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# LEADER

## TV-FM SWEMAR GENERATOR

### MODEL LSG-532

### OPERATING INSTRUCTIONS

#### GENERAL

The LSG-532 TV-FM SWEMAR Generator is designed for use in the alignment and checking of television and FM receivers. It consists of the sweep and marker generators combined in one cabinet for the maximum convenience. It is used to obtain the response curves on an oscilloscope. It is very compact and small in size and occupies little bench space. The construction is very rugged and is suitable for field use, manufacturing plants and development.

The sweep generator covers the range from 2.0 to 270 Mc in 2 bands, excepting for a narrow range between 120 and 150 Mc.

The marker generator frequency range is from 3.5 to 250 Mc in 8 bands, 4 fundamental and 4 harmonic frequencies.

#### FEATURES

1. The sweep and marker are assembled in one cabinet, occupying minimum bench space and eliminating many cable connections.
2. The leakage field is very low.
3. The sound, video and FM frequencies, both carrier and IF, are covered by the sweep generator.
4. An accurate 4.5 Mc (or 5.5 Mc) quartz crystal oscillator is used for the sound IF checks and also for frequency checking; 1 to 12 Mc crystals can be used.
5. The vibrating capacitor for the sweep has been specially designed and excellent frequency linearity is achieved.
6. The sweep width is variable to 12 Mc or more, with minimum amplitude variation.
7. Test signals in the range 3.5 to 250 Mc are available for receiver sensitivity, frequency range, etc.
8. The marker can be used externally for calibration. A sensitive heterodyne detector is incorporated for self-calibration of the marker.

#### SPECIFICATIONS

##### Sweep Generator

Frequency Range	A 2~120 Mc (beat) B 150~270 Mc (fund)
Sweep Deviation	0~12 Mc (20 Mc max)
Sweep Method	Vibrating Capacitor, sinusoidal
Output Voltage	over 50,000 $\mu$ V

Output Impedance	75 $\Omega$ , unbalanced						
Output Control	$\times 1$ , $\times 10$ , $\times 100$ , $\times 1,000$ continuously adjustable FINE						
Output Variation	within 2 dB						
Frequency Linearity	within $\pm 5\%$						
Marker Generator							
Frequency Range	3.5 to 250 Mc						
	Fundamentals			Harmonics			
	A	3.5~ 6.5 Mc		7~ 13 Mc			
	B	10~ 18 Mc		20~ 36 Mc			
	C	36~ 68 Mc		72~136 Mc			
	D	58~125 Mc		116~250 Mc			
Frequency Accuracy	within $\pm 1\%$						
Quartz Crystal	4.5 Mc, or 5.5 Mc, as specified; 0.05 %						
Internal Modulation	audio, 600 cps						
Output Voltage	over 50,000 $\mu V$						
Crystal Socket	for FT-243 holder						
Quartz Oscillator	1~12 Mc						
Tube Complement	6J6	6U8	12BH7	6CB6	6C4	6AV6	6X4
Accessories	Cables: 300 $\Omega$ 75 $\Omega$ Signal Pickup Earphone						
Power Supply	AC 50/60 cps, 100, 115 or 230 V as specified; 60 VA approx						
Size and Weight	14 $\frac{1}{4}$ " $\times$ 10 $\frac{1}{2}$ " $\times$ 7 $\frac{1}{2}$ " (360 $\times$ 265 $\times$ 190 mm); 23 lb (10 kg)						

## **DESCRIPTION**

The function of the LSG-532 is to provide two sources of signals for the testing of TV, FM and other receiving equipment in the higher frequencies. In some respects, these signals are similar to those obtained from the lower frequency generators.

The sweep generator furnishes signals having a "frequency band-width". The marker is an accurate frequency calibrator, and as the name implies, supplies the frequency check points for visual alignment work.

The block diagram of the LSG-532 is shown in Fig. 1.

The sweep section is made up of the following elements: variable swept RF oscillator, fixed frequency oscillator, mixer, blanking horizontal phasing and the output controls.

The marker comprises three oscillators: multi-band RF, crystal and 600 cps audio.

