, New Jersey. U.S.A.

ELECTRON TUBES

STATION LOCATION	OBTAIN ELECTRON TUBES FROM
Continental United States or Alaska	Local Distributor or nearest of the following warehouses: 34 Exchange Place Jersey City 2, New Jersey 589 E. Illinois Street Chicago 11, Illinois 420 S. San Pedro Street Los Angeles 13, California
Dominion of Canada	Local Broadcast Equipment Sales Representative, his office, or directly from RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec.
Outside of Continental United States, Alaska, and the Dominion of Canada	Local Distributor or from: Tube Department RCA International Division 30 Rockefeller Plaza New York 20, New York. U.S.A.

If for any reason, it is desired to return tubes, please return them to the place of purchase. If this is not convenient, please notify your RCA serving warehouse so that Return Authorization may be forwarded to you.

PLEASE DO NOT RETURN TUBES DIRECTLY TO RCA WITHOUT AUTHORIZATION AND SHIPPING INSTRUCTIONS.

It is important that complete information regarding each tube (including type, serial number, hours of service and reason for its return) be given.

When tubes are returned, they should be shipped to the address specified on the Return Authorization form. A copy of the Return Authorization and also a Service Report for each tube should be packed with the tubes.

FIELD ENGINEERING SERVICE*

STATION LOCATION	REQUEST FIELD ENGINEERING SERVICE FROM
Continental United States or Alaska	Local Broadcast Equipment Sales Representative or the RCA Service Company, Inc., Broadcast Communications Service Division, Camden, N.J. Telephone: Woodlawn 3-8000.
Dominion of Canada	Local Broadcast Equipment Sales Representative, his office, or directly from RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec.
Outside of Continental United States, Alaska, and the Dominion of Canada	Chief Engineer RCA International Division 30 Rockefeller Plaza New York 20, New York, U.S.A.

**Charges for field engineering service will be made at current rates.*

PARTS LIST

For ordering information see page 29

SYMBOL NO.	DESCRIPTION	DRAWING NO.	STOCK NO.
	TELEVISION SIDEBAND RESPONSE ANALYZER, MI-34000		
C1	Capacitor, disc, ceramic high K; 1000 mmf +100% -0%, 500 volt	449696-52	96507
C2	Capacitor, feedthru; 500 mmf ±20%, 350 volt d. c.	887883-1	55300
C3	Capacitor, variable, air; 1. 8 mmf to 5. 1 mmf; 7 stator and 6 rotary plates; screwdriver slot in shaft; 2-3/32" x 5/8" x 3/4"	455882-8	96508
C4	Capacitor, vibrating	914902-1	59756
C5	Not Used		
C6	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C7, C8	Capacitor, feedthru; 500 mmf ±20%, 350 volt d. c. Same as C2	887883-1	55300
C9	Capacitor, variable, air; 3. 2 mmf to 11 mmf; 20 stator, 11 rotary plates; screwdriver slot in shaft	455882-7	96509
C10	Capacitor, fixed; mica dielectric; 4 mmf ±5%, 500 volt d. c.	737817-304	97746
C11	Capacitor, variable, air; 0 to 4. 9 mmf; two gang, 5 plates double-spaced, gear-driven - 2:1	149801-1	96997
C12	Capacitor, mica, fixed; 22 mmf ±5%, 500 volt	727853-207	96998
C13	Capacitor, oil filled paper; 0. 022 mf ±10%, 400 volt	737816-89	96999
C14, C15	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C16	Capacitor, oil filled paper; 0. 022 mf ±10%, 400 volt. Same as C13	737816-89	96999
C17, C18	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C19 to C21	Capacitor, oil filled paper; 0. 022 mf ±10%, 400 volt. Same as C13	737816-89	96999
C22	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C23	Capacitor, oil filled paper; 0. 022 mf ±10%, 400 volt. Same as C13	737816-89	96999
C24	Capacitor, molded paper; 0. 22 mf, 400 volt	735715-79	73794
C25	Capacitor, molded paper; 4700 mmf, 600 volt	735715-259	73920
C26	Capacitor, oil filled paper; 0. 022 mf ±10%, 400 volt. Same as C13	737816-89	96999
C27	Capacitor, mica; 33 mmf ±5%, 500 volt	727853-211	73807
C28	Capacitor, fixed, mica; 22 mmf ±5%, 500 volt. Same as C12	727853-207	96998
C29	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C30	Capacitor, ceramic insulated; 100 mmf ±20%, 500 volt d. c.	735717-329	75437
C31	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C32A/B	Capacitor, paper oil; 0. 5/0. 5 mf ±15%, 400 volt	984680-417	97497
C33	Capacitor, disc, ceramic, high K; 4700 mmf +100% -0%, 500 volts d. c.	990119-11	73473
C34 to C36	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0 %, 500 volt. Same as C1	449696-52	96507
C37A/B	Capacitor, paper oil; 0. 5/0. 5 mf ±15%, 400 volt. Same as C32A/B	984680-417	97497
C38 to C42	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C43A/B	Capacitor, paper oil; 0. 5/0. 5 mf ±15%, 400 volt. Same as C32A/B	984680-417	97497
C44	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C45A/B	Capacitor, paper; 0. 5/0. 5 mf +20% -10%, 600 volt d. c.	8887746-575	96510
C46	Capacitor, mica; 220 mmf ±5%, 500 volt	727853-231	96518
C47A/B	Capacitor, paper oil, 0. 5/0. 5 mf ±15%, 400 volt. Same as C32A/B	984680-417	97497
C48A/B	Capacitor, paper oil 0. 5/0. 5 mf ±15%, 400 volt. Same as C32A/B	984680-417	97497
C49, C50	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C51	Capacitor, fixed, mica: 22 mmf ±5%, 500 volt. Same as C12	727853-207	96998
C52	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C53	Not Used		
C54 to C56	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C57, C58	Capacitor, molded paper; 0. 22 mf, 400 volt. Same as C24	735715-79	73794
C59A/B	Capacitor, paper oil, 0. 5/0. 5 mf ±15%, 400 volt. Same as C32A/B	984680-417	97497
C60	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C61	Capacitor, fixed; electrolytic; 50 mf -10% +250%, 25 volt d. c.	442901-48	91392
C62	Capacitor, fixed, mica; 22 mmf ± 5%, 500 volt. Same as C12	727853-207	96998
C63	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507

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SYMBOL NO.	DESCRIPTION	DRAWING NO.	STOCK NO.
C64	Capacitor, disc, ceramic, high K; 4700 mmf +100% -0%, 500 volt d.c. Same as C33	990119-11	73473
C65	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt Same as C1	449696-52	96507
C66	Not Used		
C67 to C69	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt Same as C1	449696-52	96507
C70	Capacitor variable, air; 5.3 to 102 mmf; 27 plates; 5/16" bushing mounting, 13 rotary plates, 14 stator plates.	845600-10	96511
C71 to C74	Capacitor, disc. ceramic, high K; 1000 mmf +100% -0%, 500 volt Same as C1	449696-52	96507
C75	Capacitor, disc, ceramic, high K; 0.01 mf, 500 volt d.c.	990119-13	73960
C76	Capacitor, fixed, mica; 22 mmf ±5%, 500 volt. Same as C12	727853-207	96998
C77, C78	Capacitor, variable, air; 5.3 to 102 mmf; 27 plates; 5/16" bushing mounting, 13 rotary plates, 14 stator plates. Same as C70	845600-10	96511
C79	Capacitor, variable, air; 1.8 mmf to 5.1 mmf; 7 stator and 6 rotary plates; screwdriver slot in shaft; 2-3/32" x 5/8" x 3/4". Same as C3	455882-8	96508
C80, C81	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C82	Capacitor, disc, ceramic, high K; 0.01 mf, 500 volt d.c. Same as C75	990119-13	73960
C83, C84	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C85, C86	Capacitor, mica; 39 mmf. ±5%, 500 volt d.c.; part of T4	727853-213	97496
C87, C88	Capacitor, disc, ceramic, high K; 0.01 mf, 500 volt. Same as C75	990119-13	73960
C89, C90	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C91, C92	Capacitor, mica; 39 mmf ±5%, 500 volt d.c.; part of T4. Same as C85	727853-213	97496
C93	Capacitor, disc, ceramic, high K; 0.01 mf, 500 volt d.c. Same as C75	990119-13	73960
C94	Capacitor, mica; 220 mmf ±5%, 500 volt. Same as C46	727853-231	96518
C95	Capacitor, electrolytic; 10 mf -10% +50%, 450 volt d.c.	86028-9	95907
C96	Capacitor, ceramic insulated 100 mmf ±20%, 500 volt d.c. Same as C30	735717-329	75437
C97	Capacitor, disc, ceramic, high K; 1000 mmf +100% -0%, 500 volt. Same as C1	449696-52	96507
C98	Not Used		
C99	Capacitor, disc, ceramic, high K; 0.01 mf, 500 volt d.c. Same as C75	990119-13	73960
C100	Capacitor, disc, ceramic, high K; 1000 mmf +100%-0%, 500 volt. Same as C1	449696-52	96507
C101 to C103	Capacitor, pyranol; 10 mf ± 10%, 600 volt	984629-8	18501
C104	Capacitor, fixed; paper dielectric; 1 mf ±10%	8887746-14	97495
C105	Capacitor, oil filled paper; 0.022 mf ±10%, 400 volt. Same as C13	737816-89	96999
C106	Capacitor, molded paper; 0.22 mf, 400 volt. Same as C24	735715-79	73794
C107 to C110	Capacitor, mica; 6800 mmf ±10%, 500 volt	727876-167	58337
C111	Capacitor, mica; 10 mmf ±5%, 500 volt; body 33/64" x 19/64" x 7/32"	727853-202	59905
CR1, CR2	Rectifier, crystal	IN69	97887
E1	Neon Bulb; max. overall length 1 7/8"; neon gas approx. starting volts 65 a.c. - 90 d.c. (GE type NE-2)	872291-4	48474
F1, F2	Fuse, 5 amp; 3AG; Slo-blo	896698-5	94802
I1, I2	Lamp, miniature bayonet base; 6.3 volts, 0.25 amp; clear finish blue-bead color, max. overall length 1 3/16" (Mazda 44)	61114-15	11891
J1	Connector, female; UG-290, BNC	445813-2	54890
J2	Connector, female; SO-239 flange mtg; four 0.125" dia. mtg. holes, VHF	255223-1	51800
J3	Connector, female; UG-58/U flange mtg; four 1/8" dia. holes (Type N)	433647-1	92180
J4	Connector, female, 3 contact (Amphenal)	420410-3	95182
J5	Connector, receptacle, black; 15/16" overall x 7/16" dia.	8876936-1	96512
L1	Coil, sweep osc. grid	176270-502	97017
L2	Coil, sweep osc. plate	8879559-1	
L3	Coil; sweep osc. R-F pickup loop	8879560-501	
L4	Coil; R-F choke; sweep osc. filament	8879558-501	97000
L5	Coil; R-F choke; 180 microhenrys, resistance 1 meg (minimum)	940144-9	74214
L6	Capacitor; part of C4		
L7	Reactor, R-F choke; 4.7 microhenrys ±10%, resistance 2.8 ohms ±15% (IRC-CL-1)	941689-24	76510
L8	Not Used		
L9	Coil, iron core; marker tank; 120-140 mc, bushing mtg.	176270-503	97018
L10	Choke; 1.5 microhenrys ±10%, resistance 0.72 ohm ±20%, current rating, 1.02 amps	941689-18	76640