### **Sweep Generator**

The sweep generator consists of a 6J6 tube and an LC resonant circuit. The frequency range is from 150 to 270 Mc. The center frequency is varied by the inductance and the deviation is

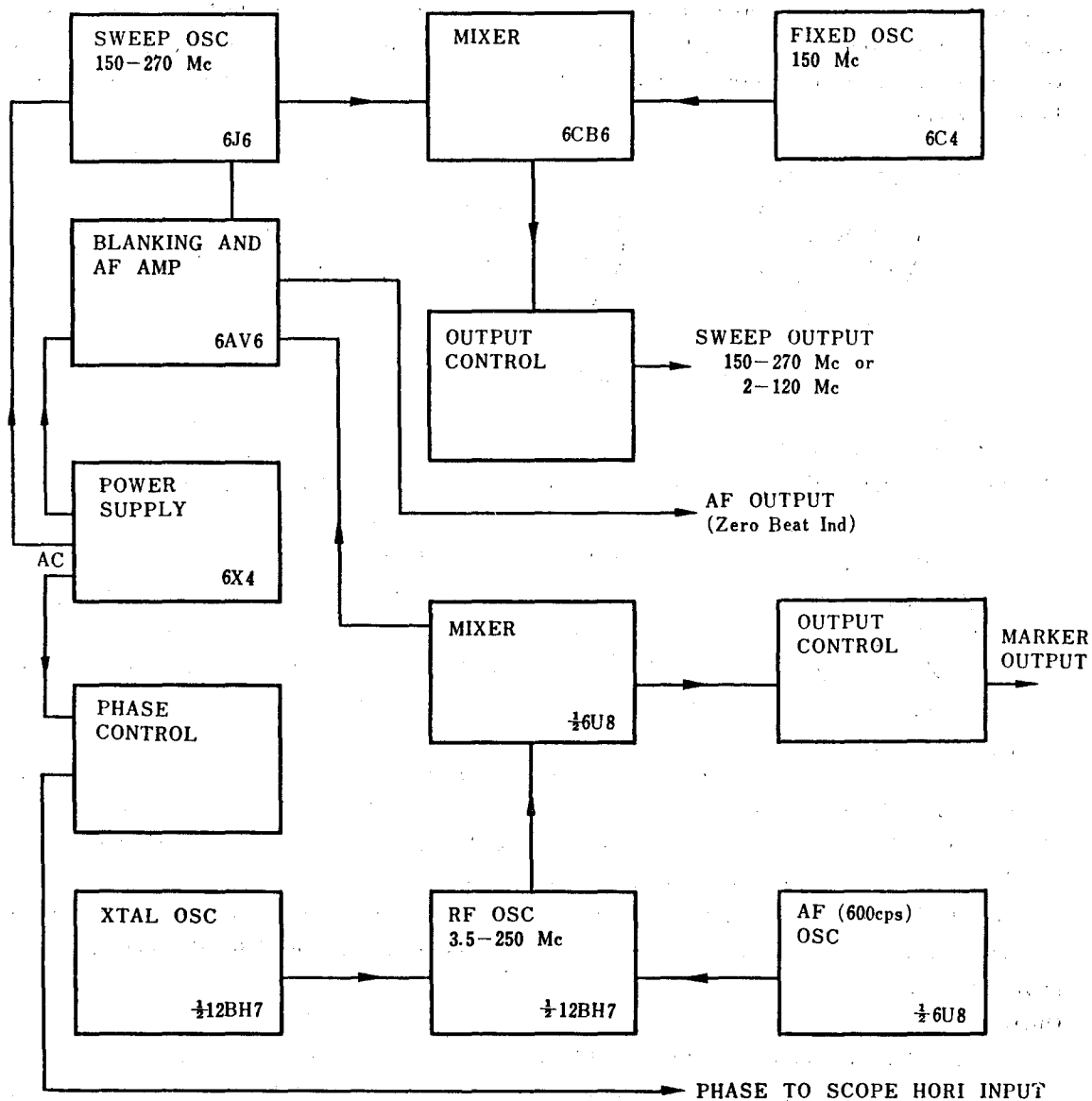


Fig. 1 BLOCK DIAGRAM

controlled by the capacitance element. The "rotor" of the capacitor is attached to the vibrator and the stator directly to the tuning coil. The vibrator is actuated by passing a current at the line frequency through its moving coil. The oscillator frequency will vary on either side of the center frequency in accordance with the amount of the capacitance change. The process of varying the frequency at a given rate is known as frequency modulation, or sometimes as "wobulation" as applied to test instruments.