For ordering information see page 29

SYMBOL NO.	DESCRIPTION	DRAWING NO.	STOCK NO.
L11	Coil, heterodync osc; 65 mc; square can with adj. core, lug mtg.	8879554-503	97020
L12	Coil, sweep osc. grid. Same as L1	176270-502	97017
L13, L14	Choke; 1.5 microhenrys +10%, resistance 0.72 ohm +20%, current rating, 1.02 amps. Same as L10	941689-18	76640
L15	Coil, video peaking; 3.3 microhenrys +10%, resistance 2.0 ohms +20%; current rating, 0.61 amp	941689-22	96513
L16	Reactor, R-F choke; 4.7 microhenrys +10%, resistance 2.8 ohms + 15% (IRC-CL-1). Same as L7	941689-24	76510
L17	Coil, video peaking; 12-13 mc; square can with adj. core, lug mtg.	8879554-504	97021
L18	Choke, R-F: 0.47 microhenry +15%, resistance 0.22 ohm +30%, current rating, 1.5 amps	941689-1	97886
L19	Choke; 1.5 microhenrys +10%, resistance 0.72 ohm +20%, current rating, 1.02 amps. Same as L10	941689-18	76640
L20	Coil, R-F choke; 180 microhenrys, resistance 1 meg. (minimum). Same as L5	940144-9	74214
L21, L22	Choke; 1.5 microhenrys +10%, resistance 0.72 ohm +20%, current rating, 1.02 amps. Same as L10	941689-18	76640
L23	Coil, iron core; receiver oscillator; 33-94 mc; bushing mtg.	176270-501	97004
L24	Choke; 1.5 microhenrys +10%, resistance 0.72 ohm +20%, current rating, 1.02 amps. Same as L10	941689-18	76640
L25	Coil, R-F choke; 180 microhenrys, resistance 1 meg (minimum). Same as L5	940144-9	74214
L26	Not Used		
L27	Coil, R-F choke; 180 microhenrys, resistance 1 meg (minimum). Same as L5	940144-9	74214
L28	Not Used		
L29 to L32	Coil, R-F choke; 180 microhenrys, resistance 1 meg (minimum) Same as L5	940144-9	74214
L33	Coil, R-F choke; sweep osc. filament. Same as L4	8879558-501	97000
L34	Reactor, filter; air cooling; continuous duty; 10 henrys, 30 volt 60 cycles, 200 amps; hi-pot volts, 2800 volt d.c.	447226-1	56407
L35, L36	Coil, R-F choke; line filter	8879557-501	97010
L37	Wire; vinyl insulated; 3-1/4" lg., 7-010 wht-grn (form at assembly 1 turn)		
M1	Meter; 0-200 microamps d.c., accuracy 2%	176268-1	97005
P1	Connector, plug; UG-88/U; crystal pickup	8898625-501	54392
P2	Connector; motor base; 10 amps, 250 volts 15 amps, 125 volts; flange mtg, two 0.152" dia. holes	30186-1	47594
R1, R2	Resistor fixed; composition; 33,000 ohms + 10%, 1/2 watt	82283-80	502333
R3	Resistor, fixed; composition; 270 ohms +10%, 1/2 watt	82283-55	30929
R4, R5	Resistor, fixed; composition; 51 ohms +5%, 1/2 watt	82283-128	3614
R6	Resistor, fixed; composition; 1000 ohms +10%, 1 watt	90496-62	512210
R7	Resistor, variable; 10 ohms +10%, 4 watt; linear curve	737809-16	58729
R8	Resistor, adjustable, wire wound; 20 ohms, 25 watt	427491-12	52017
R9	Resistor, fixed; composition; 51 ohms +5%, 1/2 watt. Same as R4	82283-128	3614
R10	Resistor, fixed; composition; 47,000 ohms +10%, 1/2 watt	82283-82	30787
R11	Resistor, fixed; composition; 10,000 ohms +10%, 1/2 watt	82283-74	502310
R12	Resistor, fixed; composition; 220,000 ohms +10%, 1/2 watt	82283-90	502422
R13	Resistor, fixed; composition; 1800 ohms +10%, 1/2 watt	82283-65	502218
R14	Resistor, fixed; composition; 1 megohm +10%, 1/2 watt	82283-98	502510
R15	Resistor, fixed; composition; 47,000 ohms +10%, 1/2 watt. Same as R10	82283-82	30787
R16	Resistor, fixed; composition; 68,000 ohms +10%, 1/2 watt	82283-84	502368
R17	Resistor, fixed; composition; 10,000 ohms +10%, 1/2 watt. Same as R11	82283-74	502310
R18	Resistor, variable; carbon; 100,000 ohms	737829-33	96675
R19	Resistor, fixed; composition; 3300 ohms +10%, 1/2 watt	82283-68	30733
R20	Resistor, fixed; composition; 1 megohm +10%, 1/2 watt. Same as R14	82283-98	502510
R21	Resistor, fixed; composition; 22,000 ohms +10%, 1/2 watt	82283-78	30492
R22	Resistor, fixed; composition; 1 megohm +10%, 1/2 watt. Same as R14	82283-98	502510
R23	Resistor, variable; carbon; 25,000 ohms +20%, 2 watt; linear curve	737801-15	56874
R24, R25	Resistor, fixed; composition; 1 megohm +10%, 1/2 watt. Same as R14	82283-98	502510
R26	Resistor, fixed; composition; 22,000 ohms +10%, 1/2 watt. Same as R21	82283-78	30492
R27	Resistor, fixed; composition; 27,000 ohms +10%, 1/2 watt	82283-79	502327
R28	Resistor, fixed; composition; 120,000 ohms +10%, 1/2 watt	82283-87	30180
R29	Resistor, fixed; composition; 100,000 ohms +10%, 1/2 watt	82283-86	502410
R30	Resistor, fixed; composition; 1 megohm +10%, 1/2 watt. Same as R14	82283-98	502510
R31	Resistor, variable; carbon; 500,000 ohms +10%; linear curve	737854-11	94775
R32	Resistor, fixed; composition; 100,000 ohms +10%, 1 watt	90496-86	512410
R33, R34	Resistor, fixed; composition; 27,000 ohms +10%, 1 watt	90496-79	71990

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SYMBOL NO.	DESCRIPTION	DRAWING NO.	STOCK NO.
R35	Resistor, fixed; composition; 100,000 ohms +10%, 1 watt. Same as R32	90496-86	512410
R36	Resistor, fixed; composition; 33,000 ohms +10%, 1/2 watt. Same as R1	82283-80	502333
R37	Resistor, fixed; composition; 82,000 ohms +10%, 1/2 watt	82283-85	8064
R38	Resistor, fixed; composition; 120,000 ohms +10%, 1/2 watt. Same as R28	82283-87	30180
R39	Resistor, fixed; composition; 100,000 ohms +10%, 1/2 watt. Same as R29	82283-86	502410
R40	Resistor, fixed; composition; 51 ohms +5%, 1/2 watt. Same as R4	82283-128	3614
R41	Resistor, fixed; composition; 270 ohms +10%, 1/2 watt. Same as R3	82283-55	30929
R42	Resistor, fixed; composition; 560 ohms +10%, 1 watt	90496-59	38884
R43, R44	Resistor, fixed; composition; 68,000 ohms +10%, 1/2 watt. Same as R16	82283-84	502368
R45	Resistor, fixed; composition; 56,000 ohms +10%, 1/2 watt	82283-83	502356
R46	Resistor, fixed; composition; 180,000 ohms +10%, 1/2 watt	82283-89	11959
R47	Resistor, variable; wire wound; 70,000 ohms; output	845139-15	18003
R48	Resistor, fixed; composition; 680 ohms +5%, 1 watt	90496-155	512168
R49	Resistor, fixed; composition; 68 ohms +10%, 1/2 watt	82283-48	34763
R50 to R52	Resistor, fixed; composition; 12,000 ohms +10%, 1/2 watt	82283-75	30436
R53	Resistor, fixed; composition; 82,000 ohms +10%, 1/2 watt. Same as R37	82283-85	8064
R54	Resistor, fixed; composition; 180,000 ohms +10%, 1/2 watt. Same as R46	82283-89	11959
R55	Resistor, fixed; composition; 680 ohms +5%, 1 watt. Same as R48	90496-155	512168
R56	Resistor, fixed; composition; 68 ohms +10%, 1/2 watt. Same as R49	82283-48	34763
R57	Resistor, carbon; 1000 ohms +10%, 1 watt. Same as R6	90496-62	512210
R58	Resistor, fixed composition; 100 ohms + 10%, 1 watt	90496-50	512110
R59	Resistor, fixed; composition; 100,000 ohms +10%, 1/2 watt. Same as R29	82283-86	502410
R60	Resistor, fixed; composition; 180 ohms + 10%, 1/2 watt	82283-53	502118
R61	Resistor, fixed; composition; 100 ohms +10%, 1/2 watt	82283-50	502110
R62	Resistor, fixed; composition; 1000 ohms +10%, 1/2 watt	82283-62	502210
R63	Resistor, variable; carbon; 5000 ohms; meter sensitivity	737829-30	94039
R64	Resistor, fixed; composition; 51 ohms +5%, 1/2 watt. Same as R4	82283-128	3614
R65	Resistor, fixed; composition; 22,000 ohms +10%, 1/2 watt. Same as R21	82283-78	30492
R66	Not Used		
R67, R68	Resistor, fixed; composition; 33,000 ohms +10%, 1/2 watt. Same as R1	82283-80	502333
R69, R70	Resistor, fixed; composition; 51 ohms +5%, 1/2 watt. Same as R4	82283-128	3614
R71	Resistor, fixed; composition; 820 ohms +10%, 1/2 watt	82283-61	502182
R72	Resistor, fixed; composition; 1000 ohms +10%, 1 watt. Same as R6	90496-62	512210
R73	Resistor, fixed; composition; 22,000 ohms +10%, 1/2 watt. Same as R21	82283-78	30492
R74	Resistor, fixed; composition; 56,000 ohms +10%, 1/2 watt. Same as R45	82283-83	502356
R75	Resistor, fixed; composition; 10,000 ohms +10%, 1/2 watt. Same as R11	82283-74	502310
R76	Resistor, fixed; composition; 22,000 ohms +10%, 1/2 watt. Same as R21	82283-78	30492
R77	Resistor, fixed; composition; 4700 ohms +10%, 1 watt.	90496-70	512247
R78	Resistor, fixed; composition; 56,000 ohms +10%, 1/2 watt. Same as R45	82283-83	502356
R79	Resistor, fixed; composition; 270 ohms +10%, 1/2 watt. Same as R3	82283-55	30929
R80	Resistor, fixed; composition; 27,000 ohms +10%, 1/2 watt. Same as R27	82283-79	502327
R81	Resistor, fixed; composition; 270 ohms +10%, 1/2 watt. Same as R3	82283-55	30929
R82	Resistor, fixed; composition; 68,000 ohms +10%, 1/2 watt. Same as R-16	82283-84	502368
R83	Resistor, fixed; composition; 10,000 ohms +10%, 1/2 watt. Same as R11	82283-74	502310
R84	Resistor, fixed; composition; 8200 ohms +10%, 1 watt	90496-73	512282
R85	Resistor, fixed; composition; 3300 ohms +10%, 1/2 watt	82283-68	30733
R86	Resistor, fixed; composition; 100,000 ohms +10%, 1/2 watt. Same as R29	82283-86	502410
R87	Resistor, fixed; composition; 3.3 megohms +10%, 1/2 watt	82283-104	31417
R88	Resistor, fixed; composition; 560 ohms +10%, 1/2 watt	82283-59	5164
R89, R90	Resistor, fixed; composition; 68 ohms +10%, 1 watt	90496-48	36976
R91	Resistor, fixed; composition; 1 megohm +10%, 1/2 watt. Same as R14	82283-98	502510
R92	Resistor, fixed; composition; 560 ohms +10%, 1/2 watt. Same as R88	82283-59	5164
R93	Resistor, variable; carbon; 10,000 ohms +10%, 2 watt; log. curve	737885-32	96514
R94	Resistor, fixed; composition; 39,000 ohms +10%, 1 watt	90496-81	71084
R95	Resistor, variable; wire wound; 5000 ohms d. c., continuous	845139-7	57134
R96	Resistor, fixed; composition; 33,000 ohms +10%, 1 watt	90496-80	38895
R97	Resistor, fixed; composition; 100,000 ohms +10%, 1 watt. Same as R32	90496-86	512410
R98	Resistor, fixed; composition; 2700 ohms +10%, 1 watt	90496-67	512227
R99	Resistor, fixed; composition; 18,000 ohms +10%, 2 watt	99126-77	39158
R100	Resistor, fixed; composition; 1000 ohms +10%, 1/2 watt	82283-62	502210
R101	Resistor, variable; composition; 75,000 ohms +10%, 2 watt; log. curve	737885-31	96515
S1	Switch, toggle; SPDT; bat type handle; 15 amp 125 volt, 10 amp 250 volt	449663-103	97009
S2	Switch, SPST; bat type handle; 10 amp 250 volt a.c., 15 amp 125 volt a.c.	449663-102	94395
S3	Switch, DPST; 15 amp 125 volt a.c., 10 amp 250 volt a.c.; 15/32" x 1-5/16" x 3/4" (black phenolic)	449663-106	56882
T1	Not Used		
T2	Transformer, mixer; 44-84 mc; square can with adj. core; lug mtg.	8879554-501	97001
T3	Transformer, R-F amplifier; 44-84 mc; square can with adj. core; lug mtg.	8879554-502	97019