The frequency range from 2 to 120 Mc is obtained by the beat frequency principle. The fixed oscillator on 150 Mc uses a 6C4 tube. The frequencies are mixed in the 6CB6 mixer-buffer and fed into a 4-step attenuator and fine adjuster. The maximum output is over 50,000  $\mu$ V.

The horizontal phase control is used for the synchronizing of the response curve on the scope

with that of the sweeping action. It is necessary to have the lowest and highest frequencies at each end of the trace. The PHASE control is adjusted so that the forward and return curves coincide, or appear as one curve as shown in Fig. 2-A. The curves of Figs. 2-B and 2-C are not Phased properly.

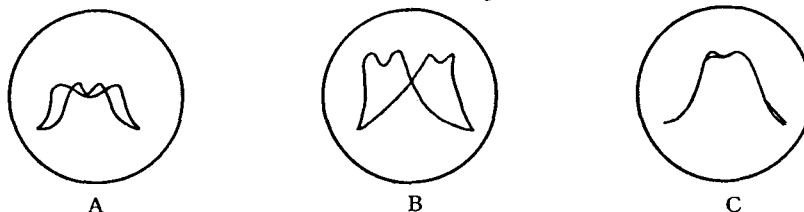


Fig 2 HORIZONTAL BLANKING OFF

In the alignment work, it is desirable that the return trace be eliminated. This is done by blanking, or operating the sweep oscillator to oscillate only during the forward trace. By setting the SELECTOR to BLANK ON, a curve like that shown in Fig. 3 will be observed. It must be noted that the PHASE is adjusted while the SELECTOR is at the BLANK OFF position. Marker Generator.

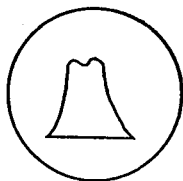


Fig. 3 BLANKING ON

In the marker generator, the RF oscillator uses a  $\frac{1}{2}$  12BH7 and covers from 3.5 to 125 Mc on fundamentals and up to 250 Mc on harmonics in 8 ranges.

The crystal oscillator, a  $\frac{1}{2}$  12BH7, is used for the crystal supplied, but will oscillate with suitable crystals from 1 to 12 Mc. The 600 cps audio oscillator uses a  $\frac{1}{2}$  6U8 in a stable phase-shift circuit to modulate the RF output. The mixer-buffer is a  $\frac{1}{2}$  6U8 from whose plate circuit the marker output is taken.

For checking the marker and external frequencies, the crystal oscillator can be employed for accurate calibrations. A crystal diode rectifier and the 6AV6 tube are used for the audio amplifier in zero beating.

#### Operation

For visual alignment of the TV and FM circuits, it is necessary to have a scope of high sensitivity, at least with 2 stages of vertical amplifications. The LEADER Models LBO-3A or LBO-5A are recommended.

The alignment of receivers follows a basic method. It is recommended that the MANUFACTURER'S SERVICE INSTRUCTIONS AND DATA BE FOLLOWED CLOSELY.

Before proceeding with the use of the LSG-532, the receiver under test should be checked thoroughly for the proper voltages and for defective components.

#### A. Tuner Alignment

The equipment layout is shown in Fig. 4.