For ordering information see page 29

SYMBOL NO.	DESCRIPTION	DRAWING NO.	STOCK NO.
T4, T5	Transformer, 1st I-F; 10.7 mc; square can complete with adj. cores; lug mtg.	8879553-501	97002
T6	Transformer, power; pri, 115 volt; secd, 800/400 volt 0.2 amp; 6.3 volt 6 amp; 6.3 volt 3 amp; 5 volt 3 amp	447213-1	56406
T7	Transformer, 6.3 volt; scope phasing	878739-1	64306
XF1, XF2	Holder, fuse; type 3AG fuses only, 2 17/64" lg.	99088-2	48894
	MISCELLANEOUS		
	Dial, tuning; graduated +10 -10 mc frequency control	149488-501	97003
	Knob, small; 1 1/16" O.D.		
	Knob	712336-507	30075
	Screw-set	843365-12	
	Knob, large; 1 1/2" O.D.		
	Knob	712336-505	17268
	Screw-set	56442-5	
	Knob, small; black, 3/4" O.D. x 9/16" lg. two #8-32 set screws	69916-4	4323
	Knob, small; push-on, 1 1/16" O.D.		
	Knob	717296-503	28000
	Spring	65807-3	
	Mask, window; front panel plastic, for dial and meter; Methacrylate sheet, 0.125" thick	149463-1	97006
	Screw, thumb; #8-32 thread 1 13/16" lg., special head	8878886-1	97007
	Socket, tube; 7 contact; flange mtg; two 0.125" dia. holes; molded plastic natural color	99370-2	54271
	Socket, tube; 7 pin ceramic; flange mtg; two 0.125" dia. holes; steatite	99370-3	53347
	Socket, tube; 9 contact; flange mtg; two 0.125" dia. holes: molded mica-filled phenolic, natural color	984055-2	56333
	Socket, tube; 9 contact; flange mtg; two 0.125" dia. holes; mica-filled phenolic	737870-14	94926
	Socket, tube; octal; 8 contact; flange mtg; two 0.156" dia. holes; bakelite	99390-1	54414
	Socket, pilot lamp; miniature bayonet base; shell grounded, 16" lead	8879574-1	97008

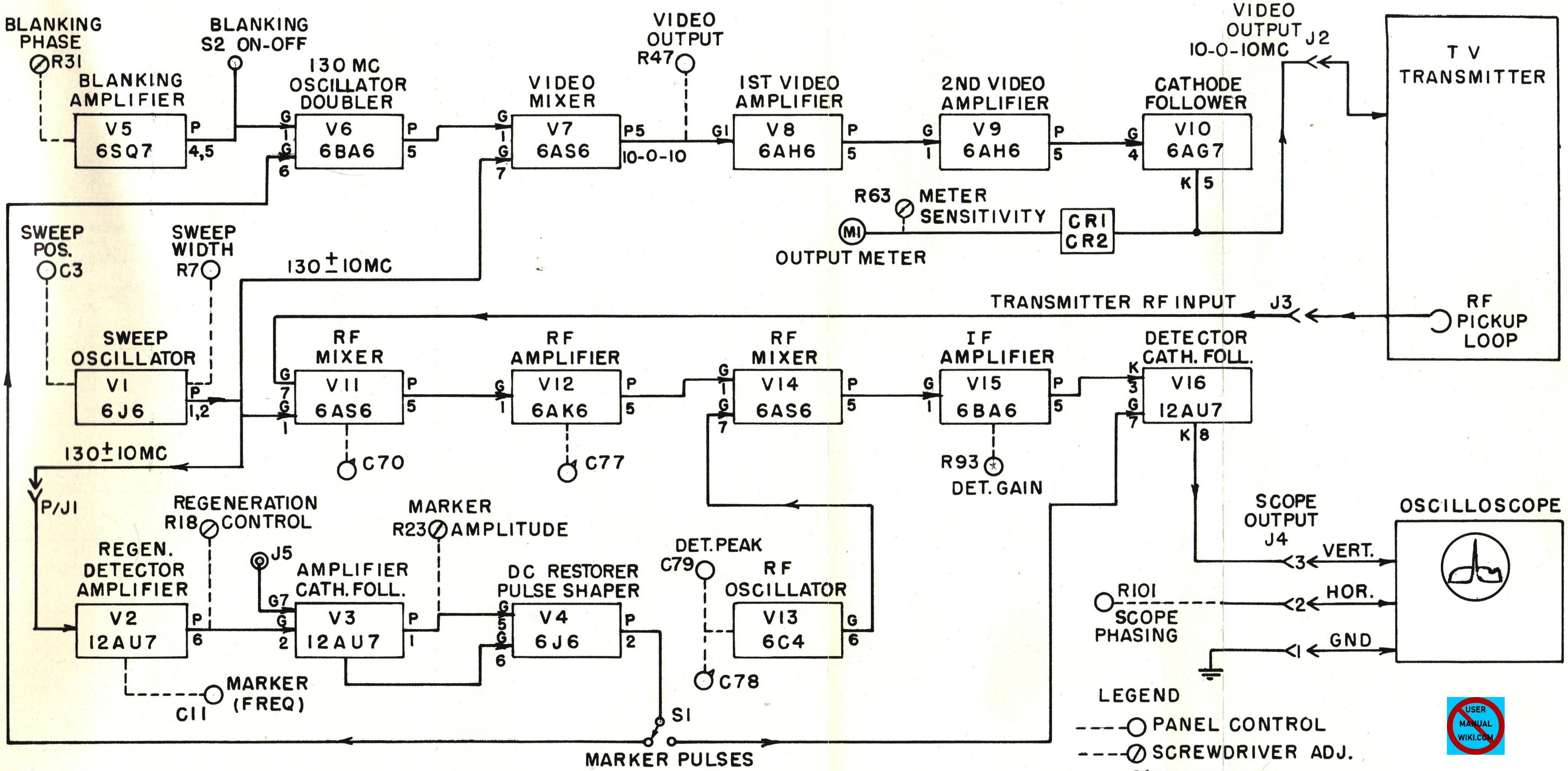
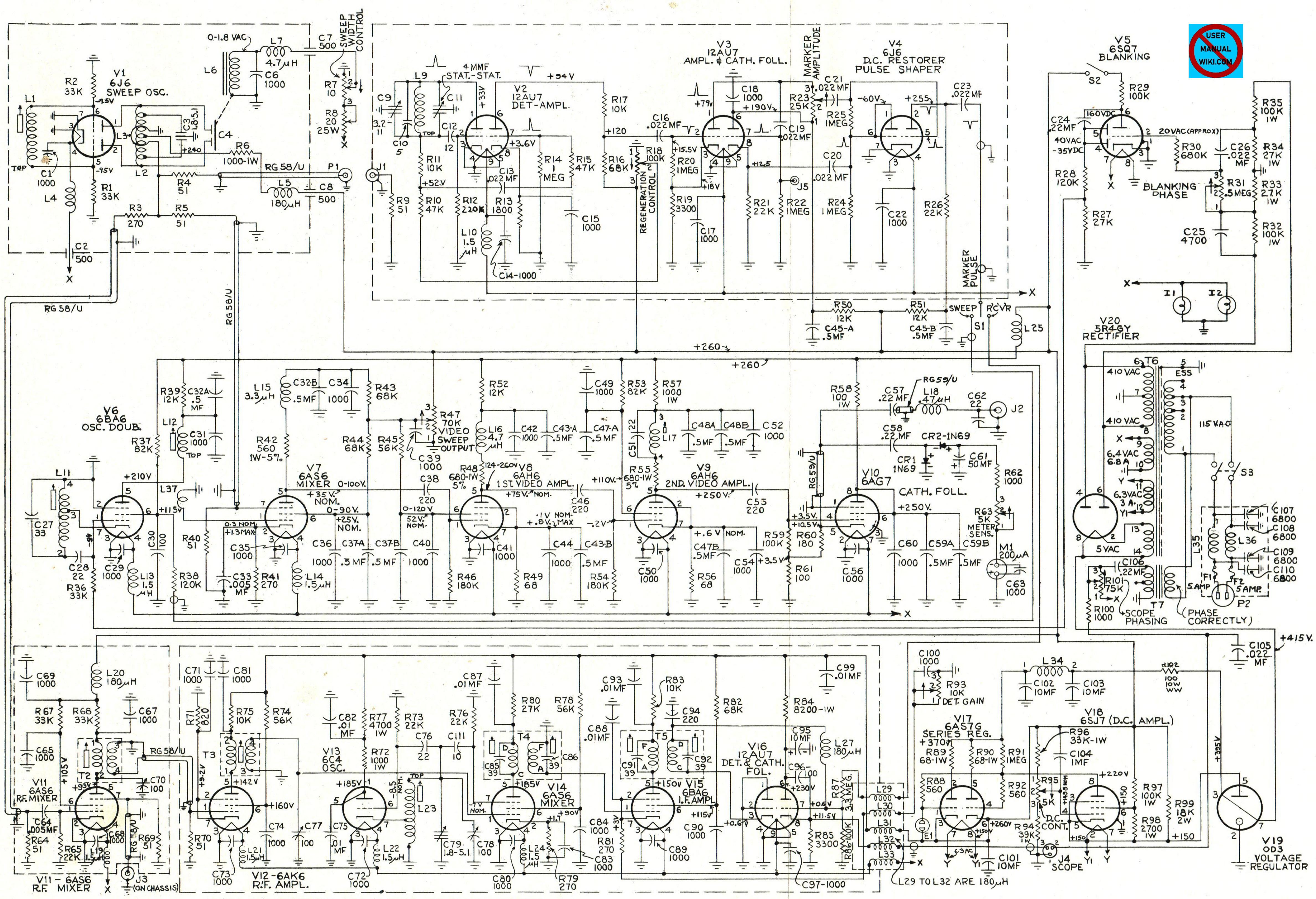