The switches and controls are set as follows:

Sweep Width to full clockwise

SELECTOR to BLANKING OFF

PHASE to AC ON

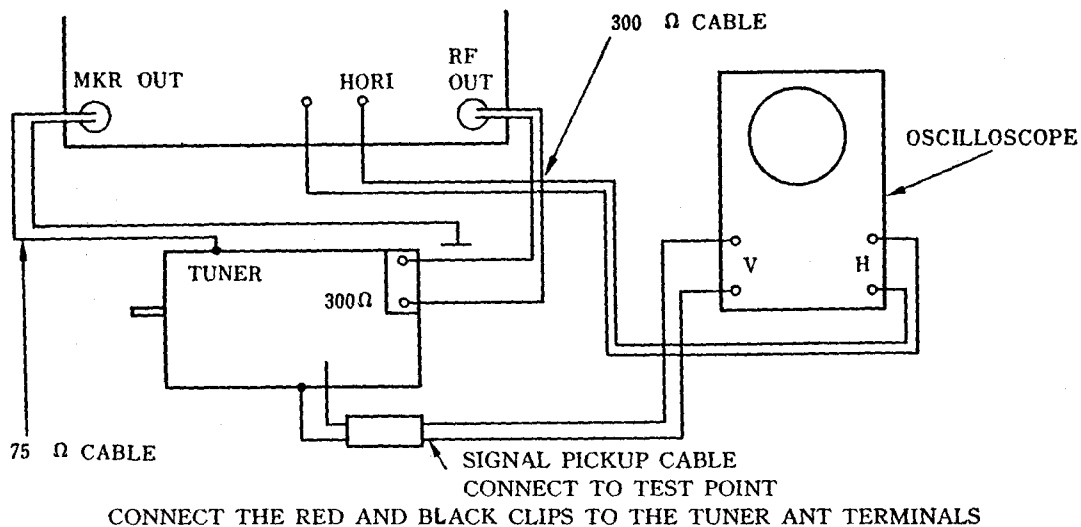


Fig. 4 TUNER ALIGNMENT

The 300Ω cable is connected to the RF OUTPUT and the 75Ω cable to the MARKER OUTPUT.

The HORI output terminals must be connected to the horizontal input of the scope if there is no provision for phasing in the scope.

The spot controls are adjusted for normal operation. The other controls are the vertical and horizontal amplitude. The horizontal selector is set for external input and the internal sweep, or timing is not used.

Connect the black and red clips of the 300Ω cable to the antenna terminals of the tuner. The Signal Pickup cable is connected to the scope vertical input, the probe tip to the chassis test point and the clip to the chassis.

Set the tuner to the channel under test.

Remove the 1st IF amplifier tube, or disconnect the lead to the IF amplifier before the alignment process.

The marker output is very loosely coupled to the tuner by connecting the ground clip to the chassis and placing the "hot" lead near the antenna leads or terminals.

Set the sweep frequency to the channel under test. Adjust the sweep circuit controls so that the trace amplitude covers about 60% of the screen. The trace should be like one of those shown in Fig. 2. Adjust the PHASE so the two line coincide. At this stage, the SELECTOR

is set to BLANK ON. A single line trace as in Fig. 5 will be observed.

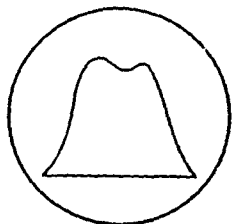


Fig. 5 TUNER RESPONSE

The tuner adjustment must be made to obtain the curves specified by the manufacture. It is best to keep the input signal levels low as possible to avoid overloading. After the adjustments, make certain that the frequencies are correct by checking with the marker generator.

On the response curves, a small superposed signal, or

"pip", will appear. These pips "mark" the frequency of that portion of the curve. The pip amplitude control, MARKER SIZE, must be kept low to prevent overloading, since under this condition the adjustments are impossible.

As the frequency of the marker is varied in the vicinity of the channel under test, a "pip" will move along the trace. The peaks and valley on the trace can be determined rapidly.

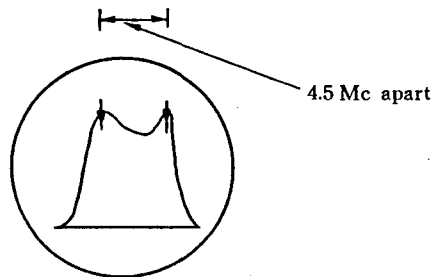


Fig. 6 2-pip TRANCE

Then the 4.5 Mc crystal is inserted in its socket at the panel center left, a composite marking signal from the tuned RF and crystal oscillators will be available. This allows the 2-pip marking method whereby a pip 4.5 Mc away from the main marker will be on the trace at the same time. The proper use of this convenient method will save much time in alignment, both for tuners and IF amplifiers. See Fig. 6.