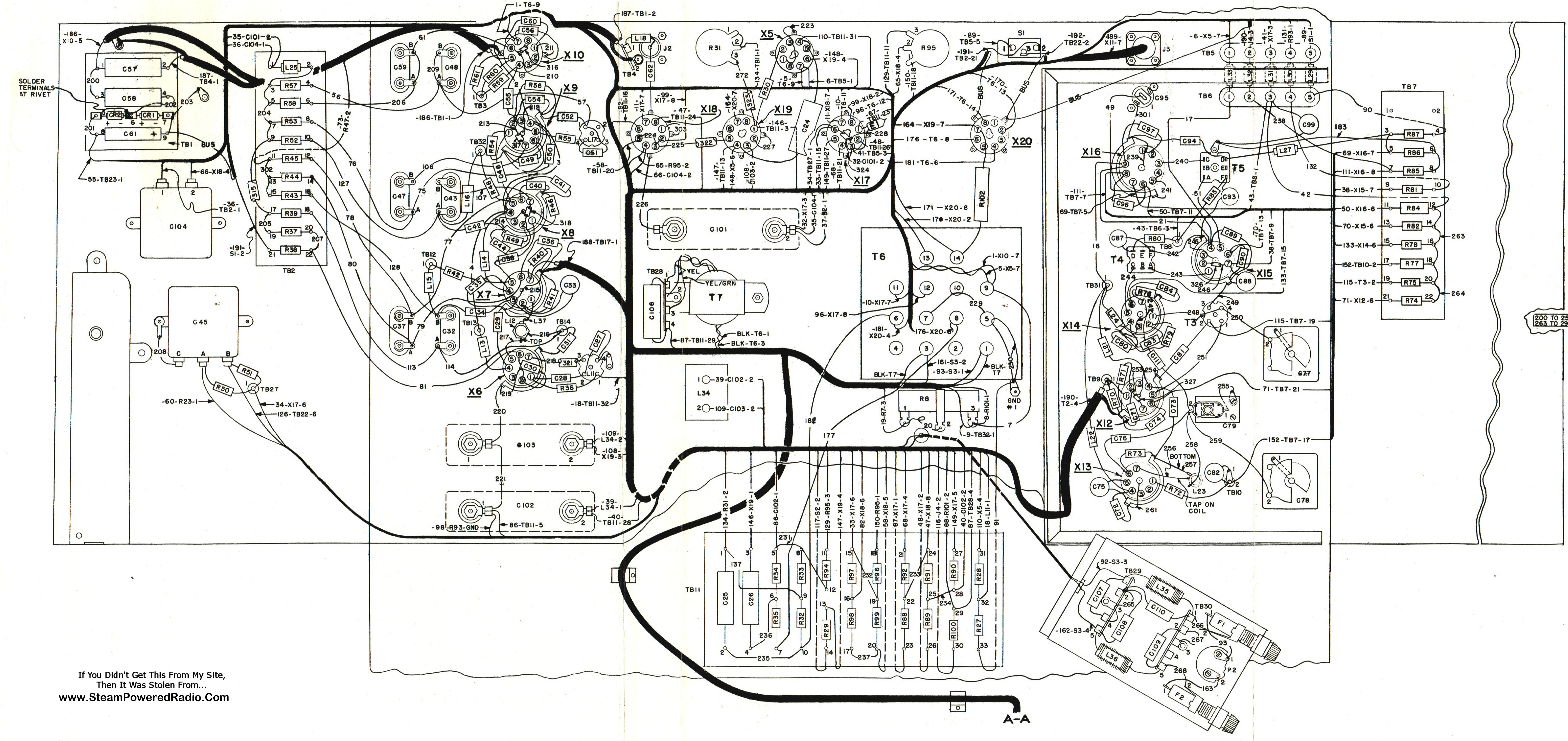