### B. Video amplifier Alignment

The connections are shown in Fig. 7. The yellow and red clips of the 300  $\Omega$  cable are connected to the IF amplifier. There are two general methods of signal injection to the amplifier. One is that of connecting the red clip to a test input point. The other is by means of a "floating coupler" which is an ungrounded tube shield to cover the glass envelope of the input tube, the mixer or amplifier. The marker cable is loosely coupled to the input.

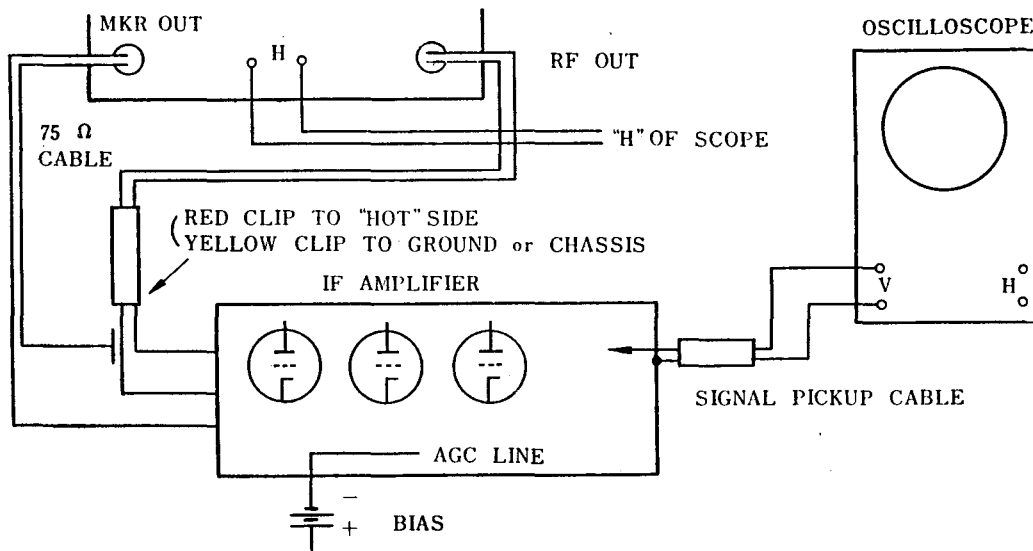


Fig. 7 LAYNUT FOR IF AMPLIFIER & DETECTOR TESTING

The local oscillator in the tuner must be made inoperative by shorting the coil or some other method without removing the tube. The AGC circuit in the receiver must be opened and a fixed bias about  $-3$  to  $-8$  V dc substituted.

Connect the Signal pickup cable to the test point.

Set the sweep to the intermediate frequency, with the SELECTOR to BLANK OFF and the

MARKER SIZE at minimum. The sweep width is set to about 50% and the output adjusted to a suitable level. Adjust the PHASE until the lines on the trace coincide. Turn the SELECTOR to BLANK ON for trace with the base line.

Set the marker frequency to the IF and adjust the MARKER SIZE. The pip input should be kept as low as possible. After the response has been properly adjusted, insert the 4.5 Mc crystal for the 2-pip indication, and the final touchup.

Follow the manufacture's directions for the alignment procedure.

**C. Sound IF AMPLIFIER**

There are two types of sound IF systems, the intercarrier and separate channel. The inter-carrier uses the 4.5 Mc center frequency and the separate channel uses a frequency in the 25 Mc spectrum.

The intercarrier which widely employed will be treated. The separate channel amplifiers are aligned in a combination video and intercarrier sound IF method.

The connections are shown in Fig. 7, the general layout being the same as for the video amplifier channel.

Set the sweep to 4.5 Mc and the width to approximately 1 Mc. Wider sweeps make alignment difficult.