Figure 12. BW-5A Servicing Block Diagram



NOTE: ALL RESISTORS ARE IN OHMS AND ALL CAPACITORS ARE IN MMF UNLESS OTHERWISE SPECIFIED.
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
K = 1000
VOLTAGE INDICATIONS SHOWN ARE MEASURED WITH A VOLTOHMYST AT NOMINAL OPERATING CONDITIONS.

Figure 13. BW-5A Schematic Diagram



WIRE TABLE		A-88 78 355		
WIRE NOS. (INCLUSIVE)	DESCRIPTION COLOR AND CONDUCTOR	PS NUMBER OR DWG. NO.	PARTS LIST ITEM NO.	WIRE NOS. NOT USED
1 TO 21	BRN 10/.010	PS-724-11	175	
29 TO 45	RED 7/.010	PS-724-1	177	
47 TO 51 54 TO 61	BLUE 7/.010	PS-724-1	180	62 52-53
65 TO 73 75 TO 84	GREEN 7/.010	PS-724-1	178	74
86 TO 100	BLACK 10/.010	PS-724-11	176	
106 TO 111 113 TO 120	YELLOW 7/.010	PS-724-1	179	112
126 TO 129 131 TO 137	ORANGE 7/.010	PS-724-1	181	130
146 TO 150 152 TO 153	RED/BLUE 7/.010	PS-724-1	182	151
161 TO 164	RED/BLK 10/.010	PS-724-11	170	
170 TO 171	BRN/RED 10/.010	PS-724-16	171	172
176 TO 177	BRN 7/.010	PS-724-14	172	
181 TO 183	BLK 7/.010	PS-724-14	173	
188 TO 192	WIRE RG-58U	K-99258-2	183	
200 TO 251, 253 TO 259-261- 263 TO 297, 299 TO 303	WIRE-TINNED COPPER .032 DIA.	PS-105	184	252 TO 260 262 TO 298
315 TO 324 326 TO 336	SLEEVING-TREATED COTTON .042 I.D.	PS-8	174	
186 TO 187	WIRE-COAX RG-59U	K-99259-2	185	
190 TO 192	1 CONDUCTOR SHIELDED	K-8845679-1	186	

NOTE ⊕ I- NUMBERS IN WIRES ARE WIRE NUMBERS AND WIRE DESTINATIONS RESPECTIVELY.

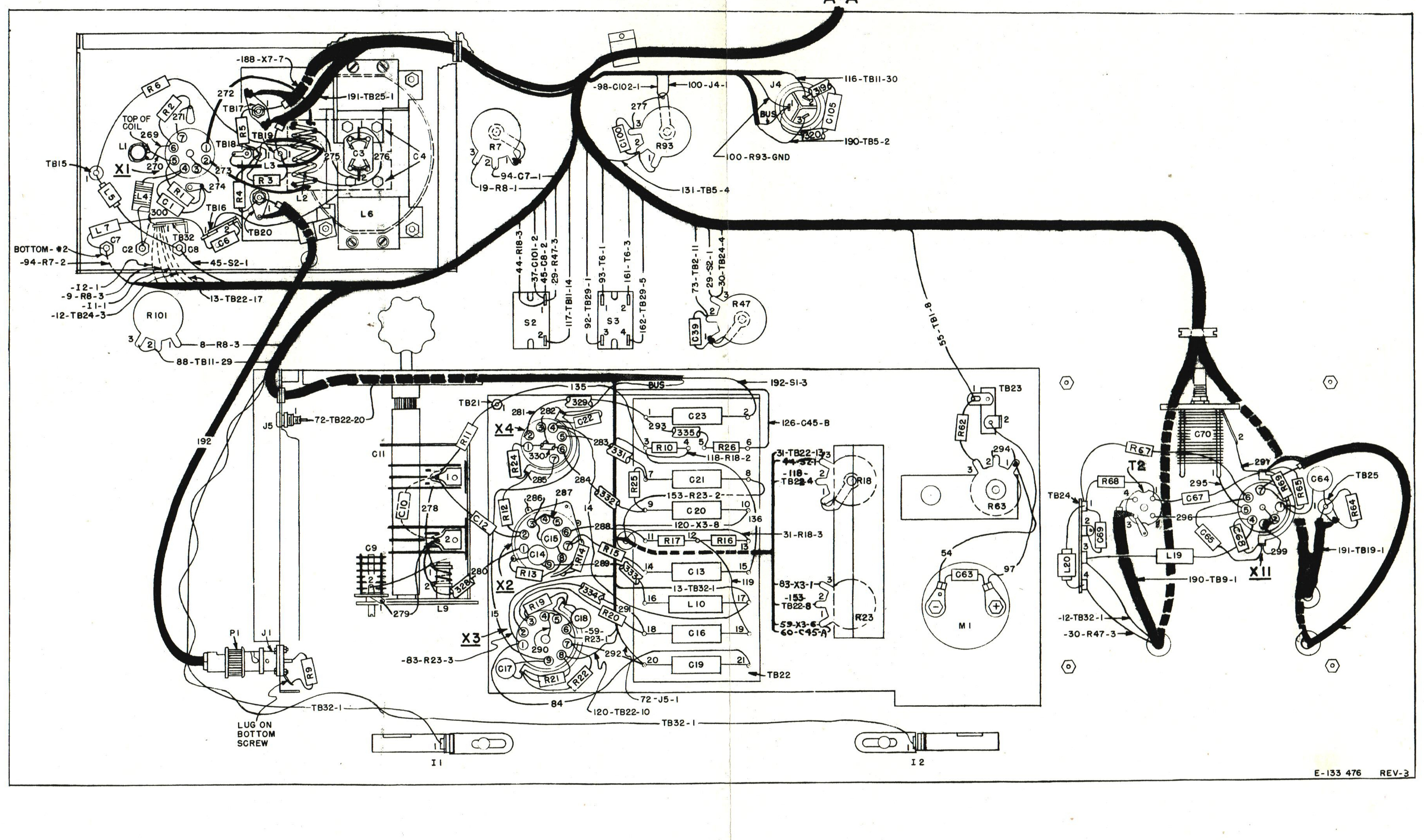


Figure 14. BW-5A Wiring Diagram

RADIO CORPORATION OF AMERICA

ENGINEERING PRODUCTS DEPARTMENT CAMDEN, N. J.