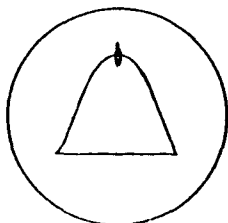


Fig. 8 SOUND IF RESPONSE

When the signal is injected at the input of the sound IF channel and picked up across the resistor of the limiter tube a trace like that shown in Fig. 8. will be observed.

Set the SELECTOR to BLANK OFF and adjust the PHASE so the curves coincide.

Set the SELECTOR to BLANK ON.

Inset the 4.5 Mc crystal in the socket, and set the marker frequency to the highest range. (This is to utilize the crystal frequency output only)

Adjust the circuits, trimming for a symmetrical curve.

**D. Sound Detector.**

The FM de tector is adjusted by feeding the sweep output to the limiter stage and the pickup cable is connected to the detector output.

Set the SELECTOR to BLANK OFF and adjust the PHASE to make the curves appear as one line. Set the SELECTOR to BLANK ON for the trace with the base line as in Fig. 9.

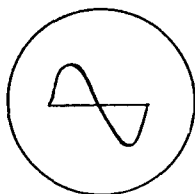


Fig. 9 FM DETECTOR

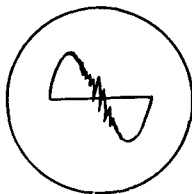


Fig. 10-A FM DETECTOR MARKING

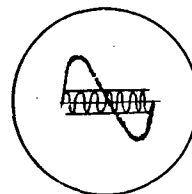


Fig. 10-B MARKER WITH AUDIO MODULATION

The response curve must be symmetrical as possible with maximum linearity. When marking with the 4.5 Mc signal, the pip will appear where the curve crosses the base line in a series of waves. At points close to resonance, the amplitude is large, but gradually decreases but with a larger



number of waves. See Fig. 10-A.

The circuit can be centered to 4.5 Mc by adjustment so that the waves will lie symmetrically along the diagonal of the "S" curve.

Another method of adjustment is to use an audio modulated carrier for the marker. The 4.5 Mc marker is modulated by setting the SELECTOR to AF-MOD. If the detector circuit is not aligned properly, the "S" curve will be affected by the audio component and will show up by the widening of the trace. See Fig. 10-B.

When the circuit is exactly tuned to 4.5 Mc, the "modulation" will disappear.

#### **E. Frequency Calibration**

Internal Oscillator. The 4.5 Mc crystal is used to check the marker oscillator.

The controls are set as follows: SELECTOR to MARKER CALIB

Sweep FREQ RANGE to OFF

The earphone is inserted in the PHONE USE TO CALIB. As the marker tuning dial is turned from the low to the high frequencies on each range, beats will be heard at various settings.

Check points which will be heard most clearly are listed on the following page. The harmonics of both the crystal and RF oscillators are used for this purpose. As the order the harmonics goes high, the signals will become weak and care must be taken to select the proper one.

The logging scale which is the outermost are on the dial plate, can be used for reference calibration.

Other crystals, 1~12 Mc can be used for checking.

TABLE OF CHECK FREQUENCIES USING 4.5 Mc CRYSTAL

3.6 Mc	12.0 Mc	54.0 Mc	103.5 Mc
4.5	18.0	76.5	108.0
6.0	22.5	81.0	112.5
6.75	27.0	85.5	117.0
7.2	31.5	90.0	121.5
7.5	36.0	94.5	
9.0	45.0	99.0	

External Source. In service work, it is especially helpful to determine or to set the local oscillator frequency of the TV or FM receivers.

The loosest coupling to the source must be employed. The coupling should not affect the unknown oscillator frequency. Three methods will be described briefly, all using the 75  $\Omega$  cable.

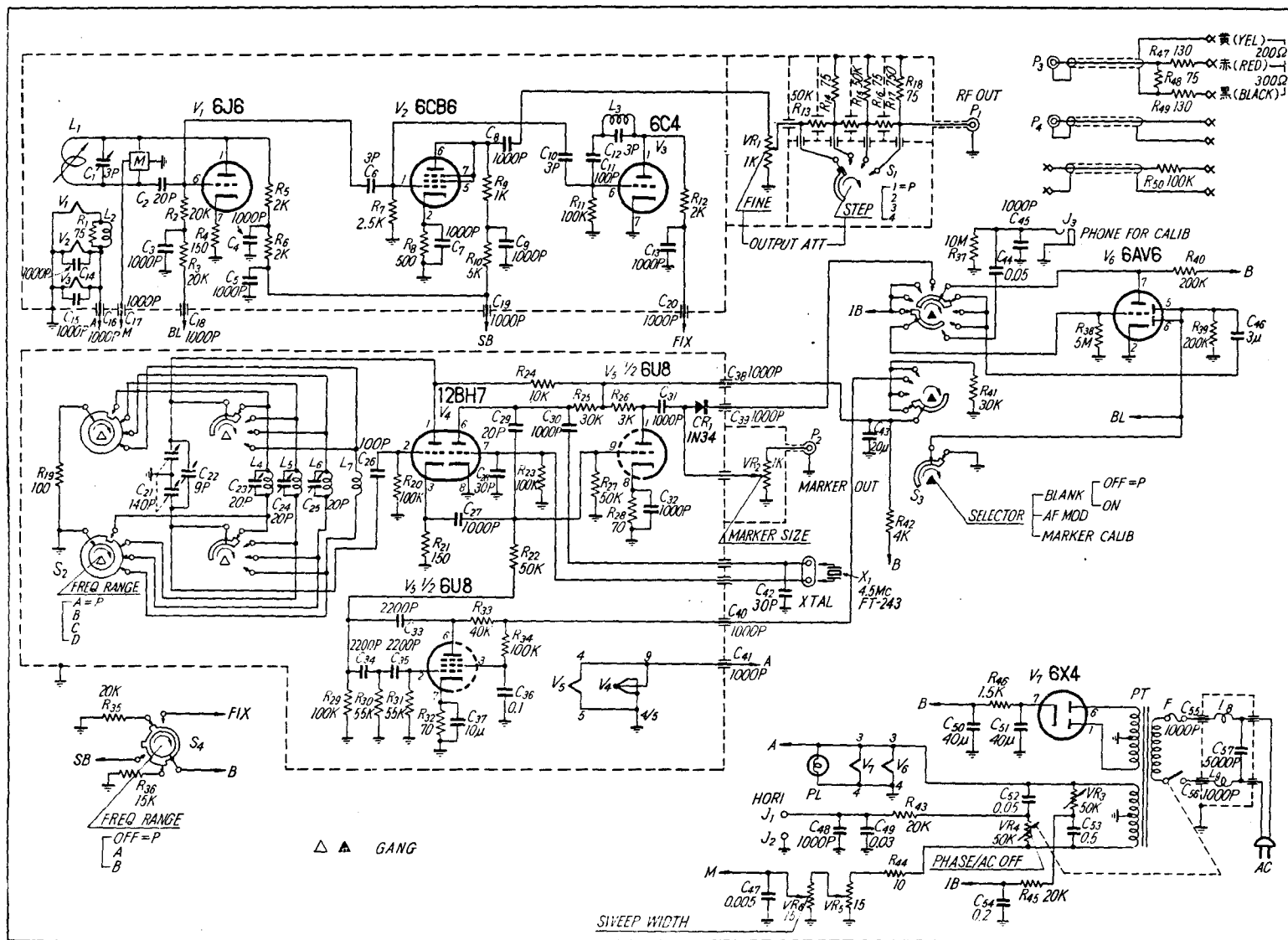
1. Direct coupling to the test point as per manufacturer's instructions.
2. Coupling by a small capacitor, 0.5 to 1 pf.
3. Use of a few turns of wire connected to the ends.

The zero beat will be heard in the earphone. Care is required that the fundamental or its known harmonic of the unknown oscillator is be measured.

LSG-532 TV-FM SWEMAR GENERATOR  
TABLE OF CHECK FREQUENCIES USING 5.5 Mc CRYSTAL

A-BAND (Mc)	5.5	4.4				
B-BAND (Mc)	11	16.5				
C-BAND (Mc)	38.5	44	49.5	55	60.5	66
D-BAND (Mc)	60.5	77	82.5	88	93.5	99
	104.5	110	115.5	121		

# LSG-532 CIRCUIT



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